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Report of the individual review of the annual submission of Portugal submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 annual submission of Portugal, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 5 to 10 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Paul Filliger (Switzerland) and Ms. Anke Herold (Germany); energy – Ms. Kristien Aernouts (Belgium), Mr. Vishwa Bandhu Pant (India) and Mr. Glen Whitehead (Australia); industrial processes – Mr. Menouer Boughedaoui (Algeria) and Ms. Youngsook Lyu (Republic of Korea); agriculture – Mr. Michael Anderl (Austria) and Mr. Jacques Kouazounde (Benin); land use, land-use change and forestry (LULUCF) – Mr. Nagmeldin Elhassan (Sudan) and Mr. Héctor Ginzo (Argentina); and waste – Mr. Davor Vešligaj (Croatia). Mr. Elhassan and Ms. Herold were the lead reviewers. The review was coordinated by Mr. Javier Hanna and Mr. Roman Payo (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Portugal, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Portugal was carbon dioxide (CO_2), accounting for 75.2 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (17.1 per cent) and nitrous oxide (N_2O) (6.1 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 71.9 per cent of total GHG emissions, followed by the agriculture sector (10.4 per cent), the waste sector (10.3 per cent), the industrial processes sector (7.0 per cent) and the solvent and other product use sector (0.4 per cent). Net removals from the LULUCF sector amounted to 14,094.56 Gg CO_2 eq. Total GHG emissions amounted to 74,660.29 Gg CO_2 eq and increased by 25.5 per cent between the base year[2] and 2009.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from Annex A sources only.

Table 1

Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year to 2009[a]

			Gg CO_2 eq								*Change (%)*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009*
Annex A sources		CO_2	43 702.46	43 702.46	52 571.45	63 739.99	67 716.94	60 831.12	59 461.47	56 154.72	28.5
		CH_4	10 187.53	10 187.53	11 257.77	11 419.23	12 470.28	12 295.96	12 636.65	12 803.80	25.7
		N_2O	5 533.90	5 533.90	5 608.09	5 824.57	5 080.38	5 106.27	4 879.33	4 586.16	–17.1
		HFCs	55.45	NA, NE, NO	55.45	303.44	779.61	947.16	1 038.24	1 107.75	1 897.6
		PFCs	NA, NO	NA, NE, NO	NA, NO	0.03	0.05	0.03	0.04	0.003	NA
		SF_6	5.34	NA, NE, NO	5.34	5.83	7.12	7.73	7.63	7.85	47.1
KP-LULUCF	Article 3.3[b]	CO_2							–1 261.43	–1 355.99	
		CH_4							0.99	4.85	
		N_2O							36.32	38.49	
	Article 3.4[c]	CO_2	–472.90						–9 323.92	–10 072.50	NA
		CH_4	0.003						10.70	48.58	NA
		N_2O	23.16						19.72	27.07	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NE = not estimated, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 2
Greenhouse gas emissions by sector and activity, base year to 2009[a]

			Gg CO_2 eq								*Change (%)*
		Sector	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009*
Annex A		Energy	40 356.37	40 356.37	48 902.19	59 381.34	63 163.39	56 177.60	55 280.05	53 670.70	33.0
		Industrial processes	4 760.11	4 699.32	5 184.84	6 104.83	6 769.84	7 034.20	6 903.27	5 202.51	9.3
		Solvent and other product use	346.47	346.47	329.26	316.62	337.97	318.46	281.79	298.23	–13.9
		Agriculture	8 036.00	8 036.00	8 026.10	8 673.89	7 946.58	8 059.36	7 888.43	7 796.39	–3.0
		Waste	5 985.72	5 985.72	7 055.72	6 816.42	7 836.60	7 598.64	7 669.84	7 692.45	28.5
		LULUCF	NA	–9 325.90	–10 815.43	–13 561.21	–6 215.76	–12 556.28	–13 454.36	–14 094.56	NA
		Total (with LULUCF)	**NA**	**50 097.99**	**58 682.67**	**67 731.89**	**79 838.62**	**66 631.98**	**64 569.00**	**60 565.72**	**NA**
		Total (without LULUCF)	**59 484.68**	**59 423.89**	**69 498.10**	**81 293.10**	**86 054.38**	**79 188.26**	**78 023.36**	**74 660.29**	**25.5**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation							–2 621.39	–2 745.99	
		Deforestation							1 397.27	1 433.33	
		Total (3.3)							**–1 224.12**	**–1 312.65**	
	Article 3.4[d]	Forest management	NA						–8 221.73	–8 790.89	
		Cropland management	168.16						–118.93	–242.39	–244.1
		Grazing land management	–617.90						–952.84	–963.56	55.9
		Revegetation	NA						NA	NA	NA
		Total (3.4)	**–449.74**						**–9 293.50**	**–9 996.85**	**NA**

Abbreviations: LULUCF = land use, land-use change and forestry, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in the national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

5. Table 3 provides information on the most important emissions and removals and accounting parameters that will be included in the compilation and accounting database.

Table 3
Information to be included in the compilation and accounting database in tonnes of CO_2 eq

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	343 743 774			343 743 774	
Annex A emissions for current inventory year					
CO_2	56 077 760	56 154 721		56 154 721	
CH_4	12 803 650	12 803 802		12 803 802	
N_2O	4 585 572	4 586 156		4 586 156	
HFCs	1 107 754			1 107 754	
PFCs	3			3	
SF_6	7 849			7 849	
Total Annex A sources	**74 582 588**	**74 660 285**		**74 660 285**	
Activities under Article 3, paragraph 3, for current inventory year					
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–3 228 678			–3 228 678	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	482 692			482 692	
3.3 Deforestation for current year of commitment period as reported	1 433 335			1 433 335	
Activities under Article 3, paragraph 4, for current inventory year[d]					
3.4 Forest management for current year of commitment period	–8 790 895			–8 790 895	
3.4 Cropland management for current year of commitment period	–242 391			–242 391	
3.4 Cropland management for base year	168 161			168 161	
3.4 Grazing land management for current year of commitment period	–963 560			–963 560	
3.4 Grazing land management for base year	–617 900			–617 900	
3.4 Revegetation for current year of commitment period					
3.4 Revegetation for base year					

Abbreviation: NA = not applicable.

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] "Accounting quantity" is included in this table only for Parties that chose annual accounting for activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, if any.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. Portugal's 2011 annual inventory submission was submitted on 15 April 2011; it contains a complete set of common reporting format (CRF) tables for the period 1990–2009 and a national inventory report (NIR). Portugal also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 15 April 2011. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Portugal submitted revised emission estimates and a revised NIR on 25 May 2011. The Party officially submitted revised emission estimates and additional information on activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol on 24 October 2011 in response to the list of potential problems and further questions raised by the ERT during the review. The values used in this report are based on the values contained in the submission of 24 October 2011.

8. Where necessary, the ERT also used the previous years' submissions during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

9. During the review, Portugal provided the ERT with additional information which is not part of the annual submission (see annex I). The full list of documents used during the review is provided in annex I to this report.

Completeness of inventory

10. The inventory is complete in terms of years and gases, but is not complete in terms of geographical coverage because Portugal has not reported the emissions and removals from the LULUCF sector and from KP-LULUCF activities for the two autonomous regions (Azores and Madeira). This issue had already been raised in the 2010 annual review report. In response to the list of potential problems and further questions raised by the ERT during the review, Portugal provided an action plan describing: the availability of land-use data (i.e. data on the area and land-use types and conversions), information and other data that will be used to identify and classify land-use areas and land-use changes as well as the carbon stock changes for the two autonomous regions (Azores and Madeira); the planned methodological approaches and tier levels to be used for the estimation of emissions and removals from KP-LULUCF activities; and a detailed timetable which indicates that the estimation of emissions and removals from the two autonomous regions will be reported in

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry.

the next annual submission. The ERT strongly reiterates the recommendation in the previous review report that Portugal report the land use and land-use changes and relevant emissions and removals for the total area of the country in its next annual submission.

11. Portugal has provided inventory data for most categories. However, CH_4 and N_2O emissions from the combustion of landfill gas and biogas captured, and CO_2, CH_4 and N_2O emissions from the combustion of fuels in lime production have not been estimated under the energy sector (see paras. 44–46 below). In response to the list of potential problems and further questions raised by the ERT during the review, Portugal provided estimates for the missing categories and resubmitted the CRF tables. The ERT strongly recommends that Portugal report emission estimates for these categories in its next annual submission.

12. CO_2 emissions from agricultural lime application on cropland and grassland and for KP-LULUCF activities have been reported as not estimated ("NE") due to a lack of activity data (AD) (see paras. 120 and 137 below). The ERT strongly recommends that Portugal estimate and report these emissions in its next annual submission.

13. Portugal has reported CO_2, CH_4 and N_2O emissions from biomass burning from wildfires for cropland management and grassland management as "NE" for the years 1990, 2008 and 2009 (see paras. 155 and 160 below). The Party has not provided any explanation for not estimating these emissions. The ERT recommends that Portugal estimate these emissions or provide justification for not estimating them in its next annual submission.

14. The NIR (page 6-54) states that emissions from the application of sewage sludge as a soil amendment are not included in the inventory, as there are no reliable statistics for this activity, which is considered by Portugal to be negligible (see paras. 93–95 below). In response to the list of potential problems and further questions raised by the ERT during the review, Portugal clarified that the statement in the NIR is incorrect. All nitrogen (N) from sewage sludge is estimated and reported under the waste sector in line with the default method provided by the Intergovernmental Panel on Climate Change (IPCC) and a separate estimation of these emissions under the agriculture sector would lead to a double counting of N_2O emissions from sewage sludge. The ERT recommends that Portugal, in its next annual submission, obtain AD for sewage sludge application on agricultural soils in order to estimate the N_2O emissions or, if this is not possible, correct the notation key and improve the explanations provided in the NIR.

15. Portugal has reported the actual emissions of some HFC species for several subcategories under consumption of halocarbons and SF_6 as not occurring ("NO"). The ERT noted that other reporting Parties report emission estimates for these subcategories and species. The ERT also noted that the Party's 2010 NIR identified the inclusion of additional sources of fluorinated gases (F-gases) in the inventory as an area for improvement. However, in its 2011 annual submission, Portugal has not included these additional sources in its inventory and has classified the activities relating to the assessment of the completeness of F-gas emissions as low priority in its inventory improvement plan (see para. 64 below). The ERT recommends that Portugal assess the completeness of its reporting of actual HFC emissions from consumption of halocarbons and SF_6 and either provide estimates or justify why the emissions do not occur in its next annual submission.

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

Overview

16. The ERT concluded that the national system and institutional arrangements continue to perform their required functions. No changes have occurred in the national system since the previous annual submission.

Inventory planning

17. The NIR describes the national system and institutional arrangements for the preparation of the inventory. The Portuguese Environment Agency (APA) has overall responsibility for the national inventory. Other organizations contracted by APA, namely InventAR and Ecoprogresso, are also involved in the preparation of the emission estimates, the preparation of the NIR, the compilation of the CRF tables and quality assurance/quality control (QA/QC) activities. Other institutions, such as the National Institute of Statistics (INE), the Ministry of Agriculture, the Directorate-General for Geology and Energy and the National Authority for Forestry, have been appointed as sectoral focal points. They are also involved in the preparation, planning and management of the inventory. These sectoral focal points, and in particular the entities involved in the inventory process, contribute to the preparation of the inventory by providing AD and support for the development of methodologies and EFs.

18. The inventory improvement plan provided by the Party during the review clearly outlines the responsibilities of the different organizations involved in the planned improvements and assigns priorities to the individual tasks. Planned improvements are also included in the methodological development programme, which is part of the national system. A considerable number of recommendations from previous review reports have been addressed. However, the ERT identified several recommendations from earlier review reports that have not yet been addressed. The improvement plan foresees that most of the planned improvements should be implemented in time for the 2012 annual submission. To increase transparency, the ERT recommends that Portugal report, in table 9.1 of its next NIR, more specific timelines for the planned improvements that are "under development", consistent with the timelines indicated in the improvement plan, and explain the reasons for any delays in the implementation of the planned improvements. The improvement plan provided to the ERT during the review only addressed very few recommendations from the 2010 annual review report. The ERT recommends that Portugal incorporate the findings of the review reports into the national inventory improvement plan as soon as possible after their publication.

Inventory preparation

Key categories

19. Portugal has reported a key category tier 2 analysis, both level and trend assessment, as part of its 2011 submission. The Party has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). Portugal's tier 2 key category analysis identified 54 key categories (including LULUCF). The key category analysis

performed by the Party and that performed by the secretariat[4] produced similar results; differences are due to the use of different tiers and the different levels of disaggregation of the categories.

20. Portugal has identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol using a tier 2 approach in accordance with the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

Uncertainties

21. Portugal has performed a tier 1 uncertainty assessment. For 2009, the total uncertainty (9.2 per cent) decreased compared with most of the previous years of the time series (8.9–15.5 per cent). The total uncertainty in the trend is 14.4 per cent. The uncertainties for the LULUCF sector are reported as 0.0 for 2009 (NIR table 1.7, page 1-17), but as relatively high values for earlier years of the time series. However, the NIR states that the uncertainty assessment is under development. No uncertainty estimates have been provided for the LULUCF sector in annex B to the NIR, where the uncertainty assessment is documented. The ERT recommends that Portugal revise its estimate of the uncertainty for the LULUCF sector and report thereof in its next annual submission. From the description provided by the Party in the NIR, it is not clear whether and how the uncertainty assessment is used to prioritize future inventory improvements, and the inventory improvement plan does not consider the uncertainty of the categories. The ERT recommends that Portugal clarify, in its next annual submission, how the uncertainties are used to prioritize inventory improvements. The ERT also recommends that the Party implement a tier 2 uncertainty analysis in its next annual submission.

Recalculations and time-series consistency

22. Portugal has reported that recalculations of the time series 1990–2008 have been undertaken due to: the revision of AD (in the energy, industrial processes, agriculture and waste sectors) and EFs (for transport); the verification of inventory estimates with information reported under the European Union emissions trading scheme (EU ETS); and the correction of errors and the elimination of double counting (in the energy and industrial processes sectors). Portugal has extensively revised the AD, assumptions and parameters used to estimate emissions and removals from the LULUCF sector and from KP-LULUCF activities in order to respond to the recommendations in previous review reports and to more extensively apply the guidance provided in the IPCC good practice guidance for LULUCF.

23. The recalculations performed in the 2011 submission resulted in an increase in estimated total GHG emissions in 1990 (0.2 per cent) and a decrease in 2008 (0.5 per cent). The most significant recalculations occurred in the LULUCF sector, where total net removals increased by 10,496.83 Gg CO_2 eq or 354.9 per cent for 2008 (see para. 100 below) and by 13,797.42 Gg CO_2 eq or 308.6 per cent for 1990. The rationale for these recalculations is provided in the NIR and in CRF table 8(b). The general explanations of the recalculations in the NIR (section 9) do not address the changes in the LULUCF sector

[4] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

because the methodologies and data sources have been so substantially revised that the entire description of the LULUCF sector has been updated. The ERT recommends that Portugal, following the substantial revision of the methodologies and data sources for the LULUCF sector, describe any further revisions of the LULUCF sector in table 9.3 of the NIR in its next annual submission. The ERT identified some inconsistencies between the CRF tables and the NIR for the recalculations in the agriculture sector (see paras. 86, 90 and 104(g) below). The ERT, therefore, recommends that Portugal improve its QA/QC activities to ensure the consistency of its reporting in its next annual submission.

Verification and quality assurance/quality control approaches

24. Portugal has reported on the established QA/QC system and the related QA/QC procedures in the NIR. According to the NIR, both tier 1 and tier 2 QC procedures are applied by the inventory team during the calculation of the emission estimates and during the compilation of the inventory, in line with the Party's QA/QC plan. Tier 2 QC procedures are reported for all sectors except the LULUCF sector, which was extensively revised for the 2011 submission. In response to a question raised by the ERT during the review, Portugal provided the ERT with a copy of its inventory improvement plan. The inventory improvement plan includes the recommendations from previous review reports and indicates how, by which institution and with what priority the outstanding recommendations and improvements will be addressed. Recommendations from previous review reports regarding the use of data and information from the EU ETS for the QA of the GHG inventory were implemented in the 2011 submission. In addition, the QA of the inventory was improved in the 2010 submission through a more detailed comparison of the fuel consumption data reported in the inventory and the data reported to the International Energy Agency (IEA).

25. However, the ERT identified several issues that indicate that the Party's QA/QC procedures could be further improved, for example the correction of incorrect or incorrectly used equations (see paras. 81 and 118 below) and the consistency of the information provided in the CRF tables and in the NIR. The ERT recommends that Portugal improve its QA/QC procedures in the next annual submission.

Transparency

26. In general, the information provided in the NIR is well-structured and detailed descriptions of the methods, data and assumptions used have also been provided. The transparency of the 2011 NIR has been further improved through the inclusion of a separate section in the NIR wherein the inventory data for the energy sector are compared with the IEA data over the entire time series, and by addressing the transparency issues highlighted in previous review reports in relation to the agriculture and LULUCF sectors. However, the detailed recommendations in the sectoral chapters of this report and the number of questions raised by the ERT during the review indicate that the transparency of the inventory could be further improved (see paras. 48, 49, 52, 58, and 72 below). Some transparency issues identified in previous review reports have not yet been resolved by the Party, such as the reporting of additional information on waste incineration emissions (see para. 132 below). In addition, the ERT recommends that Portugal provide more complete information in the "additional information" box in CRF table 4.A for the agricultural sector, clarify the types of land areas that are classified as "other land" and implement the outstanding recommendations from previous review reports regarding the improvement of transparency.

Inventory management

27. Portugal has a centralized archiving system which is maintained by APA and includes the archiving of methodologies, calculation spreadsheets, original data submissions, disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. Annually reported data (e.g. CRF tables) are stored both in hard copy and in electronic format. Minor corrections to the inventory are not archived due to storage limitations. APA had planned to develop an integrated IT system for the management of the inventory; however, this project has not yet been implemented due to several resource constraints. The ERT reiterates the encouragement in the previous review report that Portugal continue to develop an enhanced integrated IT system which resolves the current data storage limitations and report on the development of the system in its next annual submission.

3. Follow-up to previous reviews

28. Portugal has made efforts to improve the transparency, completeness and accuracy of its GHG inventory and to address the majority of the recommendations from previous review reports for all sectors, which are documented in NIR table 9.1 – "overview of the responses to the UNFCCC review". Due to delays in the availability of the 2010 annual review report, the recommendations included therein could not be fully addressed in NIR table 9.1 for the 2011 annual submission. The ERT commends the Party for the transparent documentation of implemented and outstanding inventory improvements. The ERT encourages Portugal to further improve this documentation by adding the review year in which the recommendation originally arose and by including a timeline for the planned implementation of the recommendation and information on the action already taken. NIR table 9.1 does not seem to contain completely updated information (e.g. N_2O emissions from flaring are reported as "under development", but estimates are provided in the CRF tables); therefore, the ERT recommends that Portugal improve the consistency of the information reported in the CRF tables and in the NIR. The ERT also encourages the Party to include the general recommendations from the review reports in NIR table 9.1 in its next annual submission. During the review, the ERT received the Party's inventory improvement plan (see para. 24 above).

29. In response to the recommendations in previous review reports, Portugal has made the following improvements to the completeness of its 2011 annual submission:

(a) The estimation of CO_2 emissions and removals from grassland remaining grassland;

(b) The estimation of N_2O emissions from flaring of oil and the reporting of N_2O emissions from flaring of gas as included elsewhere ("IE");

(c) The completion of the KP-LULUCF CRF tables for the base year with estimates of emissions and removals and not only with notation keys;

(d) The provision of information on the methods and emission factors (EFs) used for the estimation of HFC, PFC and SF_6 emissions from consumption of halocarbons and SF_6;

(e) The estimation of emissions from the use of carbonates in the production of N fertilizers;

(f) The provision of estimates for the carbon stock changes in living biomass in the LULUCF sector, which were previously reported as "NO" (see para. 111 below), as well as the provision of estimates for many emissions that were previously not reported ("NR").

30. The ERT recommends that Portugal urgently address the recommendations of previous review reports that have not yet been addressed, including:

(a) The inclusion of emissions and removals from the LULUCF sector and from KP-LULUCF activities for Azores and Madeira (see para. 10 above);

(b) The estimation of CO_2 emissions from agricultural lime application (see para. 12 above);

(c) The continued incorporation of plant-specific data into the inventory for the energy and industrial processes sectors (see paras. 43, 61 and 67 below);

(d) The improvement of the estimates of emissions from the use of feedstocks and the inclusion of estimates of combustion emissions from feedstocks and non-energy use of fuels for the sectoral approach in the next annual submission;

(e) The improvement of country-specific estimation parameters for the agriculture sector (see paras. 47, 75, 80 and 84 below);

(f) The continuation of the development of an enhanced integrated IT system which resolves the current data storage limitations and the reporting on the development of the system in future annual submissions (see para. 27 above).

4. Areas for further improvement

Identified by the Party

31. In the NIR and during the review, Portugal informed the ERT about planned improvements that will improve the accuracy and time-series consistency of future annual submissions, including:

(a) The increased incorporation of facility-specific data into the inventory, including EU ETS data, and the improvement of time-series consistency where EU ETS data have been applied;

(b) Further consultation with the petroleum sector to improve the methods and EFs used to estimate fugitive emissions from the oil sector;

(c) The review of the vehicle fleet data;

(d) The separate reporting of fugitive emissions from natural gas transmission and distribution;

(e) The use of IPCC tier 2 approaches to estimate the carbon stock changes in carbon pools for KP-LULUCF activities;

(f) The addition of new units/maps to the cartographic COS (Cartogafía de Ocupação do Solo) products for 1990 and the further development of the cartographic COS products for 2007 for the LULUCF sector;

(g) The development of a new version of the national forest inventory;

(h) The development of soil carbon sequestration factors for specific agricultural systems;

(i) The improvement of the information on industrial wastewater treatment systems.

32. In the NIR, neither the general section (section 9) nor the sectoral chapters identify planned improvements for the industrial processes, solvent and other product use or agriculture sectors. The ERT strongly recommends that Portugal add information on

planned improvements to the respective sectoral chapters of the NIR, consistent with the Party's improvement plan.

Identified by the expert review team

33. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 182 below.

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

B. Energy

1. Sector overview

35. The energy sector is the main sector in the GHG inventory of Portugal. In 2009, emissions from the energy sector amounted to 53,670.70 Gg CO_2 eq, or 71.9 per cent of total GHG emissions. Since 1990, emissions have increased by 33.0 per cent. The key driver for the rise in emissions is the growth in emissions from road transportation, which increased by 94.3 per cent. Within the sector, 36.6 per cent of the emissions were from energy industries, followed by 35.1 per cent from transport, 15.9 per cent from manufacturing industries and construction and 9.8 per cent from other sectors. Fugitive emissions from oil and natural gas accounted for 2.4 per cent, and the remaining 0.2 per cent were from the category other.

36. Portugal has made recalculations for the energy sector between the 2010 and 2011 submissions largely due to updates to AD, including corrections identified through the incorporation of EU ETS data. The impact of these recalculations on total GHG emissions is a decrease in emissions of 0.2 per cent for 2008 and of 0.04 per cent for 1990 (the impact on the energy sector emissions is a decrease of 0.4 per cent for 2008 and of 0.07 per cent for 1990). The main recalculations took place in the following categories:

(a) Energy industries, largely due to improvements in the allocation of AD to manufacturing industries and construction, including through the analysis of EU ETS data;

(b) Manufacturing industries and construction, largely due to improvements in the allocation of AD between categories and to the separation of biodiesel from diesel oil;

(c) Transport, mainly due to the revision of the energy balance and the use of the latest version of the COPERT model.

37. In the NIR and throughout the review, Portugal informed the ERT about planned improvements that will improve the accuracy and time-series consistency of future annual submissions, including:

(a) The increased incorporation of facility-specific data into the inventory, including EU ETS data, and the improvement of time-series consistency where EU ETS data have been applied;

(b) Further consultation with the petroleum sector to improve the methods and EFs used to estimate fugitive emissions from the oil sector;

(c) The review of the vehicle fleet data;

(d) The separate reporting of fugitive emissions from natural gas transmission and distribution.

38. The reporting on the energy sector is generally complete. However, Portugal did not estimate emissions from the following gases and categories in its submissions of 15 April

2011 and 25 May 2011: CH_4 and N_2O emissions from the combustion of landfill gas and biogas; and emissions from the combustion of fuels in lime production. The ERT strongly recommends that the Party include these missing estimates in its next annual submission or clarify whether these emissions do not occur in the country or whether they are included under other categories. In response to the list of potential problems and further questions raised by the ERT during the review, Portugal submitted revised CRF tables on 24 October 2011 including emission estimates for these categories (see paras. 44–46 below).

2. Reference and sectoral approaches

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

39. CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2009, the estimates calculated using the reference approach are 3.2 per cent higher than the estimates calculated using the sectoral approach. The variation is partially explained by the treatment of large point-source facilities between the two approaches, where specific energy content values are used in the inventory but not necessarily in the energy balance. Explanations for the variation are provided in the documentation box of CRF table 1.A(c) and in the NIR.

40. The apparent energy consumption reported by Portugal to the UNFCCC is within 8 per cent of that reported to IEA, with data in later years of the time series tending to be more closely correlated. The IEA values are systematically lower than the values reported to the UNFCCC. A comparison between the fuel consumption values reported by Portugal and those reported to IEA was published in the 2011 NIR for the first time. The ERT welcomes this improvement to the QA/QC of the Party's inventory. During the review, Portugal advised the ERT that some errors in the data reported to IEA had been detected. The ERT notes Portugal's efforts (through the Directorate General for Energy and Geology) to correct the data reported to IEA.

International bunker fuels

41. Discrepancies have been identified between CRF tables 1.C and 1.A(b) for jet kerosene (international aviation), gas/diesel oil, residual fuel oil and lubricants (international marine bunkers) for all years of the time series because the fuel classification is different between the energy balance and the national inventory. The energy balance uses the country of registration as the basis for the split rather than the origin and destination of the trip. This contributes to the differences between the reference and sectoral approach.

42. Portugal has improved the transparency of its annual submission by including a separate section in the NIR comparing the GHG inventory data with the IEA data over the entire time series. The ERT commends the Party for the improved transparency of its reporting.

3. Key categories

Stationary combustion: all fuels[5] – CO_2, CH_4 and N_2O

43. Portugal has incorporated facility-level EU ETS data into the inventory from 2007 onwards for the largest electricity-generating plants under public electricity and heat production. Before 2007, facility-level data were collected through different mechanisms,

[5] Not all emissions related to all gases and fuels under this category are key categories. However, since the calculation procedures for issues related to this category are discussed as whole, the individual gases and fuels are not assessed in separate sections.

all of which are listed in the NIR. Despite the consistent use of facility-specific data, the transition to the use of the EU ETS data has resulted in variations in the implied emission factors (IEFs) for all fuels. The value of the CO_2 IEFs increased by 4.5 per cent between 2006 and 2007 for solid fuels, by 1.3 per cent for liquid fuels and by 0.8 per cent for gaseous fuels. In response to a question raised by the ERT during the review, Portugal informed the ERT that in its next annual submission it will implement better and more accurate backward extrapolation procedures. The ERT recommends that Portugal review and, where appropriate, update the time series using the most up-to-date facility-level data in its next annual submission.

44. In its submissions of 15 April and 25 May 2011, Portugal reallocated the emissions from lime production from the energy sector to the industrial processes sector. In response to a question raised by the ERT during the review, the Party confirmed that only the emissions associated with the calcination of the carbonate are reported under the industrial processes sector and the fuel combustion emissions (CO_2, CH_4 and N_2O emissions) had mistakenly been omitted from the 2011 annual submission.

45. In response to the list of potential problems and further questions raised by the ERT during the review, the Party submitted, on 24 October 2011, revised CO_2, CH_4 and N_2O emission estimates for fuel combustion from lime production, based on lime production data for emissions during the period 1990–2004, fuel consumption data for emissions for 2005, and plant-specific fuel consumption data for the period 2006–2009. Compared with the submission of 25 May 2011, the GHG emissions for the category other under manufacturing industries and construction increased by 79.97 Gg CO_2 eq (by 1.5 per cent) for 2009 and increased by 9.94 Gg CO_2 eq (by 0.2 per cent) for 1990. The ERT commends Portugal for providing revised estimates and agrees with these estimates. The ERT strongly recommends that the Party include emissions from fuel combustion from lime production under the energy sector in its next annual submission.

46. In its submissions of 15 April and 25 May 2011, Portugal did not report CH_4 or N_2O emissions or AD from the combustion of landfill gas or biogas under the energy sector. The recovery of this gas is reported under the waste sector. However, no emissions associated with the combustion of these fuels have been estimated. The *Revised 1996 IPCC Guidelines for National Greenhouse Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) state that where waste material is used directly as fuel or converted into fuel it should be reported under the energy sector. The ERT strongly recommends that Portugal report the combustion of these fuels under the energy sector and estimate the CH_4 and N_2O emissions from the combustion of these fuels in its next annual submission. In response to the list of potential problems and further questions raised by the ERT during the review, the Party submitted revised emission estimates for landfill gas and biogas combustion. This resulted in an increase in emissions from public electricity and heat production of 0.41 Gg CO_2 eq (0.0 per cent) for 2009 and no changes for 1990. The ERT commends Portugal for providing revised estimates and agrees with these estimates.

Road transportation: liquid fuels – CO_2

47. Portugal updated the CO_2 EFs for gasoline, diesel and liquid petroleum gas for the full time series for the 2010 annual submission. Previously, the EFs used by the Party were based on the *EMEP/CORINAIR Emission Inventory Guidebook*.[6] The revised EFs were sourced from domestic legislation which in turn was sourced from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). In response to a question raised by the ERT during the review, the Party

[6] European Environment Agency. 2007.

was unable to provide any country-specific information to justify the change in EFs. As it is good practice to use country-specific data for this category, the ERT recommends that Portugal work with liquid fuel suppliers to develop country-specific EFs for these fuels. The ERT recommends that the Party include the updated EFs together with transparent explanation of the method used to derive them in its next annual submission.

Oil and natural gas: natural gas – CO_2 and CH_4

48. In its 2011 annual submission, Portugal has stated that emissions from compressor stations are included under fugitive emissions from natural gas. In response to a question raised by the ERT during the review, the Party confirmed that there is only one compressor station in Portugal, which is powered by a co-generation plant and, therefore, the emissions are included under stationary combustion. The ERT recommends that Portugal clarify the allocation of these emissions in its next annual submission.

49. Fugitive emissions from natural gas transmission and distribution and from Portugal's regasification plant are reported together in the CRF tables under natural gas transmission. The methodology, AD and EFs used are different for each of these subcategories. In response to a question raised by the ERT during the review, Portugal was able to provide a time series of estimates for each subcategory. The ERT recommends that Portugal report these estimates separately in its next annual submission.

50. According to the information provided by Portugal during the review, the time series for fugitive emissions from natural gas distribution varies significantly. For example, emissions of 26.0 Gg CH_4 are estimated for 2003, no emissions are estimated for 2005 and 2006, while emissions of 23.2 Gg CH_4 are estimated for 2009. This variation is due to the AD, estimated as the difference between the losses of natural gas from the system reported in the energy balance and the estimated losses during transmission and from the regasification plant. To improve the accuracy and time-series consistency of the estimates, the method could be updated so that pipeline length is used as the AD together with an IPCC default EF. A preliminary estimate using publicly available data on pipeline length and default EFs from the IPCC good practice guidance resulted in emission estimates of between 7.5 Gg CH_4 and 10.3 Gg CH_4 for this category. The ERT recommends that Portugal update the method used to estimate emissions from natural gas distribution, as outlined above or using another methodology in accordance with the IPCC good practice guidance.

4. Non-key categories

Road transportation: liquid fuels – CH_4 and N_2O

51. Portugal has reported on the differences between the fuel consumption emissions derived from the COPERT IV model and those derived from the energy balance (NIR section 3.3.3.2.6, page 3-124). These differences were 46 per cent for diesel and 31 per cent for gasoline for 2008. To ensure completeness, the fuel consumption emissions derived from the COPERT IV model are corrected to ensure consistency with the data from the energy balance. In response to a question raised by the ERT during the review, Portugal confirmed that these differences have triggered a review of the COPERT IV model inputs, specifically the composition of the vehicle fleet. The Party is taking steps to review and, if appropriate, update these data in future annual submissions. The ERT supports Portugal's use of QA/QC tools to prioritize inventory improvements and recommends that Portugal report on the outcome of this review in the next annual submission.

Other (energy sector): liquid fuels – CO_2, CH_4 and N_2O

52. Emissions from military navigation and military ground transport are not reported separately in the NIR. These emissions are included elsewhere under fuel combustion. The ERT encourages Portugal to investigate whether data are available to estimate and report emissions from military navigation and military ground transport separately in its next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

53. In 2009, emissions from the industrial processes sector amounted to 5,202.51 Gg CO_2 eq, or 7.0 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 298.23 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Since 1990, emissions have increased by 10.7 per cent in the industrial processes sector, and decreased by 13.9 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is the increase in emissions from consumption of halocarbons and SF_6: between 1995 (the first year with estimates) and 2009, emissions increased by 1,735.2 per cent (by 1,054.82 Gg CO_2 eq). Between 1990 and 2009, emissions from chemical industry decreased by 81.1 per cent (by 979.79 Gg CO_2 eq). Within the industrial processes sector, 73.8 per cent of the emissions were from mineral products, followed by 21.4 per cent from consumption of halocarbons and SF_6 and 4.4 per cent from chemical industry. The remaining 0.3 per cent were from metal production.

54. Portugal has made recalculations for the industrial processes sector between the 2010 and 2011 submissions in response to the revision of the AD time series and due to methodological changes. The impact of these recalculations on the industrial processes sector is a decrease in emissions of 0.2 per cent (12.36 Gg CO_2 eq) for 2008 and an increase in emissions of 1.9 per cent (88.29 Gg CO_2 eq) for 1990. The impact on total GHG emissions is a decrease of 0.03 per cent for 2008 and an increase of 0.1 per cent for 1990. The main recalculations took place in the following categories:

(a) Mineral products (see paras. 57 and 59 below);

(b) Chemical industry (see para. 63 below);

(c) Metal production (see para. 68 below).

55. Portugal has also made recalculations for the solvent and other product use sector between the 2010 and 2011 submissions following changes in the AD time series due to the use of national statistics which were made available during 2010. The impact of these recalculations on the solvent and other product use sector is an increase in emissions of 6.3 per cent for 2008 and of 4.3 per cent for 1990 (an increase of 0.02 per cent in total GHG emissions for 2008 and of 0.02 per cent for 1990).

56. Portugal has improved the accuracy of its emission estimates by using higher-tier methods and collecting AD directly from the production plants. The main improvements relate to the emission estimates for cement production and lime production for the years 2005–2009.

2. Key categories

Cement production – CO_2

57. In its 2011 annual submission, Portugal has changed the estimation methodology used for the period 2005–2009 from a tier 2 to a tier 3 method using data from the EU ETS.

The calculation of the emissions is based on the carbonate content of the process inputs (including fly ash and blast furnace slag) and the cement kiln dust and bypass dust deducted from the raw material consumption (tier 3). For the period 2005–2009, the carbonate content and raw materials data are obtained from the EU ETS, and for the period 1990–2004 the data are extrapolated backwards based on the clinker production (data received directly from each industrial plant for the years 1990–2009). The Party compared the sum of the information received from each individual plant with the data in the INE National Statistical Database in order to check the consistency of the AD. The ERT welcomes the efforts made by Portugal to improve the accuracy of its emission estimates.

58. However, for the period 1990–2004, the emissions were estimated based on a simple backcasting methodology using the clinker production time series provided directly by the cement production plants as a driver, but the Party has not provided a clear explanation of this methodology in the NIR. The ERT recommends that Portugal provide additional descriptions of the estimation methodologies used for the period 1990–2004, in order to improve the transparency of its next annual submission.

Lime production – CO_2

59. In its 2011 submission, Portugal has changed the estimation methodology used for lime production to a tier 3 methodology. The calculation of the emissions is based on the amount of calcium carbonate and magnesium carbonate in the raw materials consumed: for the period 2005–2009, the data were obtained from the EU ETS, while for the period 1990–2004, the data were extrapolated backwards based on the lime production time series using data from INE.

60. The AD were obtained from different data sources for different time periods. Portugal made efforts to collect the AD directly from industry and by using national statistics. Lime production data for the period 1990–2009, except for the iron and steel and paper and pulp industries, were obtained from INE. Data on lime production in the iron and steel industry were received from the industry for the period 1991–1994; for the years 1990 and 1995–2001 the lime production data were estimated based on energy consumption as a surrogate indicator, and no lime has been produced since 2002. In the paper and pulp industry, lime production data are not available and were therefore estimated based on limestone and dolomite consumption data from INE and on assumptions regarding the stoichiometric ratios of limestone and dolomite rock.

61. The ERT welcomes the efforts made by Portugal to improve the accuracy of its emission estimates for this category and encourages the Party to continue its efforts to collect AD directly from production plants and INE for the years currently estimated using estimated AD in its next annual submission.

62. According to page 4-9 of the NIR, it is possible that there is some double counting of CO_2 emissions in this category, if part of the quicklime that is produced in an industrial unit is sold and used again to produce slacked lime or hydraulic lime in a different industrial plant. The ERT recommends that Portugal make further efforts to address this issue and avoid any possible double counting of emissions in this category in its next annual submission.

Ammonia production – CO_2

63. The NIR indicates that the only plant still manufacturing ammonia ceased production in 2009. In CRF table 2(I).A–G, Portugal has reported the AD as confidential ("C") but has reported the CO_2 emissions. New data provided by the plant led to recalculations of the emissions for the period 1990–2008: for 2008, the CO_2 emissions

decreased by 78.54 Gg (by 12.0 per cent for the category). The ERT recommends that Portugal report additional information on this recalculation in its next annual submission.

Ozone-depleting substances substitutes – HFCs

64. As indicated in the previous review report, Portugal identified, in its 2010 NIR, the incorporation of additional sources of F-gases in the inventory as a planned improvement. However, the Party has not incorporated these additional sources in its 2011 submission and has classified the activities related to the assessment of the completeness of F-gas emissions as low priority in its inventory improvement plan. The ERT noted that other reporting Parties report emission estimates for these subcategories and species (e.g. for refrigeration and air-conditioning equipment (HFC-23 and HFC-152a), fire extinguishers (HFC-125 and HFC-236fa), aerosols/metered dose inhalers (HFC-152a) and solvents). The ERT recommends that Portugal assess the completeness of its reporting of actual HFC emissions for consumption of halocarbons and SF_6 and either provide estimates or justify why the emissions do not occur in its next annual submission.

3. Non-key categories

Ferroalloys production – CO_2

65. Portugal continues to estimate emissions from ferroalloys production based on constant production from data for the year 1990. The use of constant AD over the entire time series (1990–2009) is not in line with the IPCC good practice guidance. According to data from the US Geological Survey, there is only one main producer of ferroalloys in Portugal, Eurominas Electormetalurgia S.A.R.L, with a production capacity of 100 kt per year. In the third phase of the EU ETS (2013–2020), ferroalloys production will be included in the scope of the EU ETS when the total rated thermal input exceeds 20 MW.[7] In accordance with the provisions of Article 9a of EU directive 2009/29/EC, competent authorities had to collect verified emissions from the operators of installations that will be included in the third phase of the EU ETS by 30 April 2010. Thus, verified emissions from ferroalloys production should be available for Portugal through this data collection exercise from 2010 onwards, at least for the more recent years of the time series.

66. The ERT included the issue of the constant AD for ferroalloys production in its list of potential problems and further questions raised during the review, because the ERT considered that the CO_2 emission estimates were not in line with the IPCC good practice guidance. In its response, Portugal clarified that all ferroalloys production ceased before 1990 and, accordingly, the Party reported its CO_2 emission estimates for ferroalloys production as "NO" for every year in the period 1990–2009 in its revised estimates submitted on 24 October 2011. The ERT recommends that Portugal explain this update in its next annual submission.

Iron and steel production – CO_2

67. As indicated in the previous review report, for the period 1990–2004 Portugal uses AD that are mainly based on interpolated or proxy data for the estimation of emissions from iron and steel production. The ERT reiterates the encouragement from the previous review report that Portugal make efforts to find appropriate statistical data for the whole time series

[7] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community.

or use plant-specific data and report its emission estimates accordingly in its next annual submission.

68. Portugal has used EU ETS data for the estimation of CO_2 emissions from iron and steel production for the period 2005–2009 and has recalculated its estimates for the period 2005–2008. The recalculations resulted in an increase in CO_2 emissions from iron and steel production of 8.13 Gg (or 60.6 per cent) for 2008. To increase transparency, the ERT recommends that Portugal report additional information on this recalculation, including how the Party ensures the consistency of the time series 1990–2009, in its next annual submission.

D. Agriculture

1. Sector overview

69. In 2009, emissions from the agriculture sector amounted to 7,796.39 Gg CO_2 eq, or 10.4 per cent of total GHG emissions. Since 1990, emissions have decreased by 3.0 per cent (by 239.61 Gg CO_2 eq). Between 1990 and 2009, the key drivers for the fall in emissions are the decline in agricultural production and the decrease in the use of fertilizers: N_2O emissions from the category direct soil emissions decreased by 30.5 per cent (by 438.40 Gg CO_2 eq) and indirect emissions decreased by 17.7 per cent (by 233.70 Gg CO_2 eq), although emissions from non-dairy cattle increased by 27.5 per cent (by 283.00 Gg CO_2 eq). Within the sector, 37.3 per cent of the emissions were from agricultural soils, followed by 36.7 per cent from enteric fermentation and 20.3 per cent from manure management. Rice cultivation accounted for 5.3 per cent, and the remaining 0.5 per cent were from field burning of agriculture residues.

70. Portugal has made recalculations for the agriculture sector between the 2010 and 2011 submissions in response to the 2010 annual review report, including: the reallocation of N_2O emissions from organic matter when soil is converted to cropland, as recommended in the previous review report (until the 2010 annual submission these emissions were reported under agricultural soils for the period 1990–2008); changes in the slaughtering values for several animal types for 2008, the milk production for dairy cattle for 2008, the crop area and crop production for the years 2004–2008 and the apparent consumption of fertilizers for the years 2005–2008; and in order to rectify an identified estimation error for poultry for the years 2001–2008. The impact of these recalculations on the agriculture sector is an increase in emissions of 0.7 per cent for 2008 and a decrease in emissions of 0.03 per cent for 1990 (the impact on total GHG emissions is an increase of 0.07 per cent for 2008 and a decrease of 0.003 per cent for 1990). The main recalculations took place in the category N_2O emissions from agricultural soils (direct and indirect soil emissions) for the years 1990–2008 (see paras. 89 and 92 below).

71. In general, the inventory for the agriculture sector is complete in terms of categories and gases, and estimates have been reported for all years of the time series. No categories have been reported as "NE", except for CH_4 emissions due to direct and indirect emissions from agricultural soils, for which no EFs are provided in the IPCC good practice guidance. Portugal explained that emissions from prescribed burning of savannas and from other do not occur, and have therefore been reported as "NO". The ERT identified a potential incompleteness issue regarding the emissions from agricultural soils due to the application of sewage sludge as a soil amendment. This issue was included in the list of potential problems and further questions raised by the ERT during the review. The ERT considers that Portugal, in its response, has resolved this issue (see paras. 93–95 below).

72. In general, the NIR is transparent in terms of the reporting of methods, emissions and data. However, the ERT noted a lack of background information supporting the use of

some of the IPCC parameters or those derived from IPCC default values (see paras. 79, 85 and 87 below), as well as the lack of a rationale supporting the assumptions applied to the methods and EFs (see paras. 80 and 96 below) and inconsistencies in the information provided in the NIR and in the CRF tables or between the NIR and the CRF tables (see paras. 82–84, 86, 88, 90 and 91 below). The ERT recommends that Portugal enhance the transparency of its NIR by providing this information and ensuring consistency between the NIR and the CRF tables.

73. The ERT also noted that the references for the data used are not always reported in a transparent manner in the NIR. For example, the data sources in NIR table 6.4 have not been reported and the references to IPCC default values are sometimes incomplete because the NIR does not distinguish between the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Portugal improve the transparency of these issues in its next annual submission. The ERT reiterates the recommendation in the previous review report that the Party provide more recent information on the AD and EFs used within the sector, including the rationale for their selection, and information to justify the use of country-specific parameters and methods in its next NIR.

74. The uncertainty analysis has been carried out by category using a tier 1 methodology and IPCC default values for the uncertainties of the AD and EFs, or using country-specific uncertainty values derived from non-scientific assumptions. As in the previous review report, the ERT encourages Portugal to develop and include country-specific uncertainty values for the AD and EFs for the key categories and to document them in the NIR.

75. The ERT reiterates the recommendations from previous review reports that Portugal, in its next annual submission: develop a country-specific EF for indirect N_2O emissions from anaerobic lagoons; develop country-specific values for feed digestibility for cattle for enteric fermentation; and implement measures to avoid the need to conduct frequent recalculations of the consumption of mineral N fertilizers, including any recalculations undertaken and their impact on time-series consistency and the emissions trend.

2. Key categories

Enteric fermentation – CH_4

76. Portugal has used a tier 2 methodology with country-specific EFs to estimate CH_4 emissions from enteric fermentation for all livestock except for horses, mules and asses, for which an IPCC tier 1 method has been used, and for dairy cows (see para. 77 below). This is not in line with the IPCC good practice guidance.

77. Portugal has estimated the CH_4 EF for dairy cows using a regression equation derived from IPCC default EFs per region and based on annual milk production. This method is in line with the IPCC good practice guidance, which recommends the adjustment of the default EFs when the Party's characteristics are significantly different from the IPCC default EFs. The Party has classified its method as a tier 2 method, but the ERT disagrees with this classification because the EF has not been developed in line with equation 4.14 of the IPCC good practice guidance. As CH_4 emissions from dairy cows contribute significantly to the emissions from this category, the ERT recommends that Portugal use an appropriate tier 2 method to estimate CH_4 emissions from dairy cows in its next annual submission.

78. Young animals under weaning age are taken into account in the estimates of CH_4 emissions from enteric fermentation. As rumen function is absent in this category of herbivore livestock, the ERT recommends that Portugal improve its livestock characterization by excluding young animals under weaning age from the appropriate livestock subcategories in its next annual submission.

79. Portugal has used a tier 2 method from the IPCC good practice guidance to develop the country-specific EFs for sheep, goats and non-dairy cattle. The coefficients used to calculate the net energy per metabolic function (e.g. the coefficients to distinguish between animal categories (C_{fi}), feeding situation (C_a) or pregnancy ($C_{pregnant}$)) and the methane conversion rate (Y_m) were not always the IPCC default values. In response to a question raised by the ERT during the review, Portugal explained that the coefficients are derived from IPCC default values revised based on country-specific information, and provided this information to the ERT. The previous review report identified a transparency issue with regard to the reporting of the method used by Portugal to develop the country-specific EFs and recommended that the Party include the detailed background data used for the calculation of its EFs for the whole time series in the next NIR, in order to improve the transparency of the methods used to estimate emissions from sheep and non-dairy cattle. The ERT reiterates this recommendation for sheep, non-dairy cattle and goats. In addition, the IPCC good practice guidance provides different values for Y_m for mature sheep and young sheep. However, the Party used the same value from the Revised 1996 IPCC Guidelines for all sheep. The ERT recommends that Portugal use updated values of Y_m from the IPCC good practice guidance for sheep in its next annual submission.

80. The country-specific EFs for goats have been calculated by adapting the tier 2 method for sheep from the IPCC good practice guidance. However, Portugal has not provided any scientific rationale for assimilating goats with sheep; the two species do not have the same digestive system. The ERT encourages the Party to use an enhanced method for the estimation of CH_4 emissions from goats which is better suited to the digestive system of goats.

81. The equation used to calculate the net energy for work for non-dairy cattle is from the IPCC good practice guidance. This equation, as reported in the page 6-10 of the NIR, is not the same as equation 4.6 in the IPCC good practice guidance (Portugal is missing one term of the equation, the number of hours worked per day). In response to a question raised by the ERT during the review, Portugal explained that this is due to a mistake. The ERT recommends that the Party improve its QA/QC activities to ensure the accuracy of its reporting in the NIR and correct the calculations for this category in its next annual submission.

82. The Party has not used the information in the NIR to correctly complete CRF table 4.A (additional information). For example, the feeding situation for many livestock types and the weight of dairy cattle are reported as "NE", and the weight of young cattle is not reported (left blank). The ERT recommends that Portugal enhance the transparency of the reporting in the CRF tables and the consistency between the NIR and the CRF tables by completing consistently the information required in CRF table 4.A (additional information) in its next annual submission.

83. The ERT noted that Portugal has again reported recalculations of CH_4 emissions for enteric fermentation due to the correction of an estimation error for poultry (NIR page 6-28, section 6.3.1.7) but, as indicated in the previous review report, the CH_4 emissions for poultry are reported as "NO" for this category in the CRF tables. The ERT also noted that, in page 6-1 of the NIR, Portugal has reported that enteric fermentation is the most important category of GHG emissions from the agriculture sector in 2009, but figure 6.2 in the NIR and the values reported in the CRF tables indicate that the most important category is agricultural soils. The ERT reiterates the recommendation in the previous review report that Portugal improve its QA/QC activities to ensure consistent reporting between the NIR and the CRF tables.

Manure management – CH_4

84. Portugal has used a tier 2 method from the IPCC good practice guidance with country-specific data to estimate emissions from this category, which is in line with the IPCC good practice guidance. However, the country-specific EFs developed by the Party are not provided in the NIR and are not compared with the IPCC default EFs. The ERT recommends that Portugal improve the transparency of the NIR and its QA/QC activities when reporting these EFs and comparing them to the IPCC default EFs.

85. The IPCC good practice guidance suggests a range (0–100 per cent) as the default value for the methane conversion factor (MCF) for manure treated in anaerobic lagoons for all climates. For this parameter, Portugal has used default values of 45 per cent and 39 per cent for temperate and cool regions, respectively, but no justification has been provided in the NIR. The ERT recommends that Portugal improve the transparency of the NIR by providing the background information supporting the values used for the MCF in its next annual submission.

86. The ERT identified some inconsistencies in the allocation of livestock by climate region in CRF table 4.B(a). For example, for 2009, CRF table 4.B(a) reports an allocation for non-dairy cattle of 25.5 per cent for cool climate regions and 74.5 per cent for temperate regions, while the additional information table (in sheet two of CRF table 4.B(a)) reports shares of 24.0 per cent and an 76.0 per cent, respectively. In response to a question raised by the ERT during the review, Portugal explained that different estimation methods are used to determine the allocation of livestock for each of the above-mentioned tables. Since the two CRF tables are complementary, the ERT recommends that the Party use a single method for the allocation of livestock by climate region and manure management system to ensure consistency between the tables under CRF table 4.B(a).

87. Portugal has improved the transparency of the NIR regarding the explanation of the difference between the IPCC default and country-specific manure management CH_4 EF for swine. The ERT welcomes this effort made by the Party in response to recommendations from the previous review report.

Direct soil emissions – N_2O

88. The method used by Portugal to estimate N_2O emissions from agricultural soils is a combination of tier 1a and tier 1b methods from the IPCC good practice guidance. This is in line with the IPCC good practice guidance. The ERT noted that the Party has reported two different values for the fraction of livestock N excreted and deposited onto soil during grazing ($Frac_{GRAZ}$) for the estimation of direct emissions from agricultural soils: 0.28 in the NIR and 0.53 in CRF table 4.D. In response to a question raised by the ERT during the review, Portugal indicated that the correct value is the one in CRF table 4.D (0.53). This parameter is estimated by dividing the total amount of N excreted during pasture by the total amount of N excreted. This implies that Portugal did not adjust the total amount of N excreted during pasture for the N that has already been lost as N_2O, ammonia or nitrogen oxide. This mean that $Frac_{GRAZ}$ = total amount of N excreted during pasture $(1–Frac_{GASM})$/total amount of N excreted. The ERT recommends that the Party, in its next annual submission, use the appropriate formula to calculate $Frac_{GRAZ}$ and improve its QA/QC activities to ensure consistency between the NIR and the CRF tables.

89. On page 6-73 of its NIR, Portugal has explained that the recalculations of N_2O emissions for 2008 for this category include revisions to crop areas, crop production and the apparent use of fertilizer. For 2008, the recalculations resulted in an increase in N_2O emissions from direct soil emissions by 3.4 per cent.

90. Some inconsistencies were detected between the CRF tables and the NIR with regard to the reporting of the recalculations of agricultural soil emissions. Portugal has

reported on pages 6-73 and 6-82 of its NIR that the recalculations of direct and indirect N_2O emissions from agricultural soils for 2008 are the consequence of, inter alia, recalculations of N_2O emissions from manure management due to updated milk production data for dairy cows and the correction of an error for poultry, but that these recalculations do not affect direct and indirect N_2O emissions from agricultural soils. In response to a question raised by the ERT during the review, Portugal indicated that the updated milk production data and the correction for poultry were mistakenly included in the causes of the recalculations for agricultural soils. The ERT recommends that Portugal improve its QA/QC activities to ensure consistent reporting between the NIR and the CRF tables and the accuracy of information provided on the impact of the recalculations in its next annual submission.

Indirect emissions – N_2O

91. N_2O emissions from the release of N from organic matter in soils are not reported in a transparent manner in the NIR as the information related to this issue is not consistent. Page 6-1 of the NIR indicates that these emissions are discussed in the LULUCF chapter, although these emissions are reported under the agriculture sector in CRF table 4.D. However, page 6-74 of the NIR indicates that N_2O direct soil emissions have been reclassified (excluded from the agriculture sector) following a recommendation in the previous review report. In response to a question raised by the ERT during the review, Portugal confirmed that the reclassification had been carried out. The ERT therefore recommends that the Party improve its QA/QC activities to ensure consistent reporting in the NIR.

92. On page 6-82 of its NIR, Portugal has explained that the recalculations of indirect N_2O emissions for 2008 include revisions to crop areas, crop production and the apparent use of fertilizer. For 2008, the recalculations resulted in an increase in indirect N_2O emissions of 2.2 per cent.

93. On page 6-54 of its NIR, Portugal has reported that emissions due to the application of sewage sludge as a soil amendment are not included in the inventory as there are no reliable statistics for this activity, which is considered negligible by the Party. The NIR also states that all N from sewage sludge is included under the waste sector. However, the ERT found several sources that report on significant sewage sludge application on agricultural soils in Portugal, including a report prepared for the European Commission.[8] Despite the general statement provided in the NIR that all N from sewage sludge is included under the waste sector, the NIR and the CRF tables do not provide transparent information on the pathways of sewage sludge discharge in Portugal, how the N_2O emissions related to these discharge pathways were calculated and in which categories these estimates were included.

94. N_2O emissions from sewage sludge from industrial wastewater treatment are reported as "IE" in CRF table 6.B and the NIR only describes the estimation of N_2O emissions from wastewater treatment, not from sewage sludge disposal. N_2O emissions from human sewage are estimated based on equation 15 from the Revised 1996 IPCC Guidelines (volume 6, page 6.28), which considers that the amount of protein consumed determines the quantity of N contained in sewage. However, this equation does not include emissions from the disposal of sewage sludge either. For CH_4 emissions, the NIR provides some information on sewage sludge spreading under the section on wastewater, but not for N_2O emissions. Thus, the ERT could not find transparent information in the NIR that

[8] Milieu Ltd, WRc and RPA. 2010. *Environmental, Economic and Social Impacts of the Use of Sewage Sludge on Land, Part III*. Available at <http://ec.europa.eu/environment/waste/sludge/pdf/part_iii_report.pdf>.

supports the statement that N_2O emissions from sewage sludge used in agriculture are included in the estimation of emissions from wastewater and, therefore, this issue is considered as a potential underestimation of emissions.

95. The potential underestimation of emissions described in paragraph 94 above was included in the list of potential problems and further questions raised by the ERT during the review. In its response, Portugal indicated that the statement on page 6-54 of the NIR that emissions due to the application of sewage sludge as a soil amendment are not included in the inventory is incorrect, and should read that the emissions are not estimated separately due to the unavailability of, or poor, data. Portugal also confirmed that all N from sewage sludge is included in the emissions for the waste sector, both for domestic and commercial wastewater and for industrial wastewater. The ERT considers that this issue has been resolved, but recommends that the Party correct the information provided in the NIR and increase the transparency of its next NIR by transparently explaining, in the agriculture chapter of the NIR, that: sewage sludge application on agricultural soils occurs in Portugal; N_2O emissions due to this practice are not estimated due to the unavailability of, or poor, data on sewage sludge application on agricultural soils; and that all N from sewage sludge is included under the waste sector. In this context, CRF table 4.D as currently completed is not consistent with the NIR, as the notation key used to report N_2O emissions from the subcategory other direct emissions ("NO") is not correct. The appropriate notation key should be "IE". The ERT recommends that Portugal, in its next annual submission, collect AD for sewage sludge application on agricultural soils in order to estimate N_2O emissions, or, if that is not possible, correct the notation key and improve the explanations provided in the NIR.

3. Non-key categories

Manure management – N_2O

96. Portugal has used a tier 1 method to estimate N_2O emissions from manure management. Previous review reports indicated that the country-specific N excretion rate for swine is lower than the IPCC default value, and recommended that Portugal verify the value and, if unchanged, justify its use in the following annual submission. The ERT reiterates the recommendation made in the previous review report. As the N excretion rate for sheep is also lower than the IPCC default value, the ERT extends the recommendation to sheep.

E. Land use, land-use change and forestry

1. Sector overview

97. In 2009, net removals for the LULUCF sector amounted to 14,094.56 Gg CO_2 eq. Since 1990, net removals have increased by 51.1 per cent. The key driver for the rise in removals is the 173.1 per cent increase in net removals from forest land remaining forest land. Within the sector, net removals of 14,808.66 Gg CO_2 eq were from forest land, followed by 958.32 Gg CO_2 eq from other land, 592.19 Gg CO_2 eq from grassland and 419.97 Gg CO_2 eq from other, while net emissions of 1,784.09 Gg CO_2 eq were from settlements, followed by 511.27 Gg CO_2 eq from wetlands and 389.22 Gg CO_2 eq from cropland.

98. The LULUCF sector reduced Portugal's total GHG emissions by 18.9 per cent for 2009. The most important gas by far was CO_2; the combined emissions of CH_4 and N_2O reduced the CO_2 net removals by 0.4 per cent in terms of CO_2 eq. Since 1990, the biggest relative increases have occurred in settlements (312.8 per cent), followed by forest land (100.2 per cent), wetlands (54.1 per cent) and grassland (21.9 per cent), while the biggest

relative decreases have occurred in other (LULUCF) (78.0 per cent), cropland (65.8 per cent) and other land (33.5 per cent).

99. Portugal has generally used tier 2 methods from the IPCC good practice guidance for LULUCF to estimate GHG emissions and carbon stock changes, except for other (harvested wood products) and other land (Portugal has defined other land as the aggregation of settlements, wetlands and other land), which were estimated using tier 1 methods. The CO_2 EFs were a combination of IPCC default and country-specific EFs for all categories except other (LULUCF), for which default EFs only were used. The Party used IPCC default methods and EFs for the calculation of CH_4 and N_2O emissions from forest land.

100. Portugal has made recalculations for the LULUCF sector between the 2010 and 2011 submissions in response to the 2010 review report and in order to rectify identified errors. The ERT notes that the recalculations reported by Portugal of the time series 1990–2008 have been undertaken to take into account the consistency and accuracy of the reporting of land areas and their conversions by means of the CORINE land cover cartography, and by disaggregating the cropland category into subcategories. For 2008, the impact of these recalculations on the LULUCF is an increase in net GHG removals of 354.9 per cent (from 2,957.53 Gg CO_2 eq to 13,454.36 Gg CO_2 eq). For 1990, the impact is an increase in net GHG removals of 308.6 per cent (from net emissions of 4,471.53 Gg CO_2 eq to net removals of 9,325.90 Gg CO_2 eq). Recalculations took place in all LULUCF categories.

101. The reporting of the LULUCF sector and the information provided on KP-LULUCF activities is incomplete due to a lack of information on the autonomous regions of Azores and Madeira (see para. 10 above). In response to a question raised by the ERT during the review, Portugal asserted that it is undertaking measures to incorporate the autonomous regions into the national inventory of emissions and removals from LULUCF activities both under the Convention and under the Kyoto Protocol. The ERT strongly reiterates the recommendation from the previous review report that Portugal include emissions and removals from the LULUCF sector for these regions in its next annual submission.

102. In its 2010 submission, Portugal reported CO_2 emissions and removals from the category other (LULUCF) as "NO", and reported N_2O emissions of 0.01 Gg for 2008. However, in its 2011 submission, Portugal has reported CO_2 removals from the category other of 426.22 Gg and has reported N_2O emissions as "NO" for 2008. The Party reported CO_2 emissions from grassland remaining grassland and wetlands remaining wetlands as "NE, NO" and "NO", respectively, for 2008 in its 2010 submission, while the Party has reported CO_2 emissions of –829.09 Gg and 81.50 Gg, respectively, in its 2011 submission.

103. The major improvement in the LULUCF sector has been the new approach to the more accurate identification and quantification of land-use areas and their conversions by means of cartographic surveys. This approach has facilitated the construction of land-use matrices, particularly those required for the reporting under the Kyoto Protocol. The disaggregation of the land-use categories forest land and cropland into subcategories (as recommended in the previous review report) has been implemented and reported in the 2011 annual submission.

104. The LULUCF sector of the inventory is much more transparent in the 2011 annual submission than in the 2010 annual submission. Portugal has implemented most of the recommendations from the previous review report and has satisfactorily explained many of the issues raised during the 2011 review. The recommendations addressed by Portugal in relation to the LULUCF sector include:

(a) The clarification of the origin of the GHG emissions from the burning of dead wood in forest land remaining forest land and its appropriate reporting;

(b) The revision of land-uses for some of the IPCC land-use categories to account for the effect of large forest fires in 2003 and 2005;

(c) The description of the methods and assumptions applied to the identification of land uses and their conversion by using an updated cartographic methodology for conterminous Portugal. This methodology compares two cartographic products: one for 1990 and the other for 2006. As a result of the comparison, Portugal estimated the areas of each broad land-use class: forest land, agriculture (cropland and grassland) and other land (wetlands, settlements and other land). The total areas corresponding to intermediate years were obtained by direct interpolation, which resulted in a constant variation rate of the area among the years of the time series. The trend derived for 1990–2006 was considered constant for the periods 1970–1989 and 2007–2009;

(d) The construction of a land-use and land-use conversion matrix on the basis of the recalculation of land areas using an updated cartographic methodology;

(e) The description of the biomass expansion factors used for the estimation of the changes in biomass carbon stocks in the category forest land;

(f) The replacement of the constant values used for the area and carbon stock change per unit area for many carbon pools in several categories (e.g. the net carbon stock change in living biomass in land converted to forest land for the period 1990–2009). The new values are based on a new approach to estimate land-use areas and their conversions;

(g) The inconsistent distribution of cropland among many subcategories, which was identified by Portugal as an editorial error to be amended in its 2012 annual submission. The ERT recommends that the Party implement this amendment by its next annual submission;

(h) The improbable conversion of wetlands and settlements to forest land, cropland or grassland.

2. Key categories

Forest land remaining forest land – CO_2

105. Net CO_2 removals from forest land remaining forest land amounted to 12,744.45 Gg CO_2 for 2009. This sink represented 82.3 per cent of the total net CO_2 removals from forest land (15,489.98 Gg CO_2).

106. The transparency of the reporting has been improved since the 2010 annual submission. Several transparency issues raised by the previous ERT have been addressed in the current annual submission, namely:

(a) The explanation of the negative values reported for the carbon stock changes in mineral soils in forest land remaining forest land, which were the consequence of the Party's use of a 20-year transition period for the complete conversion of some forest types to other forest types. In the 2011 annual submission, Portugal explained that those negative values resulted from the method used by the Party, whereby one twentieth of the carbon stock changes were attributed to a nominally unchanged land-use every year, which allows the possibility that an average carbon stock change may be negative;

(b) The reporting of changes in the dead organic matter and soil organic carbon pools, which in the previous annual submission were assumed to be not occurring.

Land converted to forest land – CO_2

107. Compared with the 2010 annual submission, Portugal has improved the transparency of the information on this category. Several transparency issues raised in the previous review report have been addressed in the current inventory, namely:

(a) The constant annual rate of the area of land converted to forest land is the result of a methodological approach used for the estimation of land-use areas and their conversions since 2009;

(b) The constant values reported in the 2010 submission for each of the net carbon stock changes in living biomass per area, the net carbon stock changes in dead organic matter per area (–0.065 Mg C/ha) and the net carbon stock changes in mineral soils per area (0.314 Mg C/ha) for the whole time series (1990–2008) have been recalculated and are no longer constant. Further, the original 14-year period used by the Party for the completion of any land-use change was replaced by the IPCC default 20-year transition period, following a recommendation in the previous review report.

Cropland remaining cropland – CO_2

108. Compared with the 2010 submission, Portugal has improved the transparency of the information on this category. Several transparency issues raised both in the previous review report and in the current one have been addressed either in the current inventory or in replies by Portugal to questions raised by the ERT during the 2011 annual review. However, there are some issues that have not yet been addressed, including:

(a) Removals of CO_2 increased steadily from 1990 until 1999, when they began to decrease steadily until 2009. The Party has not provided an explanation for this trend in the 2011 NIR. The ERT recommends that Portugal clarify this trend in its next annual submission;

(b) An editorial error in the percentage shares reported for the distribution of various types of cropland and grassland, such that the sum of the relative areas of those land uses is greater than 100 per cent. The ERT recommends that Portugal amend this error in its next annual submission.

109. In CRF table 9(a), Portugal has reported CO_2 emissions from cropland remaining cropland as "NE", but in CRF table 5.B the Party has reported emission estimates. The ERT recommends that Portugal resolve this inconsistency in its next annual submission.

Land converted to cropland – CO_2

110. Compared with the 2010 annual submission, Portugal has improved the transparency of the information on this category. In its 2010 submission, the Party reported as constant the area, net carbon stock changes in living biomass per area, net carbon stock changes in dead organic matter per area (–0.122 Mg C/ha) and net carbon stock changes in mineral soils per area of land converted to cropland for the period 1990–2008. In its 2011 annual submission, Portugal has recalculated these values and, as a result, they are no longer constant.

Grassland remaining grassland – CO_2

111. The Party reported the living biomass carbon pool as "NO". In CRF table 9(a) Portugal has reported CO_2 emissions from grassland remaining grassland as "NE", but in CRF table 5.C the Party has reported emission estimates. The ERT recommends that Portugal resolve this inconsistency in its next annual submission.

Land converted to grassland – CO_2

112. The trend for the period 1990–2009 for net CO_2 emissions from cropland converted to grassland (a sink throughout) shows an increase in CO_2 removals between 1990 and 1995, followed by fairly constant values until 1999, and a noticeable decrease in removals thereafter. The ERT recommends that Portugal explain this behaviour in the trend in its next annual submission.

Settlements – CO_2

113. For 2009, settlements remaining settlements was a net source, with CO_2 emissions of 433.24 Gg CO_2. This subcategory was a net sink for 1990 (104.06 Gg CO_2), but emissions increased steadily thereafter and it became a net source.

114. The previous review report recommended that Portugal provide detailed explanations for the estimation of the carbon stock changes in all carbon pools. The Party has addressed these transparency issues in its 2011 annual submission. The ERT commends Portugal for this improvement in transparency.

3. Non-key categories

Wetlands remaining wetlands – CO_2

115. Transparency issues in relation to the Party's reporting, as noted by previous review reports and in the current review, were satisfactorily addressed in the course of the current review. The ERT noted a significant inter-annual variation in the net carbon stock changes in dead organic matter per area reported for 1999/2000 and in the net carbon stock changes in soils per area reported for the period 1990–2006. The ERT also noted a shift in the rates of change in the carbon stock in soils per area from positive in 1990 to negative in 2006: the 1990 value (0.22 Mg C/ha) decreased by 166 per cent compared with the 2009 value (–0.18 Mg C/ha). The ERT further noted that Portugal has reported emissions and removals from wetlands, settlements and other land separately in the CRF tables but aggregately in the NIR. The ERT considers that the aggregated reporting of land-use categories is not in line with the IPCC good practice guidance for LULUCF and, therefore, the ERT recommends that Portugal report each land-use category separately in the NIR of its next annual submission.

Land converted to wetlands – CO_2

116. Land converted to wetlands was a net source, with CO_2 emissions of 431.48 Gg CO_2 for 2009. The time series (1990–2009) for net CO_2 emissions from land converted to wetlands shows a decrease between 1990 and 1994/1995, followed by steady increase until 2009. To increase transparency, the ERT recommends that Portugal explain this trend in its next annual submission.

Other land – CO_2

117. The assessment of the removals from land converted to other land poses a serious problem of transparency, because the ERT has found it problematic to establish the true composition of the category other land. Table 7.6 of the NIR (page 7-9) indicates that other land is composed of the subcategories shrubland and other land. In section 7.4.2 (page 7-26) of the NIR, the categories wetlands, settlements and other land are aggregated into a land-use category denominated as other land. In the NIR, the title of section 7.4.3.1.1 is "Other Land (Wetlands + Settlements + Other Land) remaining Other Land (OO)". In CRF table 5.F, Portugal has reported emissions from land converted to other land for all possible conversions. Further, in section 7.4.3.1.1 of the NIR, the Party states that transitions of

settlements and wetlands to other land uses are considered improbable, but both of those transitions are reported as a sink in CRF table 5.F for 2009. The ERT considers that there is some circularity in the Portuguese definition of the category other land. In CRF table 5.F, all changes in carbon stocks are reported as "NA" for other land remaining other land, but in NIR figure 7.15 net emissions and removals are presented for that same land-use category. To increase transparency, the ERT recommends that Portugal characterize precisely what "other land" represents in its inventory, make every effort to avoid circularity in the referencing of land-use categories, and report this key category for CO_2 emissions in a transparent and consistent way in its next annual submission.

Other (LULUCF) – CO_2

118. For the category other (LULUCF), Portugal has reported that net removals from harvested wood products amounted to 419.97 Gg CO_2 for 2009. The ERT notes that the use of equation 12.6 from the 2006 IPCC Guidelines (volume 4, chapter 12) for estimating production for the period 1900–1963 is not duly justified in view of the fact that the equation has been developed for the period 1900–1961. The ERT recommends that Portugal review its use of this equation in its next annual submission. Further, the other equation used for estimating the annual change in carbon in domestic harvested wood products disposed in solid waste sites (equation 12.4) is a term of equation 12.5, which is needed for estimating the carbon released from harvested wood products. However, the latter equation is not mentioned in the text of the NIR. The ERT considers that there is a lack of transparency in the reporting of estimates for harvested wood products. The ERT recommends that Portugal improve the transparency of the estimation of CO_2 emissions from this carbon pool in its next annual submission.

Direct N_2O emissions from N fertilization of forest land and other

119. Emissions of N_2O from fertilization were reported as "IE" in CRF table 5(I); the Party indicated that these emissions were reported under the agriculture sector as the statistical information available does not distinguish fertilizer use in forest areas and agricultural areas. The ERT recommends that Portugal disaggregate these emissions and report the N_2O emissions from N fertilization of forest land and other in the appropriate category under the LULUCF sector in its next annual submission.

CO_2 emissions from agricultural lime application

120. Portugal has continued to report CO_2 emissions from agricultural lime application for all land-use categories as "NE" or "NO". As also identified in the previous review report, this results in a potential underestimation of CO_2 emissions from cropland and grassland. In response to a question raised by the ERT during the review, the Party replied that CO_2 emissions from liming were still not estimated in the inventory due to a lack of reliable AD, as liming in other land uses besides cropland is not a common practice. Portugal also indicated that it will try to obtain relevant information and estimate these emissions in its 2012 submission. The ERT strongly recommends that Portugal estimate these emissions or justify that they do not occur and, if so, report them as "NO".

F. Waste

1. Sector overview

121. For 2009, GHG emissions from the waste sector amounted to 7,692.45 Gg CO_2 eq, or 10.3 per cent of total GHG emissions. Since 1990, emissions have increased by 28.5 per cent. Between 1990 and 2009, the key drivers for the rise in emissions are due to changes in the consumption pattern of an increasingly urban population and the development of

municipal solid waste collection and disposal systems: emissions from managed waste disposal on land increased by 2,170.58 Gg CO_2 eq (by 507.7 per cent) during that period, and emissions from other managed industrial waste disposal on land increased by 1,384.78 Gg CO_2 eq (by 321.1 per cent), while emissions from other unmanaged industrial waste disposal on land decreased by 911.82 Gg CO_2 eq (by 78.1 per cent). Within the sector, 68.8 per cent of the emissions were from solid waste disposal on land, followed by 31.2 per cent from wastewater handling. The remaining 0.03 per cent were from waste incineration.

122. Portugal has made recalculations for the waste sector between the 2010 and 2011 submissions in response to the 2010 annual review report and following changes in AD. The impact of these recalculations on the waste sector is a decrease in emissions of 2.7 per cent for 2008 and an increase in emissions of 1.0 per cent for 1990 (or, for total GHG emissions, a decrease of 0.3 per cent for 2008 and an increase of 0.1 per cent for 1990). The main recalculations took place in the following categories:

(a) CH_4 emissions from solid waste disposal on land (see para. 126 below);

(b) CH_4 emissions from wastewater handling (see para. 128 below).

123. The information provided in the NIR and in the CRF tables is generally complete and transparent. The ERT considers that the information on QA/QC activities reported in the NIR is not completely transparent. In response to a question raised by the ERT during the review, Portugal provided additional information on the applied tier 2 QA/QC procedures. To increase transparency, the ERT recommends that Portugal include this additional information in its next annual submission.

2. Key categories

Solid waste disposal on land – CH_4

124. CH_4 emissions from solid waste disposal on land amounted to 5,293.54 Gg CO_2 eq for 2009. The first order decay method (tier 2) was applied to estimate CH_4 emissions from this category. The parameters used for the estimation of emissions are mainly IPCC default values, except degradable organic carbon which is derived from country-specific data on waste composition. The ERT reiterates the recommendations in previous review reports that Portugal explore the possibilities of developing country-specific parameters.

125. Data on the amount and composition of municipal solid waste from 1999 onwards are collected and reported by municipal authorities responsible for waste management. For the period prior to 1999, the amount of municipal waste is based on expert judgement on the per capita waste generation rate. The amount of biodegradable industrial waste deposited on waste disposal sites is based on expert judgement on growth rates and, for recent years (2007–2009), it is based on data from the Waste Registry. The ERT reiterates the recommendations in previous review reports that Portugal provide more information on the changes in emissions trends, particularly those caused by changes in industrial waste disposal, in its next annual submission. The ERT also recommends that Portugal provide more information on how the Party has ensured time-series consistency despite the multiple sources for AD.

126. In its 2011 submission, Portugal has recalculated the CH_4 emissions from solid waste disposal on land for 2008. The recalculations resulted in an increase in CH_4 emissions for this category of 2.27 per cent for 2008. In CRF table 8(b), Portugal has indicated that this change is due to an update of the chemical oxygen demand values for industrial waste.

Wastewater handling – CH_4 and N_2O

127. For 2009, CH_4 emissions from wastewater handling amounted to 89.24 Gg and N_2O emissions amounted to 1.69 Gg. The methodology used to estimate N_2O emissions from industrial wastewater is from the *EMEP/CORINAIR Emission Inventory Guidebook*, as the Revised 1996 IPCC Guidelines and the IPCC good practice guidance do not provide a methodology. The ERT commends Portugal for estimating these emissions.

128. In its 2011 submission, Portugal has recalculated the CH_4 and N_2O emissions from the subcategories industrial wastewater and domestic and commercial wastewater. The recalculations resulted in a decrease in emissions for this category of 10.8 per cent for 2008. On page 8-41 of its NIR, the Party indicated that it has updated the AD and treatment types.

129. The previous review report encouraged Portugal to continue its efforts to improve the information on industrial wastewater based on the implementation of a new survey system and database implemented by the National Water Institute. As the data collected by the Institute are not yet suitable for the estimation of CH_4 emissions from industrial wastewater, the Party has developed a preliminary approach to estimate emissions from this subcategory. The ERT reiterates the recommendation in the previous review report that Portugal continue to implement its original plans to collect additional data on industrial wastewater in its next annual submission.

130. The NIR (page 6-54) states that emissions due to the application of sewage sludge as a soil amendment are not estimated as there are no reliable statistics for this activity and that all N_2O emissions from sewage sludge are included under the waste sector. In response to a question raised by the ERT during the review, Portugal clarified that the statement included on page 6-54 of the NIR is incorrect, and that N_2O emissions from the application of sewage sludge are not estimated separately under the agriculture sector, because the IPCC default method (from the Revised 1996 IPCC Guidelines) for domestic and commercial wastewater assumes that all N is discharged directly into the aquatic environment and, therefore, all N from sewage sludge is included under the waste sector regardless of the final destination of the sludge after exiting the wastewater treatment plant (see paras. 93–95 above).

3. Non-key categories

Waste incineration – CO_2

131. CO_2 emissions from waste incineration with energy recovery are reported under the energy sector and emissions from incineration of hospital waste without energy recovery are reported under the waste sector, which is in line with the Revised 1996 IPCC Guidelines. The Party used an IPCC default method and country-specific EFs for the estimation of emissions.

132. The previous review report recommended that, in order to increase transparency, Portugal specify the amount of emissions that are from waste incineration and are accounted for under the energy sector. As the Party has not specified those emissions in its 2011 annual submission, the ERT reiterates the recommendation made in the previous review report.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

133. Portugal has elected to account for forest management, cropland management and grazing land management as activities under Article 3, paragraph 4, of the Kyoto Protocol, for the first commitment period. The Party has chosen to account for activities under Article 3, paragraphs 3 and 4, at the end of the commitment period.

134. The previous review report indicated that, although Portugal has elected cropland management and grazing land management, the Party has reported most of the KP-LULUCF CRF tables for its base year (1990) using the notation keys "NE" and "NO" only. In its 2011 submission, Portugal has reported CO_2 emission estimates for both of these activities, while the CH_4 emissions have been reported as "NE, NO" for both activities, and N_2O emission estimates have been provided for cropland management but have been reported as "NE, NO" for grazing land management. The ERT commends the Party for the progress made but reiterates the recommendations in the previous review report that Portugal complete the calculations for 1990 and report these in its next annual submission.

135. Portugal has provided information on the mandatory and elected activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in its NIR. This information has been generally reported in accordance with paragraphs 5–9 of the annex to decision 15/CMP.1. However, Portugal has assumed that the area of organic soils is negligible and reported net carbon stock changes for mineral soils for these activities as "NO", but has not provided a justification. In addition, Portugal has reported the changes in carbon stocks in dead wood for both cropland management and grazing land management as "NO", without any justification. The ERT, therefore, recommends that Portugal demonstrate that these pools are not net sources in its next annual submission.

136. In addition, the incomplete geographical coverage of activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol was included in the list of potential problems and further questions raised by the ERT during the review. In response, Portugal described the approach taken to address this problem and provide complete geographical coverage of KP-LULUCF activities in its next annual submission (see para. 10 above). The ERT considers that the potential problem has been resolved, and recommends that Portugal report on the progress made in its next annual submission.

137. Portugal has reported all carbon emissions from lime application for afforestation and reforestation, deforestation, forest management, cropland management and grazing land management as "NE" in CRF table 5(KP-II)4 for 1990, 2008 and 2009. The ERT strongly recommends that Portugal estimate these emissions in its next annual submission.

138. Portugal has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions in response to the 2010 annual review report and in order to rectify identified errors. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

(a) Afforestation and reforestation: net GHG removals decreased by 121.28 Gg CO_2 eq (by 4.4 per cent);

(b) Deforestation: net GHG emissions decreased by 5,479.93 Gg CO_2 eq (by 79.7 per cent);

(c) Forest management: Portugal has reported net GHG removals (8,221.73 Gg CO_2 eq), replacing the net GHG emissions (2,441.27 Gg CO_2 eq) reported in the previous annual submission. Net emissions and removals decreased by 10,784.73 Gg CO_2 eq;

(d) Cropland management: net GHG removals increased by 82.74 Gg CO_2 eq (by 228.6 per cent);

(e) Grazing land management: net GHG removals increased by 867.29 Gg CO_2 eq (by 1,013.9 per cent).

139. Portugal has identified the following areas for the improvement of the accuracy of the estimates of emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol:

(a) Increasing the use of tier 2 methods for the estimation of the carbon stock changes in carbon pools;

(b) Adding new units/maps to the cartography COS products for 1990 and further developing the cartography COS products for 2007. These cartographies are used together for estimating the annual rates of afforestation and deforestation areas with a spatial resolution of 1 ha. A newer cartography (COS product 2010) is being developed from COS product 2007 through the computer-assisted visual interpretation of ortho-rectified aerial photographs acquired in 2010;

(c) Developing a new version of the national forest inventory, which, inter alia, will: address the dynamics of forest and agricultural areas; produce a more complete characterization of forests through age-class structure, biomass, volume and potential production; and produce a more complete characterization of forest and agricultural soils;

(d) Developing soil carbon sequestration factors for particular agricultural systems currently lacking them, such as biodiverse pastures rich in legumes or mulched, vis-à-vis non-mulched, non-tillaged cropland.

140. The ERT encourages Portugal to implement the improvements described in paragraph 139 above in its next annual submission.

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2

141. The previous ERT noted some transparency issues with the reporting of this activity in the 2010 annual submission, as follows:

(a) Portugal did not report CH_4 and N_2O emissions from biomass burning for afforestation and reforestation activities for the year 2008. However, in its 2011 submission, Portugal has reported emission estimates;

(b) Portugal reported losses from the carbon stock changes in above-ground biomass per area and from below-ground biomass per area as "NO" for units of afforestation and reforestation land not harvested since the beginning of the commitment period (CRF table 5(KP-I)A.1.1). However, in its 2011 submission, Portugal has reported emission estimates;

(c) Portugal reported the net carbon stock changes in litter, dead wood and mineral soils for units of afforestation and reforestation land harvested since the beginning of the commitment period as "NE" (CRF table 5(KP-I)A.1.2). The Party had informed the previous ERT that the use of the notation key "NE" was based on the assumption of the equilibrium of carbon stocks in a pool or in a portion of land, and that the Party was working on arguments to support that assumption. However, in the 2011 submission of KP-

LULUCF CRF tables, Portugal has replaced the notation key "NE" with figures and, for organic soils, the notation key "NO";

(d) Portugal did not report numerical values in the KP-LULUCF CRF tables for the year 1990 but instead used the notation keys "NR", "NA" and "NE". However, in its 2011 submission, the Party has reported numerical values in the appropriate CRF tables.

142. The ERT commends Portugal for the improvements described in paragraph 141 above.

143. The previous ERT noted, in the 2010 submission, the inconsistent reporting of land areas in table NIR-2 and of afforestation and reforestation in CRF tables 5(KP-I)A.1.1 and 5(KP-I)A.1.2. Portugal explained that these inconsistencies had been caused by a mistake, either in the filling in of the tables or in the version of the data used in the submission. The Party also asserted that the reported figures were provisional because the data were going to be thoroughly revised in time for the submission of the 2011 NIR. Portugal has provided information on the respective areas under Article 3, paragraphs 3 and 4, of the Kyoto Protocol for 2008 in its 2011 submission, but the said inconsistencies have not been resolved. The ERT reiterates the recommendation in the previous review report that the Party perform a thorough check of the consistency between the figures reported in table NIR-2 and those reported in the CRF tables in its next annual submission.

Deforestation – CO_2

144. The previous ERT noted that no numerical values had been reported in the relevant CRF tables for the year 1990; notation keys had been used instead. However, numerical values have been reported in CRF table 5(KP-I)A.2 submitted in 2011.

145. The previous ERT noted some transparency issues with the reporting of this activity in 2010, as follows:

(a) Portugal did not report CH_4 and N_2O emissions from biomass burning for deforestation activities for 2008. However, the Party has reported emission estimates in its 2011 submission;

(b) Portugal reported the net carbon stock changes in litter, dead wood and mineral soils in deforested land as "NE". The Party informed the previous ERT that the use of the notation key "NE" was based on the assumption of the equilibrium of carbon stocks in a pool or in a portion of land, and that the Party was working on arguments to support that assumption. In the 2011 submission of KP-LULUCF CRF tables, Portugal has reported emission estimates.

146. The previous review report identified an inconsistency in the reporting of deforestation areas in table NIR-2 and in the corresponding CRF table 5(KP-I)A.2. Portugal replied that a mistake had been made, either in the filling in of the tables or in the version of the data used in the submission. The Party also asserted that the reported figures were provisional because the data were going to be thoroughly revised in time for the submission of the 2011 NIR. Portugal has reported the deforestation area under Article 3, paragraph 3, of the Kyoto Protocol for 2008 in its 2011 submission, but the said inconsistency has not been resolved. The ERT reiterates the recommendation in the previous review report that Portugal perform a thorough check of the consistency between the figures reported in table NIR-2 and those reported in the CRF tables in its next annual submission.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

Forest management – CO_2

147. The previous review report identified that the reporting of forest management activities was not accurate because no numerical values were reported in the forest management KP-LULUCF CRF table for the year 1990; the notation keys "NR", "NA" and "NE" were used instead. Following a recommendation from that report, Portugal has replaced the notation keys with figures in its 2011 submission.

148. The previous review report noted many instances where carbon pools and GHG sources were not reported ("NR"), namely: the carbon stock changes in litter, dead wood and mineral soils; and the CH_4 and N_2O emissions from biomass burning for 2008. In its 2011 submission, Portugal has reported emission estimates.

149. The previous review report identified that the net carbon stock changes in litter, dead wood and mineral soils in forest management lands were reported as "NE". Portugal informed the ERT that the use of the notation key "NE" was based on the assumption of the equilibrium of carbon stocks in a pool or in a portion of land, and that the Party was working on arguments to support that assumption. In the 2011 submission of KP-LULUCF CRF tables, Portugal has reported emission estimates.

150. The previous ERT identified an inconsistency in the reporting of forest management areas in table NIR-2 and in the corresponding KP-LULUCF CRF table 5(KP-I)B.1. Portugal explained that a mistake had been made, either in the filling in of the tables or in the version of the data used in the submission. The Party also asserted that the reported figures were provisional because the data were going to be thoroughly revised in time for the submission of the 2011 NIR. Portugal has reported the deforestation area under Article 3, paragraph 3, of the Kyoto Protocol for 2008 in its 2011 submission, but the said inconsistency has not been resolved. The ERT reiterates the recommendation in the previous review report that Portugal perform a thorough check of the consistency between the figures reported in table NIR-2 and those reported in the corresponding CRF table in its next annual submission.

151. The ERT noted that Portugal's shrubland is subject to forest management activity. The ERT asked Portugal whether the land classified as shrubland is the same as the land classified as "other land" under the Convention, and, if so, requested that the Party justify the different allocation of those lands. Portugal replied that shrubland is considered forest land only in those cases where the use of the land changed from shrubland to forest land during the period 1990–2006. Further, the Party clarified that reclassification of the land had been conducted in situations where apparent land conversions were considered not to be permanent land-use changes, but only temporary ones due to clear-cuts or wildfires. During these episodes, shrubs initially grow much faster than trees, but the areas covered by the former are eventually taken over by regenerating trees. In view of the lack of transparency regarding the Party's definition of "other land" (see para. 117 above), the ERT recommends that Portugal clearly define the nature and role of shrubland in order to avoid confounding, for example, a circumstantial change in the dominance of particular plant communities (forest land to shrubland) with a permanent land-use change (forest land to other land), and report the result of that effort in its next annual submission.

Cropland management – CO_2

152. The previous ERT noted that the reporting of cropland management activities in the 2010 submission was not accurate because no numerical values were reported in any of the appropriate KP-LULUCF CRF tables for 1990 (e.g. CO_2, CH_4 and N_2O emissions were

reported as "NE" in CRF table 5(KP)). In response to a recommendation in the previous review report, Portugal has replaced the notation keys with figures in its 2011 submission.

153. The previous ERT noted that, in the 2010 submission, the net carbon stock changes in litter, dead wood and mineral soils for 1990 for cropland management lands were reported as "NE". Portugal informed the previous ERT that the use of the notation key "NE" was based on the assumption of the equilibrium of the carbon stocks in a pool or in a portion of land, and that Portugal was working on arguments to support that assumption. In the 2011 submission of KP-LULUCF CRF tables, the Party has substituted those notation keys with figures.

154. The previous ERT noted an inconsistency in the reporting of cropland management areas for 1990 in CRF table NIR-2 (reported as zero) and in the corresponding CRF table 5(KP-I)B.2 (reported as "NE") in the Party's 2010 submission. Portugal explained that a mistake had been made, either in the filling in of the tables or in the version of the data used in the submission. The Party also asserted that the reported figures were provisional because the data were going to be thoroughly revised in time for the 2012 annual submission. The said inconsistency has been resolved in the 2011 submission.

155. In its 2011 submission Portugal has reported, in each of the CRF tables NIR-1 for the years 1990, 2008, and 2009, the CO_2, CH_4 and N_2O emissions from biomass burning for cropland management as "NE" for wildfires and "NO" for controlled burning. In response to a question raised by the ERT during the review, Portugal confirmed that biomass burning emissions from cropland management have not been estimated, but did not provide any explanation for not doing so. The ERT recommends that Portugal estimate those emissions or provide a justification for not doing so in its next annual submission.

156. The ERT noted some inconsistencies in the reporting of land areas in CRF table NIR-2 submitted in 2011 (e.g. the inconsistencies between the area reported for the beginning of 2009 and the area reported for the end of 2008 both for cropland management and for other (1,929.6 kha compared with 1,922.55 kha and 882.78 kha compared with 896.79 kha, respectively)). The ERT recommends that Portugal resolve these inconsistencies in its next annual submission.

Grazing land management – CO_2

157. The previous review report noted that the reporting of grazing land management activities in the 2010 submission was not accurate because no numerical values were reported for 1990 in the appropriate CRF tables; the notation keys "NR", "NA" and "NE" were used instead. The ERT encouraged Portugal to provide this information. The Party has replaced the notation keys with figures in its 2011 submission.

158. The previous review report noted many instances where emissions were not reported ("NR"), namely: the carbon stock changes in above-ground biomass, below-ground biomass, litter and dead wood; and the CO_2 emissions from biomass burning for 2008. Portugal has reported emission estimates in its 2011 submission.

159. The previous review report noted that, in the 2010 submission, the net carbon stock changes in litter, dead wood and mineral soils in grazing land management were reported as "NE". Portugal informed the ERT that the use of the notation key "NE" was based on the assumption of the equilibrium of the carbon stocks in a pool or in a portion of land, and that Portugal was working on arguments to support that assumption. In the 2011 submission, the Party has reported figures instead of notation keys.

160. In each of the CRF tables NIR-1 tables for the years 1990, 2008, and 2009, the CO_2, CH_4 and N_2O emissions from biomass burning for grazing land management are reported as "NE" for wildfires and "NO" for controlled burning. In response to a question raised by the

ERT during the review, Portugal responded that biomass burning emissions for grazing land management have not been estimated in its 2011 submission, but did not provide any explanation for not doing so. The ERT recommends that Portugal estimate those emissions or provide justification for not doing so in its next annual submission.

161. The ERT has noted an inconsistency in the reporting of the area of this activity CRF table NIR-2 submitted in 2011: the area reported for the beginning of 2009 (1,837.77 kha) is different from the area reported for the end of 2008 (1,844.69 kha) for grazing land management. The ERT recommends that Portugal resolve this inconsistency in its next annual submission.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

162. Portugal has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF tables and the SEF comparison report.[9] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

163. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements set out in paragraph 88(a–j) of the annex to decision 22/CMP.1. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. The national registry has adequate procedures in place to minimize discrepancies. Information reported by Portugal on records of any discrepancies and on any records of non-replacement was found to be consistent with the information provided to the secretariat by the ITL.

National registry

164. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate. However, the SIAR identified the following problems:

(a) In cases where issuance, cancellation, or carry-over transactions do not take place, Portugal does not provide any figures for these units on the national registry website. The ERT recommends that the Party enhance its national registry website so that actual figures (e.g. “0”) are reported;

[9] The SEF comparison report is prepared by ITL administrator and provides information on the outcome of the comparison of data contained in the Portugal’s SEF tables with corresponding records contained in the ITL.

(b) There is a discrepancy between the information on external transfers provided in the SEF tables and the information accessible though the national registry website. Because the information provided in the SEF tables is confirmed as correct, the ERT recommends that Portugal enhance its national registry website so that correct information is also reported on the website;

(c) The ERT encourages Portugal to report, in the next annual submission, on changes made to its registry database, infrastructure and/or procedures to support a user authentication mechanism as suggested by the ITL Administrator's Change Advisory Board.

165. The ERT recommends that Portugal address these problems and report on the results in its next annual submission.

Calculation of the commitment period reserve

166. Portugal has reported its commitment period reserve in its 2011 annual submission. Portugal reported that its commitment period reserve has not changed since the initial report review (343,743,774 t CO_2 eq) as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

167. Portugal has reported that there have been no changes to its national system since the previous annual submission. The ERT concluded that Portugal's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

168. Portugal has reported that there have been no changes to its national registry since the previous annual submission. The ERT concluded that Portugal's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

169. Portugal did not provide information on changes in its reporting on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, as requested in chapter I.H of the annex to decision 15/CMP.1, in its 2011 annual submission. However, the ERT noted that Portugal, compared with its 2010 annual submission, has included additional information in its 2011 annual submission. The ERT considered that the information is transparent but noted that Portugal has still not included information on how the Party gives priority to the actions listed in paragraph 24 of the annex to decision 15/CMP.1. The ERT, therefore, reiterates the recommendation in the previous annual review report that Portugal include information on the prioritization of these actions in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol.

170. Portugal has reported information on its cooperation with developing countries, mostly with Portuguese-speaking countries in Africa and Asia, on adaptation to the impacts of climate change by supporting the integration of vulnerabilities and risk assessments in sectoral policies and planning.

III. Conclusions and recommendations

171. Portugal made its annual submission on 15 April 2011. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, and changes to the national system and the national registry and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1. Portugal submitted revised CRF tables and an NIR on 25 May 2011. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal submitted revised CRF tables on 24 October 2011.

172. The ERT concludes that the inventory submission of Portugal has been prepared and reported in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". Portugal has submitted a complete set of CRF tables for the years 1990–2009 and an NIR. However, the CRF tables are not complete in terms of geographical coverage, because LULUCF estimates of emissions and removals for Azores and Madeira were not provided (see para. 10 above). The inventory is generally complete in terms of categories and gases, but some emissions, particularly in the energy sector (e.g. combustion of landfill gas and biogas captured; and combustion of fuels in lime production (see paras. 44–46 above)) and the LULUCF sector (e.g. lime application on cropland and grassland (see para. 12 above)) were originally reported as "NE".

173. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1.

174. Portugal's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for the estimates of CH_4 emissions from enteric fermentation (see para. 77 above) and the aggregated reporting in its NIR of land-use categories (see para. 115 above).

175. Portugal has made recalculations for the inventory between the 2010 and 2011 submissions to take into account revisions in AD and EFs, the implementation of QA activities, the correction of errors and the elimination of double-counting, and in response to the recommendations in the previous review report. Considerable recalculations have been reported in the LULUCF sector and for KP-LULUCF activities in order to respond to the recommendations in the previous review report and to more extensively apply the IPCC good practice guidance for LULUCF, which resulted in a general revision of the AD, assumptions and parameters used. The impact of the recalculations on the national total GHG emissions is a slight decrease in emissions of 0.5 per cent for 2008. The most significant recalculations occurred in the LULUCF sector, where total net removals increased by 10,498.83 Gg CO_2 eq or 354.9 per cent (from 2,957.53 Gg CO_2 eq in the 2010 submission to 13,454.36 Gg CO_2 eq in the 2011 submission).

176. Portugal has extensively improved its reporting of activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol compared with the previous annual submission. However, Portugal has still not reported information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol for Azores and Madeira (see paras. 10, 101 and 136 above).

177. Portugal has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions in response to the 2010 annual review report and in order to rectify identified errors. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

(a) Afforestation and reforestation: net GHG removals decreased by 121.28 Gg CO_2 eq (by 4.4 per cent);

(b) Deforestation: net GHG emissions decreased by 5,479.93 Gg CO_2 eq (by 79.7 per cent);

(c) Forest management: Portugal has reported net GHG removals of 8,221.73 Gg CO_2 eq, replacing the net GHG emissions of 2,441.27 Gg CO_2 eq reported in the previous annual submission. Net emissions and removals decreased by 10,784.73 Gg CO_2 eq;

(d) Cropland management: net GHG removals increased by 82.74 Gg CO_2 eq (by 228.6 per cent);

(e) Grazing land management: net GHG removals increased by 867.29 Gg CO_2 eq (by 1,013.9 per cent).

178. Portugal has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and has used the required reporting format tables as required by decision 14/CMP.1.

179. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

180. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions. However, the ERT identified that Portugal has not fulfilled all of the requirements regarding the public availability of information in accordance with paragraph 45(d) of the annex to decision 13/CMP.1 (see para. 164 above).

181. Portugal has reported information under chapter I.H of the annex to decision 15/CMP.1, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2011 annual submission. The information was provided on 15 April 2011 and is considered to be transparent and generally complete (Portugal has not included information on the prioritization of the actions listed in paragraph 24 of the annex to decision 15/CMP.1 in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol; see para. 169 above).

182. The ERT identifies the following cross-cutting issues for improvement:

(a) Enhance the accuracy of the estimates by using country-specific parameters for the key categories;

(b) Include more information on the planned improvements, including the recommendations from the previous annual review reports (see paras. 18, 28 and 32 above);

(c) Implement a tier 2 uncertainty assessment, clarify how the uncertainty assessment is used to prioritize future inventory improvements and improve the uncertainty assessment for the LULUCF sector (see para. 21 above);

(d) Improve the QA/QC procedures in relation to the checking of consistency between the information provided in the NIR and in the CRF tables and the documentation on the implemented and outstanding recommendations from the review reports;

(e) Address the recommendations from previous review reports that have not yet been addressed (see para. 30 above);

(f) Address the recommendations from the SIAR report for its national registry (see paras. 164 and 165 above).

183. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of the annual submission (including information under Article 7, paragraph 1, of the Kyoto Protocol). The key recommendations are that Portugal:

(a) Estimate emissions from: the combustion of landfill gas and biogas captured and the combustion of fuels in lime production (see paras. 44–46 above); HFC emissions from the consumption of halocarbons and SF_6 (see para. 64 above); lime application on cropland and grassland and for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see paras. 120 and 137 above); and biomass burning from wildfires for cropland management and grassland management (see paras. 155 and 160 above);

(b) Develop country-specific EFs for gasoline, diesel and liquid petroleum gas used in road transportation (see para. 47 above);

(c) Review the method used to estimate fugitive emissions from natural gas distribution (see para. 50 above);

(d) Revise the EFs to estimate CH_4 emissions from enteric fermentation (see paras. 76 and 77 above);

(e) Correct some of the equations used in the agriculture sector (see paras. 81 and 118 above);

(f) Estimate emissions and removals for the LULUCF sector and for KP-LULUCF activities for Azores and Madeira (see paras. 10, 101 and 136 above);

(g) Complete the reporting of CH_4 and N_2O emissions for cropland management and grazing land management for 1990 (see para. 134 above);

(h) Demonstrate that some carbon pools reported as "NO" are not net sources (see para. 135 above);

(i) Include information on the prioritization of the actions listed in paragraph 24 of the annex to decision 15/CMP.1 in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol (see para. 169 above);

(j) Increase the consistency of: the information in the agriculture sector (see paras. 86, 90 and 104(g) above); and the areas reported in the LULUCF sector and activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol;

(k) Increase the transparency of: some of the information provided in the energy, industrial processes and agriculture sectors (see paras. 48, 49, 52, 58 and 72 above); the recalculations for ammonia production (see para. 63 above) and for ferroalloys production (see paras. 65 and 66 above); the allocation of emissions from the application of sewage sludge to agricultural soils (see paras. 93–95 above); the assessment of the completeness of emissions for some HFC species under consumption of halocarbons and SF_6 (see paras. 15 and 64 above); the methods, parameters and assumptions used for the agriculture sector (see para. 72 above); the N_2O EF for manure management (see para. 96 above); the recalculations in the LULUCF sector (see para. 23 above); the information on N_2O emissions from sewage sludge used in agriculture (see paras. 94 and 95 above); and the information on waste incineration emissions (see para. 132 above).

IV. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.
Available at <http://www.ipcc-nggip.iges.or.jp/public/ 2006gl /index. html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.
Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/ invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*.
Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*.
Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/ gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9.
Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09. pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8.
Available at <http://unfccc.int/resource/ docs/cop8/08.pdf>.

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

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

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

Status report for Portugal 2011.
Available at <http://unfccc.int/resource/docs/2011/asr/ prt.pdf>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Teresa Costa Pereira (Portuguese Environment Agency), including additional material on the methodologies and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
APA	Portuguese Environment Agency
C_a	coefficient to distinguish between feeding situations
C_{fi}	coefficient to distinguish between animal categories
CH_4	methane
COS	Cartogafía de Ocupação do Solo
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
$C_{pregnant}$	coefficient to distinguish between pregnant and non-pregnant animals
CRF	common reporting format
EF	emission factor
ERT	expert review team
EU ETS	European Union emission trading scheme
F-gas	fluorinated gas
$Frac_{GASM}$	fraction of livestock N excretion that volatilizes as NH_3 and NO_X
$Frac_{GRAZ}$	fraction of livestock N excreted and deposited onto soil during grazing
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
INE	National Institute of Statistics
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
Mg	megagram (1 Mg = 1 tonne)
N	nitrogen
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
N_2O	nitrous oxide
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
UNFCCC	United Nations Framework Convention on Climate Change
Y_m	methane conversion rate