Advance Version

COMPLIANCE COMMITTEE **CC/ERT/ARR/2013/22**
16 July 2013

Report of the individual review of the annual submission of Portugal submitted in 2012

Note by the secretariat

The report of the individual review of the annual submission of Portugal submitted in 2012 was published on 15 July 2013. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2012/PRT, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

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Report of the individual review of the annual submission of Portugal submitted in 2012*

* In the symbol for this document, 2012 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

1. This report covers the in-country review of the 2012 annual submission of Portugal, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 23 to 30 September 2012 in Lisbon, Portugal, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Anke Herold (Germany); energy – Mr. Julien Vincent (France); industrial processes – Mr. Dušan Vácha (Czech Republic); agriculture – Mr. Bernard Hyde (Ireland); land use, land-use change and forestry (LULUCF) – Mr. Xiaoquan Zhang (China); and waste – Mr. Mark Hunstone (Australia). Ms. Herold and Mr. Zhang were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene (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.

3. In 2010, the main greenhouse gas (GHG) in Portugal was carbon dioxide (CO_2) accounting for 73.6 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (17.6 per cent) and nitrous oxide (N_2O) (6.6 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.1 per cent of the overall GHG emissions in the country. The energy sector accounted for 69.5 per cent of total GHG emissions, followed by the waste sector (11.2 per cent), the agriculture sector (10.6 per cent), the industrial processes sector (8.4 per cent) and the solvent and other product use sector (0.3 per cent). Total GHG emissions amounted to 71,974.17 Gg CO_2 eq and increased by 19.5 per cent between the base year[2] and 2010.

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, and also do not include the emissions from deforestation that were included in Portugal's initial report under the Kyoto Protocol for the base year and subsequently used for the calculation of the assigned amount.

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

[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[a] to 2010

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year –2010 (%)*
Annex A sources		CO_2	44 369.67	44 369.67	53 623.91	64 941.09	68 831.20	59 997.72	57 115.39	52 977.90	19.4
		CH_4	10 228.21	10 228.21	11 333.62	12 063.34	12 656.26	12 303.53	12 181.71	12 677.50	23.9
		N_2O	5 542.80	5 542.80	5 673.56	5 999.90	5 212.07	5 029.26	4 802.48	4 778.40	–13.8
		HFCs	66.27	NA, NE, NO	66.27	319.04	848.05	1 248.56	1 378.86	1 515.03	2 186.2
		PFCs	0.00	NA, NE, NO	NA, NO	0.03	0.05	0.04	0.00	0.00	NA
		SF_6	6.11	NA, NE, NO	6.11	7.80	16.41	20.78	23.67	25.34	314.8
KP-LULUCF	Article 3.3[b]	CO_2						–1 825.98	–1 966.03	–2 050.41	
		CH_4						2.70	14.42	25.90	
		N_2O						39.26	60.78	74.71	
	Article 3.4[c]	CO_2	28.49					–11 682.80	–12 047.74	–10 207.14	–3 5924.2
		CH_4	0.43					15.45	65.81	166.57	3 9026.8
		N_2O	0.05					17.17	28.95	52.43	9 9826.1

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[a] to 2010

			Gg CO_2 eq							*Change*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year –2010 (%)*
Annex A		Energy	40 997.31	40 997.31	50 079.40	60 508.84	64 369.94	55 590.01	54 383.90	50 001.72	22.0
		Industrial processes	4 736.30	4 663.92	5 072.62	6 275.66	7 029.42	7 347.27	5 746.94	6 057.62	27.9
		Solvent and other product use	331.88	331.88	312.32	300.03	322.19	266.09	272.17	228.00	–31.3
		Agriculture	8 159.50	8 159.50	8 181.00	8 698.04	7 755.60	7 624.24	7 590.00	7 596.01	–6.9
		Waste	5 988.07	5 988.07	7 058.12	7 548.63	8 086.89	7 772.28	7 509.10	8 090.81	35.1
		LULUCF	NA	–6 887.20	–8 622.93	–12 039.35	–3 350.11	–11 513.73	–11 842.47	–9 880.09	NA
		Total (with LULUCF)	**NA**	**53 253.48**	**62 080.54**	**71 291.86**	**84 213.93**	**67 086.17**	**63 659.64**	**62 094.08**	**NA**
		Total (without LULUCF)	**60 213.05**	**60 140.68**	**70 703.46**	**83 331.20**	**87 564.04**	**78 599.89**	**75 502.11**	**71 974.17**	**19.5**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation						–2 962.31	–3 129.16	–3 243.36	
		Deforestation						1 178.29	1 238.33	1 293.55	
		Total (3.3)						**–1 784.02**	**–1 890.83**	**–1 949.81**	
	Article 3.4[d]	Forest management						–11 004.88	–11 255.72	–8 751.11	
		Cropland management	12.03					–262.75	–281.68	–341.51	–2 937.7
		Grazing land management	41.66					–382.54	–415.59	–895.52	–2 249.4
		Revegetation	NA					NA	NA	NA	NA
		Total (3.4)	**53.70**					**–11 650.18**	**–11 952.98**	**–9 988.14**	**–18 700.3**

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, LULUCF = land use, land-use change and forestry, 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.

Table 3
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2010, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	343 743 774			343 743 774
Annex A emissions for current inventory year				
CO_2	52 619 103	52 977 898		52 977 898
CH_4	11 984 351	12 677 498		12 677 498
N_2O	4 756 641	4 778 398		4 778 398
HFCs	1 231 874	1 515 030		1 515 030
PFCs	0			0
SF_6	7 122	25 344		25 344
Total Annex A sources	**70 599 091**	**71 974 167**		**71 974 167**
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	–3 968 438			–3 968 438
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	725 081			725 081
3.3 Deforestation for current year of commitment period as reported	1 293 552			1 293 552
Activities under Article 3, paragraph 4, for current inventory year[c]				
3.4 Forest management for current year of commitment period	–8 751 108			–8 751 108
3.4 Cropland management for current year of commitment period	–341 505			–341 505
3.4 Cropland management for base year				
3.4 Grazing land management for current year of commitment period	–895 523			–895 523
3.4 Grazing land management for base year				
3.4 Revegetation for current year of commitment period				
3.4 Revegetation in base year				

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

Table 4
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	56 766 223	57 115 385		57 115 385
CH_4	11 659 697	12 181 710		12 181 710
N_2O	4 791 784	4 802 476		4 802 476
HFCs	1 147 427	1 378 865		1 378 865
PFCs	3			3
SF_6	6 452	23 673		23 673
Total Annex A sources	**74 371 586**	**75 502 112**		**75 502 112**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	–3 129 159			–3 129 159
3.3 Afforestation and reforestation on harvested land for 2009 as reported	–3 901 521			–3 901 521
3.3 Deforestation for 2009 as reported	772 362			772 362
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–11 255 718			–11 255 718
3.4 Cropland management for 2009	–281 676			–281 676
3.4 Cropland management for base year				
3.4 Grazing land management for 2009	–415 587			–415 587
3.4 Grazing land management for base year				
3.4 Revegetation for 2009				
3.4 Revegetation in base year				

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

Table 5
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	60 122 050	59 997 716		59 997 716
CH_4	11 601 785	12 303 533		12 303 533
N_2O	5 029 656	5 029 260		5 029 260
HFCs	1 065 166	1 248 561		1 248 561
PFCs	45			45
SF_6	5 929	20 780		20 780
Total Annex A sources	**77 824 631**	**78 599 895**		**78 599 895**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	–2 962 314			–2 962 314
3.3 Afforestation and reforestation on harvested land for 2008 as reported	–3 781 286			–3 781 286
3.3 Deforestation for 2008 as reported	818 972			818 972
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–11 004 881			–11 004 881
3.4 Cropland management for 2008	–262 753			–262 753
3.4 Cropland management for base year	–382 543			–382 543
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008				
3.4 Revegetation in base				

[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] 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. The 2012 annual inventory submission was submitted on 13 April 2012 and resubmitted on 25 May 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 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 in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 13 April 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Portugal officially submitted revised emission estimates on 12 November 2012 in response to questions raised by the expert review team (ERT) during the course of the review. The values used in this report are based on the values contained in the revised estimates submitted on 12 November 2012.

8. 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. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

Completeness of inventory

10. The inventory covers all mandatory[4] source and sink categories for the period 1990–2010 and is complete in terms of geographical coverage. However, the following issues regarding the incomplete coverage of categories were identified by the ERT during the review:

(a) CO_2, CH_4 and N_2O emissions from the combustion of specific refinery fuel, fuel oil, gas oil, off gas and tail gas in two operating petroleum refineries were not estimated and reported in the annual submission (see paras. 61–65 below);

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), and 6(c) and (k)), under the auspices of the international transaction log (ITL) 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.

[4] Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* provide methodologies and/or emission factors to estimate GHG emissions.

(b) N_2O emissions from the use of natural gas in road transportation were reported as not occurring ("NO"); however, the Party has reported natural gas consumption in road transportation, which also results in N_2O emissions (see para. 83 below);

(c) CO_2 emissions from hydrogen production and from fluid catalytic conversion in one of the refineries were not reported in the annual submission (see para. 79 below);

(d) SF_6 emissions from the manufacture of electrical equipment (switch gear and/or circuit breakers) were not reported in the annual submission, even though this activity occurs in Portugal (see para. 101 below);

(e) The carbon stock changes in dead wood were not estimated for all land-use categories (see para. 138 below).

11. In response to questions raised by the ERT during the review week, the Party provided the ERT with the revised and/or missing estimates, thereby resolving the issues listed in paragraph 10(a–d) above (see paras. 65, 81, 83 and 101 below). The ERT recommends that Portugal improve the completeness of the emission/removal estimates for the LULUCF sector by including estimates for the carbon stock changes in dead wood in the 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

12. The ERT concluded that the national system continues to perform its required functions, but that not all functions are performed in line with the "Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol" (hereinafter referred to as the guidelines for national systems) and the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). In particular, the quality assurance/quality control (QA/QC) procedures have not been fully implemented in line with the IPCC good practice guidance.

13. During the review, the Party provided the ERT with additional information on the changes to the institutional arrangements and to the national system since the previous annual submission (see paras. 188–191 below).

Inventory planning

14. During the review, Portugal explained the institutional arrangements for the preparation of the GHG inventory. The Portuguese Environmental Agency (APA), under the Ministry of Agriculture, Sea, Environment and Land-Use Planning, has overall responsibility for the GHG inventory. Other organizations are also involved in the preparation of the inventory. CAOS Sustentabilidade, a private company contracted by APA, supports APA in the development of methodological approaches and the implementation of the requirements related to the KP-LULUCF activities.

15. The sectoral focal points (experts working within APA or other relevant organizations) work with APA in the preparation of the inventory and are responsible for fostering both intrasectoral and intersectoral cooperation to ensure a more efficient use of resources. Their main tasks include coordinating the inventory preparation work; providing expert advice on methodological choices and emission factors (EFs); and ensuring the accuracy of the activity data (AD) used. The entities involved in the provision of information include both public-sector and private-sector bodies. All governmental entities

are responsible, at a minimum, for co-funding the investment needed to ensure the accuracy, completeness and reliability of the information provided for the preparation of the inventory.

16. Owing to the restructuring and reorganization of APA and other Portuguese institutions involved in the preparation of the inventory, there were no designated sectoral focal points during the review for some sectors and categories. The sectoral focal points are formally designated, but their regular cooperation with APA is not established in all cases. For example, the cooperation of APA with the focal points is very intensive for some sectors, such as the LULUCF sector, but much less so for others (e.g. inventory experts learn about the actual updates to the national energy balance a long time after their release). Furthermore, the tasks assigned to the focal points (e.g. planning the next annual submission and discussing the development of methodologies) were not implemented in 2012. The ERT noted that a scheduled meeting to discuss the preparation of the 2013 annual submission had not occurred by the time of the review and that little time was left to ensure a coordinated approach in order to address any outstanding inventory improvements in time for the compilation of the 2013 annual submission. The ERT noted that the change of many responsible focal points during 2012 may lead to a loss of knowledge and decrease the quality of the AD used for the preparation of the inventory.

17. The ERT recommends that Portugal report, in its next annual submission, on the assignment of new focal points, and provide further information on which departments/divisions of the responsible institutions are involved in the preparation of the inventory and what their specific responsibilities are. The ERT encourages the Party to communicate more frequently with the focal points through, for example, regular meetings, similar to the approach already implemented in the process for the preparation of the inventory for the LULUCF sector.

18. During the review, Portugal provided an inventory improvement plan for 2012; however, many parts of this plan had not been updated compared with the inventory improvement plan provided in the 2011 annual submission, despite many outstanding improvements. Some of the planned improvements that have already been implemented were still described as "not initiated" and improvements related to the KP-LULUCF activities were not included in the plan. Although the ERT had identified some problems in relation to the QA/QC plan, the Party had not described any follow-up activities in the inventory improvement plan to resolve these problems. Despite the absence of an updated inventory improvement plan, the sectoral experts have continued to implement improvements in their work methods.

19. The ERT recommends that Portugal report, in the next annual submission, on the update of the inventory improvement plan, in order to:

(a) Incorporate the recommendations from the 2011 and 2012 review reports, as well as the recommendations of the review team with regard to the review of the inventory submitted on behalf of the European Union (EU) member States under EU decision 406/2009/EC on effort-sharing;

(b) Accurately reflect the current status of implementation of the improvements;

(c) Include the improvements planned for the KP-LULUCF activities;

(d) Prioritize the improvements, taking into account the current lack of focal points in some sectors, and focus on activities to be implemented by the internal APA team;

(e) Establish a process for the annual updating of the inventory improvement plan;

(f) Link the improvements with and prioritize the implementation of the QA/QC activities.

20. Paragraph 12(e) of the guidelines for national systems includes the requirement to establish processes for the official consideration and approval of the inventory. The NIR explains that the Portuguese legislation includes a procedure for the official consideration of the inventory and that this consideration is performed at the level of the designated focal point representatives and involved entities. During the review, the ERT learnt that no official consideration and approval process had been implemented for the 2012 annual submission. The large network of focal points to whom this task is assigned in accordance with the NIR does not seem to be appropriate for this purpose.

21. In response to the list of potential problems and further questions raised by the ERT during the review, Portugal clarified that the final version of the inventory is considered and approved by the President of APA. The ERT recommends that the Party clarify, in its next annual submission, the process and related responsibilities for the official consideration and approval of the annual submission.

Inventory preparation

Key categories

22. Portugal has reported a tier 2 key category analysis, both level and trend assessment, as part of its 2012 annual submission. The key category analysis performed by the Party and that performed by the secretariat[5] produced different results, owing to the different tier approaches used. For the energy and the industrial processes sectors, the level of disaggregation used for the key category assessment is very detailed, resulting in some very small categories being identified as key categories. However, a high level of aggregation has been used for some categories under the agriculture sector (e.g. enteric fermentation and manure management have been identified as key for all livestock categories). This approach does not lead to the practical prioritization of methods and resources in the agriculture sector. The ERT recommends that Portugal review the level of disaggregation applied to the key category analysis on the basis of whether the current disaggregation correctly identifies the categories that should be prioritized within the national system because their estimates have a significant influence on the country's total inventory of direct GHG emissions, in terms of the absolute level of emissions, the trend in emissions, or both.

23. Portugal has included the LULUCF sector in its tier 2 key category analysis. As no information is provided on how uncertainties were derived for the LULUCF sector, the ERT could not assess whether the tier 2 key category analysis had been performed in accordance with the IPCC good practice guidance and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The thorough revision planned for the uncertainty estimation for the LULUCF sector is likely to affect the key category assessment including the LULUCF sector. The ERT recommends that Portugal revise the estimates of uncertainty for the LULUCF sector and, on that basis, update the key category analysis.

[5] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the 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.

24. The presentation of the key category analysis in the NIR includes a summary of the results of the key category analysis for all years of the time series; however, this summary is not used by the Party to prioritize the improvements for the most recent annual submission. The ERT recommends that Portugal clearly identify, in the NIR of its next annual submission, the key categories used to prioritize the improvements for the most recent annual submission.

25. During the review, Portugal explained that it uses the results of the key category analysis to prioritize the development and improvement of the inventory.

26. The Party has identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory reporting under the Convention, as provided in chapter 5.4.4 of the IPCC good practice guidance for LULUCF. All three activities under Article 3, paragraph 3, of the Kyoto Protocol and all elected activities under Article 3, paragraph 4, of the Kyoto Protocol were identified as key categories by the Party.

Uncertainties

27. Portugal has performed a tier 1 uncertainty analysis. No uncertainty estimates have been provided for the KP-LULUCF activities. The NIR does not provide information on how the uncertainty estimates were derived for the LULUCF sector. There are some inconsistencies in the presentation of data (e.g. table B3 in the annex to the NIR related to uncertainties indicates zero emissions of CH_4 and N_2O from forest land, while the CRF tables report a value for these emissions). The Party explains in the NIR that the uncertainty analysis will be revised in the near future in order to take better account of the latest methodological developments, in particular concerning the LULUCF sector, and that the uncertainty estimates should be considered as provisional.

28. The uncertainty estimates for some categories are not reasonable and lead to very high uncertainties in sectors where the actual uncertainties are likely to be much lower (e.g. in the agriculture sector). In the energy sector, while several independent data sources are available for some categories, these sources were not compared, nor were they used to assess the uncertainties. Expert judgment and/or country-specific uncertainties were not used for all sectors (e.g. the agriculture sector). The ERT recommends that Portugal revise and update, where appropriate, the uncertainty estimates in line with the planned improvements, involve the focal points in the expert judgment to assess the uncertainties of the AD used and provide explanations in the NIR of how uncertainties were determined. For 2010, the total uncertainty (14.8 per cent) increased compared with that reported for the previous years of the time series from 2004 (11.7 per cent) to 2009 (14.6 per cent). The total uncertainty in the trend is 14.4 per cent (identical to that reported in the 2011 annual submission).

Recalculations and time-series consistency

29. The ERT noted that the recalculations reported by Portugal for the period 1990–2009 were undertaken to take into account: updated AD for all sectors; changes in the EFs and other estimation parameters used; the use of data from the European Union emissions trading scheme (EU ETS) for the energy and industrial processes sectors; the use of improved methodologies for some sectors; and the correction of identified errors. The rationale for these recalculations is provided in the NIR and in CRF table 8(b). The major changes, and the magnitude of the impact, include the following: an increase in estimated total GHG emissions without LULUCF both for 1990 and for 2009 (1.1 per cent) and an increase in estimated total GHG emissions with LULUCF of 6.3 per cent for 1990 and 5.1 per cent for 2009.

30. The ERT noted that the NIR describes several recalculations that are different from those actually implemented (e.g. in the agriculture sector (see para. 111 below)). Some of the descriptions of the recalculations provided by the Party do not apply to GHG emissions, but rather to air pollutants (e.g. in the energy sector). The descriptions of the recalculations are rather general and cannot easily be linked to the methods and the data used to calculate the sectoral emission estimates. The ERT recommends that Portugal improve the description of the recalculations in the NIR of the next annual submission by including a more precise and detailed description of the changes in the sectoral chapters of the NIR.

31. The ERT identified some inconsistencies in the time series of data for industrial waste disposed to landfill under the waste sector. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates, which have improved the time-series consistency of the data for industrial waste disposed to landfill (see para. 156 below).

Verification and quality assurance/quality control approaches

32. Portugal has elaborated an inventory QA/QC plan that describes the specific QA/QC procedures and activities undertaken in the preparation of the inventory. However, the QA/QC plan does not fulfil all of the mandatory requirements specified in the IPCC good practice guidance, namely that a sample of data and calculations from each sector should be included in the QC process every year, in order to ensure that all sectors are addressed on an ongoing basis. The Party's QA/QC plan does not include a planned schedule of QC checks across different sectors over time, nor does it include a scheduled timetable for the performance of QA/QC checks during the inventory preparation process or a description of the checks to be performed at each stage of the scheduled timetable. The QA/QC plan does not clearly define the responsibilities allocated to specific tier 1 QC checks in the different sectors. Furthermore, the QA/QC plan is a general document and has not been updated on a regular basis in order to include the relevant checks to be performed for the forthcoming annual submission and to take into account the improvements and QA/QC checks that have already been implemented. The Party has not prioritized the issues to be addressed in the QA/QC plan; for example, the QA/QC checks of the NIR involve mostly editorial issues and several checks to ensure the consistency of the NIR with the underlying calculations.

33. It is good practice for the inventory agency to designate a QA/QC coordinator with responsibility for ensuring that the objectives of the QA/QC plan are implemented. However, Portugal has not assigned a QA/QC coordinator to coordinate the planning and implementation of the QA/QC procedures in line with the QA/QC plan.

34. The ERT noted that the QA/QC plan was not fully implemented for the 2012 annual submission, as only some QA/QC checks were undertaken by the sectoral experts and those checks were not systematically performed, for example: there is no mechanism in place to identify whether and which checks have been performed; the QA/QC checks performed were not systematically documented; and the forms developed for this purpose were not used. The sectoral experts lacked the necessary resources and time to fully implement the QA/QC procedures. This lack of implementation of QA/QC activities has led to a number of errors, mistakes and problems identified by the ERT.

35. In areas where several independent data sources are available (e.g. for large point-source installations in the energy sector and for potential and actual emissions of fluorinated gases in the industrial processes sector), the data from such sources have not always been used for comparison and consistency checks. During the review, Portugal explained that verified EU ETS data are used for the large point sources and are compared with data from energy balances. It was also explained that European Pollutant Release and Transfer Register data are used for the calculation of emission factors as well as for QA/QC purposes for refineries, cement production, iron and steel production, glass production and

nitric acid production. Portugal highlighted that in the areas where emissions' verification reports of the EU ETS are available data seem more reliable than in the areas where data sources are not verified. During the review Portugal informed the ERT about its plan to use other data sources to check significant differences between potential and actual emissions of fluorinated gasses.

36. No detailed procedural descriptions have been provided with regard to the methods used to calculate the emission estimates (e.g. which files include which data and the corresponding estimation methods, and how these files are used in the calculation of the estimates). In addition, the NIR does not always provide an accurate description of the calculations performed and data sources used. In such situations, it is therefore likely that if the relevant expert leaves the team, the successor may be unable to replicate the calculations.

37. During the review, the ERT requested that Portugal ensure that its national system meets the requirements outlined in paragraph 12(c–e) of the guidelines for national systems, and recommended that the Party designate a QA/QC coordinator, with responsibility for ensuring that the objectives of the QA/QC plan are implemented and for coordinating the planning and implementation of the QA/QC procedures, in line with the QA/QC plan. The ERT also recommended that the Party provide an improved QA/QC plan in the next annual submission, which should include:

(a) A schedule of the QA/QC checks across the different sectors over a longer time frame, thereby ensuring that a sample of data and calculations from each sector is included in the tier 1 QC checks every year and that all sectors are addressed by the QA/QC checks on an on-going basis over a period of several years;

(b) The prioritization of QC checks in each sector. Such priorities could, for example, be derived from: priorities already identified in the inventory improvement plan; areas where errors and mistakes have been detected during the review conducted by the ERT; and areas for which new or different experts have been integrated into the inventory team. The priorities could also include QA/QC activities to ensure the consistency of the data for categories for which different AD sources are available and have not yet been cross-checked for consistency;

(c) The designation of responsible experts for the defined sector-specific QC checks and for the defined priorities;

(d) A description of when the QA/QC checks should be performed and at which stage of the inventory preparation process;

(e) A description of how the QA/QC checks performed should be documented by the experts involved;

(f) The designation of a responsible person to conduct a review of the final inventory report (by a person who has not been involved in the compilation of the inventory).

38. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided an updated QA/QC plan and templates of checklists to document the QA/QC activities performed. The Party also submitted several documents, including a QA/QC plan, a manual containing QC procedures (in Portuguese) and an annex with checklists to verify the implementation of the QC procedures. The updated QA/QC plan includes a planned schedule of the QA/QC checks across all different sectors over three years (2012–2015); identifies the period May–June of each year as the time to define the QA/QC objectives; identifies the priorities for the QA/QC checks; describes the procedure for the discussion and approval of the QA/QC plan; and explains the procedure for the discussion and approval of the inventory development priorities and

the implementation of the QC checks, conducted during the period June to mid-December each year. The QA/QC checks performed at the sectoral level are addressed in more detail in the manual; however, this guidance does not clearly define the sectoral priorities in accordance with the status of the methodological development and issues identified, but provides a more general overview of the QA/QC checks conducted at the sectoral level. The ERT noted that the manual does not always accurately reflect the methodologies used by the Party in the inventory and therefore encourages Portugal to further refine and update the QA/QC plan and to include the sectoral priorities.

39. Portugal has also provided a list of the QA activities for 2013–2015, including the responsible experts. The Party informed the ERT that the responsible experts for the QC checks will be designated in such a way that an expert responsible for a particular sector does not revise its own sector. Portugal informed the ERT that the review of the final inventory report for each sector will be performed by the Head of the Division, who is not directly involved in the inventory compilation process.

40. The ERT recommends that Portugal implement mandatory QA/QC procedures for its next annual submission. In areas where several data sources or models exist, data comparisons should be undertaken and the consistency of the AD should be checked for the next annual submission. The ERT encourages the Party to develop standardized internal documentation on the estimation procedures performed by each expert, in order to ensure the continuation of expertise over time.

41. The ERT learnt that an integrated information technology system for the management of the inventory data and inventory system had been planned, but will not be implemented in the near future owing to financial constraints. The ERT encourages Portugal to establish and maintain less resource-demanding QA/QC activities, in order to ensure data consistency across all sectors and categories and to avoid errors introduced by manual data handling procedures. The sectoral experts should introduce automatic QA/QC procedures into the files containing the calculation procedures, such as data import macros, to the extent possible, and specific QA/QC activities should be implemented to check whether the same AD and parameters are used by different experts in different sectors (e.g. the EFs for fuels are not currently checked across the categories).

Transparency

42. The NIR provided by Portugal is generally transparent and structured in line with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines); however, the NIR is not transparent in all sectors. Whereas the energy and industrial processes sectors are generally transparent with only a few issues identified, a relatively large number of transparency-related issues were identified for the agriculture sector. The NIR does not always accurately reflect the underlying methodologies, calculations and parameters used (e.g. in the agriculture sector). For the KP-LULUCF activities, the key methodological information on the biomass and soil carbon stock changes for cropland management and grazing land management was only presented during the in-country review and had not been included in the NIR. Furthermore, not all sections of the NIR have been updated; the Party has sometimes included references to previous years' annual submissions and not to the current annual submission. The information related to the national system and to the QA/QC activities is very brief and the table containing the information on the national focal points is difficult to read.

43. The ERT recommends that Portugal enhance the consistency of the NIR by including accurate information on the underlying methods, data and parameters used to estimate the emissions. The ERT also recommends that the Party include, in its next annual

submission, a detailed description of the planned approach to define the land-area identification and carbon stock changes for the KP-LULUCF activities (e.g. by providing additional information in annexes to the NIR); and provide a more detailed description of the QA/QC system and of the institutional arrangements for the preparation of the inventory.

Inventory management

44. Portugal has a centralized archiving system, which is maintained by APA and includes the archiving of disaggregated EFs and AD. The archived information includes documentation on external and internal reviews, and on annual key categories and key category identification and planned inventory improvements. The archiving system does not systematically include internal documentation on QA/QC procedures. No guidance is available for the inventory team as to which, how and where information has to be stored. No central checks are performed to ensure that the information is appropriately archived by the sectoral experts. During the review, the ERT was not provided with all of the requested additional archived information (e.g. background papers on references for the parameters used in the agriculture and waste sectors could not be retrieved from the system).

45. The ERT recommends that Portugal improve its archiving system by providing further guidance on the record-keeping and archiving procedures, which may include guidance on the specific information to be stored in the relevant folders and on systematic terminology to be used for the folders and file names. The ERT also recommends that the Party scan the relevant paper documents containing key documentation on the estimation parameters used and include this information in the electronic storage system, in order to ensure the completeness of the referenced material. A designated QA/QC coordinator should check whether the guidance has been implemented by all experts involved in the preparation of the inventory.

3. Follow-up to previous reviews

46. Portugal has addressed recommendations in previous review reports and the status of the implementation of previous recommendations is transparently documented in the NIR. The recommendations in the most recent review report were only partially addressed, because the draft and final review reports were received after the internal completion of the 2012 annual submission. Improvements resulting from recommendations in previous review reports that were addressed include:

(a) The improvement of the transparency of the energy chapter of the NIR related to the municipal solid waste incineration facilities for electricity production;

(b) Improved explanations of trend fluctuations in the NIR;

(c) The revision of estimates for cement production;

(d) Improved AD for lime production;

(e) Improved AD for nitric acid production;

(f) Complete geographical coverage of the LULUCF emission and removal estimates for the Azores and Madeira;

(g) Enhanced transparency, completeness and improved consistency for the estimates in the LULUCF sector;

(h) An improved demonstration that carbon pools not accounted for are not net sources of emissions;

(i) The use of country-specific data for protein consumption for estimating N_2O emissions from human sewage;

(j) The improvement of the transparency and consistency of the NIR.

47. There are also recommendations in previous review reports for which the NIR indicates that the implementation is under development, including:

(a) The incorporation of more plant-specific data in the inventory;

(b) The improvement of the estimation of emissions from feedstocks and non-energy use of fuels;

(c) The improvement of the estimation methodology for iron and steel;

(d) The analysis of time-series consistency for fugitive emissions from oil refining activities;

(e) The revision of digestibility values for dairy cows and the EF for anaerobic lagoons;

(f) The more timely availability of fertilizer consumption data;

(g) Further improvements of methodologies and data sources for the estimation of KP-LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol and the land-area identification;

(h) The investigation of emission trends and unusual values in several areas;

(i) The estimation of N_2O emissions from flaring.

48. In some areas the NIR explains that efforts were made, but no data could be found for the improvements recommended. These areas include:

(a) The inclusion of removed crop residues in the estimations for the agriculture sector;

(b) The use of country-specific parameters in the first order decay (FOD) model for estimating emissions from solid waste disposal on land;

(c) Improved information on industrial wastewater handling, such as the loads and shares of treatment systems.

4. Areas for further improvement identified by the expert review team

49. During the review, the ERT identified several issues for improvement. These are listed in table 6 below.

50. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 6 below.

B. Energy

1. Sector overview

51. The energy sector is the main sector in the GHG inventory of Portugal. In 2010, emissions from the energy sector amounted to 50,001.72 Gg CO_2 eq, or 69.5 per cent of total GHG emissions. Since 1990, emissions have increased by 22.0 per cent. The key driver for the rise in emissions is the development of the transport sector, emissions from which have increased by 83.7 per cent since 1990. Following a constant increase in sectoral GHG emissions of about 50 per cent between 1990 and 2000, emissions stabilized until 2005 and have been decreasing since then. Several other factors also explain the emission

trends in the energy sector, including: the economic growth; the introduction of the distribution of natural gas in the energy industries and residential/commercial categories in 1997; the increase in renewable energy supply; and the economic crisis during the latest years of the time series. Within the sector, 36.5 per cent of the emissions were from road transportation, followed by 24.6 per cent from public electricity and heat production and 19.0 per cent from manufacturing industries and construction. The residential/commercial and agriculture subcategories together accounted for 10.6 per cent of the sectoral emissions and refineries for 4.7 per cent. The remaining 4.7 per cent were from other categories, such as other transport, military operations and fugitive emissions.

52. The Party has made recalculations for the energy sector between the 2011 and 2012 annual submissions following changes in AD for the period 2005–2008, and owing to changes in the CO_2 EFs and/or oxidation factors for power plants, the pulp and paper industry and the consumption of gasoline and diesel in road transportation. The methodology used to estimate emissions from road transportation has been updated and the updated COPERT model has been used, leading to an increase in CH_4 emissions in the energy sector. The impact of these recalculations on the energy sector is an increase in the estimated emissions of 1.3 per cent for 2009 and of 1.6 per cent for 1990. The main recalculations took place in the following categories:

(a) Fugitive emissions from fuels;

(b) Transport;

(c) Manufacturing industry and construction;

(d) Energy industries.

53. The inventory for the energy sector is mostly complete and the methodologies used by the Party are generally consistent throughout the time series. The ERT commends the Party for its efforts to enhance the transparency of the inventory for the energy sector in the NIR. The recommendations from the previous review report have been taken into account and improvements are being implemented or are planned for the coming years (e.g. the further consideration of the EU ETS verified reports and enhanced cooperation with the Portuguese Department of Energy (DGEG) with regard to data collection). The ERT encourages Portugal to facilitate cooperation between DGEG and the inventory team so that the inventory team is directly informed of any changes made to the energy balance.

2. Reference and sectoral approaches

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

54. The difference between the reference and the sectoral approaches for 2010 is 2.0 per cent for energy consumption and 1.7 per cent for CO_2 emissions. The highest discrepancy is observed for 1997, where the energy consumption and CO_2 emissions are 7.9 per cent and 8.3 per cent higher, respectively, in the reference approach than in the sectoral approach. During the review, Portugal explained the reasons for these differences: the higher liquid fuel consumption in the sectoral approach is due to the consideration of special fuels in the inventory that are not taken into account in the energy balance/reference approach (e.g. fuel gas in petrochemical industry, and waste oil and tar in iron and steel production). Conversely, biodiesel consumption is considered together with diesel consumption in the energy balance/reference approach (in total liquid fuels) but separately in the sectoral approach (with biomass).

55. For solid fuels, the lower energy consumption in the sectoral approach can be explained by the fact that plant-specific net calorific values are used for the power plants

consuming coal. Thus, the difference is due to a discrepancy in the energy unit, not in the mass unit.

56. For gaseous fuels, the difference is due to the allocation of non-energy use of natural gas in the energy balance/reference approach (non-energy use is considered in the energy sector) and to the incorrect conversion of activities expressed in toe in the energy balance to GJ in the sectoral approach (leading to the underestimation of natural gas consumption in the inventory). The ERT encourages Portugal to use the comparison between the two approaches to detect potential errors (i.e. underestimations or overestimations). The ERT recommends that the Party include detailed explanations of the differences between the two approaches in the NIR, in order to improve the transparency of the reporting. During the review, the ERT identified that the consumption of natural gas in refineries to produce hydrogen has not been included in the inventory. During the review, Portugal provided the missing estimates (see paras. 58 and 81 below).

International bunker fuels

57. For international aviation bunker fuels, Portugal has made efforts to use the IPCC methodology based on flight destination rather than on the aircraft's country of registration as the basis for the split in the energy balance. Since 2007, DGEG has been using data developed specifically for the inventory. For maritime bunker fuels, the Party uses a bottom-up approach to determine the amount of fuel used. The ERT commends Portugal for the application of this approach.

Feedstocks and non-energy use of fuels

58. The NIR mentions that the CO_2 emitted as a sub-product in production processes, such as ammonia production, has been reported. However, it is not clear what type of fuel is used. During the review, the Party informed the ERT that residual fuel oil is consumed. However, it is still not clear whether the quantity of fuel oil used should be deducted from the energy consumption to avoid double counting of emissions. During the review, another non-energy use of fuel was identified: the consumption of natural gas in refineries to produce hydrogen. This particular use has not been included in the inventory, thereby leading to an underestimation of CO_2 emissions under the subcategory oil refining/storage (CRF table 1.B.2). During the review, Portugal provided the missing estimates (see para. 81 below). The ERT encourages the Party to enhance the transparency of its reporting on feedstocks and non-energy use of fuels in the NIR of its next annual submission.

3. Key categories

Stationary combustion: all fuels – CO_2, CH_4 and N_2O[6]

59. To estimate CO_2 emissions from public electricity and heat production and the centralized production of electricity, a bottom-up approach is used to collect the AD, which are subsequently compared with the relevant data in the energy balance. Since 2005, the Party has used the EFs from the EU ETS verified reports. In line with the recommendation in the previous review report, the Party has used these EFs to revise the entire time series backwards. The ERT commends Portugal for the detailed and transparent approach used to estimate emissions for this category.

60. CO_2 emissions from limestone used for desulphurization are reported under public electricity and heat production. According to the *Revised IPCC Guidelines for National*

[6] Not all emissions related to all gases under this category are key categories, particularly CH_4 and N_2O emissions. However, since the calculations procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

Greenhouse Gas Inventories (hereinafter referred to as the Revised 1996 IPCC Guidelines), these emissions should be reported under the industrial processes sector, in the category limestone and dolomite use. The ERT recommends that Portugal reallocate CO_2 emissions from limestone used for desulphurization to the industrial processes sector.

61. Following a recommendation in the previous review report, Portugal has estimated non-CO_2 emissions from the combustion of landfill gas and biogas used to produce energy in the category public electricity and heat production. The ERT commends the Party for this improvement.

62. The AD for the liquid and gaseous fuels consumed in petroleum refining have been based on EU ETS verified reports from the two operating petroleum refineries since 2005. The CO_2 fuel combustion emissions from these two installations reported in the GHG inventory (2,292.53 Gg CO_2 eq) are 0.4 per cent lower than those reported in the EU ETS verified reports (2,301.02 Gg CO_2 eq) for 2010. This difference is explained by the Party as follows:

(a) To estimate CO_2 emissions, Portugal uses IPCC default EFs for fuel oil, natural gas and part of gas oil, even though plant-specific EFs are available for these fuels. In line with the IPCC good practice guidance, it is good practice to use the most accurate parameters available in the country;

(b) Not all fuels combusted in these two installations have been included in the inventory; for example, CO_2 emissions have not been estimated for the following fuels: specific refinery fuel and some amounts of gas oil, off gas and tail gas. However, the emissions from these fuels have been estimated and reported in the EU ETS verified reports.

63. The approach used by the Party leads to an underestimation of CO_2 emissions from petroleum refining. The ERT recommends that Portugal use the most accurate CO_2 EFs to estimate CO_2 emissions from the combustion of specific refinery fuel, fuel oil, gas oil, natural gas, off gas and tail gas, and include estimates of CO_2 emissions from the fuels that have not previously been estimated by using plant-specific AD and the EFs available in the EU ETS verified reports.

64. The ERT noted that CH_4 and N_2O emissions have not been estimated for the following fuels: specific refinery fuel, and some amounts of gas oil, off gas and tail gas, even though methodologies to estimate the emissions from these fuels and default EFs are provided in the Revised 1996 IPCC Guidelines. The Party's approach is therefore not in line with the IPCC good practice guidance and leads to an underestimation of non-CO_2 emissions from petroleum refining.

65. Non-CO_2 emissions from flaring in the petrochemical industry have not been estimated, as no methodology is available in the IPCC good practice guidance. Since non-CO_2 emissions are calculated for flaring in other industries, such as pulp and paper, the ERT encourages Portugal to estimate and report CH_4 and N_2O emissions from manufacturing industries and construction in order to enhance intersectoral consistency.

66. During the review, in response to the list of potential problems and further questions raised by the ERT during the review week, Portugal informed the ERT that plant-specific fuel consumption data were used for the period 1990–2004 and that specific refinery fuel, gas oil, off gas and tail gas consumption data and plant-specific CO_2 EFs based on the EU ETS verified reports were used for 2005 onwards. To estimate CH_4 and N_2O emissions from specific refinery fuel, gas oil, off gas and tail gas, the Party used default EFs for oil in energy industries from the Revised 1996 IPCC Guidelines (3 kg CH_4/TJ and 0.6 kg N_2O/TJ), as appropriate. Also, during the review Portugal submitted revised emission estimates for CO_2, CH_4 and N_2O emissions from petroleum refining. The revised estimates

resulted in an increase in estimated CO_2 emissions of 0.5 per cent for 2010 (from 2.292.53 Gg to 2.303.28 Gg), an increase in estimated CH_4 emissions of 417.2 per cent for 2010 (from 0.07 Gg to 0.36 Gg) and an increase in estimated N_2O emissions of 162.5 per cent for 2010 (from 0.04 Gg to 0.11 Gg). The ERT agrees with the revised estimates.

67. Portugal used different data sources to estimate the activity levels for each subcategory under manufacturing industries and construction, including the database developed for the implementation of the large combustion plant directive,[7] the large point-source installations, the EU ETS verified reports and the energy balance. The Party generally uses the default CO_2 EF from the Revised 1996 IPCC Guidelines.

68. In its 2012 annual submission, Portugal has provided an in-depth review of the pulp and paper industry, resulting in the revision of estimated emissions from fuel consumption and pulp production and in the more extensive use of plant-specific AD and EFs for the period 1990–2009. The ERT commends the Party for this improvement.

69. The AD for the consumption of oil waste and tar under iron and steel production appears to be constant over the entire time series, which implies that the emission estimates are not accurate. During the review, Portugal explained its intention to revise the methodology used to estimate emissions for this category for its next annual submission. The ERT recommends that the Party use, to the extent possible, plant-specific AD to estimate the emissions from iron and steel production. This could be done in several steps, starting with the categories involving fuel consumption, using plant-specific CO_2 EFs, or flaring of gases (e.g. for fuels such as waste fuel, fuel gas and tail gas consumed in categories such as iron and steel production, chemical industry and specific industrial processes).

70. The ERT noted the potential double counting of CO_2 emissions from ammonia production until 2009 and of CO_2 emissions from black carbon production until 2010. The ERT encourages Portugal to verify whether the CO_2 emissions are reported under both the energy sector and the industrial processes sector.

71. The EF for gasoline reported under manufacturing industries and construction and other sectors has not been revised to reflect the update carried out to the EF in the transport category. During the review, Portugal confirmed that the same type of gasoline is consumed in road transportation as in the aforementioned categories. The use of a lower EF to estimate CO_2 emissions for those categories (68.61 kg CO_2/GJ) compared with the EF used for road transportation (73 kg CO_2/GJ) leads to the underestimation of CO_2 emissions from stationary combustion. The ERT recommends that Portugal use the same CO_2 EF for gasoline across all categories where it is combusted. During the review, in response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates of the CO_2 EF and CO_2 emissions from liquid fuels (see para. 72 below).

72. During the review, in response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates of CO_2 emissions from liquid fuels. The revised estimates resulted in an increase in the estimated CO_2 emissions from liquid fuels for manufacturing industries and construction of 0.03 per cent for 2010 (from 5,226.23 Gg to 5,227.93 Gg) and an increase in the estimated CO_2 emissions from liquid fuels for other sectors of 0.06 per cent for 2010 (from 3,666.28 Gg to 3,668.38 Gg).

73. The ERT noted that Portugal has used incorrect AD for natural gas consumption to calculate GHG emissions from manufacturing industries and construction and other sectors,

[7] EU directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants.

owing to an error in the conversion from a mass unit to an energy unit. When the natural gas AD used are based on the energy balance expressed in toe, a conversion is made to t by using an average density value. This physical quantity is then reconverted into energy (GJ) for the emission calculation. This two-step conversion leads to an underestimation of natural gas consumption and of the resultant CO_2, CH_4 and N_2O emissions when compared with the direct conversion of toe to GJ (using a constant conversion factor).

74. During the review, in response to a request made by the ERT, Portugal revised the relevant AD and provided revised emission estimates. The recalculations resulted in an increase in estimated CO_2 emissions from natural gas for manufacturing industries and construction of 0.2 per cent for 2010 (from 3,596.61 Gg to 3,605.24 Gg) and an increase in estimated CO_2 emissions from natural gas for other sectors of 3.4 per cent for 2010 (from 1,220.09 Gg to 1,261.46 Gg). The ERT agrees with the revised estimates.

Road transportation: liquid and gaseous fuels – CO_2

75. The emission estimates for road transportation are based on the AD from the energy balance for all fuels (i.e. gasoline, diesel oil, liquefied petroleum gas, natural gas and biofuel). The COPERT IV model (version 9.0) has been used to estimate emissions from road transportation for the 2012 annual submission. Portugal has applied a bottom-up approach by defining the traffic conditions per vehicle type in the COPERT model. This more accurate bottom-up model allows for a more accurate representation of the national traffic conditions, such as data on km/vehicle for passenger cars and light-duty vehicles based on a database from the national vehicle inspection centres. The ERT commends the Party for the implementation of this new methodology, which has resulted in more accurate emission estimates.

76. Following the recommendations in the previous review report, Portugal has reported an updated CO_2 EF for gasoline combustion in road transportation in the 2012 annual submission by applying a revised EF (more representative of European gasoline), in line with the Revised 1996 IPCC Guidelines (73 kg CO_2/GJ (table 1-36)). However, as CO_2 emissions from road transportation is the largest key category, the ERT recommends that the Party develop country-specific parameters (e.g. hydrogen/carbon ratios and EFs) for gasoline and diesel oil.

77. CO_2 emissions from the use of natural gas in road transportation are calculated using an EF of 64.1 t CO_2/TJ. The ERT noticed that, according to the conclusions of the review of the inventory submitted on behalf of the EU member States under the effort-sharing decision,[8] this leads to an overestimation of emissions. The ERT recommends that the Party update the EF for its next annual submission.

Railways: liquid fuels – CO_2

78. Portugal uses a CO_2 EF from the European Monitoring and Evaluation Programme/ CO-oRdinated INformation on the Environment in the European Community-*EMEP/CORINAIR Emission Inventory Guidebook*[9] to estimate CO_2 emissions from liquid fuels and follows the methodology provided in the guidebook to estimate the consumption of diesel oil for railways. This EF is not consistent with the one used for the other categories involving consumption of diesel oil. The ERT recommends that Portugal consistently apply the same CO_2 EF for the same type of diesel oil across all categories where it is consumed.

[8] The review was carried out by the EU over the period May–August 2012 and focused on the potential overestimation of GHG emissions.

[9] European Environment Agency. 2007. *EMEP/CORINAIR Emission Inventory Guidebook*.

Fugitive emissions from oil refining: all fuels – CO_2

79. The following processes occur in the two national operating refineries: flaring, fluid catalytic conversion and hydrogen production. For fluid catalytic conversion and flaring, the AD used in the inventory are the same as those reported in the EU ETS verified reports. The CO_2 emissions from the processes in these two plants reported in the inventory (407.01 Gg) are 23.4 per cent lower than those reported in the EU ETS verified reports (531 Gg) for 2010. This is due to the fact that the AD for and CO_2 emissions from the production of hydrogen and the CO_2 emissions from fluid catalytic conversion in one of the refineries have not been included in the GHG inventory.

80. To estimate CO_2 emissions from flaring, Portugal uses a constant EF provided by the refineries several years ago, without a documented reference. The use of this EF leads to an underestimation of CO_2 emissions from flaring in one refinery. The omission of sources for GHG emissions and the use of an inaccurate EF without relevant justification is not in line with the IPCC good practice guidance and leads to the underestimation of CO_2 fugitive emissions.

81. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal explained that the N_2O emissions from oil refining are not correlated with the AD (unlike the associated CO_2 and CH_4 emissions). The CO_2 and CH_4 EFs are related to the fuel gas consumption in flaring. Portugal has used the N_2O EF from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), which is related to oil production in refineries and not to fuel gas consumption in flaring. The Party has provided estimates of CO_2 emissions from the production of hydrogen and from fluid catalytic conversion by using plant-specific AD and the EFs available in the EU ETS verified reports for 2005 onwards. For the period 1990–2004, the AD were obtained from the facilities and the EFs were assumed to be the same as those for 2005. Portugal submitted revised emission estimates for flaring using a CO_2 EF derived from plant-specific data on CO_2 emissions from flaring. The revised estimates resulted in an increase in estimated CO_2 emissions from flaring of 71.2 per cent for 2010 (from 474.27 Gg to 769.94 Gg). The ERT agrees with the revised estimates.

4. Non-key categories

Road transportation: liquid and gaseous fuels – CH_4 and N_2O

82. The new COPERT IV model used for the 2012 annual submission influences the CH_4 and N_2O emission estimates for road transportation: the CH_4 EFs are higher in the new COPERT model for all vehicle types. The N_2O emissions are correlated with the fuel sulphur content, thereby leading to a fall in the time series for the N_2O EFs when the sulphur content decreases.

83. N_2O emissions from the use of natural gas in road transportation are reported as "NO", even though natural gas consumption in road transportation has been reported. This leads to the underestimation of N_2O emissions from gaseous fuels used in road transportation. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal submitted revised estimates of N_2O emissions for the entire time series using a default EF for natural gas used in road transportation from the Revised IPCC 1996 Guidelines (0.1 kg N_2O/TJ (table 1-8)). The revised estimates resulted in an increase in estimated N_2O emissions from gaseous fuels used in road transportation of 0.00005 Gg for 2010. The ERT agrees with the revised estimates.

C. Industrial processes and solvent and other product use

1. Sector overview

84. In 2010, emissions from the industrial processes sector amounted to 6,057.62 Gg CO_2 eq, or 8.4 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 228.00 Gg CO_2 eq, or 0.3 per cent of total GHG emissions. Since the base year, emissions have increased by 27.9 per cent in the industrial processes sector and decreased by 31.3 per cent in the solvent and other product use sector. The key drivers for the rise in emissions in the industrial processes sector are the increases in the production of cement, lime and glass, the use of limestone and dolomite, the use of HFCs for refrigeration and air conditioning and the use of SF_6 for electrical equipment production. Within the industrial processes sector, 67.4 per cent of the emissions were from mineral products (particularly cement production), followed by 25.4 per cent from consumption of halocarbons and SF_6, 6.9 per cent from chemical industry and 0.3 per cent from metal production. Other production accounted for 0.25 Gg CO_2 eq.

85. The Party has made recalculations for the industrial processes sector between the 2011 and 2012 annual submissions following changes in AD and in order to rectify identified errors. The impact of these recalculations on the industrial processes sector is an increase in estimated emissions of 10.5 per cent for 2009. The main recalculations took place in the following categories:

(a) Lime production;

(b) Limestone and dolomite use;

(c) Glass production;

(d) Consumption of halocarbons and SF_6.

86. Portugal has made recalculations for the solvent and other product use sector between the 2011 and 2012 annual submissions following changes in AD. The impact of these recalculations on the solvent and other product use sector is a decrease in estimated emissions of 8.7 per cent for 2009. The main recalculations took place in the following categories:

(a) Paint application;

(b) Degreasing and dry cleaning;

(c) Other.

87. Portugal has improved the accuracy of its emission estimates for the industrial processes and solvent and other product use sectors by using higher-tier methods and collecting AD directly from the plants; however, this is not explained in the NIR. The ERT recommends that Portugal improve the transparency of the NIR by providing a more detailed description of the improvements made in its next annual submission.

88. The ERT appreciates the efforts made by Portugal to provide information on implemented sector-specific QA/QC activities. However, the ERT identified several inconsistencies in the information provided in the NIR, in the CRF tables and during the review. The ERT also found that the QA/QC plan for the industrial processes sector has not been updated and that it includes some chapters which are not relevant to the national circumstances of Portugal, while other relevant information is missing. The ERT recommends that the Party update the QA/QC plan for the industrial processes sector and strengthen the sector-specific QA activities in order to enhance the consistency of the information provided.

89. The ERT reiterates the recommendation in the previous review report that Portugal use appropriate notation keys and provide information on the methods and EFs used for the estimation of HFC, PFC and SF_6 emissions from the consumption of halocarbons and SF_6, which is missing from CRF table summary 3, in its next annual submission.

2. Key categories

Cement production – CO_2

90. Portugal has used an EU ETS methodology from annex VII to EU decision 2007/589/EC,[10] which is in line with the tier 3 approach provided in the 2006 IPCC Guidelines, to estimate CO_2 emissions from cement production for the period 2005–2010. This methodology is based on the carbonate content of the process inputs (including fly ash and blast furnace slag), with the cement kiln dust and bypass dust deducted from the raw material consumption. For the period 1990–2004, the emissions were estimated using a simple backcasting methodology using the clinker production time series provided directly by the cement production plants as a driver; however, the Party has not provided a clear explanation of this methodology in the NIR. The ERT reiterates the recommendation in the previous review report that Portugal provide more detailed information on the methodologies used to estimate emissions for the period 1990–2004, in order to improve the transparency of the reporting, and further describe how time-series consistency is ensured, in its next annual submission.

91. As part of its QC activities, Portugal compares the AD received from each individual plant with the data in the National Statistical Database (INE). However, the Party has not provided any information on whether there were any significant discrepancies between these data sources for 2010, unlike the information provided on the comparison of the data for 2009. The ERT encourages Portugal to provide information on the results of the comparison of the data sources in its next annual submission.

Lime production – CO_2

92. Portugal has used an EU ETS methodology from annex VIII to decision 2007/589/EC to estimate CO_2 emissions from lime production for the period 2005–2010. For different time periods and different economic activities, the emission estimates were calculated using different sources of AD. The Party informed the ERT about its intention to check all AD on lime production and to include information on the results of this check in its next annual submission.

93. Portugal also informed the ERT about its efforts to improve the accuracy of the estimates for this category. During the review, the ERT learnt that the data provided by INE allow the Party to distinguish between the quicklime produced for final consumption and for slaked lime production, and also allow Portugal to distinguish the lime produced in different economic activities and at all scales of production. 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 the lime-producing plants and from INE for the years currently estimated using estimated AD for its next annual submission.

[10] Commission Decision 2007/589/EC establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

Glass production – CO_2

94. The ERT welcomes the efforts made by Portugal to improve the accuracy of its emission estimates for glass production. The ERT appreciated the possibility provided by the Party during the review week to review all parameters (e.g. the percentage of cullet used), EFs and AD used for the emission estimates and the calculation sheets for the new methodology used. The ERT encourages Portugal to provide this information in its next annual submission.

95. The ERT noted that the estimated CO_2 emissions from glass production were recalculated for the 2012 annual submission and that the revised CO_2 emission estimates are similar to the estimates provided in the 2011 annual submission. The ERT encourages Portugal to elaborate on the rationale for the recalculations in its next annual submission.

Consumption of halocarbons and SF_6 – HFCs

96. The ERT appreciates the transparency and detailed description of the models used in the NIR. The ERT noted that the two models used to estimate the potential and actual emissions are based on many assumptions; these assumptions are described in the NIR and are based mainly on expert judgment or default values from the IPCC good practice guidance or the 2006 IPCC Guidelines. The ERT also noted that Portugal has compared the results of the models, thereby allowing the Party to verify the assumptions and results. The ERT recommends that Portugal enhance the transparency of its reporting by providing information on the outcomes of the comparison of the results from the two models in its next annual submission. The ERT also encourages the Party to integrate this comparison into its QA/QC plan.

97. The ERT commends Portugal for obtaining AD for the estimation of HFC emissions for this category. When the AD are based on expert judgment, the AD should be verified either by using models (see para. 96 above) or by using an independent data source. The ERT therefore encourages the Party to obtain and use an independent data source (e.g. national production statistics (production data) and customs office statistics (import and export data).

3. Non-key categories

Limestone and dolomite use – CO_2

98. In the NIR, Portugal mentions that limestone and dolomite is used in iron and steel production and that the CO_2 emissions therefrom are included under the energy sector, assuming that the CO_2 EF for blast furnace consumption already includes the carbon from limestone that was released from the flux in the blast furnace. However, no such limestone and dolomite use occurs in Portugal. The ERT recommends that the Party enhance the transparency of the NIR by removing inconsistent information and by accurately describing the methodologies used to estimate emissions from limestone and dolomite use.

99. Emissions from limestone and dolomite use for wet flue gas desulphurization are estimated using EU ETS data, but these emissions are reported under the energy sector instead of under the industrial processes sector. The ERT noted that the reporting of emissions from limestone and dolomite use is not in line with the UNFCCC reporting guidelines and encourages Portugal to reallocate these emissions from the energy to the industrial processes sector.

Consumption of halocarbons and SF_6 – HFCs and SF_6

100. The transparency of the description of the methodology used to estimate HFC emissions from fire extinguishers in the NIR is limited. The ERT recommends that Portugal

provide more detailed information on the methodology, AD, EFs and other parameters used to estimate HFC emissions from fire extinguishers in its next annual submission.

101. Emissions of SF_6 from manufacturing of electrical equipment (switch gear and/or circuit breakers) were not reported in the inventory. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates of actual SF_6 emissions from electrical equipment, including SF_6 emissions from manufacturing of electrical equipment (switch gear and circuit breakers). The recalculations resulted in an increase in estimated SF_6 emissions from electrical equipment of 255.9 per cent for 2010 (from 7.12 Gg CO_2 eq to 25.34 Gg CO_2 eq). The ERT agrees with the revised estimates.

102. To estimate emissions of SF_6 from manufacturing of electrical equipment, Portugal applied the methodology described in the IPCC good practice guidance and the EF provided in the 2006 IPCC Guidelines. The ERT encourages the Party to provide a description of the methodology applied to estimate the emissions and the results of the category-specific QA/QC activities performed in its next annual submission.

103. The ERT also encourages Portugal to estimate the amount of SF_6 imported or exported in products, especially in switch gears and circuit breakers. This information is very important in order to justify the development of the emission trend for actual and potential emissions.

Solvent and other product use – CO_2

104. The ERT commends Portugal for the transparent and detailed reporting on this sector in the NIR and for the development of a country-specific methodology to estimate indirect CO_2 emissions from solvent use. For many subcategories (e.g. for subcategories under chemical products, manufacture and processing) the descriptions and equations presented in the NIR are almost the same. The NIR could be significantly streamlined by, for example, reporting in an overview part the description of the methodology used for estimating emissions for all subcategories under paint application. The ERT encourages Portugal to streamline the description of solvent and other product use in the NIR of its next annual submission.

D. Agriculture

1. Sector overview

105. In 2010, emissions from the agriculture sector amounted to 7,596.01 Gg CO_2 eq, or 10.6 per cent of total GHG emissions. Since 1990, emissions have decreased by 6.9 per cent. The key drivers for the fall in emissions are the reductions in nitrogen (N) fertilizer use and animal manure applied to agricultural soils. Within the sector, 38.9 per cent of the emissions were from agricultural soils, followed by 37.4 per cent from enteric fermentation, 18.0 per cent from manure management and 5.2 per cent from rice cultivation. The remaining 0.5 per cent were from field burning of agricultural residues.

106. Portugal has made recalculations for the agriculture sector between the 2011 and 2012 annual submissions following changes in AD due to the publication of the results of the General Census of Agriculture (2009) by INE, as a result of the use of revised slaughter data for lambs, owing to the revision of the apparent consumption of synthetic fertilizers and the use of new AD for rice cultivation. The impact of these recalculations on the agriculture sector is a reduction in estimated sectoral emissions of 2.6 per cent for 2009. The main recalculations took place in the following categories:

(a) Rice cultivation;

(b) Manure management;

(c) Field burning of agricultural residues.

107. 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. The only category reported as not estimated was direct and indirect CH_4 emissions from agricultural soils, for which no EFs are provided in the IPCC good practice guidance. As prescribed burning of savannas does not occur in Portugal, the emissions have therefore been reported as "NO". The 2011 annual review report identified an apparent incompleteness in the reporting of the emissions from agricultural soils due to excluding from the estimates the emissions from the application of sewage sludge as a soil amendment. The ERT recommends that Portugal, for its next annual submission, estimate N_2O emissions from sewage sludge application to agricultural soils and enhance the relevant explanations in the NIR.

108. The ERT noted that the transparency of the NIR could be improved in terms of the reporting of AD, EFs and emission estimates. In particular, the ERT noted the lack of information with respect to the use of IPCC default parameters and EFs. The ERT also noted the lack of a sufficiently descriptive rationale for the choice of parameters and EFs, as well as inconsistencies between the NIR and the CRF tables. The ERT further noted that some of the additional information required in the CRF tables (e.g. the average live weight for dairy cattle) has not been provided. The ERT reiterates the recommendation in the previous review report that Portugal enhance the transparency of its NIR by providing this information and by ensuring consistency between the NIR and the CRF tables in its next annual submission.

109. The ERT noted that the references to the use of the Revised 1996 IPCC Guidelines and the IPCC good practice guidance are, in some cases, not reported in a transparent manner in the NIR. For example, Portugal reports the use of the default EFs for Western Europe for enteric fermentation for horses and mules and asses provided in tables 4-3 and 4-4 of the Revised 1996 IPCC Guidelines, when in fact the correct reference is table 4-2. The ERT also noted that the Party does not distinguish between the Revised 1996 IPCC Guidelines and the IPCC good practice guidance in some cases. The ERT therefore recommends that Portugal improve the transparency of its NIR by correctly identifying the source of the parameters and EFs from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

110. Previous review reports have identified that Portugal carries out the uncertainty analysis using a tier 1 methodology and IPCC default values for the uncertainties associated with the AD and EFs, or by using country-specific uncertainty values derived from non-scientific assumptions. The ERT reiterates the recommendations in previous review reports that the Party develop and include country-specific uncertainty values for the AD and EFs, at a minimum for the key categories, and document them fully in the NIR.

111. The ERT commends Portugal for undertaking recalculations on the basis of the availability of revised AD; however, the ERT noted that the Party has not transparently described the recalculations performed in its NIR. For example, Portugal reports that recalculations were undertaken for both the swine and the ovine populations, which affects the estimates for the whole time series (1990–2009). However, in response to a question raised by the ERT during the review, the ERT identified that the recalculations of the AD for swine were only undertaken for the period 1990–1995. The ERT reiterates the recommendation in previous review reports that Portugal improve the transparency of the description of the recalculations performed in the NIR of future annual submissions.

2. Key categories

Enteric fermentation – CH_4

112. The ERT commends Portugal for using tier 2 methodologies in the estimation of CH_4 emissions from enteric fermentation for almost all livestock species, with the exception of horses and mules and asses. Portugal uses a regression equation of annual milk production rather than the detailed feed intake data required to implement the tier 2 approach. The ERT is of the view that the methodological approach described by Portugal for dairy cattle is a tier 1 approach and not a tier 2 approach as described by the Party in its NIR. This is not in line with the IPCC good practice guidance. The ERT reiterates the recommendation in the previous review report that Portugal develop an appropriate tier 2 methodology in line with the IPCC good practice guidance for dairy cattle for its next annual submission.

113. Furthermore, the ERT noted that dairy cattle milk production increased by 80 per cent between 1990 and 2010, and that for 2010 the average milk yield per cow was 8,044 kg/head/year. This is one of highest milk yields reported by Parties included in Annex I to the Convention. The ERT encourages Portugal to investigate the level of milk production reported and document fully, in the NIR of its next annual submission, the estimation method used and the rationale for this level of production on the basis of country-specific production practices.

114. Portugal continues to account for young animals under weaning age in its estimates of CH_4 emissions from enteric fermentation (which leads to a potential overestimation of emissions from enteric fermentation). The ERT noted that rumen function is absent in young animals under weaning age and reiterates the recommendation in the previous review report that Portugal estimate CH_4 emissions from enteric fermentation for appropriate livestock subcategories for its next annual submission.

115. Previous review reports have identified transparency issues with regard to the description of the methods used by Portugal to derive country-specific EFs for sheep, goats and non-dairy cattle. In particular, the rationale for the use of country-specific parameters to calculate the net energy per metabolic function was not fully transparent. The ERT reiterates the recommendation in previous review reports that Portugal enhance the transparency of the description of the methods used in its next annual submission. Also, the ERT noted that the Party incorrectly referenced table 6.2.8 of its NIR, when the correct reference should be table 6.3.8. The ERT recommends that Portugal enhance its QA/QC activities in order to improve the accuracy of its NIR.

116. Portugal has not reported all of the additional information required in CRF table 4.A, including the feeding situation of some livestock species, the milk yield of non-dairy cattle and the weight of dairy cattle. The ERT reiterates the recommendation in the previous review report that the Party enhance the transparency of its reporting by providing the additional information required in CRF table 4.A.

117. Portugal uses a value of 56 days for the length of the lactation period for non-dairy cattle. During the review week, the Party could not provide the ERT with a transparent rationale for the use of this value, which is significantly lower than the average period of five to eight months (150 to 240 days) that would be expected for this livestock category. The length of the lactation period is a driver in the estimation of the net energy for lactation, which in turn is one of the determinants of the total energy requirement for non-dairy cattle and, as a result, of CH_4 emissions from enteric fermentation for this livestock category.

118. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates using a lactation period length

of 188 days, estimated using values for average milk production per cow obtained from Jarrige R. 1988, reference to Annex I.B of this document. This recalculation resulted in an increase in estimated CH_4 emissions from enteric fermentation of 2.8 per cent for 2010 (from 2,766.49 Gg CO_2 eq to 2,844.63 Gg CO_2 eq).

Manure management – CH_4

119. The ERT commends Portugal for using a tier 2 method from the IPCC good practice guidance and country-specific data to estimate CH_4 emissions from manure management. However, the country-specific EFs derived by the Party are not provided in the NIR and are not compared to the IPCC default EFs. The ERT reiterates the recommendation in the previous review report that Portugal improve the transparency of the NIR by providing additional background information, enhance its QA/QC activities by ensuring that the information presented in the NIR and the CRF tables is consistent and compare the country-specific EFs with the IPCC default EFs.

120. The ERT also reiterates the recommendation in the previous review report that Portugal provide background information to support the use of the IPCC default values of 45 per cent and 39 per cent for the methane conversion factor for manure treated in anaerobic lagoons in temperate and cool regions, respectively.

121. The ERT noted that Portugal reports the recovery of CH_4 from biogas production from manure management under the waste sector. During the review week, the Party explained that the recovery of CH_4 from biogas production from manure management relates to the use of CH_4 for electricity production from the anaerobic digestion of swine manure. Portugal further explained that the AD used to derive the estimates of CH_4 recovery are included in the energy balance and that the estimates of emissions from the use of CH_4 for energy production are included under the energy sector. The final report of the 2012 EU technical review of the GHG inventory of Portugal to support the determination of annual emission allocations under the EU effort-sharing decision[11] also identified this issue. The ERT recommends that the Party follow the methodological approach provided in the footnote to table 4.10 of the IPCC good practice guidance, in order to correctly reflect the practice of anaerobic digestion of swine manure, and that Portugal document this approach in the NIR of its next annual submission.

122. Portugal uses a value of 56 days for the length of the lactation period for non-dairy cattle. During the review week, the Party could not provide the ERT with a transparent rationale for the use of this value, which is significantly lower than the average period of five to eight months (150 to 240 days) that would be expected for this livestock category. The length of the lactation period is a driver in the estimation of the net energy for lactation, which in turn is one of the determinants of the total energy requirement for non-dairy cattle and, as a result, of CH_4 emissions from manure management for this livestock category.

123. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal submitted revised emission estimates using a lactation period length of 188 days, estimated using values for average milk production per cow obtained from Jarrige (1988). This recalculation resulted in an increase in estimated CH_4 emissions from manure management of 0.2 per cent for 2010 (from 1,064.75 Gg CO_2 eq to 1,067.26 Gg CO_2 eq). The ERT agrees with Portugal's approach.

[11] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

Direct soil emissions – N_2O

124. 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. The ERT commends Portugal for this approach, which is in line with the IPCC good practice guidance.

125. Portugal frequently undertakes recalculations of the consumption of mineral N fertilizers applied to soils. The ERT reiterates the recommendations in previous review reports that Portugal implement, for its next annual submission, QC measures which obviate the need to conduct recalculations of the consumption of mineral N fertilizers, and that the Party clarify in the NIR of future annual submissions whether the values derived include all mineral N fertilizers applied to soils, including those applied to forest land.

126. Noting that the IPCC good practice guidance does not provide default data or guidance on collecting such data, the ERT encourages Portugal, for its next annual submission, to collect AD for sewage sludge application to agricultural soils in order to estimate N_2O emissions from this source.

Indirect emissions – N_2O

127. Portugal reported that the recalculations of indirect N_2O emissions for 2009 include revisions to the crop areas, crop production statistics and apparent consumption of fertilizer. The recalculations resulted in an increase in estimated indirect N_2O emissions of 1.6 per cent for 2009.

128. Portugal states in its NIR that 20 per cent of the effluent in anaerobic lagoons is discharged to the water system. The ERT encourages the Party to investigate the applicability of this assumption and to include a more detailed description of anaerobic lagoons in the NIR of its next annual submission.

3. Non-key categories

Manure management – N_2O

129. The ERT noted that Portugal has reported a country-specific N excretion value for swine in the 2012 annual submission. Portugal reports a value of 9.6 kg N/head/year, which is over 50 per cent lower than the IPCC default of 20 kg N/head/year. The ERT recommends that the Party provide additional information on country-specific N excretion rates for swine in the NIR of the next annual submission.

130. The ERT also noted that Portugal reports zero values for the N excretion of piglets (< 20 kg), lambs and young goats. During the review, the Party explained that the N excretion of these young animals is included in the values reported for adult females. However, as separate N excretion values for their young do exist in the estimation of N excretion for adult females, the ERT encourages Portugal to improve the accuracy of its reporting by reporting the N excretion values for young animals and adult females separately.

Rice cultivation – CH_4

131. Portugal has reported recalculations of the CH_4 emission estimates for rice cultivation based on the availability of new AD on areas of rice cultivation in *Techniques of Integrated Production*,[12] leading to a revision of the time series 1996–2009. Noting that the

[12] Ministry of Agriculture, Rural Development and Fisheries. 2006. Techniques of Integrated Production (in Portuguese).

NIR does not provide elaborated or clear information with regard to the source of the recalculations, the ERT encourages the Party to provide more detailed information thereon in its next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

132. In 2010, net removals from the LULUCF sector amounted to 9,880.09 Gg CO_2 eq. Since 1990, net removals have increased by 43.5 per cent. The key driver for the rise in removals is the increase in removals from forest land remaining forest land. Within the sector, net removals of 10,948.7Gg CO_2 eq were from forest land, followed by 688.2Gg CO_2 eq from other land, 544.5Gg CO_2 eq from grassland and 471.1Gg CO_2 eq from other (harvested wood products), while net emissions of 2,052.3Gg CO_2 eq were from settlements, followed by 487.5Gg CO_2 eq from wetlands and 232.6Gg CO_2 eq from cropland.

133. The net removals from the LULUCF sector offset Portugal's total GHG emissions by 13.7 per cent for 2010. 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 2.6 per cent in terms of CO_2 eq. Since 1990, the largest relative increases in emissions/removals have occurred for grassland (669.8 per cent), followed by settlements (87.7 per cent), forest land (68.4 per cent) and wetlands (25.8 per cent) while the largest relative decreases have occurred for other (LULUCF) (75.3 per cent), cropland (68.7 per cent) and other land (14.2 per cent).

134. The Party has made recalculations for the LULUCF sector between the 2011 and 2012 annual submissions in response to the 2011 annual review report. The impact of these recalculations on the LULUCF sector is a decrease in estimated net removals of 16.0 per cent for 2009. The main recalculations took place in all LULUCF categories except for other (harvested wood products).

135. The land area of the Portuguese territory has been classified according to the six land-use categories from the IPCC good practice guidance for LULUCF. Each category has then been divided into "X land remaining X land" and "land converted to X land". Following IPCC approach 3, the Party has implemented wall-to-wall mapping, based mainly on the CORINE Land-Cover data (CLC90-R and CLC06_PT) for 1986 and 2006. A complete time series of land-use/land-cover maps and land-use matrices for the period 1970–2010 was subsequently developed using extrapolation and intrapolation techniques, together with supplementary data from the General Census of Agriculture (for 1979, 1989, 1999 and 2009). The ERT noted that, in addition to the ongoing sixth National Forest Inventory (NFI 6), Portugal is developing new land-use/land-cover maps based on aerial photographs for 1995, 2007 and 2010. The Party is planning to use this information in the 2014 annual submission. The ERT commends Portugal for its work and encourages the Party to use data from the NFI as supplementary information for the intrapolation/extrapolation of the time series of land-use/land-cover data.

136. Portugal has reported GHG emissions/removals for all land-use categories and carbon pools, except for dead wood and direct N_2O emissions from N fertilization of forest land. Tier 2 methods from the IPCC good practice guidance for LULUCF have been used to estimate the GHG emissions and carbon stock changes, except for other (harvested wood products), grassland remaining grassland and other land remaining 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 for other land, 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, cropland and grassland.

137. The major improvements to the inventory for the LULUCF sector since the previous annual submission include:

(a) The accounting of the whole national territory in order to consider the two autonomous regions of the Azores and Madeira;

(b) The refinement of the land-use/land-cover change matrices;

(c) The consideration of biomass losses for non-irrigated and irrigated annual crops and rice paddies;

(d) The use of the assumption that the biomass of grassland and cropland reaches equilibrium after 20 years, compared to the 10-year transition period used in the previous annual submission;

(e) The estimation of CO_2 emissions from agricultural lime application for the first time;

(f) The estimation of emissions from wildfires on cropland and grassland for the first time.

138. In the ERs view, the carbon stock changes in dead wood were not estimated for all land-use categories. This could lead to a potential underestimation of CO_2 removals from land converted to forest land and of CO_2 emissions from forest land converted to other land uses. During the review, the ERT was informed that, in Portugal's view, emissions from dead wood are reported as losses in the biomass pool, as both harvesting and fire emission estimates include the whole tree. The ERT recommends that Portugal collect data on dead wood and estimate the carbon stock changes in this pool for its next annual submission.

139. The carbon stocks in living biomass and soil organic matter for wetlands, settlements and other land were assumed to be zero. This could lead to a potential overestimation of CO_2 removals from wetlands, settlements and other land converted to forest land, cropland and grassland and of CO_2 emissions from forest land, cropland and grassland converted to wetlands, settlements and other land. The ERT recommends that Portugal collect data and develop estimates for the carbon stocks in living biomass and soil organic matter for wetlands, settlements and other land for its next annual submission.

140. The ERT noted many errors, as well as non-specific, unclear and missing information, in the description of the methods, AD and parameters used in the NIR. The ERT reiterates the recommendation in the previous review report that Portugal improve the transparency of its reporting in the next annual submission by providing a clear and detailed description of the methods, AD and parameters used for all pools, as well as the GHG sources for each category.

141. In addition, the ERT found that the default values for the biomass expansion factor (BEF) and root–shoot ratio from the IPCC good practice guidance for LULUCF (see para. 144 below) chosen and applied by the Party were not appropriate (see para. 139 above). Furthermore, the ERT identified inconsistencies between the description in the NIR and the respective calculations in the CRF tables, as well as in the CRF tables between the reporting of the LULUCF sector under the Convention and the reporting of the KP-LULUCF activities (non-tillage activity and biodiverse sowing of pasture activity were reported under cropland management and grazing land management, respectively, for activities under the Kyoto Protocol for 2008 to 2010, but were not included in the reporting under the Convention). The ERT recommends that the Party enhance its QA/QC procedures for its next annual submission.

142. The uncertainty analysis has not been implemented for all LULUCF categories. The ERT recommends that the Party conduct an uncertainty analysis for the key categories in the LULUCF sector for its next annual submission.

143. During the review week, Portugal described the framework, technical approach and status of the ongoing NFI 6, which contains three elements: a land-use/land-cover evaluation (for 1995, 2005 and 2010); the biometric characterization of forest stands; and an evaluation of soil carbon (agricultural and forest soils). The results of the NFI 6 are expected to be fully available by the end of 2013. The ERT noted that the successful implementation of the NFI 6 will significantly improve the Party's LULUCF inventory, both for the reporting under the Convention and for the reporting under the Kyoto Protocol, especially for the 2014 annual submission (the first annual submission for which the new data will be used). The ERT commends the Party for its efforts and recommends that Portugal implement the NFI 6 in a timely manner. The ERT encourages the Party to include information on the technical specifications of the NFI 6 in an appendix to the NIR of the next annual submission, and to include soil carbon sampling of wetlands, settlements and other land in the NFI 6.

2. Key categories

Forest land remaining forest land – CO_2

144. Net CO_2 removals from forest land remaining forest land amounted to 8,199.51 Gg CO_2 eq for 2010. This sink represents 73.5 per cent of the total net CO_2 removals from forest land (11,150.93 Gg CO_2 eq). Default BEF values for Quercus suber and Quercus rotundifolia from the IPCC good practice guidance for LULUCF were incorrectly used by the Party as the biomass conversion and expansion factor in the estimation of above-ground biomass, which could lead to a potential overestimation of net removals from living biomass. Relatively higher default values for the root–shoot ratio from the IPCC good practice guidance for LULUCF were used by the Party, which could also lead to a potential overestimation of net removals from below-ground living biomass. The specific data sources used for the BEF and the root–shoot ratio, as well as the method used to apply the BEF to the under-bark volume, were not explicitly described in the NIR. The ERT recommends that Portugal use the correct BEF values, reconsider the choice of root–shoot ratio and transparently describe the data sources used in the NIR of its next annual submission.

Land converted to forest land – CO_2

145. The carbon stock changes in land converted to forest land were potentially overestimated owing to the incorrect use of default BEF values, the use of an inappropriate root–shoot ratio and the assumption of zero carbon stock applied for living biomass and soil organic matter in wetlands, settlements and other land. Furthermore, the carbon stock changes were potentially underestimated owing to the omission of dead wood in forest land (see paras. 138, 139 and 144 above).

Land converted to settlements, land converted to wetlands and land converted to other land – CO_2

146. The carbon stock changes in land converted to settlements, land converted to wetlands and land converted to other land were potentially overestimated owing to the incorrect use of default BEF values, the use of an inappropriate root–shoot ratio and the assumption of zero carbon stock applied for living biomass and soil organic matter in wetlands, settlements and other land (see paras. 139 and 144 above). Furthermore, the

carbon stock changes were potentially underestimated owing to the omission of dead wood in forest land (see para. 138 above).

Forest land converted to cropland and grassland – CO_2

147. The carbon stock changes in forest land converted to cropland and grassland were potentially overestimated owing to the incorrect use of default BEF values and the use of an inappropriate root–shoot ratio, and were potentially underestimated owing to the omission of dead wood in forest land (see paras. 138 and 144 above). The carbon stock changes in wetlands, settlements and other land converted to cropland or grassland were also potentially overestimated owing to the use of the assumption of zero carbon stock for living biomass and soil organic matter in wetlands, settlements and other land (see para. 139 above).

Land converted to wetlands – CO_2

148. The carbon stock changes in land converted to wetlands were potentially overestimated owing to the incorrect use of default BEF values, the use of an inappropriate root–shoot ratio and the assumption of zero carbon stock applied for living biomass and soil organic matter in wetlands (see paras. 139 and 144 above). Furthermore, the carbon stock changes were potentially underestimated owing to the omission of dead wood in forest land (see para. 138 above).

3. Non-key categories

Direct N_2O emissions from nitrogen fertilization of forest land – N_2O

149. Portugal reported direct N_2O emissions from N fertilization of forest land as included elsewhere and explained in the NIR that such emissions are estimated together with the emissions from N fertilization of cropland and grassland and are reported under the agriculture sector, since it is not possible to distinguish among the fertilizers used in agriculture and in forestry.

F. Waste

1. Sector overview

150. In 2010, emissions from the waste sector amounted to 8,090.81 Gg CO_2 eq, or 11.2 per cent of total GHG emissions. Since 1990, emissions have increased by 35.1 per cent. The key driver for the rise in emissions is the increase in emissions from solid waste disposal, resulting from the increase in waste disposal in managed landfills. Within the sector, 64.5 per cent of the emissions were from solid waste disposal on land, followed by 21.2 per cent from industrial wastewater handling, 14.1 per cent from domestic wastewater handling and 0.2 per cent from incineration. Biogas flaring accounted for the remaining 0.001 per cent.

151. The Party has made recalculations for the waste sector between the 2011 and 2012 annual submissions following changes in AD, in response to the recommendations made by the ERT during the review week and in order to rectify identified errors. The impact of these recalculations on the waste sector is an increase in estimated emissions of 5.2 per cent for 2009. The main recalculations took place in the following categories:

(a) CH_4 emissions from solid waste disposal on land;

(b) CH_4 emissions from wastewater handling.

152. The information in the NIR and in the CRF tables is generally transparent. However, in some instances, improvements could be made to the transparency of the reporting through the improved referencing of the EFs and other parameters used, as well as through the provision of the underlying AD used. The sector-specific QA/QC procedures are generally well documented, but should be expanded to include more specific results of the QC measures undertaken. The documentation on the recalculations and uncertainty estimates could also be expanded in order to enhance transparency.

2. Key categories

Solid waste disposal on land – CH_4

153. For the estimation of emissions from urban and industrial solid waste disposal on land, Portugal applies the FOD model, in line with the IPCC good practice guidance. The default parameters from the IPCC good practice guidance are used in the FOD model and the AD on waste disposal and composition are based on data reported by the Waste Registry to INE for 1999 onwards. For the period 1960–1998, the waste disposal data have been extrapolated backwards on the basis of the per capita waste generation rate, the population figures and the proportion of the population connected to a waste collection system. The Party has used a country-specific decay rate constant value of 0.07 throughout the time series.

154. The quantity and composition of disposed industrial solid waste are based on annual waste registries for 1999 onwards. In 2000, there was a significant drop in the quantities of some organic waste fractions (particularly paper and sludge). The ERT considers that there has been an underestimation of emissions from industrial solid waste disposal associated with the low estimate of solid waste disposed and the degradable organic carbon (DOC) estimate for 2000. In addition, the ERT considers that the solid waste disposal and DOC estimates for 2001 have also been underestimated as the disposal data for 2001 have been derived using interpolation techniques for between 2000 and 2002. If an underestimation of the amount of solid waste disposed and the DOC estimate has occurred, this will lead to an underestimation of emissions for all years following the disposal of waste. The ERT therefore recommends that Portugal revise the solid waste disposal and DOC estimates for 2000 and 2001 using interpolation techniques for between 1999 and 2002.

155. Portugal uses a revised waste classification system to estimate the weighted average of DOC for 2004 onwards. This has led to a structural break in the time series of DOC values, as several waste types that were previously reported individually have been aggregated in the revised classification system. Portugal assumes a DOC value for the aggregated waste category "household and similar waste" of 0.15; this value does not accurately reflect the paper and wood fractions of this waste category. The ERT considers that this approach has caused an underestimation of the DOC values and an associated underestimation of emissions for the years 2004–2010. When the composition is taken into account, the DOC value becomes 0.17. The ERT recommends that the Party use interpolation techniques to derive the data on the amount of waste disposed and the DOC value for the years 2004–2006 where no disposal or composition data are currently available, and that Portugal make efforts to obtain disposal and DOC data for those years. In the absence of the required waste composition data, the ERT recommends that Portugal use waste composition data from countries with similar national circumstances to derive an appropriate DOC value.

156. In response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised estimates for 2000 onwards. These recalculations have resulted in an increase in estimated emissions from industrial solid waste disposal on land of 645.45 Gg CO_2 eq for 2010. The ERT recommends that the Party

include a full description of the measures taken to address the time-series consistency issues and provide revised emission estimates in its next annual submission.

Wastewater handling – CH_4 and N_2O

157. Portugal has estimated emissions from domestic wastewater handling using the method provided in the Revised 1996 IPCC Guidelines. The total organic waste is estimated using a per capita biochemical oxygen demand (BOD) value of 60 g BOD_5/capita/day. The allocation of BOD to the various wastewater handling systems is based on a study undertaken by the Portuguese Wastewater Institute (INAG). The Party has generally provided a clear description of the approach taken to estimate emissions from domestic wastewater handling, including detailed information on the proportions of the population connected to each wastewater handling system and the assumptions associated with each of these systems.

158. Portugal has used DGEG biogas data to estimate the quantity of CH_4 to be deducted from the domestic wastewater handling emissions. An assumed fraction of CH_4 in biogas of 60 per cent is used to derive an estimate of CH_4 from the quantities of biogas. The Party has not provided any information in the NIR on the source of this assumption and has not justified its use. The ERT recommends that Portugal enhance the transparency of its reporting by providing this information in its next NIR.

159. Portugal has estimated N_2O emissions from human sewage in accordance with the method provided in the Revised 1996 IPCC Guidelines. The data tables provided in the NIR indicate that a quantity of sludge generated from wastewater treatment is spread on land. However, the N_2O emissions associated with this activity are not estimated separately, but are instead included as part of the total estimate of N_2O emissions from wastewater handling. Portugal states in the NIR that there is insufficient information to enable a separate calculation for sewage sludge spreading. The ERT encourages the Party to make efforts to obtain the necessary information to enable this calculation to be performed. In addition, the ERT recommends that Portugal reallocate any emissions from sewage sludge spreading on agricultural land to the agriculture sector.

160. The method used to estimate emissions from industrial wastewater handling is also based on the Revised 1996 IPCC Guidelines. Portugal has provided a clear description of the methods and AD used for the emission estimation. However, the assumptions used by the Party on the types of industrial wastewater treatment systems in use are based on much more limited information than that available for domestic wastewater. Furthermore, the assumptions used for the values of wastewater and chemical oxygen demand generation by industry are based on a study by Cartaxo (1985) which was conducted a considerable time ago. Portugal has indicated in its NIR that a new survey system and database implemented by the National Water Institute will be used to improve the understanding of the AD for industrial wastewater treatment. The ERT encourages the Party to proceed with this planned improvement, while taking into account the need to ensure the time-series consistency of the existing data with any new data sources used.

161. DGEG data on biogas recovery from industrial wastewater systems are used to derive the quantity of CH_4 to be deducted from the industrial wastewater treatment emissions. These data cover biogas recovery in pulp and paper manufacturing and "agriculture". During the review week, the Party confirmed that biogas recovery in "agriculture" relates to the recovery of CH_4 from piggeries. The ERT recommends that Portugal report the quantity of CH_4 recovered from piggeries under the agriculture sector.

3. Non-key categories

Waste incineration – CO_2, CH_4 and N_2O

162. Portugal has estimated emissions from the incineration of municipal and industrial solid waste and clinical waste in accordance with the Revised 1996 IPCC Guidelines. Where waste incineration for energy recovery takes place (as is the case for municipal and industrial solid waste), the associated emissions are reported under the energy sector, as appropriate. The biogenic and non-biogenic carbon content of municipal and industrial solid waste are derived from the waste composition information provided in CRF table 6.A.

163. The AD for clinical waste are sourced from registry maps of public hospital units and the AD for industrial solid waste incineration are sourced from information provided by industrial units. The ERT observed that the Party has not provided information on the source of the AD used for municipal solid waste incineration. The ERT recommends that Portugal provide information on the sources of the AD used for each waste stream in the next annual submission.

164. The ERT noted some large, unexplained inter-annual fluctuations in the time series of emissions from waste incineration. For example, the emissions decreased by 44.7 per cent between 2000 and 2001 and increased by 165.6 per cent in 2004. This appears to be the result of a structural break in the time series of the AD for industrial solid waste (see para. 160 above). Any significant inter-annual fluctuations should be fully investigated and explained in the NIR. The ERT therefore recommends that Portugal provide an explanation for these inter-annual fluctuations in the time series in the NIR of its next annual submission.

165. As for other categories under the waste sector, there are some structural breaks in the time series of the AD for industrial solid waste incineration. For example, INE has corrected the industrial solid waste incineration data for 2004 onwards to account for missing information from respondents. However, this correction has not been applied to the data for the earlier years of the time series. The ERT recommends that Portugal address all time-series consistency issues related to the AD for waste incineration in its next annual submission.

166. The ERT noted that the AD for waste incinerators related to energy production are also available in the DGEG energy balance. The ERT encourages Portugal to cross-check this information with the AD used for the waste incineration estimates and explain any discrepancies between the two data sets, as appropriate.

Other (waste) – CH_4 and N_2O

167. Portugal has estimated non-CO_2 emissions from the flaring of biogas. The ERT commends the Party for providing these emission estimates, which are not required by the IPCC good practice guidance. The ERT recommends that the Party provide additional information in the NIR on the sources of the EFs used, as well as the energy content, in order to enhance the transparency of this section of the NIR.

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

168. Portugal has reported emissions and removals from afforestation, reforestation and deforestation under Article 3, paragraph 3, of the Kyoto Protocol and emissions and removals from forest management, cropland management and grazing land management under Article 3, paragraph 4, of the Kyoto Protocol for the years 2008–2010 and 1990 for cropland and grassland management under Article 3, paragraph 4. The emissions and removals reported under Article 3, paragraphs 3 and 4, were not estimated fully in accordance with the IPCC good practice guidance for LULUCF and decision 16/CMP.1 (see para. 169 below). In the NIR, the Party provided information on the requirements outlined in decision 15/CMP.1, annex, paragraphs 5–9. Portugal has chosen to account for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the commitment period.

169. The use of wall-to-wall mapping based on the CORINE Land-Cover data (products CLC90-R and CLC06_PT) allows the Party to identify land areas subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. However, the 25 ha resolution used by Portugal is not sufficiently fine to identify minimum forest areas (1 ha) and is therefore currently not in line with the IPCC good practice guidance for LULUCF and requires further improvement to allow for the identification of minimum forest areas of 1 ha. Portugal explained to the ERT that new land-use/land-cover maps based on aerial photographs for 1995, 2005 and 2010 are being developed, together with the NFI 6, both of which the Party is planning to use in the preparation of the 2014 annual submission at the latest. If implemented, the new land-use/land-cover maps would allow Portugal to identify minimum areas of 1 ha under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT recommends that the Party implement the NFI 6 and a higher-resolution land-area identification method in a timely manner, in order to ensure the accurate identification of areas under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

170. The methods, AD and EFs used for the calculation of the emission/removal estimates for afforestation and reforestation, deforestation and forest management activities are the same as those used for the reporting under the Convention. However, the reporting of grassland remaining grassland and cropland remaining cropland under the Convention is not in line with the reporting of cropland management and grazing land management activities under Article 3, paragraph 4, of the Kyoto Protocol (see paras. 176 and 178 below). The ERT recommends that Portugal consistently report the emissions and removals from these activities both under the Convention and under the Kyoto Protocol in the next annual submission.

171. In the NIR, the Party has not provided a quantitative analysis of the uncertainties for the emissions/removals from afforestation and reforestation, and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol and elected cropland management and grazing land management activities under Article 3, paragraph 4, of the Kyoto Protocol. The ERT recommends that Portugal conduct an uncertainty analysis of the estimates for these activities for its next annual submission.

172. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions in response to the 2011 annual review report. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) Afforestation and reforestation: an increase in estimated net GHG removals of 383.17 Gg CO_2 eq (or 13.9 per cent);

(b) Deforestation: a decrease in estimated net GHG emissions of 195.01 Gg CO_2 eq (or 13.6 per cent);

(c) Forest management: an increase in estimated net GHG removals of 2,464.82 Gg CO_2 eq (or 28.0 per cent);

(d) Cropland management: an increase in estimated net GHG removals of 39.28 Gg CO_2 eq (or 16.2 per cent);

(e) Grazing land management: a decrease in estimated net GHG removals of 547.97 Gg CO_2 eq (or 56.9 per cent).

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

173. The ERT noted that the removals from afforestation and reforestation activities and the emissions from deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol may have been overestimated, owing to:

(a) The assumption that the carbon stock in living biomass and soil organic matter in wetlands, settlements and other land is zero (see para. 139 above);

(b) The inappropriate choice and application of default BEF values and the root–shoot ratio from the IPCC good practice guidance for LULUCF (see para. 144 above).

174. The ERT also noted that the removals from afforestation and reforestation activities and the emissions from deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol may have been underestimated, owing to the omission of dead wood in forest land (see para. 138 above). The ERT recommends that Portugal improve the accuracy of its reporting by addressing this issue, as well as those described in paragraph 173 above.

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

Forest management – CO_2

175. The ERT noted that the removals from forest management activities under Article 3, paragraph 4, of the Kyoto Protocol may have been overestimated, owing to the inappropriate choice and application of the default BEF values and the root–shoot ratio from the IPCC good practice guidance for LULUCF (see para. 142 above). The ERT recommends that Portugal revise its choice of parameters and describe the reasons for choosing those parameters in its next annual submission.

Cropland management – CO_2

176. Consistent with the reporting of cropland remaining cropland under the Convention, Portugal has used an IPCC tier 2 method and country-specific EFs to estimate CO_2 emissions/removals from cropland management. However, non-tillage activity was reported under cropland management for activities under the Kyoto Protocol for 2008 to 2010, but was not included in the reporting under the Convention. Non-tillage activity in 1990 was reported as zero.

177. In the NIR, the Party has not provided a description of the methods and EFs applied to the non-tillage activity. During the review, Portugal explained that a mean carbon (C) accumulation rate of 0.84 t C $ha^{-1}yr^{-1}$ was used to estimate the additional carbon sequestration in mineral soils for non-tillaged cropland, compared with traditional tillage activity. However, the documents provided by the Party do not allow the ERT to assess the appropriateness of the value used.

178. The ERT strongly recommends that Portugal, in its next annual submission:

(a) Provide detailed information on the methods and procedures used to derive the value of the soil carbon accumulation rate, including peer-reviewed documents;

(b) Provide information on the identification of non-tillaged land, the reporting and verification system, the sector-specific QA/QC procedures, and the monitoring and reporting system; and document how these procedures are effectively implemented, in line with the methods and practices described in chapter 4 of the IPCC good practice guidance for LULUCF;

(c) Apply IPCC tier 1 or tier 2 methods by developing land-use, management and input factors based on observations and other data sources, or use the IPCC default factors, and compare the results with those derived from the use of the mean accumulation rate;

(d) Transparently demonstrate that the non-tillage of cropland did not occur in 1990.

Grazing land management – CO_2

179. Consistent with the reporting of grassland remaining grassland under the Convention, Portugal has used an IPCC tier 2 method and country-specific EFs to estimate CO_2 emissions/removals from grazing land management. However, the biodiverse sowing of pasture activity was reported under grazing land management for activities under the Kyoto Protocol for 2008 to 2010, but was not included in the reporting under the Convention.

180. The biodiverse sowing of pasture activity in 1990 was reported as zero. During the review, the Party explained that the sowing of pasture started in the 1990s and that the area subject to sowing in the pre-1990 period was not significant. The ERT recommends that Portugal transparently describe the practice related to the sowing of pasture in the NIR of its next annual submission.

181. In the NIR, the Party has not provided a description of the methods and EFs used to estimate the emissions/removals from the biodiverse sowing of pasture. During the review, Portugal explained that a mean carbon accumulation rate of 1.77 t C $ha^{-1}yr^{-1}$ was used to estimate the additional carbon sequestration in mineral soils for the biodiverse sowing of pasture, compared with the baseline pasture activities. This value was derived from a soil organic matter (SOM) model that was established based on field observations conducted over a period of five years on two sowing sites. However, on the basis of the documents provided, the ERT assessed that the value applied by the Party does not allow for an accurate estimate of CO_2 removals from the biodiverse sowing of pasture and that the emissions may have been overestimated. With regard to the application of the SOM model, the ERT observed that:

(a) The rate of increase in SOM would slow down in line with the increase in the number of years after sowing. The Party used data based on field observations conducted over a five-year period to build a model from which the 10-year average SOM accumulated rate was projected (beyond the observed time period). The modelled data beyond the five-year period were not validated. In response to questions raised by the ERT during the review, the Party explained that it was considering the possibility of gathering additional field data and/or using detailed process models;

(b) The lifetime of the biodiverse pasture sowing project is five years. After the end of the project, farmers may return to the baseline activities, at which time the current model would not be applicable. The Party informed the ERT that this model will only be

applied to biodiverse sowing activities that have been implemented for no longer than five years;

(c) The soil bulk density (BD) was not measured in the experiment; instead, the national/regional average BD was used to convert the SOM content as a percentage to the SOM stock/ha. However, since the BD is spatially very variable, the use of an average BD for the entire project area would have led to a large bias;

(d) The BD usually decreases in line with the increase in the SOM content; thus, the use of a national/regional average BD would also introduce a different bias for different sites and years with a dissimilar SOM content. In response to questions raised by the ERT during the review, the Party explained that efforts are under way to collect detailed field information on BD, which Portugal is planning to use in the inventory calculations for the next annual submission;

(e) In addition to sowing, the pasture in the experiment received special treatment, such as tillage, phosphate and potassium fertilization, limestone application and the application of many other micronutrients. In response to questions raised by the ERT during the review, the Party explained that optimal plant conditions have to be adapted to the nutrient status of the soil conditions, and that the fertilization of the soil is therefore adjusted from farm to farm. Consequently, there is no single prescribed method with regard to the non-N fertilization of Sown Biodiverse Permanent Pastures Rich in Legumes; however, certain practices are recommended in order to ensure that the pasture is at its highest level of productivity under certain soil conditions and to ensure that it recovers quickly after summer and grazing. Nevertheless, the ERT noted that the explanation provided by Portugal confirms that the activities of the implemented project are not fully consistent with the activities conducted under the experiment;

(f) The experiment was conducted at eight farms with different climates and soils, including parent rock. The use of an average value for these farms would result in a significant underestimation or overestimation of the SOM accumulation rate. During the review, the Party agreed to rebuild the SOM model using data excluding plot 6 and to apply the model to the current project area only.

182. Therefore, the ERT strongly recommends that Portugal, in its next annual submission:

(a) Provide detailed information in the NIR on the methods and procedures used to identify the pasture sowed, the reporting and verification system, the QA/QC procedures, and the post-sowing monitoring and reporting system; and document how these procedures are effectively implemented, in line with the methods and practices described in chapter 4 of the IPCC good practice guidance for LULUCF;

(b) If the SOM model is used, disaggregate the model according to the different climate and soil conditions, or include climate and soil parameters in the model, and compare the results of the SOM model with the results of the IPCC tier 1/tier 2 methods;

(c) Demonstrate that the common practices related to the pasture sowing project are consistent with the activities conducted under the experiment from which the SOM model was built;

(d) Ensure that the SOM model is applied within five years after the start of the pasture-sowing activities;

(e) Demonstrate that the sowing of pasture occurred after 1990 (i.e. that pasture-sowing activities did not occur in 1990);

(f) Transparently describe the method used in the NIR, especially how the average soil carbon accumulation rate is derived on the basis of the results of the SOM model.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

183. 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.[13] 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.

184. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, 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 referred to in decision 22/CMP.1, annex, paragraph 88(a–j). 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. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

National registry

185. 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 findings 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.

186. However, the SIAR identified that some of the publicly accessible information on the registry website has not been correctly displayed. Portugal confirmed that it will further investigate this issue. The SIAR, part II, also identified discrepancies related to the connection of the national registry to the EU registry. The Party explained that the responsibility for the registry software had shifted from the Portuguese registry administrator to the EU level and, therefore, it is no longer possible or necessary to address this issue because the problem was related to the old software.

Calculation of the commitment period reserve

187. Portugal has reported its commitment period reserve in its 2012 annual submission. The Party 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. Portugal has provided information on its commitment period reserve in the NIR.

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

3. Changes to the national system

188. Portugal reported that there have been changes to its national system since the previous annual submission. The organizations InventAR and Ecoprogresso have terminated their contracts with APA. Another consultant, CAOS Sustentabilidade, has been contracted to support the inventory team in the development of methodological approaches to quantify the KP-LULUCF activities.

189. During the review, Portugal informed the ERT about additional changes to the national system that had occurred in 2012. After the 2011 elections, the Ministries of Environment and of Agriculture were merged into the new Ministry of Agriculture, Sea, Environment and Land-Use Planning. A significant restructuring of the public authorities and institutions was conducted after these elections and additional institutions were integrated into the former APA, including the former INAG, five hydrographic regional administrations, the Climate Change Commission, the Commission for Waste Management, the Commission for Emergency Planning on Environment, and the Department for Planning and Prospective.

190. All these institutions are now part of APA. The previous departments within APA were also restructured and the inventory agency is now part of the adaptation and monitoring unit. The restructuring of several departments within APA is ongoing and, accordingly, the national system has not yet been completely reformulated. Similar restructuring and reorganization processes are ongoing in other ministries, leading to a situation whereby the external focal points and data producers are no longer specified and designated. During this transition period, cooperation with regard to the inventory preparation process has continued with the previous focal points.

191. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1. The ERT recommends that the Party report, in its next annual submission, any change(s) in its national system in accordance with decision 15/CMP.1, annex, chapter I.F.

4. Changes to the national registry

192. Portugal reported that there have been changes to its national registry since the previous annual submission. The Party described that the host for the registry software has been changed to the EU registry. The ERT concluded that, taking into account the confirmed change to the Party's national registry, it 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

193. Portugal reported that there have been no changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The ERT concluded that the information provided continues to be complete and transparent.

194. Portugal reported on key policies and measures, on the cooperation with third countries to improve the integration of adaptation into sectoral policies and instruments, and on its support provided at the multilateral and bilateral levels in the area of adaptation to climate change. The Portuguese activities are somewhat focused on geographical priorities related to countries with Portuguese as the official language, which are all within the group of the most vulnerable countries.

III. Conclusions and recommendations

A. Conclusions

195. Portugal made its annual submission on 13 April 2012, which it resubmitted on 25 May 2012. In response to questions raised by the ERT during the review, Portugal resubmitted its CRF tables for the entire time series on 12 November 2012. The annual submission contains the GHG inventory (comprising the 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, 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.

196. The ERT concludes that the inventory submission of Portugal has generally been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2010 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as mostly complete in terms of categories and gases. Some GHG emissions for a few categories, particularly in the energy sector (e.g. petroleum refining, fugitive emissions from oil refining and road transportation), the industrial processes sector (e.g. manufacturing of electrical equipment) and the LULUCF sector (e.g. the carbon stock changes in dead wood) were not reported in the inventory. During the review, in response to the list of potential problems and further questions raised by the ERT during the review week, Portugal provided revised or missing estimates for categories under the energy and industrial processes sectors.

197. 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.

198. The Party's inventory is mostly in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. Whereas the energy and industrial processes sectors are generally transparent and only a few issues were identified, a relatively large number of transparency-related issues were identified for the agriculture sector. Some parts of the NIR have not been updated. The key category analysis performed by the Party for some sectors (i.e. the agriculture sector) is based on an inappropriate level of disaggregation. Portugal has not provided an uncertainty analysis for the KP-LULUCF activities and the uncertainty estimates for some categories do not appear to be reasonable. Furthermore, the Party has not fully implemented its verification and QA/QC activities.

199. The Party has made recalculations for the inventory between the 2011 and 2012 annual submissions in response to the recommendations in the 2011 annual review report, following changes in AD, EFs and methodologies and in order to rectify identified errors. The impact of these recalculations on the national totals is an increase in estimated total GHG emissions without LULUCF of 1.1 per cent for the base year and a decrease of 0.4 per cent for 2009, and an increase in estimated total GHG emissions with LULUCF of 6.3 per cent for 1990 and 5.1 per cent for 2009. The main recalculations took place in the following sectors/categories:

(a) The energy sector: an increase in estimated emissions of 1.0 per cent for 2009;

(b) The industrial processes sector: an increase in estimated emissions of 10.5 per cent for 2009;

(c) The solvent and other product use sector: a decrease in estimated emissions of 8.7 per cent for 2009;

(d) The agriculture sector: an increase in estimated emissions of 2.6 per cent for 2009;

(e) The LULUCF sector: a decrease in estimated net removals of 16.0 per cent for 2009;

(f) The waste sector: an increase in estimated emissions of 5.2 per cent for 2009.

200. With regard to the emissions and removals under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Portugal provided information in the NIR on the requirements outlined in decision 15/CMP.1, annex, paragraphs 5–9. The Party has chosen to account for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the commitment period. The resolution of the land-area identification is currently not in line with the IPCC good practice guidance for LULUCF and requires further improvement to allow for the identification of minimum forest areas of 1 ha. Portugal explained to the ERT that new land-use/land-cover maps will be developed together with the ongoing NFI in time for use in the preparation of the 2014 annual submission. In the reporting of cropland management and grazing land management activities, the ERT found inconsistencies between the reporting under the Convention, where no changes are reported for related activities, and the reporting under the Kyoto Protocol. For these activities, the information provided by the Party was not sufficiently transparent and the justification of the assumptions and parameters used should be improved and more fully documented. In addition, the ERT identified issues with regard to the accuracy of the estimation of removals from afforestation and reforestation activities and emissions from deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol, owing to:

(a) The assumption that the carbon stock in living biomass and soil organic matter in wetlands, settlements and other land is zero;

(b) An inappropriate choice of default BEF values and root–shoot ratio from the IPCC good practice guidance for LULUCF;

(c) The omission of dead wood in forest land.

201. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions in response to the 2011 annual review report. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) Afforestation and reforestation: an increase in estimated net GHG removals of 383.17 Gg CO_2 eq (or 13.9 per cent);

(b) Deforestation: a decrease in estimated net GHG emissions of 195.01 Gg CO_2 eq (or 13.6 per cent);

(c) Forest management: an increase in estimated net GHG removals of 2,464.82 Gg CO_2 eq (or 28.0 per cent);

(d) Cropland management: an increase in estimated net GHG removals of 39.28 Gg CO_2 eq (or 16.2 per cent);

(e) Grazing land management: a decrease in estimated net GHG removals of 547.97 Gg CO_2 eq (or 56.9 per cent).

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

203. The national system generally continues to perform its required functions as set out in the annex to decision 19/CMP.1; however, the ERT identified issues related to: the implementation of QA/QC activities; the institutional arrangements for sectoral data collection; the inventory improvement plan; the archiving of inventory-related information; and the official approval of the inventory. During the review, in response to the list of potential problems and further questions raised by the ERT during the review week, Portugal addressed these issues.

204. 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 decisions of the CMP.

205. Portugal has reported information under decision 15/CMP.1, annex, chapter I.H, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2012 annual submission. The information provided is complete and transparent.

B. Recommendations

206. The ERT identifies issues for improvement as listed in table 6 below.

Table 6
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph reference*
Cross-cutting	Completeness	Estimate the carbon stock changes in dead wood	11
	National system	Report on the assignment of new focal points, and provide further information on which departments/divisions of the responsible institutions are involved in the preparation of the inventory and what their specific responsibilities are	17
	QA/QC	Report on the update of the inventory improvement plan, in order to: (a) incorporate the recommendations from the 2011 and 2012 review reports, as well as the recommendations of the review team with regard to the review of the inventory submitted on behalf of the European Union (EU) member States under EU decision 406/2009/EC on effort-sharing; (b) accurately reflect the current status of implementation of the improvements;(c) include the improvements planned for the KP-LULUCF activities; (d) prioritize the improvements, taking into account the current lack of focal points in some sectors, and focus on activities to be implemented by the internal APA team; (e) establish a process for the annual updating of the inventory improvement plan; and (f) link the improvements with and prioritize the implementation of the QA/QC activities	19
	National system	Report on the update of the inventory improvement plan	19
	National system	Clarify the process and related responsibilities for the official consideration and approval of the annual submission	21
	Key category analysis	Review the level of disaggregation applied to the key category analysis and implement a higher level of aggregation for the livestock categories under the agriculture sector	22
	Key category analysis	Review the methodological approach used for the preparation of the key category assessment, including the LULUCF sector, and	23

Sector	*Category*	*Recommendation*	*Paragraph reference*
		explain why some relatively large LULUCF categories were not identified as key	
	Key category analysis	Clearly identify, in the NIR of the next annual submission, the key categories used to prioritize the improvements to the most recent annual submission	24
	Uncertainties	Revise and update, where appropriate, the uncertainty estimates in line with the planned improvements and involve the focal points in the expert judgment to assess the uncertainty of the AD used	29
	Recalculations	Improve the description of the recalculations in order to correctly reflect the changes to the sectoral chapters of the NIR and include more detailed descriptions of the changes that have occurred in the NIR	30
	QA/QC	Implement mandatory QA/QC procedures in the next annual submission	40
	Transparency	Include a detailed description of the planned approach to define the land area identification and carbon stock changes for KP-LULUCF activities (e.g. by providing additional information in annexes to the NIR); and provide a more detailed description of the QA/QC system and of the institutional arrangements for the preparation of the inventory	43
	Archiving	Improve the archiving system by providing further guidance on the record-keeping and archiving procedures	45
Energy	Public electricity and heat production: all fuels – CO_2	Reallocate CO_2 emissions from limestone used for desulphurization to the industrial processes sector	60
	Petroleum refining: all fuels – CO_2	Use the most accurate CO_2 EFs to estimate CO_2 emissions from the combustion of specific refinery fuel, fuel oil, gas oil, natural gas, off gas and tail gas and include CO_2 emissions from these fuels that have not previously been estimated by using plant-specific AD and the EFs available in the European Union emissions trading scheme verified reports	63
	Stationary combustion and manufacturing industries and construction: all fuels – CO_2	Use, to the extent possible, plant-specific AD to estimate the emissions from iron and steel production	69
	Road transportation: liquid fuels – CO_2	Develop country-specific parameters (e.g. hydrogen/carbon ratios and EFs) for gasoline and diesel oil	76
	Railways: liquid fuels – CO_2	Consistently use the same CO_2 EF for the same type of diesel oil consumed	78
	Stationary combustion, manufacturing industries and	Use the same CO_2 EF for gasoline across all categories where it is combusted	72

Sector	*Category*	*Recommendation*	*Paragraph reference*
	construction, and other sectors: liquid fuels – CO_2		
Industrial processes	Transparency	Provide more detailed information on the methodologies used to estimate emissions for the period 1990–2004, in order to improve the transparency of the reporting, and further describe how time-series consistency is ensured, in the next annual submission	88
	QA/QC	Update the QA/QC plan for the industrial processes sector and strengthen the sector-specific QA activities in order to enhance the consistency of the information provided	88
	Transparency	Use appropriate notation keys and provide information on the methods and EFs used for the estimation of HFC, PFC and SF_6 emissions from the consumption of halocarbons and SF_6, which is missing from CRF table summary 3, in the next annual submission	89
	Transparency	Provide information on the results of the comparison of the data sources in the next annual submission	91
	Refrigeration and air-conditioning equipment – HFCs	Enhance transparency by providing the outcomes of the comparison of the results from the two models in the next annual submission	96
	Limestone and dolomite use	Enhance the transparency of the NIR by removing inconsistent information and by accurately describing the methodologies used to estimate emissions from limestone and dolomite use	98
	Fire extinguishers – HFCs	Provide more detailed information on the methodology, AD, EFs and other parameters used to estimate HFC emissions from fire extinguishers in the next annual submission	100
Agriculture	Transparency	Collect AD for sewage sludge application to agricultural soils in order to estimate N_2O emissions or, if this is not possible, enhance the explanations provided in the NIR	107
	Transparency	Enhance the transparency of the NIR by providing information on the choice of parameters and EFs and by ensuring consistency between the NIR and the CRF tables in the next annual submission	107
	Transparency	Improve the transparency of the NIR by correctly identifying the source of the parameters and EFs from the *Revised 1996 IPCC Guidelines* and the IPCC good practice guidance.	109
	Uncertainty	Develop and include country-specific uncertainty values for the AD and EFs, at a minimum for the key categories, and document them fully in the NIR	110
	Recalculations	Improve the transparency of the description of the recalculations performed in the NIR of future annual submissions	111
	Enteric fermentation – CH_4	Develop an appropriate tier 2 methodology in line with the IPCC good practice guidance for estimating emissions from dairy cattle for the next annual submission	112
	Enteric fermentation – CH_4	Estimate CH_4 emissions from enteric fermentation for appropriate livestock subcategories for the next annual submission	114

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Enteric fermentation – CH_4	Enhance the transparency of the description of the methods used in the next annual submission; and enhance the QA/QC activities in order to improve the accuracy of the NIR	115
	Enteric fermentation – CH_4	Enhance the transparency of the reporting by providing the additional information required in CRF table 4.A	116
	Manure management – CH_4	Improve the transparency of the NIR, enhance the QA/QC activities and compare the country-specific EFs with the IPCC default EFs	119
	Manure management – CH_4	Provide background information to support the use of the IPCC default values of 45 per cent and 39 per cent for the methane conversion factor for manure treated in anaerobic lagoons in temperate and cool regions, respectively	119
	Manure management – CH_4	Follow the methodological approach provided in the footnote to table 4.10 of the IPCC good practice guidance in order to correctly reflect the practice of anaerobic digestion of swine manure, and document this approach in the NIR of the next annual submission	121
	Direct soil emissions – N_2O	Implement QC measures which obviate the need to conduct recalculations of the consumption of mineral N fertilizers, and identify whether the values derived include all mineral N fertilizers applied to soils, including those applied to forest land	125
LULUCF	Completeness	Collect data on dead wood and estimate the associated carbon stock changes for the next annual submission	138
	Accuracy	Collect data and develop estimates for the carbon stocks in living biomass and soil organic matter for wetlands, settlements and other land for the next annual submission	139
	Transparency	Improve the transparency of the reporting in the next annual submission by providing a clear and detailed description of the methods, AD and parameters used for all pools, as well as the emission sources for each category	140
	QA/QC	Enhance the QA/QC procedures for the next annual submission	141
	Uncertainty	Conduct an uncertainty analysis for the key categories in the LULUCF sector	142
	Forest land remaining forest land – CO_2	Use the correct BEF values, reconsider the choice of root–shoot ratio and transparently describe the data sources used in the NIR of the next annual submission	142
	Direct N_2O emissions from N fertilization of forest land – N_2O	Disaggregate direct N_2O emissions from N fertilization of forest land and report the N_2O emissions from N fertilization of forest land and other land in the appropriate category under the LULUCF sector in the next annual submission	147
Waste	Solid waste disposal on land – CH_4	Revise the solid waste disposal and DOC estimates for 2000 and 2001 using interpolation techniques for between 1999 and 2002	152
	Solid waste disposal on land – CH_4	Use waste composition data from countries with similar national circumstances to derive an appropriate DOC value	155
	Solid waste disposal on	Use interpolation techniques to derive data on the amount of waste disposed and the DOC value for the years 2004–2006 where no	155

Sector	*Category*	*Recommendation*	*Paragraph reference*
	land – CH_4	disposal or composition data are currently available; and make efforts to obtain disposal and DOC data for those years	
	Solid waste disposal on land – CH_4	Include a full description of the measures taken to address the time-series consistency issues and revise the emission estimates in the NIR of the next annual submission	155
	Wastewater handling – CH_4 and N_2O	Enhance the transparency of the reporting by providing information on the source of the assumptions used in the next NIR	157
	Wastewater handling – CH_4 and N_2O	Reallocate any emissions from sewage sludge spreading on agricultural land to the agriculture sector	158
	Wastewater handling – CH_4 and N_2O	Report the quantity of CH_4 collected from piggeries under the agriculture sector	160
	Waste incineration – CO_2, CH_4 and N_2O	Provide information on the sources of the AD used for each waste stream in the next annual submission	162
	Waste incineration – CO_2, CH_4 and N_2O	Provide an explanation for the inter-annual fluctuations in the time series in the next annual submission	163
	Waste incineration – CO_2, CH_4 and N_2O	Address all time-series inconsistency issues related to the AD for waste incineration in the next annual submission	164
	Biogas flaring – CH_4 and N_2O	Provide additional information in the NIR on the sources of the EFs used, as well as the energy content, in order to enhance the transparency of this section of the NIR	166
KP-LULUCF	National system	Implement the sixth National Forest Inventory in a timely manner, in order to ensure the accurate identification of forest areas under Article 3, paragraph 3, of the Kyoto Protocol	168
	Uncertainty	Conduct an uncertainty analysis of the estimates for the KP-LULUCF activities for the next annual submission	170
	Completeness	Report the N_2O emissions from N fertilization of afforestation and reforestation, and forest management activities, or include the emissions under the agriculture sector in the next annual submission	171
	Activities under Article 3, paragraph 3, of the Kyoto Protocol	Improve the accuracy of the reporting	173
	Activities under Article 3, paragraph 4, of the Kyoto Protocol	Revise the choice of parameters and describe the reasons for choosing them in the next annual submission	174
	Cropland	Provide detailed information on the methods and procedures used	176

Sector	*Category*	*Recommendation*	*Paragraph reference*
	management – CO_2	to derive the value of the soil carbon accumulation rate, including peer-reviewed documents.	
	Cropland management – CO_2	Provide information on the identification of non-tillaged land, the reporting and verification system, the QA/QC procedures, and the monitoring and reporting system, and document how these procedures are effectively implemented, in line with the methods and practices described in chapter 4 of the IPCC good practice guidance for LULUCF	176
	Cropland management – CO_2	Apply IPCC tier 1 or tier 2 methods by developing land-use, management and input factors based on observations and other data sources, or use the IPCC default factors, and compare the results with those derived from the use of the mean accumulation rate.	176
	Cropland management – CO_2	Transparently demonstrate that the non-tillage of cropland did not occur in 1990	176
	Grazing land management – CO_2	Transparently describe the practice related to the sowing of pasture in the NIR of the next annual submission	179
	Grazing land management – CO_2	Provide detailed information in the NIR on the methods and procedures used to identify the pasture sowed, the reporting and verification system, the QA/QC procedures, the post-sowing monitoring and reporting system, and document how these procedures are effectively implemented; if the SOM model is used, disaggregate the model according to the different climate and soil conditions, or include climate and soil parameters in the model, and compare the results of the model with results of the IPCC tier 1/tier 2 methods; demonstrate that the common practices related to the pasture-sowing project are consistent with the activities conducted under the experiment from which the SOM model was built; ensure that the SOM model is applied within five years after the start of the pasture-sowing activities; demonstrate that the sowing of pasture occurred after 1990 (i.e. that pasture-sowing activities did not occur in 1990); and transparently describe the method used in the NIR, especially how the average soil carbon accumulation rate is derived based on the results of the SOM model	181

Abbreviations: AD = activity data, BEF = biomass expansion factor, CRF = common reporting format, DOC = degradable organic carbon, EF = emission factor, IPCC = Intergovernmental Panel on Climate Change, 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, N = nitrogen, NIR = national inventory report, QA/QC = quality assurance/quality control, SOM = soil organic matter.

IV. Questions of implementation

207. 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 2012. Available at <http://unfccc.int/resource/docs/2012/asr/prt.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <http://unfccc.int/resource/webdocs/sai/2012.pdf>.

FCCC/ARR/2011/PRT. Report of the individual review of the annual submission of Portugal submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/prt.pdf>.

UNFCCC. *Standard independent assessment report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by Portugal

Responses to questions during the review were received from Ms. Teresa Costa Pereira (Portuguese Environmental Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Portugal:

APA. 2004. *ANEXO III Sistema de Controlo e Garantia de Qualidade Anexo B: Manual de Procedimentos de Controlo e Garantia de Qualidade.* (ANNEX III Quality Assurance and Control System Annex B: Procedures Manual Control and Quality Assurance) Ficha Técnica. Elaborado para o Instituto do Ambiente Pela EcoProgresso – Consultores em Ambiente e Desenvolvimento, Lda Alfragide, 19 August 2004.

APA. 2012. *Plano de desenvolvimento metodológico (PDM 12) para INERPA a entregar EM 12 referente a dados do ano 2010*. (Methodology Development Plan (PDM 12) to deliver the INERPA in 2012 referring to data of the year 2010).

Jarrige, R., (1988). Alimentação dos Bovinos, Ovinos e Caprinos. Publicações Europa-América." reference to Jarrige, (1988) Feeding of Cattle, Sheep and Goats. Publications Europe-America. "

Cartaxo et al, (1985). Determinação das cargas poluidoras brutas produzidas pelos sectores de actividade industrial em Portugal Continental. Ministério do Equipamento Social. Direcção-geral dos Recursos e Aproveitamentos Hidráulicos. Direcção de Serviços de Controle da Poluição.

Teixeira R.F.M., Domingos T., Costa A.P.S.V. et al. 2011. *Soil organic matter dynamics in Portuguese natural and sown rainfed grasslands*. Ecological Modelling, 222: 993–1001.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
BD	bulk density
BEF	biomass expansion factor
BOD	biochemical oxygen demand
DOC	degradable organic carbon
CH_4	methane
C	carbon
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
EU	European Union
EU ETS	European Union emissions trading scheme
FOD	first order decay
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
GJ	gigajoule (1 GJ = 109 joule)
HFCs	hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
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
Mg	megagram (1 Mg = 1 tonne)
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	National Forest Inventory
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SOM	soil organic matter
UNFCCC	United Nations Framework Convention on Climate Change