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

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

Contents

I. Introduction and summary

1. This report covers the in-country review of the 2011 annual submission of Spain, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 17 to 22 October 2011 in Madrid, Spain, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Mario Contaldi (Italy); energy – Mr. Leonidas Girardin (Argentina); industrial processes – Ms. Laura Dawidowski (Argentina); agriculture – Mr. Sergio González (Chile); land use, land-use change and forestry (LULUCF) – Mr. Daniel Martino (Uruguay); and waste – Mr. Eduardo Calvo Buendia (Peru). Mr. Mario Contaldi and Mr. Sergio González were the lead reviewers. The review was coordinated by Mr. Vitor Gois Ferreira (UNFCCC secretariat).

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

3. In 2009, the main greenhouse gas (GHG) in Spain was carbon dioxide (CO_2), accounting for 80.8 per cent of total GHG emissions[1] expressed in carbon dioxide equivalent (CO_2 eq), followed by methane (CH_4) (9.9 per cent) and nitrous oxide (N_2O) (7.1 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 77.1 per cent of total GHG emissions, followed by the agriculture sector (10.5 per cent), the industrial processes sector (7.2 per cent), the waste sector (4.4 per cent) and the solvent and other product use sector (0.7 per cent). Total GHG emissions amounted to 369,490.24 Gg CO_2 eq and increased by 29.5 per cent between the base year[2] and 2009. Total GHG emissions have increased in Spain between 1990 and 2007, when the maximum value of emissions was attained (154.7 per cent of emissions compared with 1990). After that, emissions decreased from 2007 to 2008 (by 7.2 per cent), and from 2008 to 2009 emissions decreased by 9.2 per cent. The decrease of total emissions in the last two inventory years, which was mostly driven by the energy and industrial processes sectors, reflects the recent economic crisis following the previous period of high development and the structural measures implemented, and the expert review team (ERT) concludes that the trend of total emissions is reasonable.

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.

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

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

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

Table 1

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

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A sources		CO_2	225 815.08	225 815.08	253 703.72	305 278.62	364 926.85	364 980.97	336 460.66	298 719.70	32.3
		CH_4	26 318.28	26 318.28	29 093.12	33 599.94	35 412.59	36 629.84	36 086.80	36 426.60	38.4
		N_2O	27 681.80	27 681.80	26 586.95	32 464.14	28 490.46	29 519.98	26 464.01	26 393.87	–4.7
		HFCs	4 645.48	2 403.18	4 645.48	8 351.64	5 423.25	6 318.42	7 056.61	7 302.18	57.2
		PFCs	832.52	882.92	832.52	436.03	288.05	297.85	314.51	296.93	–64.3
		SF_6	108.34	66.92	108.34	204.60	271.63	339.97	354.07	350.98	224.0
KP-LULUCF	Article 3.3[b]	CO_2							–6 291.36	–6 408.59	
		CH_4							0.87	2.71	
		N_2O							0.09	0.27	
	Article 3.4[c]	CO_2	–19 377.01						–22 189.91	–21 628.92	11.6
		CH_4	172.83						20.79	59.11	–65.8
		N_2O	17.54						2.11	6.00	–65.8

Abbreviation: 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.

[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 2009

			Gg CO_2 eq							*Change*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A		Energy	210 161.67	210 161.67	239 443.00	287 566.37	343 748.28	343 419.13	317 876.84	285 007.55	35.6
		Industrial processes	28 035.91	25 802.59	26 661.75	33 861.46	33 623.99	34 127.94	31 656.08	26 773.32	–4.5
		Solvent and other product use	1 809.04	1 809.04	2 338.88	2 530.40	2 744.91	2 791.53	2 677.72	2 552.90	41.1
		Agriculture	37 743.39	37 743.39	36 696.87	44 144.28	40 869.43	42 741.52	38 842.63	38 889.97	3.0
		Waste	7 651.49	7 651.49	9 829.63	12 232.46	13 826.21	15 006.91	15 683.39	16 266.51	112.6
		LULUCF	NA	–19 058.14	–19 231.39	–23 280.88	–24 595.56	–29 660.01	–29 118.37	–28 627.96	NA
		Total (with LULUCF)	**NA**	**264 110.03**	**295 738.74**	**357 054.09**	**410 217.27**	**408 427.01**	**377 618.30**	**340 862.29**	**NA**
		Total (without LULUCF)	**285 401.50**	**283 168.18**	**314 970.13**	**380 334.97**	**434 812.83**	**438 087.03**	**406 736.66**	**369 490.25**	29.5
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation							–6 396.57	–6 512.71	
		Deforestation							106.17	107.10	
		Total (3.3)							**–6 290.40**	**–6 405.61**	
	Article 3.4[d]	Forest management							–18 608.23	–18 564.10	
		Cropland management	–711.55						–3 558.78	–2 999.71	321.6
		Grazing land management	NA						NA	NA	NA
		Revegetation	NA						NA	NA	NA
		Total (3.4)	–711.55						**–22 167.02**	**–21 563.81**	**NA**

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

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

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

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	1 499 576 336			1 499 576 336	
Annex A emissions for current inventory year					
CO_2	296 942 310	298 719 702		298 719 702	
CH_4	36 387 219	36 426 596		36 426 596	
N_2O	26 209 491	26 393 869		26 393 869	
HFCs	7 361 152	7 302 180		7 302 180	
PFCs	297 276	296 927		296 927	
SF_6	350 975			350 975	
Total Annex A sources	**367 548 424**	**369 490 249**		**369 490 249**	
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	–6 710 224	–6 512 714		–6 512 714	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NA	NA		NA	
3.3 Deforestation for current year of commitment period as reported	389 950	107 103		107 103	
Activities under Article 3, paragraph 4, for current inventory year[d]					
3.4 Forest management for current year of commitment period	–18 564 096	–18 564 096		–18 564 096	
3.4 Cropland management for current year of commitment period	–2 999 714	–2 999 714		–2 999 714	
3.4 Cropland management for base year	–711 550	–711 550		–711 550	
3.4 Grazing land management for current year of commitment period					
3.4 Grazing land management for base year					
3.4 Revegetation for current year of commitment period					
3.4 Revegetation in base year					

Abbreviation: NA = not applicable.

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

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

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

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

6. The GHG inventory is in line with the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)

7. The 2011 inventory submission is generally of a high quality, but during the review the ERT identified several factors that may have resulted in potential underestimation of GHG emissions or an overestimation of removals in 2009 in the original submission made on 14 April 2011, as follows:

(a) Spain did not report transparently the information on emissions from coke production (reported under the categories manufacture of solid fuels and other energy, and solid fuel transformation) to ensure that emissions are not underestimated;

(b) The Party could not trace fully the use of some quantities of feedstocks and non-energy uses of fuel, and could not identify whether these uses result in carbon storage or emissions (including natural gas in the chemical industry and liquid fuels in the non-ferrous metal industry);

(c) Spain could not justify the different value of consumption of hard coal reported in the national energy balance and in the inventory, for the category other sectors;

(d) Spain reported HFC and PFC emissions from disposal of fire extinguishers and HFC from disposal of aerosols/metered dose inhalers as not estimated ("NE");

(e) The Party did not consider the total quantity of nitrogen (N) synthetic fertilizers, as reported in national statistics, when calculating direct and indirect emissions from agricultural soils.

8. Spain acknowledged these findings at the time of the review and undertook measures to improve the quality of the 2011 inventory during the review by submitting a complete set of common reporting format (CRF) tables with revised estimates and resolving all the issues identified by the ERT in the list of potential problems and further questions identified by the ERT during the review in a manner that the ERT found to be appropriate.

9. By submitting the revised inventory and supplying the additional information requested by the ERT, Spain has demonstrated sufficient capacity to comply 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) and the IPCC good practice guidance.

10. The Party has submitted supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with chapter I of the annex to decision 15/CMP.1.

11. Spain has chosen to account for activities under Article 3, paragraph 3, of the Kyoto Protocol at the end of the commitment period. The Party elected the activities forest management and cropland management under Article 3, paragraph 4 and has chosen accounting at the end of the commitment period. The Party has reported information on activities under Article 3, paragraph 3, of the Kyoto Protocol and elected activities under Article 3, paragraph 4, of the Kyoto Protocol in accordance with decisions 15/CMP.1, 16/CMP.1 and 6/CMP.3.

12. Spain has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and has used the standard electronic format (SEF) tables as required by decision 14/CMP.1.

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

14. The national registry continues to perform the functions set out in the annex to decision 5/CMP.1 and the annex to decision 13/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).

15. Spain has reported information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, as requested in chapter I.H of the annex to decision 15/CMP.1, in its national inventory report (NIR). However, the ERT encourages the Party to submit additional information on the adverse impacts, in particular those related to the agricultural policies of the European Union (EU).

16. In the course of the review, the ERT formulated a number of recommendations, the most important being: improving the completeness of the inventory; enhancing transparency; enhancing the national system in relation to the communication between the inventory team and regional authorities; including the energy balance; and continuing to improve the methodology and reporting in relation to Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see paras. 220 and 221 below).

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

17. The 2011 annual inventory submission was submitted on 14 April 2011; it contains a complete set of CRF tables for the period 1990–2009 and an NIR. Spain 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 (KP-LULUCF activities), accounting of Kyoto Protocol units, changes in the national system and in the national registry, and adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The SEF tables were submitted on 14 April 2011. The annual submission was submitted in accordance with decision 15/CMP.1.

18. Spain officially submitted revised emission estimates on 5 December 2011 in response to the list of potential problems and further questions raised by the ERT in the course of the review, including information on KP-LULUCF. The Party submitted revised estimates for: CO_2, CH_4 and N_2O emissions from liquid and gaseous fuels use in other (manufacturing industries and construction); CO_2, CH_4 and N_2O emissions from solid use in commercial/institutional and residential; HFC and PFC emissions from fire extinguishers; HFC emissions from aerosols/metered dose inhalers; and direct and indirect N_2O emissions from agricultural soils (application of synthetic fertilizers). The values in this report are based on the values reported by the Party on 5 December 2011.

19. Where necessary, the ERT also used the previous year's submission 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]

20. During the review, Spain 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

21. The ERT noted that Spain has improved the completeness of its inventory, since the previous annual submission, by reporting estimates for: N_2O emissions from use of gaseous fuels in road transportation; CO_2 from fugitive emissions from solid fuel transformation; and PFC and HFC emissions from manufacturing and decommissioning of fire extinguishers, which were reported as "NE" in the previous annual submission. During the in-country review, the Party also clarified that emissions of HFCs from decommissioning of aerosols, previously reported as "NE" are in fact included elsewhere ("IE").

22. In addition, the ERT encourages the Party to continue its efforts to improve the completeness of its inventory and to include emission estimates for other categories reported as "NE", using alternative methodologies than those included in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, including: CO_2 emissions from coal handling (underground and surface mining); CH_4 emissions from incineration of hospital waste; and N_2O emissions from incineration of corpses. Finally, the ERT notes that, in spite of recommendations in previous review reports, Spain does not yet report potential emissions of HFCs, PFCs and SF_6 from consumption of halocarbons and SF_6, and therefore encourages the Party to provide estimates of potential emissions of HFCs, PFCs and SF_6 from consumption of halocarbons and SF_6, in its next annual submission.

23. The LULUCF categories, KP-LULUCF activities and carbon pools that are reported as "NE" or are not reported in the inventory are discussed in chapters II.E and II.G.1 of this report.

24. Spain has provided all the CRF tables for the years 1990–2009, and the NIR follows the outline set out in the UNFCCC reporting guidelines.

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

Overview

25. The ERT concluded that the national system continued to perform its required functions.

Inventory planning

26. The ERT welcomes the Party's efforts to improve the description of the institutional arrangements for the preparation of the inventory and the national system, in the NIR of its 2011 submission. These descriptions were complemented by information provided to the ERT during the review week. The Directorate-General for Environmental Quality and

[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 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.

Assessment (DGCEA)[4] of the Ministry of the Environment and Rural and Marine Affairs (MARM)[5] is the single national entity and has the overall responsibility for the national inventory. Within DGCEA, the Strategic Environmental Information Unit (UIAE) is responsible for the preparation of the inventory and the processing of the information collected from several data sources.

27. Among the organizations involved in the preparation of the inventory and the provision of technical support is Análisis Estadístico de Datos, S.A. (AED), which acts under public contract with MARM, processes the activity data (AD), proposes the emission factors (EFs) and prepares CRF tables and the NIR. AED has a stable relationship within the national system with long-term contracts with MARM (the current one up to 2014).

28. DGCEA/UIAE ensures effective cooperation with other government organizations, in particular those of the transport, agriculture and forestry sectors, and local governments. DGCEA/UIAE is also responsible for contacts with international organizations. Detailed information on the institutional arrangements involved and the data that are delivered by each institution are presented in chapter 1.2 of the NIR.

29. Furthermore, the ERT notes with appreciation the various permanent working groups, comprising representatives from MARM and sectoral experts from other institutions, that have been set up with specific objectives to support the development of the inventory: agriculture (GT-INV-AG); livestock (GT-INV-GAN); the land use and climatic change thematic group (GT-USCC); the thematic group for the regional coordination of technical aspects regarding AD and methodologies; and the forum to handle issues related to the disaggregation of the inventory at the regional level. The ERT highlights the latter objective, having been shown information during the review documenting how DGCEA ensures the harmonization of the underlining data and emission estimates at national and regional level, in spite of the fact that coordination with local authorities require significant effort: there are 17 regional governments in Spain and about half of them prepare their own emissions inventory. The ERT welcomes these efforts by Spain.

30. The procedure for the approval of the inventory is clearly defined: the inventory, prepared by DGCEA, is submitted by MARM to the Government's Delegated Committee for Economic Affairs for final approval.

Inventory preparation

Key categories

31. Spain has reported key category tier 1 and tier 2 analyses, both level and trend assessment, as part of its 2011 submission. Spain has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance for LULUCF. In addition, the Party used qualitative criteria, such as plans to improve estimates in the future given the recognition that estimates are not sufficient accurate, to include additional categories in its key category analysis (e.g. categories in the energy and industrial processes affected by the share of energetic and non-energetic use of natural gas, petroleum coke and lubricants; N_2O from road transportation; navigation; and HFCs from refrigeration and air conditioning equipments).

32. The tier 1 key category analysis performed by the Party and that performed by the secretariat[6] produced different results owing to the use of a more detailed level of

[4] Dirección General de Calidad y Evaluación Ambiental, in the Spanish original.

[5] Ministerio de Medio Ambiente y Medio Rural y Marino, in the Spanish original.

[6] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*.

disaggregation by the Party. The NIR contains explanations regarding the level of disaggregation of categories applied to perform the key category analysis.

33. Spain has identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol using the tier 2 approach. The LULUCF categories identified as key categories under the Kyoto Protocol are the same as those identified for the LULUCF sector under the Convention.

34. The ERT concluded, during the review week, that Spain effectively uses the results of key category analysis to prioritize the improvements of its inventory.

Uncertainties

35. Spain performed and has reported a tier 1 uncertainty analysis for 2008 and 2009, and for the uncertainty in the trend in the period 1990–2009. The ERT considers the uncertainty analysis to be in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. Spain reports the results of the uncertainty analysis: excluding the LULUCF sector; including the LULUCF sector; and including the uncertainty of the KP-LULUCF activities.

36. The overall uncertainty of the 2009 inventory excluding LULUCF was estimated at 10.4 per cent, and the uncertainty in the trend was estimated at 3.0 per cent. When the LULUCF sector is included, the estimated uncertainty of the 2009 inventory increases to 12.0 per cent, and the uncertainty in the trend increases to 3.3 per cent. In comparison with the previous submission, the uncertainty for 2008 (10.5 per cent) is similar to the uncertainty level estimated in the current submission for 2009, while the uncertainty in the trend has decreased from the previous year's level (4.9 per cent). The ERT recommends that the Party analyse the reasons for the changes in the uncertainty in trend in its next annual submission.

37. The ERT commends Spain for updating its uncertainty analysis on an annual basis. During the review, Spain informed the ERT that, in line with the recommendations in the previous review report,[7] it plans to implement a tier 2 uncertainty analysis for the sectors/categories for which such methodologies are more developed, such as agriculture, road transportation and civil aviation, and to report the results in its 2012 annual submission. The ERT supports the efforts by the Party.

Recalculations and time-series consistency

38. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. Clear and detailed explanations for the recalculations are provided in the NIR and in CRF table 8(b) for all categories, and the ERT commends the Party for the improvements in reporting since its previous annual submission and following the recommendations in the previous review report.[8]

39. The ERT noted that recalculations reported by the Party for the period 1990 to 2008 have been undertaken to take into account:

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.

[7] FCCC/ARR/2010/ESP, paragraph 27.

[8] FCCC/ARR/2010/ESP, paragraph 29.

(a) Improvements of AD in some sectors (e.g. statistical data concerning the numbers of chickens, the quantities and N content of fertilizers and the quantities of wastes produced and sludge incinerated);

(b) Improvements in the EFs in the industrial processes sector, in particular due to the introduction of the use of data from the European Union emissions trading scheme (EU ETS) to estimate emissions from cement production for the whole time series;

(c) An improved methodology (model) to estimate emissions from civil aviation for the entire time series;

(d) Reallocation of the use of natural gas from the industrial processes sector to the energy sector;

(e) The implementation of revised estimates for the use of N_2O anaesthetic (for the entire time series).

40. The overall impact of the recalculations was a decrease in estimated total GHG emissions in the base year (0.7 per cent) and an increase in total GHG emissions in 2008 (0.1 per cent).

Verification and quality assurance/quality control approaches

41. Spain has developed a quality assurance/quality control (QA/QC) plan which is in line with the IPCC good practice guidance. The plan includes general tier 1 as well as tier 2 QC procedures. DGCEA, as the single national entity, is the body responsible for the QA/QC system, coordinating the system and ensuring that tasks are performed on time.

42. The NIR contains a comprehensive and detailed description of the general QC procedures that are performed annually, and information on procedures implemented at each category level are reported in the sectoral chapters of the NIR. The ERT commends Spain for the documentation delivered to the ERT during the review week reporting on the results of QC activities performed between the 2010 and 2011 submissions. The ERT notes that the QC activities performed were the reason for some of the recalculations in the 2011 submission, but that these reasons are not well described in the NIR. The ERT recommends that the Party enhance the reporting of the outcome of QC activities and the consequent recalculations in the NIR of next annual submissions.

43. The NIR also contains information on QA and verification activities, in particular explaining how QA procedures are organized. During the review week Spain presented an updated version of the QC plan and a draft document describing the methodology of the quantitative approach used to identify outliers and errors in the inventory data. Further, during the review week, Spain informed the ERT that it envisages establishing institutional arrangements with other EU member States in order to undertake bilateral independent reviews of their inventories during the commitment period (2008–2012). The ERT reiterates the recommendations in the previous review report, that Spain proceed with the planned independent review of the inventory and report on the review in its next annual submission.

44. As a follow-up of the previous review, the ERT raised a number of questions regarding the availability and use of EU ETS data in the inventory, and in particular in QA/QC practice. In response to the questions raised, Spain explained that the central government and the inventory team only have access to emission data from EU ETS operators, while the valuable additional AD (such as EFs and the level of implemented QA/QC procedures that are submitted yearly by the EU ETS verifiers (EU ETS emissions are certified on a plant-by-plant basis)) are submitted by operators to regional governments. Moreover, the format of the data differs from region to region and in some cases data are supplied to the central government only on paper. Spain also informed the ERT that it had

reached an agreement with the regional authorities on a common format for electronic data, but, due to a lack of resources, this agreement has not yet been fully implemented. Therefore, the inventory team currently only has access to EU ETS data with appropriate levels of detail for some individual plants and these are used for QA/QC purposes only for cement, lime and refineries industrial plants. The ERT recommends that Spain increase efforts to use more information from the EU ETS verifiers' reports from regional governments, and use this information to improve the accuracy of the inventory and for QA/QC activities.

45. Therefore, the ERT reiterates the recommendation in the previous review report,[9] that, to increase transparency, Spain report yearly in its NIR on the performed QA/QC activities, because this information is useful to provide evidence of the current accuracy of the inventory estimates, and of the improvements made to the inventory.

Transparency

46. Spain's inventory is in general transparent, with regard to both the NIR and the CRF tables. However, the ERT found areas that require further improvement, as explained in the following paragraphs.

47. During the review week, the ERT asked for a copy of the national energy balance in order to analyse several discrepancies observed between the AD used for energy consumption as reported in the CRF tables and that communicated to international organizations. These discrepancies had also been identified in the previous review report. In response to the questions raised by the ERT, Spain provided a copy of the official energy balances for coal, oil, natural gas and renewables for the year 2009. Spain also provided an additional energy balance, also referred to as the national energy balance, that was elaborated by the inventory team and used as a basis for the emissions calculations. Further, the Party explained that there are several reasons for the discrepancies between both energy balances, the main one being that the emission inventory also uses data collected directly by the inventory team from transport authorities and main industrial operators. The ERT notes that the existence of two energy balances referred to as "national energy balance" and the fact that the differences between both are not explained in the NIR, resulted in transparency problems in previous reviews and had even led to some of the adjustment cases applied in the previous review. The ERT found that the energy balances provided have different units of measurement (tonnes, TJ, Mtoe), and that some refer to net calorific values while others refer to gross calorific values. Therefore, these factors made it very difficult for the ERT to verify the consistency between the data reported to international statistics and the data used in the annual inventory (CRF tables) during the review week. Therefore, the ERT strongly recommends that Spain include, in its next annual submission, a copy of the official energy balance submitted to the International Energy Agency (IEA) and a comparison of that and the CRF data, together with explanations for any discrepancies.

48. The ERT also found that the use of notation keys is not always consistent with the information provided in the NIR and in the notes to CRF tables. For example, Spain uses the notation key "NE" in cases where emissions are not estimated, but also in cases where emissions are considered negligible. This issue had already been identified in the previous review report, and the ERT reiterates these recommendations that Spain revise the use of notation keys, in its next annual submission, in accordance with the UNFCCC reporting guidelines.

49. The NIR provides a detailed analysis of the trends in emissions, but the ERT considered that, although some improvements had been made, it still does not provide adequate explanations of the underlying reasons for the trends and inter-annual variations in

[9] FCCC/ARR/2010/ESP, paragraph 33.

AD in all cases. The ERT recommends that the Party continue to improve the transparency of its reporting by providing explanations for the trends in terms of technological and economic changes.

50. The ERT considers that the information in the NIR was not complete enough to allow it to make a good assessment of the estimates for the industrial processes sector (e.g. information is not provided for nitric acid production, electric arc furnaces, chemical industries, due to confidentiality issues). During the review week, Spain provided the ERT with copies of a more detailed and extended NIR, which is only used for internal reference by the inventory team, and where the Party includes, on an annual basis, detailed information on the methodology, EFs and AD, including the confidential data. The ERT concludes that this procedure results in good inventory management, but the ERT recommends that the Party include, in the NIR of its next annual submission, more information on the assumptions used and the origins of country-specific methodologies and EFs.

Inventory management

51. Spain has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, and documentation on annual key categories and key category identification. The centralized archiving system is available at the DGCEA premises. All relevant information is also archived at the AED offices. During the review, the ERT was provided with the requested additional archived information and had access to the centralized archiving system.

3. Follow-up to previous reviews

52. Spain has implemented several of the recommendations made in previous review reports, the most relevant being:

(a) Providing emission estimates for categories previously reported as "NE" for which there are estimation methodologies available in the Revised 1996 IPCC Guidelines or in the IPCC good practice guidance (namely N_2O emissions from use of gaseous fuels in road transportation; CO_2 from fugitive emissions from solid fuel transformation; and PFC and HFC emissions from manufacturing and decommissioning of fire extinguishers);

(b) Increasing the transparency of its reporting, including an improvement on the use of notation keys and the inclusion of explanations of the underlying reasons for trends and inter-annual variations;

(c) Making efforts to implement a tier 2 uncertainty analysis and to broaden the coverage of sectors in that analysis;

(d) Using EU ETS data to improve the accuracy of the inventory with country-specific data;

(e) Enhancing the reporting on natural gas used as feedstocks, providing clarity on where these fuels are used;

(f) Recalculating emissions from consumption of halocarbons and SF_6 and CO_2 from cement production.

53. Spain has not implemented some of the recommendations made in previous review reports, the most relevant being to:

(a) Implement QA activities on a regular basis;

(b) Improve its reporting, in the NIR, of the results of QA/QC activities during the preparation of the annual inventory submission in order to facilitate the assessment of the inventory and its accuracy by review teams;

(c) Report the energy balance in the NIR;

(d) Use EU ETS data in a systematic manner to enhance the QA/QC procedures;

(e) Continue to improve its reporting of the non-energy use of natural gas and liquid fuels, by providing clarity on where these fuels are used;

(f) Find alternative ways to report confidential AD and emission estimates without violating the existing rules on confidentiality.

4. Areas for further improvement

Identified by the Party

54. The 2011 NIR identifies several areas for improvement, including plans for general areas and sector-specific improvements. The most important areas for improvement at the general level are:

(a) The further development of the institutional arrangements, in particular in relation to the collaboration of the ministerial focal points, the thematic groups and the comparison with the inventories prepared by the autonomous authorities;

(b) The development of a questionnaire to be sent to the autonomous communities, so that they may report background information and emissions data received under the EU ETS to the inventory team;

(c) The selective implementation of a tier 2 uncertainty analysis for specific sectors, including the agriculture sector.

55. The NIR lists in detail some more specific areas in need of improvement, including:

(a) The revision of the methodology for the elaboration of the energy balance for liquid fuels, in collaboration with the Ministry of Industry, Tourism and Trade (MITYC), and for biomass and waste, in collaboration with the Institute for Diversification and Saving of Energy and the Sub-Directorate General of Production and Sustainable Development;

(b) The use of plant-specific AD and EFs to estimate emissions from several categories (such as coke oven plants, combustion in non-ferrous metal industry, cement production and chemical industry);

(c) The development of methodologies to estimate emissions from the use of limestone in sugar refineries;

(d) The elaboration of carbon balances for electrical steel production;

(e) The improvement of the methodologies used to estimate emissions from several categories in agriculture (such as enteric fermentation, N_2O and CH_4 from manure management and N_2O from agriculture soils);

(f) The improvement of the methodologies used to estimate emissions and removals for KP-LULUCF activities.

56. The ERT commends Spain for the extensive and detailed presentation of its planned improvements, but recommends that the Party prioritize the list of improvements and identify which will be implemented for its next annual submission.

Identified by the expert review team

57. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 220 below.

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

B. Energy

1. Sector overview

59. The energy sector is the main sector in the GHG inventory of Spain. In 2009, emissions from the energy sector amounted to 285,007.55 Gg CO_2 eq, or 77.1 per cent of total GHG emissions. Since the base year (1990), emissions have increased by 35.6 per cent. The key driver for the rise in emissions was fuel combustion in the transport sector (which increased by 39,343.98 Gg CO_2 eq, or 71.4 per cent, since 1990), but other categories have also contributed to the general increase in emissions since 1990, as follows: manufacturing industries and construction, an increase of 13,107.07 Gg CO_2 eq (28.0 per cent since the base year); energy industries, an increase of 12,138.78 Gg CO_2 eq (15.6 per cent since the base year); other (energy), an increase of 10,978.18 Gg CO_2 eq (41.5 per cent since the base year); and fugitive emissions from oil and natural gas, up 450.73 Gg CO_2 eq (19.9 per cent since the base year). Only fugitive emissions from solid fuels have decreased between 1990 and 2009, by 1,172.86 Gg CO_2 eq or –63.9 per cent since the base year. Within the sector, 33.1 per cent of the emissions were from transport, followed by 31.5 per cent from energy industries, 21.0 per cent from manufacturing industries and construction and 13.1 per cent from other sectors. Fugitive emissions from oil and natural gas accounted for 1.0 per cent and fugitive emissions from solid fuels accounted for the remaining 0.2 per cent. Emissions from other (energy) are reported as "IE" under the category other sectors.

60. The ERT noted that total emissions from the energy sector decreased by 10.3 per cent (32,869.29 Gg CO_2 eq) in a single year, between 2008 and 2009. It appears that the decrease in emissions from energy industries (15.3 per cent decrease between 2008 and 2009, or 16,176.40 Gg CO_2 eq) was one of the key factors for that decrease, but also the decrease in emissions from manufacturing industries and construction (12.2 per cent decrease, or 8,303.71 Gg CO_2) and from transport (6.8 per cent decrease, or 6,869.69 Gg CO_2 eq) contributed significantly to the change in those two years. During the review week, Spain explained to the ERT that the general decrease in emissions in the energy sector was due to the economic downturn in 2008–2009, while the decrease in emissions from energy industries was also the result of the phasing out of coal use.

61. The ERT commends Spain for having followed most of the recommendations in the previous review report, in particular for having improved the completeness of the inventory for the energy sector by including estimates of N_2O emissions from the use of gaseous fuels in road transportation. The ERT encourages the Party to continue its efforts to improve the completeness of the inventory, and provide emission estimates for N_2O emissions from flaring of oil in its next annual submission.

62. The ERT also commends the Party for the improvements made in terms of the transparency of its reporting on the energy sector. In this year's submission, the Party has followed the recommendations made in previous review reports and has provided disaggregated AD for the subcategories commercial/institutional, residential and agriculture/forestry/fisheries. In addition, Spain has included in the NIR information on the composition of the fuel mixes and has explained changes in implied emission factors (IEFs) over time as they relate to the changes in the fuel mix. The Party also addressed issues of

time-series consistency in the NIR and provided information on trends in fuel consumption at the category level, supported by graphical presentations of fuel consumption and GHG emissions, for all categories, following the recommendations in the previous review report.[10]

63. The ERT notes that one very important recommendation made in previous review reports (i.e. the inclusion of official energy balances) remains to be addressed and recommends that the Party include the energy balance as an annex to the NIR in its next annual submission. During the review week Spain provided the ERT with the 2009 official energy balances.[11]

64. ERT commends Spain for having started to use EU ETS data regarding emission estimations from industrial plants that are part of the energy sector (mainly in the subcategories public electricity and heat production, and petroleum refining) to improve the accuracy of the inventory, in line with the recommendation in the previous review report.[12] Spain made these improvements by using the plant-specific data and enhancing its QA/QC procedures. The ERT recommends that Spain continue its efforts to use more plant-specific data to improve the quality of its inventory, in particular by enhancing the national system so that data available at the regional level can reach the inventory team (see para. 44 above for further details).

65. Spain has made recalculations for the energy sector between the 2010 and 2011 submissions. The Party has provided clear explanations of the recalculations in the NIR of its 2011 submission for the energy sector. The recalculations in this sector resulted in an overall decrease in emission estimates of 803.28 Gg CO_2 eq (0.3 per cent) for 2008, as well as in all years in the time series, with decreases of emissions ranging between 0.2 per cent (1994) and 1.1 per cent (1990). According to information in the NIR, recalculations in the energy sector have been mainly undertaken to take into account the availability of updated AD and the revision of methodologies. The main recalculations took place for the following reasons:

(a) Revision of the methodology used in domestic civil aviation causing a significant systematic decrease in fuel consumption and emissions in the full time series (the decrease in 2008 was 3,178.90 Gg CO_2 eq, or 43.0 per cent);

(b) Inclusion in the energy sector (iron and steel) of emissions from consumption of natural gas as a fuel which, in previous submissions, were assumed to be included in the steel sector (industrial processes), resulting in an increase of emissions (277.00 Gg CO_2 eq, or 0.1 per cent in 2008);

(c) Changes in the data for fuel consumption for road transportation, including the incorporation of new data regarding total travelled km and the composition of the vehicle fleet, and the inclusion of emissions of N_2O from buses using natural gas in road transportation, which altogether resulted in an increase of emissions for 2008 (994.67 Gg CO_2 eq, or 1.1 per cent).

66. The ERT considered that the recalculations were performed in accordance with the IPCC good practice guidance.

[10] FCCC/ARR/2010/ESP, paragraph 48.

[11] Spain considers that the official energy balance is the energy balance submitted to International Energy Agency (IEA) and Eurostat.

[12] FCCC/ARR/2010/ESP, paragraph 50.

2. Reference and sectoral approaches

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

67. Estimated CO_2 emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For 2009, CO_2 emissions estimated using the reference approach are 0.07 per cent higher than those calculated using the sectoral approach. Generally, the difference between the estimates calculated using the two approaches in the period 1990–2009 is less that 2 per cent, with the exception of 1996, 1997 and 1998, for which the differences in the estimates were 2.0 per cent, 2.6 per cent and 2.4 per cent, respectively. Spain provides an extensive discussion of the reasons for the differences in annex 4 of the NIR, the most important reasons being structural differences between the approaches, and differences between variables and parameters used. The ERT commends the Party for having followed the recommendations made in the previous review report[13] regarding the need to expand the explanations with references to the differences between both approaches.

68. The ERT identified significant differences between the fuel consumptions reported in the energy balance used to elaborate the inventory (which is mainly the compilation of AD for the inventory) and the energy balance that Spain provided to Eurostat and to IEA, which Spain had informed the ERT is the official national energy balance. One example of these divergences is the consumption of coal reported in other sectors (see para. 91 below). The ERT notes that the energy balance, and the transparent manner in which it is presented, are key elements for the inventory because the accuracy of inventory estimates in the energy sector mainly reflect the accuracy of the energy balance. Therefore, the ERT recommends that Spain develop efforts within the national system in order to ensure the consistency between the energy balance used for preparing the inventory and the national official energy balance sent to Eurostat and IEA, in particular by developing actions together with MITYC.

69. To aid the transparency of the reporting, the ERT recommends that Spain include the official energy balance (prepared by MITYC and sent to Eurostat and IEA) in the NIR, and explain in the NIR the differences between this energy balance and the energy balance used for the inventory for each category and fuel. In addition, the ERT considers that it may be useful to include, at least in an annex of the NIR, information on fuel quantities expressed in tonnes.

International bunker fuels

70. The ERT commends Spain for having improved the accuracy of emissions from international aviation by implementing a model consistent with a tier 2 IPCC method. As a result of this improvement the large inter-annual variations in CO_2 emissions from international aviation identified in the previous review report,[14] are no longer visible in the 2011 submission.

71. However, the inventory still maintains large inter-annual variations in the time series relative to CO_2 emissions from marine bunkers, which were also identified in the previous review report, as follows: an increase of 46 per cent in the period 1995–1996; and an increase of 23.3 per cent in the period 1996–1997. The ERT reiterates the recommendation made in the previous review report that Spain include in the NIR a discussion of the AD and emission estimates for international bunker fuels, including an analysis of the trends and drivers, in its next annual submission.

[13] FCCC/ARR/2010/ESP, paragraph 51.
[14] FCCC/ARR/2010/ESP, paragraph 56.

72. The ERT reiterates the finding of the previous review report,[15] and encourages Spain to revise the methodology that it uses to estimate fuel consumption from international maritime bunkers by using data on movements registered between national ports and a characterization of the vessels, and to use these data to achieve a better allocation of liquid fuels between domestic navigation and international marine bunkers, in its next annual submission.

Feedstocks and non-energy use of fuels

73. Although Spain provided information in CRF table 1.A(d) concerning the quantities of the carbon fractions that are emitted from or stored in products and under which other categories these CO_2 emissions are included, the ERT concludes that the information in the NIR is incomplete (e.g. there is insufficient information on the amount of natural gas stored in non-energy uses). During the course of the review, the ERT reminded the Party of the importance of this issue, which was the cause of adjustments to the 2008 estimates during the review of its 2010 submission. During the review week, and in its responses to the list of potential problems and further questions raised by the ERT, the Party provided the ERT with additional information on the use of the natural gas reported in the energy balance as feedstocks and non-energy uses. The ERT considers this has improved the transparency of the reporting. The ERT recommends that the Party include this information in the NIR in its next annual submission and continue its efforts to determine the uses of non-energy-related fuels such as natural gas and petroleum coke (see paras. 84 and 90 below).

3. Key categories

Stationary combustions: all fuels – CO_2; CH_4 and N_2O

74. During the review week, Spain informed the ERT that there are four coke-producing plants/companies in Spain, and that emissions from coke production are reported in two categories: emissions from the use of fuels are reported under manufacture of solid fuels and other energy industries (energy industries); and fugitive CH_4 and CO_2 emissions are reported under solid fuel transformation (fugitive emissions from solid fuels). To estimate emissions, Spain uses two different sources of data:

(a) Detailed carbon balance data provided by the larger integrated coke-producing company (responsible for 88 per cent of the total CO_2 emissions) including input and output data on carbon materials and also the factory's own consumption of derived fuels (e.g. coke oven gas);

(b) Input and output data on carbon materials reported to the EU ETS by the three other companies, that do not include their own consumption of derived fuels.

75. The previous review report had identified a potential underestimation related to the corresponding amount of carbon not accounted under either the energy sector or the industrial processes sector. However, Spain had not provided sufficient information in the NIR to enable an assessment of whether all emissions from transformation of coking coal into coke were included in the inventory, and the Party could not clarify the issue during the course of the previous review. Therefore, an adjustment was calculated and applied for 2008.[16] The ERT found that this problem remained unsolved in the original 2011 submission, and therefore asked for further clarifications during the review week. In response to this issue raised by the ERT during the review week, Spain presented detailed carbon mass balances for each plant, including confidential data and, to solve the lack of data related to the in-plant consumption of fuels in the three smaller companies, Spain used

[15] FCCC/ARR/2010/ESP, paragraph 57.
[16] FCCC/ARR/2010/ESP, paragraphs 60–62 and 133–144.

the rate of in-plant consumption/coke production as reported for the larger company. However, at the time of the review week, Spain could not obtained consistent mass balances for all plants, and was not able to ensure that the corresponding emissions were complete.

76. The ERT concluded that, during the review week, Spain could not solve the problem of transparency identified in the previous review report and that a potential case of underestimation of emissions may still be occurring for both 2008 and 2009. Therefore, in the list of potential problems and further questions, the ERT requested that Spain:

(a) Obtain additional data from operators and prepare revised carbon balances that are consistent and complete for 2008 and 2009;

(b) Ensure that all GHG emissions are accounted for in the energy or in the industrial processes sectors and that no missing source stream exist;

(c) Recalculate the corresponding CO_2, CH_4 and N_2O emissions from combustion and fugitive emissions in accordance with the carbon balances, allocating the estimations into the categories from which emissions occur, for 2008 and 2009.

77. Responding to the list of potential problems and further questions raised by the ERT, Spain provided detailed confidential data for each of the four individual plants existing in the country, relative to 2008 and 2009, including: carbon balances for each plant (inputs and outputs of materials with carbon); clear information on net calorific values (NCV) and the corresponding humidity rates; quantities of coke oven gas recovered and consumed and the associated NCVs and EFs; and the EFs for CH_4 and N_2O. The ERT concluded that the information provided is complete, transparent and consistent between 2008 and 2009.

78. In accordance with the revised estimates prepared by Spain, total emissions from coke oven furnaces (combustion and fugitive emissions) were revised from 958.65 Gg CO_2 eq to 922.84 Gg CO_2 eq, with reference to 2008, and 788.62 Gg CO_2 eq to 798.37 Gg CO_2 eq, with reference to 2009.

79. The ERT agrees with the revised calculations provided by Spain for 2008 and 2009 and, in accordance with paragraph 82 to the annex to decision 22/CMP.1, decided to replace the adjusted estimate.

80. In its original 2011 annual submission, Spain reported in CRF table 1.A(d) that 15,826.49 TJ of natural gas was used in 2009 as feedstock or non-energy uses, while information collected by Spain traces back only 15,732.32 TJ (99.4 per cent) of the use of natural gas in the chemical industry (mainly used in refineries and ammonia production). Likewise, with reference to 2008, Spain reported that 16,452.42 TJ was used as a feedstock. However, again, the information collected by Spain could trace only 15,010.23 TJ (91.2 per cent of the total value reported) for 2008. In a similar manner, the previous ERT concluded that the corresponding emissions for 2008 could be underestimated, and calculated and applied an adjustment.[17] During the review week, Spain recognized the potential problem and informed the ERT that it intends to consider the natural gas not used as feedstock as fuel combustion and report the respective emissions of CO_2, CH_4 and N_2O, in order to avoid any underestimation. However, the ERT concluded that this problem remains unsolved, and included the problem in the list of potential problems and further questions at the end of the review week.

81. For both 2008 and 2009, the ERT recommended that Spain:

(a) Report the uses of the remaining quantities of natural gas;

[17] FCCC/ARR/2010/ESP, paragraphs 65 and 157–169.

(b) Recalculate the corresponding CO_2 and/or CH_4 and N_2O emissions, allocating the estimations into the categories where the emissions occur, for 2008 and 2009;

(c) In case that the category could not be identified, as a temporary measure, allocate the respective emissions of CO_2, CH_4 and N_2O in the most likely category.

82. In response to the list of potential problems and further questions raised by the ERT, Spain stated that it could not identify the uses for the remaining quantities of natural gas, but it had estimated emissions as if this natural gas was consumed as fuel in accordance with the general use of this gas (55.0 per cent in boilers, 33.0 per cent in gas turbines and 17.0 per cent in engines) and the estimates are included under the category other (manufacturing industries and construction). Spain provided detailed information on the quantities consumed and the EFs used.

83. In accordance with the revised estimates prepared by Spain, total emissions from the use of natural gas in the category other (manufacturing industries and construction) were revised from 19,991.97 Gg CO_2 eq to 20,075.47 Gg CO_2 eq, with reference to 2008 (0.4 per cent increase), and 17,429.54 Gg CO_2 eq to 17,434.99 Gg CO_2 eq, with reference to 2009 (0.03 per cent increase).

84. The ERT agrees that the revised calculations provided by Spain for 2008 and 2009 mean that there is no longer an underestimation in the inventory for both years and, in accordance with paragraph 82 to the annex to decision 22/CMP.1, decided to replace the adjusted estimate. However, the ERT recommends that Spain continue its efforts to identify and report all uses of natural gas from feedstocks and non-energy use of fuels and allocate any emissions in the appropriate categories, in its next annual submission.

85. During the review week, Spain provided to the ERT the energy balance used in the inventory and the energy balance reported to Eurostat and IEA. The ERT notes that, in accordance with the information in the energy balances, from the total of 504 kt of petroleum coke reported as final non-energy consumption in chemical industry for 2009 (equivalent to 16,407.72 GJ reported in CRF table 1.A(d) in its original 2011 submission) Spain could only trace the use of 183 kt in the iron and steel, calcium carbide, silicon carbide and aluminium industries, and stated that it had no information on the use of the remaining 321 kt. A similar situation had also been identified in the previous review (submission 2010) with respect to 2008 data, when there was no information on the use of 321 kt petroleum coke reported as non-energy use, and therefore the previous ERT had concluded that the corresponding emissions could have been underestimated for 2008 and applied an adjustment.[18]

86. During the review week, the Party's inventory team and the ERT agreed that the use of the remaining 321 kt of petroleum coke in both 2009 and in 2008 could not be identified and that emissions from the use of this quantity of petroleum coke are not included in the inventory, either in the energy sector or in the industrial processes sector. Also, Spain confirmed that it could not yet provide information that could justify the removal of the adjustment for 2008. Therefore the ERT concluded that there was an underestimation of emissions for both 2008 and 2009, and included this problem in the list of potential problems and further questions at the end of the review week.

87. The ERT requested that Spain:

(a) Report the use of the 321 kt of petroleum coke that could not be traced as non-energy use, for 2008 and 2009;

[18] FCCC/ARR/2010/ESP, paragraphs 63–64 and 145–156.

(b) Recalculate the CO_2 and/or CH_4 and N_2O emissions corresponding to the part that is not yet included in the energy sector or the industrial processes sector, allocating the estimations into the categories where the emissions occur, for 2008 and 2009;

(c) Allocate the corresponding emissions into the most probable category, for example fuel consumption, if the Party could not identify the category responsible for these emissions.

88. Responding to the list of potential problems and further questions, Spain informed the ERT that it could not identify the uses for the remaining quantities of petroleum coke, but it had estimated emissions as if it were consumed as fuel in boilers and the resulting estimates were included under the category other (manufacturing industries and construction). Spain provided detailed information on the quantities consumed and the EFs used.

89. In accordance with the revised estimates prepared by Spain, total emissions from the use of liquid fuels in other manufacturing industries were revised from 18,310.79 Gg CO_2 eq to 19,344.96 Gg CO_2 eq, with reference to 2008 (a 5.6 per cent increase) and 16,352.46 Gg CO_2 eq to 17,387.37 Gg CO_2 eq, with reference to 2009 (a 6.3 per cent increase).

90. The ERT agrees that the revised calculations provided by Spain for 2008 and 2009 mean that there is no longer an underestimation in the inventory for both years and, in accordance with paragraph 82 to the annex to decision 22/CMP.1, decided to replace the adjusted estimate. However, the ERT recommends that Spain continue its efforts to identify and report all uses of petroleum coke from feedstocks and non-energy use of fuels and allocate any emissions in the appropriate categories, in its next annual submission.

91. Spain reported a constant consumption of hard coal (4,551 TJ) under the category other sectors for the period 2004–2009 (table 3.9.5 in the NIR). This value corresponds to a consumption of 150 kt coal, as reported in the energy balance used to elaborate the inventory (provided to the ERT during the review week). However, the ERT found that the value included in the energy balance submitted to the Eurostat and IEA, for 2009 is twice as large (300 kt) as the value used in the inventory. This situation had already been identified in the previous review report, in which the difference between the amount of coal consumption reported in the NIR (150 kt) and the submitted to Eurostat and IEA (300 kt) was the same (300 kt). Therefore, the previous ERT had concluded that the corresponding emissions could have been underestimated and calculated and applied an adjustment.[19]

92. During the review week, Spain agreed to use a value of 300 kt to estimate emissions for 2008 and 2009. In order to prevent an underestimation in the 2011 submission for both 2008 and 2009, the ERT requested that the Party address this issue in its response to the list of potential problems and further questions. In particular, the ERT requested that the Party update the AD and emission estimates for the subcategory residential in line with the official balance submitted to the international organizations and recalculate emissions, as provided during the review week.

93. Responding to the list of potential problems and further questions, Spain stated that, as result of the previous review,[20] the MITYC has already revised the values of solid fuel consumption reported in the national energy balance[21] for the period 1999–2009 for the subcategories included in the category other sectors (in particular for commercial/institutional and residential). From that revision, consumption of bituminous

[19] FCCC/ARR/2010/ESP, paragraphs 66–67 and 170–185.

[20] In particular, the recommendation in paragraph 67 of FCCC/ARR/2010/ESP.

[21] The energy balance submitted to IEA and Eurostat.

coal in the commercial/institutional subcategory has increased from 30 t/year, in both 2008 and 2009, to 60 and 80 t/year, for 2008 and 2009 respectively. Also, annual consumption of bituminous coal in the residential sector has increased from 120 t/year to 300 t/year, in both 2008 and 2009. In its submission of 5 December 2011, Spain submitted revised estimates using the updated AD and using the same NCV and EFs. Detailed information on calculations was provided to the ERT during the review.

94. In accordance with the revised estimates prepared by Spain, total emissions from solid fuels in the category other sectors were revised from 603.70 Gg CO_2 eq to 1,310.19 Gg CO_2 eq, with reference to 2008 (a 117.0 per cent increase) and by 592.89 Gg CO_2 eq to 1,366.66 Gg CO_2 eq, with reference to 2009 (a 130.5 per cent increase).

95. The ERT agrees with the revised estimates provided by Spain for 2008 and 2009 and in accordance with paragraph 82 to the annex to decision 22/CMP.1, decided to replace the adjusted estimate.

Civil aviation – CO_2

96. In its 2011 annual submission, Spain includes separate time series of emission estimates for each fuel in the NIR, as was recommended by the previous review report.[22] The ERT commends the Party for the improvement made to the transparency of its reporting.

97. For the first time, in its 2011 submission, Spain used a model (MECETA) to calculate, in a disaggregated manner, fuel consumption and emissions from civil aviation, instead of the methodology that was used in previous inventories, which was based on aggregated information on aircraft movements and questionnaires regarding fuel combustion conducted by MITYC. The MECETA model brings differentiated estimation for national and international fuel consumption and emissions and is consistent with a tier 2 IPCC methodology. In addition, total fuel consumption resulting from the model was compared and harmonized with total sales of aviation fuel, which the ERT finds to be in accordance with the IPCC good practice guidance. Implementation of this model to calculate fuel consumption and emissions in national civil aviation has resulted in a decrease in the fuel consumption for this key category, while at the same time resulted in the corresponding increase in fuel consumption assigned to international aviation and a correspondent decrease in emissions of 53.8 per cent in 1990 (2,244.75 Gg CO_2 eq) and 43.0 per cent in 2008 (3,178.90 Gg CO_2 eq), when comparing the 2010 submission with the 2011 submission.

Coal mining and handling – CH_4

98. Previous review reports recommended that Spain undertake a study to determine the extent of degasification activities and CH_4 recovery and flaring in coal mining, and to assess the possible impacts of these activities on GHG emissions for the fugitive emissions and stationary combustion categories. In response to questions raised by the ERT during the review week regarding progress on this issue, Spain stated that the issue is still being analysed and that no definitive results are available yet. The ERT reiterates the previous recommendations that Spain complete the study as soon as possible.

[22] FCCC/ARR/2010/ESP, paragraph 68.

4. Non-key categories

Railways – CO_2

99. The ERT commends Spain for including, in the NIR, information of CO_2 emissions from railways, including fuel combustion and EFs, as was recommended in the previous review report.[23]

100. In the energy balance referring to the inventory and provided by Spain during the in-country review, Spain reports a consumption of 85 kt gas/diesel oil for 2009 that is consistent with the value expressed in energy units (3,688.80 TJ) in CRF table 1.A(a). However, in the energy balances submitted to Eurostat and IEA, the value reported for consumption of gas/diesel oil is 620 kt. A similar issue was identified in the previous review report with reference to 2008.[24] Spain stated that the value reported in the inventory was provided directly by the main railway companies and that it is accurate. In addition, the Party stated that the rest of the fuel consumption was reallocated. The ERT recommends that the inventory team make joint efforts with MITYC and enhance the transparency of the reporting by ensuring that both the inventory and the energy balances submitted to IEA report consistent values, or explain the reasons for the difference in the NIR of its next annual submission.

Other – CO_2

101. In previous review reports it was noted that the NIR was not sufficiently transparent on whether fuel consumption for military purposes was included in the energy statistics. During the review week, Spain informed the ERT that those fuel consumptions and emissions are included in the AD and emissions of several categories, in accordance with similarity of uses. However, the ERT noted that in CRF table 1.A(a) the Party reports fuel consumption and emissions in the category other (energy) as "IE" for liquid and gaseous fuels and the NIR does not refer to other emission categories included under other (energy). The ERT considers that the information reported by the Party on this issue is not yet transparent enough to allow it to consider this issue solved and therefore reiterates the recommendations of previous review reports that Spain improve the transparency and consistency of reporting for this category, in its next annual submission.

5. Areas for further improvement

Identified by the Party

102. Spain lists in the NIR several areas for improvement of the energy sector that are identified by category:

(a) Improve the energy balance in relation to liquid fuels, biomass and residues and, in close collaboration with several institutes under MITYC. The efforts will centre in collecting information on AD for energy and non-energy use of fuels and developing a better knowledge of fuel characteristics (e.g. NCV);

(b) Revise the fuel characteristics and EFs used in the energy industry with the objective of reducing the use of default values and to increase the use of EU ETS data (in particular for oil refineries);

(c) Increase the use of plant-specific data to improve the quality of the inventory for the secondary lead and cooper production industries;

[23] FCCC/ARR/2010/ESP, paragraph 71.
[24] FCCC/ARR/2010/ESP, paragraph 72.

(d) Investigate the possibility that fuel consumption in non-commercial lime produced by some industrial activities not yet accounted for (e.g. sugar production, copper smelting) and whether the associated emissions are accounted for in the inventory;

(e) Continue to develop the use of the MECETA model to estimate emissions from aviation, and proceed with the integration of the calculations based on that model in the inventory;

(f) Continue to improve basic information used for road transportation, such as the composition of the fleet;

(g) Continue the ongoing efforts with several institutions to obtain data on ship movements and maritime routes, which will allow the development of a new methodology to estimate emissions from domestic navigation;

(h) Revise the methodology used (equipment, EFs) to estimate emissions from off-road vehicles in the agro-forestry category;

(i) Continue efforts to improve the estimates of fugitive emissions from natural gas, in particular by enlarging the information collected to include new provider companies.

Identified by the expert review team

103. The ERT recommends that Spain, in its next annual submission:

(a) Include the national energy balance as an annex to the NIR, and explain the differences between the national energy balance and the energy balance prepared by the inventory team;

(b) Continue its efforts to use more plant-specific data, in particular EU ETS data, to improve the quality of the inventory, and to enhance collaboration between the inventory team and regional administrations;

(c) Revise the methodology to estimate emissions from maritime transportation;

(d) Continue efforts to determine the uses of non-energy fuels, in particular natural gas and petroleum coke, and estimate any missing emissions and allocate them to the appropriate categories, if necessary;

(e) Develop efforts to determine the extent of degasification activities and CH_4 recovery and flaring in coal mining facilities;

(f) Improve the transparency of the information provided for fuel consumption in railways and for military purposes.

C. Industrial processes and solvent and other product use

1. Sector overview

104. In 2009, emissions from the industrial processes sector amounted to 26,773.32 Gg CO_2 eq, or 7.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 2,552.90 Gg CO_2 eq, or 0.7 per cent of total GHG emissions. Since the base year, emissions have increased by 3.8 per cent in the industrial processes sector, and increased by 41.1 per cent in the solvent and other product use sector. The key driver for the rise in emissions since the base year is the increase of emissions from consumption of halocarbons and SF_6, which increased by 7,269.04 Gg CO_2 eq, or 6,350.6 per cent, since 1995 due to increases in emissions of fluorinated gases (F-gases) from HFC consumption in refrigeration and air-conditioning equipment (by 4,696.88 Gg CO_2 eq) and from fire extinguishers (by 1,921.37 Gg CO_2 eq). On the other hand, a decrease of emissions occurred in all other categories: emissions from the category

production of halocarbons and SF_6 decreased by 4,155.17 Gg CO_2 eq or 89.6 per cent since the base year; emissions from the category chemical industry by 2,108.04 Gg CO_2 eq or 58.0 per cent since the base year; emissions from the category metal production decreased by 1,590.08 Gg CO_2 eq or 37.1 per cent since the base year; and emissions from the category mineral products decreased by 729.09 Gg CO_2 eq or 4.7 per cent since the base year. The following reasons explain the fall in these emissions since the base year: the economic crisis, affecting the country since 2007, led to a decrease in CO_2 emissions from cement production (877 Gg CO_2 eq or 7.1 per cent), a decrease in CO_2 emissions from iron and steel production (744 Gg CO_2 eq or 30.6 per cent) and a decrease in CO_2 emissions from ammonia production (198.8 Gg CO_2 eq or 28.1 per cent); the reduction in the production of HCFC-22 that produce a decrease in HFC-23 emissions (4,352.3 Gg CO_2 eq or 93.8 per cent) and the reduction in production of nitric acid which resulted in a decrease in N_2O emissions (1,905 Gg CO_2 eq or 68.0 per cent); and the shift of technology applied for aluminium production, which reduced PFCs emissions (750.1 Gg CO_2 eq or 90.1 per cent). Within the industrial processes sector, 54.8 per cent of the emissions were from mineral products, followed by 27.6 per cent from consumption of halocarbons and SF_6, 10.1 per cent from metal production and 5.7 per cent from chemical industry. The remaining 1.8 per cent was from production of halocarbons and SF_6. Emissions from other production are reported as not applicable ("NA").

105. Spain has made recalculations for the industrial processes sector between the 2010 and 2011 submissions in response to the 2010 annual review report, and following changes in EFs and in order to rectify identified errors. The impact of the recalculations on the industrial processes sector was a decrease in emissions of less than 0.1 per cent for 2008. Main recalculations took place in the following categories:

(a) Consumption of halocarbons and SF_6 in fire extinguishers (decrease of 96.56 Gg CO_2 eq or 1.4 per cent since the previous submission);

(b) Iron and steel production (increase of 69.81 Gg CO_2 eq or 3.7 per cent since the previous submission);

(c) Cement production (increase of 8.80 Gg CO_2 eq or 0.1 per cent since the previous submission).

106. The ERT found that, in its original submission of 14 April 2011, the inventory of emissions from the industrial processes sector was not complete, because emissions of F-gases from manufacturing and disposal of fire extinguishers and aerosols were reported as "NE" (see para. 114 below). Responding to the list of potential problems and further questions from the ERT, Spain provided estimates of HFC and PFC emissions from manufacturing and disposal of fire extinguishers, and explained that HFC emissions from aeorosols are in fact "IE". Therefore, the ERT concludes that the inventory of industrial processes from Spain is now complete.

107. The ERT considers that the transparency and the comparability of the inventory continue to be inhibited by the use of the notation key "C" (confidential). Spain reports AD and IEFs as "C" for all the categories where there are fewer than three companies in the country, which corresponds with a significant number of categories in the inventory for industrial processes: soda ash production and use; magnesite production (other mineral products); silicon carbide and calcium carbide production; carbon black production; ethylene and styrene production; pig iron and sinter production; flaring in iron and steel production (other (iron and steel production)); aluminium production; and HCFC-22 production. During the review week Spain shared the confidential information with the ERT. It was able to do this because the Party's inventory team keeps record of these data in an extended NIR that is used solely for the purpose of documentation and it is not published. The ERT commends Spain for its arrangements for documenting confidential

data and for sharing it with the ERT during the review. However, the ERT recommends that, in its future annual submissions, the Party identify case by case the reasonability of the confidentiality claim. The ERT also reiterates the recommendation in the previous review report[25] that Spain find alternative ways to report AD and IEF without violating the existing rules on confidentiality and provide information on the trends in the AD time series.

2. Key categories

Cement production – CO_2

108. Spain used a tier 2 approach, based on plant-specific monitoring data, to estimate emissions from cement production. In order to address a recommendation in the previous review report,[26] regarding inconsistency in the time series of emissions and IEFs, Spain has recalculated the emission estimates for the whole period (1990–2008), taking into consideration the available information included in the EU ETS reports of cement producing companies. However, the ERT notes that the new IEF time series shows a constant value in the period 1990–2005 (0.529 t/t clinker) which drops in 2006 to 0.522 t/t clinker, and presents a steadily grow in the following three years up to 0.528 t/t clinker in 2009. The ERT notes that the time series does not appear to be consistent in accordance with the IPCC good practice guidance. In addition, Spain does not include in the NIR, or in the additional documents presented to the ERT during the review week, background information supporting this trend (e.g. contents of calcium oxide (CaO), magnesium oxide (MgO) and cement kiln dust factor (CKD)). Further, during the review week, the Party informed the ERT that its inventory team has access to plant-specific data for clinker production and the IEF included in the EU ETS reports, but that it does not have access to the full content of the EU ETS reports with all relevant inputs/outputs to clinker kilns in terms of carbonates and oxides for the whole time series. The ERT concludes that the IEF trend is not supported by the information and justifications given by Spain and reiterates the recommendation in the previous review report that, in its next annual submission, the Party revise the time series of emissions and IEFs, in order to achieve the necessary consistency, and find ways to provide, in a transparent manner, CaO and MgO content and CKD factor for the whole time series.

109. During the review week, the Party's inventory team informed the ERT that Spain performed QC checks to AD and IEFs taking into consideration that the procedures implemented for the EU ETS to estimate emissions are in accordance with the IPCC good practice guidance. The ERT recommends that Spain include a brief description of the EU ETS-based QC measures in the NIR of its next annual submission.

Lime production – CO_2

110. Spain has estimated CO_2 emissions from lime production, from calcined limestone and dolomite, and also from dolomite sinterization, using plant-specific data reported by industrial plants under EU ETS. As described above (para. 108 above) in relation to cement production, Spain trusts the procedures implemented under EU ETS, but complements these by performing a statistical analysis of IEFs. The ERT commends Spain for having strengthened the QC procedures performed under the EU ETS scheme.

111. The ERT found that the time series of the IEF show one apparent inconsistency: the average IEF in the period from 1990 to 2005 (0.767 t/t lime produced on average) is 2.8 per cent larger than the value for the period from 2006 to 2009 (0.748 t/t lime produced, on average), and a drop of 5.1 per cent between 2005 (0.770 t/t lime produced) and 2006 (0.731 t/t lime produced). During the review week, the ERT noted that this difference is

[25] FCCC/ARR/2010/ESP, paragraph 77.
[26] FCCC/ARR/2010/ESP, paragraph 80.

explained by data on the purity of lime, and the Party provided data on the purity of lime supporting the trend of the time series. Spain does not present information about the purity of lime in the NIR, or any discussion of the apparent inconsistency in the time series. Therefore, the ERT recommends that Spain improve the transparency of its reporting, by including data on the purity of lime for the whole time series, in its next annual submission.

112. During the review week, the Party's inventory team informed the ERT that Spain also produces lime in sugar mills, but does not account for the corresponding emissions under the category lime production because all of the CO_2 produced is captured into a sub-product that is used as a soil amelioration product. The ERT notes that sufficient information is not included in the NIR and, in particularly, that it is insufficient to conclude whether the total flow of CO_2 produced is captured or whether a portion is emitted. In the latter case the associated emissions would not be accounted for in the inventory, which would therefore be underestimated. The ERT strongly recommends that Spain ensure that its inventory is fully complete by including, in the NIR of its next annual submission, information about the production of this soil product and the reasons that all the CO_2 is stored; otherwise Spain is recommended to calculate and report on the percentage of the CO_2 that is not captured and estimate the corresponding emissions.

Iron and steel production – CO_2

113. The methodology that Spain uses to estimate emissions from iron and steel production is presented in the NIR in a transparent manner, but the ERT noted that quantitative information on carbon balances is not provided (i.e. tables 4.5.4 to 4.5.6 of the NIR are empty). Responding to a request during the review week, the Party provided separate carbon balances: one for the single integrated plant existing in the country in 2009; and others for the industrial plants producing iron and steel in electric arc furnaces. The ERT concluded that the information provided by the Party during the review week is sufficient to explain the CO_2 emissions reported by Spain. The ERT notes that the reason given by the Party for not including this in the NIR (to maintain confidentiality of data for integrated plants) is justified, in accordance with Spanish law, since there are fewer than three plants, but that justification does not apply for industrial plants that produce iron and steel by electric arc furnaces because there are more than 30 plants of this kind in Spain. The ERT recommends that Spain improve the transparency of reporting by presenting separately emissions, AD and EFs from integrated and electric arc furnace plants emissions, in the NIR of its next annual submission.

Substitutes of ozone depleting substances – HFCs and PFCs

114. In its original submission, Spain reported as "NE" the amount of perfluorobutane (C_4F_{10}), and some HFC species (HFC-125, HFC-227, HFC-23 and HFC-236) remaining in fire extinguishers at decommissioning and reported as "NE" the amount of HFC-134a remaining in aerosols at decommissioning. During the review week, Spain informed the ERT that a percentage of the extinguishers are recovered by manufacturers, but not all. The ERT concluded that the inventory could be underestimated for these two categories, and therefore included this problem in the list of potential problems and further questions at the end of the review week. In particular, the ERT requested that Spain:

(a) Obtain information on the percentage of the initial charge remaining in aerosols and extinguishers at the time of disposal;

(b) Investigate whether the manufacturers include practices of reuse of the extinguishers recovered or recover the gases remaining in the extinguishers recovered;

(c) Estimate the emissions following the methodology included in the IPCC good practice guidance.

115. Responding to the list of potential problems and further questions, Spain informed the ERT that it has consulted with national experts (Experts from the Department of Air Quality and Industrial Environment of MARM and MITYC), and that it has obtained the following additional information:

(a) There are no data about the recovery or recycling of fire extinguishers and aerosols in Spain;

(b) Experts prepared estimates of the above-mentioned gases remaining at decommissioning from fire extinguishers and during manufacturing using a set of assumptions on the type and use of the equipment, and using the EF for manufacturing and disposal from another Party (Austria) (0.05 per cent during manufacturing and 1 per cent over 95 per cent remaining at the end of useful life). At the same time, Spain revised the AD, lowering the quantity of gas in operation. Documentation and calculations were provided to the ERT. In accordance with the revised estimates prepared by Spain, total emissions from consumption of halocarbons and SF_6 in fire extinguishers were revised from 1,984.91 Gg CO_2 eq to 1,925.59 Gg CO_2 eq in 2009 (a 3.0 per cent decrease);

(c) For aerosols, the Party's experts stated that current estimates assume that 50 per cent of emissions occur in the first and second year when the aerosol is sold. Spain discussed the fact that emissions at decommissioning could be less than 2 per cent of the initial charge, but preferred to report all emissions under "from stock" and report emissions from decommissioning as "IE".

116. The ERT agrees that the revised estimates submitted by the Party do not cause an underestimation of emissions and are reported in a transparent manner. The ERT recommends that the Party describe the assumptions that it used to prepare the estimates in the NIR of its next annual submission.

3. Non-key categories

Aluminium production – PFCs

117. Spain reported tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) emissions from aluminium production, but used the notation key "C" to report the corresponding AD and IEFs in the CRF tables. The ERT notes that the inter-annual changes of the C_2F_6/CF_4 emissions rate for 2000/2001 (–20.1 per cent), for 2004/2005 (–13.8 per cent) and for 2008/2009 (17.5 per cent) are unexpected and not justified in the NIR. In response to this question raised by the ERT, Spain stated that this is related to a shift between the three technologies used by the three existing plants: between 2000 and 2001 there was a change in the technology used, so that the centre worked pre-bake anode technology replaced the side-worked pre-bake anode technology, while the Söderberg vertical stud technology increased its share in total production. Spain also showed the ERT a graph with the relative use of the three technologies for the whole time series. The ERT concluded that the information provided explains the trend, and recommends that the Party include information related to the relative use of the technologies in the NIR of its next annual submission.

4. Areas for further improvement

Identified by the Party

118. Spain lists in the NIR several areas for improvement of the industrial processes sector, which are identified by category:

(a) Lime production: Spain is planning to investigate whether there are small industrial producers that were not accounted for in the 2009 inventory;

(b) Limestone and dolomite use: Spain is developing country-specific carbonate content in feedstock;

(c) Iron and steel production: Spain is working on institutional arrangements to access plant-by-plant information for all companies using electric arc furnaces;

(d) Calcium carbide production: Spain is preparing carbon mass balances by plant and by process, to assess the change in the tendency of the IEF detected for 2009;

(e) SF_6 in electrical equipment: Spain is revisiting emission estimates related to the equipment during maintenance and is also analysing the management related to the efficiency of SF_6 recovery at decommissioning.

Identified by the expert review team

119. The ERT recommends that Spain, in its next annual submission:

(a) Revise the reporting of confidential data, analysing case by case the claim (e.g. plants producing iron by the electric arc furnace), investigate alternative ways to report data without violating the existing rules on confidentiality and provide information on the trends in the AD time series;

(b) Revise the background data related to cement production (CaO and MgO contents and CKD factor) in order to obtain a consistent time series of IEFs;

(c) Improve the transparency of reporting for the category lime production by including the time series of the purity of lime;

(d) Investigate the occurrence of CO_2 emissions from lime produced in sugar mills;

(e) Improve the transparency of reporting of CF_4 and C_2F_6 emissions from aluminium production, in particular the technology shifts that explain the trend in the IEF time series.

D. Agriculture

1. Sector overview

120. In 2009, emissions from the agriculture sector amounted to 38,889,97 Gg CO_2 eq, or 10.5 per cent of total GHG emissions. Since the base year, emissions have increased by 3.0 per cent. The key driver for the rise in emissions was the increase in livestock numbers, reflected in increased emissions from the following categories: manure management, which have increased by 1,733.16 Gg CO_2 eq or 27.3 per cent since the base year; and enteric fermentation, which have increased by 949.00 Gg CO_2 eq or 8.2 per cent since the base year. However, other categories showed a decrease of emissions: for agricultural soils emissions have decreased by 1,412.05 Gg CO_2 eq or 7.4 per cent since the base year, mostly reflecting a decrease in the use of N applied as fertilizer; and for field burning of agricultural residues emissions decreased by 136.62 Gg CO_2 eq or 25.4 per cent since the base year. Within the sector, 45.4 per cent of the emissions were from agricultural soils, followed by 32.2 per cent from enteric fermentation and 20.8 per cent from manure management. Crop residues from field burning and rice cultivation accounted for 1.0 and 0.6 per cent, respectively. Prescribed burning of savannas was reported as not occurring ("NO"). For the year 2009, N_2O and CH_4 contributed 51.9 and 48.1 per cent of the sectoral emissions, respectively.

121. The Party has made recalculations for the agriculture sector between the 2010 and 2011 submissions, mostly following changes in AD. The impact of recalculations on the

agriculture sector is small, and CRF table 8(a) reports a decrease in emissions of 0.3 per cent for 2008. The main recalculations took place in manure management.

122. The ERT concluded that the inventory for the agriculture sector is complete, as it includes all gases, covers all territory and includes all categories occurring in Spain.

123. The ERT notes that the annual submission is generally transparent, but that Spain may further improve the transparency of its reporting by providing additional information to allow a clear understanding on the assumptions and rationale followed to derive country-specific parameters and EFs, in particular when country-specific EFs are calculated (see paras. 126, 127 and 130 below). Therefore, the ERT reiterates the recommendations in the previous review report,[27] that the Party include, in the NIR of its next annual submission, a short description of the methodologies and underlying information used for the calculation of country-specific EFs. In addition, the ERT recommends that Spain complete the information provided with reference to some classes included under "others", for example under field burning of crop residues, which is not specified in either the CRF tables or the NIR. Also, Spain does not provide information on which animal species are included under "other poultry", as reported in CRF tables 4.A, 4.B(a) and 4.B(b). During the review week, Spain clarified that this subcategory includes turkeys, ducks and geese. The ERT recommends that Spain include this information in its next annual submission, in the NIR and the CRF tables.

124. Taking into consideration that the national inventory is prepared as the sum of estimates made for individual provinces, the ERT recommends that Spain enhance QC procedures at that level. In particular, given that an important proportion of the supporting information for the development of methodologies is based on field surveys, the ERT recommends that Spain define QC procedures for the collection of these data, in order to reduce uncertainty and increase the confidence on the information collected.

125. The ERT found differences between animal livestock populations reported in CRF tables (tables 4.A for enteric fermentation and 4.B(a) and 4.B(b) for manure management) and the respective values available from FAOSTAT and in the Party's official statistics yearbooks, the most relevant for pigs: for 2009, the Food and Agriculture Organization of the United Nations (FAO) reports a number of pigs (26,290.60 thousands) that is 5.0 per cent higher than the value used in the inventory (25,046.18 thousands). In the NIR and also by additional clarifications during the review week, Spain informed the ERT that animal populations were determined following different strategies, so that, case by case, the most accurate values were obtained, as follows :

(a) Cattle and swine populations represent the average value of two (for cattle) and three (for swine) annual surveys during each year;

(b) Sheep and goat populations are consistent with the statistics yearbooks;

(c) For the remaining species, livestock numbers were estimated using interpolation and extrapolation methods from the available data.

126. Nevertheless, the Party informed the ERT that, in all cases, published official and public data were used. The ERT concludes that the procedures are in accordance with the IPCC good practice guidance, but recommends that Spain add, in its next NIR, tabular information that facilitates the understanding of how the time series of animal livestock numbers were determined. The ERT recommends that Spain analyse and explain the differences between its data and FAO data in annual submissions, and improve its explanations of how the time series are prepared.

[27] FCCC/ARR/2010/ESP, paragraph 92.

2. Key categories

Enteric fermentation – CH_4

127. Spain reports using a tier 3 method to estimate emissions from swine, tier 2 methods to estimate emissions from cattle and sheep, and tier 1 methods to estimate emissions from the other animal species. The ERT considered that this approach is in accordance with the IPCC good practice guidance, because emissions from the most significant animal species (non-dairy cattle and sheep, 48.5 per cent and 29.2 per cent, respectively, of total enteric fermentation emissions) are estimated by applying higher tiers. The development of country-specific EFs for swine is briefly explained in the NIR, and detailed information was made available to the ERT during the review week. Important features of the methodology include the differentiation of the two major breeds existing in Spain (white and black Iberian pigs) and the consideration of their typical diets on the basis of expert opinion. The ERT recommends that the Party provide the additional information shared with the ERT during the review week, in its next NIR, to allow a clear understanding of the rationale applied to develop the country-specific parameters. Also, in order to increase transparency, the ERT recommends that Spain include a table in the NIR with the EFs per sex/age class.

128. However, the ERT does not agree that the method used by Spain to estimate emissions from swine is tier 3, because Spain uses the set of equations developed by the IPCC together with country-specific parameters, which is a tier 2 method. Therefore, the ERT recommends that Spain reclassify the method applied as tier 2 with country-specific EFs in its next annual submission.

Manure management – CH_4 and N_2O

129. To estimate CH_4 emissions from manure management, Spain uses country-specific methods (reported in the NIR as tier 3) for swine and poultry, tier 2 methodologies for dairy cattle and non-dairy cattle and tier 1 methods for other animal types. The ERT considers that this approach is in line with the IPCC good practice guidance, because swine are responsible for 89.1 per cent of total CH_4 emissions. However, the ERT disagrees with the classification of the used method for swine and poultry as tier 3, for the same reasons indicated for enteric fermentation (see para. 128 above).

130. Spain explains in the NIR that the country-specific approach for swine and poultry consider estimated quantities of excretion of volatile solids (VS) for these species on the basis of the requirements of metabolic energy and typical diets, and that for swine the country-specific approach also takes into account that waste is handled by different animal waste management systems (AWMS) at different stages. The ERT considers that the information provided in the NIR on how the country-specific parameters were derived is insufficient for a transparent understanding of the applied assumptions and rationale and reiterates the recommendations in the previous review report[28] that Spain include, in its next NIR, a schematic description on the procedures followed to estimate country-specific values. Likewise, in line with the recommendations in the previous review report, which considered that the information provided in the NIR on parameters and assumptions used to estimate country-specific EFs for dairy cattle and non-dairy cattle were insufficient to allow a clear understanding on the rationale followed, the ERT recommends that, in the NIR of its next annual submission, the Party include such information in a schematic way, in line with the information that was delivered to the ERT during the review week.

131. Taking into consideration some specifics of the AWMS existing in Spain, and given that a significant proportion of the modifications and/or adaptations applied to the IPCC methods result from the fact that management of animal manures differs from the assumptions used to derive the IPCC defaults, the ERT noted that the information provided

[28] FCCC/ARR/2010/ESP, paragraph 97.

in the NIR on AWMS is insufficient for it to have a clear understanding of the differences between the AWMS of Spain and the AWMS classes defined by IPCC. Detailed information was provided by the Party during the review week. The ERT recommends that, in its next annual submission, Spain provide additional information on the AWMS and the share of AWMS that are specific to Spain, focusing on the differences between those described in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

132. Spain developed a set of linear equations to soften the values for the scaled methane conversion factors (MCFs) and EFs, which are functions of the average temperature in each climatic region in Spain and interpolate the IPCC defaults for each IPCC climate region (cool, temperate and warm) directly. The Party states in the NIR that this methodology was considered appropriate by the "Institute for Global for Global Management Strategies (IGES-IPCC)". The ERT considers that this procedure is appropriate, adding to the accuracy of the inventory, but recommends that the Party improve the transparency of its submission by explaining in the NIR how the individual values were calculated, providing aggregate MCFs per region and animal types in CRF table 4.(b)a.

133. In CRF table 4.B(a), Spain reports in the "Allocation (%)" rows values which, because of their order of magnitude (billions), cannot represent the percentage of manure treated as required by the UNFCCC reporting guidelines, and also do not represent livestock numbers or nitrogen quantities. During the review week, Spain clarified that this resulted from a failure in the system used to prepare the CRF tables, and the value uploaded was the required one (the sign "." which had been used to separate decimal places had been electronically deleted). Given that a similar problem was detected in the previous review report,[29] the ERT recommends that Spain enhance the QC procedures on the final CRF tables in order to avoid this problem in future annual submissions.

134. Spain uses the default IPCC method and country-specific N excretion rates to estimate N_2O emissions from manure management. The country-specific N excretion rates are based on nitrogen balances for cattle, sheep, swine and poultry. The ERT considers that the used methodology is in accordance with the IPCC good practice guidance, because non-dairy cattle, swine and dairy cattle are responsible for 34.5 per cent, 29.9 per cent and 13.7 per cent, of total N_2O emissions, respectively, but recommends that Spain improve the transparency of its submission by including the assumptions and steps taken to obtain N excretion rate values (e.g. explanations of the nitrogen balances), in its next annual submission.

135. Given that N balances are not available for goats and equines (horses, mules and asses), the Party uses the IPCC default values contained in the Revised 1996 IPCC Guidelines (table 4.20) for the Near East and Mediterranean for other animals, instead of those from Western Europe, and supports this decision by reference to expert judgement. The ERT recommends that Spain clarify this issue in the next NIR, by including the explanations supporting the expert judgement.

Agricultural soils – N_2O

136. Spain estimates N_2O emissions from agricultural soils using the IPCC tier 1 methodology, disaggregated as 1a and 1b, and country-specific values[30] for the following parameters: $Frac_{GASF}$; $Frac_{GASM}$; $Frac_{GRAZ}$; the ratio of above-ground biomass to crop product mass ($Res_{BF}/Crop_{BF}$); the fraction of dry matter in the above-ground biomass ($Frac_{DM}$); and $Frac_{NCRBF}$. The ERT recommends that, in its next annual submission, Spain improve the transparency and accuracy of its reporting by distinguishing the inputs that were estimated by tier 1a from those where tier 1b was used, and also to clarify, in the NIR, how the country-specific values were obtained.

[29] FCCC/ARR/2010/ESP, paragraph 100.

[30] The country-specific parameters are based on the *EMEP/EEA Air Pollutant Emission Inventory Guidebook*, European Environment Agency (EEA), 2009 methodology.

137. The ERT noted that, in its original submission of 14 April 2011, the values for nitrogen applied to soils as fertilizers reported in the national statistics were slightly higher than the values reported in CRF table 4.D. as total nitrogen applied to soils as synthetic fertilizers. During the review week, Spain explained to the ERT that a small fraction of nitrogen, classified as "non-specified compounds" in the national statistics was not included in the AD of synthetic fertilizers added to agricultural soils due to a lack of information on the compounds composition, which prevent the Party from estimating the volatilized fraction as it was applied for this nitrogen input (note: Spain used values from the EMEP/EEA air pollutant emission inventory guidebook (formerly referred to as the EMEP CORINAIR emission inventory guidebook) after disaggregating the usage by provinces and crops). The ERT noted that there is no reason to eliminate that fraction of nitrogen because the IPCC provides default parameters that can be used to estimate fractions lost and emissions, if the Party's information is incomplete. The ERT notes that, because the AD are incomplete, the inventory is underestimated with regard to direct and indirect emissions of N_2O from agricultural soils. The ERT included this issue in the list of potential problems and further questions. In its submission of 5 December 2011, Spain submitted revised estimates for direct and indirect N_2O emissions taking into account the previously unaccounted nitrogen fraction, and providing detailed documentation on AD, assumptions, methodology and EFs. In accordance with the revised estimates prepared by Spain, total emissions from agricultural soils were revised from 56.34 Gg N_2O to 56.92 Gg N_2O in 2009 (a 1.0 per cent increase). The ERT agrees with the revised estimates by the Party, and recommends that the Party update the NIR of its next annual submission using the information provided to the ERT during the review.

138. The ERT noted that, in this submission, Spain corrected the AD for estimating nitrogen leaching and runoff[31] by completing the data for all the provinces. This means that the IEFs for N leaching and runoff no longer show variation over time. The ERT commends the Party's efforts to solve this issue, but nevertheless recommends that Spain apply QC procedures thoroughly in order to minimize the chance of making mistakes by accidentally omitting the data for provinces or any other data.

3. Non-key categories

Field burning of crop residues – CH_4 and N_2O

139. Spain reports emissions from field burning of agricultural residues for the subcategory other non-specified, but the crops that compose that subcategory are not identified in the NIR or in CRF tables. (For all other categories Spain reports CH_4 and N_2O emissions as "NO" for 2009.) During the review week, the Party clarified that these emissions refer to burning of residues from pruning in olive groves and vineyards, plus some residues from industrial crops (cotton, tobacco). The ERT recommends that Spain clarify this issue in its next annual submission, by identifying the crops and presenting the necessary information on these crops (crop production, quantity of residues, dry matter fraction of residue and fraction burned in fields) in the NIR.

140. The ERT could not find information in the NIR on the legal status of field burning of crop residues in Spain, which is important for the clear understanding of the national conditions, and therefore, recommends that Spain include this information in its next annual submission.

[31] See FCCC/ARR/2010/ESP, paragraph 103.

4. Areas for further improvement

Identified by the Party

141. Spain lists in the NIR several areas for the improvement of the agricultural sector, which are identified by category as follows:

(a) Implement a general revision of the methodology to obtain country-specific parameters, under the responsibility of the GT-GAN-INV working group, as a follow-up to the first results (which are already available for poultry and swine);

(b) Continue the ongoing field surveys that are being conducted to improve knowledge of AWMS;

(c) Implement a general revision of the methodology to estimate emissions from agricultural soils, under the responsibility of the GT-AG-INV working group.

Identified by the expert review team

142. The ERT recommends that Spain, in its next annual submission:

(a) Enhance the transparency of reporting in the agriculture sector by explaining the assumptions used to derive country-specific parameters (EF for CH_4 emissions from enteric fermentation, the share of AWMS, MCF, N excretion values and the fractions used to estimate N_2O from agricultural soils) and EFs, and report EFs by age/sex classes when different values are used in the inventory;

(b) List the crops included under "others" for field burning of crop residues and the animal types under poultry (manure management), and provide the underlying data and parameters used to estimate emissions in the NIR (including the legal status of the burning of residues in the country);

(c) Explain the differences between FAO data and livestock numbers in the NIR;

(d) Reclassify the method used to estimate enteric fermentations from swine and CH_4 emissions from manure management from poultry and swine as tier 2;

(e) Correct detected errors in the share of AWMS as reported in CRF table 4.B(a) and the calculations of IEF in CRF table 4.D;

(f) Explain the reasons for the use of the IPCC defaults for the Near East and Mediterranean for goats, horses, and mules and asses.

E. Land use, land-use change and forestry

1. Sector overview

143. In 2009, net removals from the LULUCF sector amounted to 28,627.96 Gg CO_2 eq. Since the base year, net removals have increased by 50.2 per cent. The key driver for the rise in removals is the increase in carbon stock in land converted to forest land, causing that removals from forest land have decreased by 6,504.48 Gg CO_2 eq, or 35.0 per cent since the base year. Over the same period, removals from cropland have increased by 241.2 per cent (2,241.51 Gg CO_2 eq). Removals from grassland decreased by 887.47 Gg CO_2 eq, or 1,897.7 per cent since the base year, and emissions from settlements increased by 63.64 Gg CO_2 eq, or 13.0 per cent since the base year. Within the sector, 18,564.10 Gg CO_2 eq of the removals were from forest land remaining forest land, followed by 6,512.71 Gg CO_2 eq from land converted to forest land, 3,170.78 Gg CO_2 eq from cropland and 934.23 Gg CO_2 eq from land converted to grassland. Land converted to settlements was a net source, and accounted for emissions of 553.87 Gg CO_2 eq. Emissions from land converted to

settlements are mainly related to losses in biomass and soil carbon stocks associated with the land conversions.

144. Although Spain has substantially increased the number of categories, gases and pools reported with respect to previous annual submissions (e.g. carbon stock changes in mineral soils of cropland converted to grassland and dead organic matter on forest lands converted to settlements were reported for the first time), reporting on the LULUCF sector is not yet complete. Several categories are reported as "NE", due to either lack of methods (all carbon pools in grassland remaining grassland; living biomass in cropland converted to grassland; soil organic carbon in grassland converted to settlements) or lack of AD (emissions from controlled burning of biomass in forest land remaining forest land). Some carbon pools are reported as "NE" supported by the argument that they are not net sources (e.g. carbon stock changes in dead organic matter and mineral soils of other land converted to forest land and cropland remaining cropland; soil carbon change in soils converted from croplands, grasslands and other lands to settlements; all pools for conversion of croplands and grasslands into other land). In addition, the ERT found that carbon stock changes and GHG emissions are not reported for herbaceous crops in cropland and for grassland remaining grassland, and a fraction of the forest land (lands converted to forest without human intervention). CO_2, CH_4 and N_2O emissions from controlled burning on forest land remaining forest land and from wildfires (on cropland remaining cropland, grassland remaining grassland, wetlands remaining wetlands and other land remaining other land) are also reported as "NE" due to a lack of reliable statistics. The ERT strongly recommends that Spain continue with its efforts to improve the completeness of its reporting of the LULUCF sector, and report on its achievements in its next annual submissions.

145. The ERT found some apparent inconsistent reporting in the CRF tables. Firstly, net CO_2 emissions/removals in harvested wood products (HWP) were reported as "IE" in CRF table 5, and the information in the explanatory notes indicates that emissions/removals from this category are included in the estimates for the forest system. However, the ERT notes that this is not consistent with the fact that the Party also explains that estimates of carbon stock changes in biomass for forest land are based on the IPCC default assumption of instant oxidation of wood at harvesting. Secondly, the information items in the same CRF table, with reference to forest land converted to other land-use categories and grassland converted to other land-use categories, are reported as "NO", when changes in carbon stocks are reported for these land use conversions in the background CRF tables. The ERT recommends that Spain enhance the consistency of its reporting within the CRF tables and, in particular, recommends that the Party revise the way it reports net CO_2 emissions/removals in HWP and in forest land and grassland conversions in its next annual submission.

146. Recalculations made in the LULUCF sector between the 2010 and the 2011 submission resulted in substantial reductions in removals: 44.5 per cent in total net removals for the year 2008; and a 51.3 per cent reduction in total net removals for the base year (1990). For 2008, the reported removals: decreased by 52.4 per cent for forest land remaining forest land; decreased by 37.7 per cent for land converted to forest land; and increased by 52.6 per cent for cropland remaining cropland;. For the same year, emissions from settlements increased by 111.1 per cent. For 1990, the reported removals: decreased by 52.4 per cent for forest land remaining forest land; decreased by 50.4 per cent for land converted to forest land; and increased 34.7 per cent for cropland remaining cropland. Emissions from settlements decreased by 13.4 per cent for 1990.

147. The ERT considers that the representation of land use is not fully in line with the IPCC good practice guidance for LULUCF, and several unresolved problems have been identified during this and previous reviews, namely:

(a) Some woodland areas under the management practice called "dehesas" that do not reach the threshold of 20 per cent crown cover to be considered as forests were allocated to the category other land category instead of to the category grassland, as had been recommended in previous review reports;[32]

(b) Stratification of the areas under cropland and grassland in order to identify different systems of management and types of land cover was not performed, except for permanent crops;

(c) Land-use areas and soil management in the period 1970–1990 were assumed to be constant and are not reported in the NIR.

148. Therefore, the ERT encourages the Party to continue with its efforts to improve the accuracy of the representation of historical and current land-use data in accordance with the IPCC good practice guidance for LULUCF.

149. During the in-country review, the ERT and the inventory team agreed that the reported uncertainties for removals in the LULUCF categories (e.g. 50 per cent for forest land remaining forest land, 93 per cent for land converted to forest land and 200 per cent for removals in cropland) were unrealistically high. Although Spain closely follows the IPCC good practice guidance to estimate uncertainties using the tier 1 method, the ERT recommends that the Party revise the procedure in order to generate realistic values for uncertainties. Specifically, Spain may wish to consider deriving country-specific values for uncertainties for the various parameters used for calculations, using existing statistics, new sampling schemes or, if these data are unavailable, the use of expert judgement according to section 6.2.5 of the IPCC good practice guidance. Alternatively, Spain may wish to consider using a tier 2 method for the estimation of uncertainties, or, for the cases where tier 2 is not possible, aggregating categories to avoid the possible effects of correlation among input variables, in accordance with the IPCC good practice guidance for LULUCF (box 5.2.2).

2. Key categories

Forest land remaining forest land – CO_2

150. In 2009, net removals from this category were responsible for 64.9 per cent of total net removals in the LULUCF sector, down from 97.5 per cent in 1990. Carbon stock changes in living biomass (above-ground and below-ground) were estimated by using the stock change method with country-specific parameters (tier 2). Soil carbon changes from organic soils are reported as "NO". For the other carbon pools (dead organic soils and mineral soils), the IPCC tier 1 method was used, resulting in no stock changes with time (Spain reports these as "NE").

151. Currently, Spain has completed three national forest inventories (NFIs), one approximately every ten years, and it is currently collecting information for the fourth NFI. Permanent sampling plots were implemented only in the second NFI and therefore data for applying the stock change method for estimating carbon stock changes in biomass are available for only two points in time (the second and third NFIs): the remaining time series was constructed by interpolations and extrapolations. The ERT encourages Spain to improve the accuracy of the estimation of carbon stock changes in biomass by making use of the information from the fourth NFI, as soon as it becomes available, even if it has only partial geographical coverage. Alternatively, Spain may wish to consider using the default method (gains minus losses), which would require building suitable growth curve models for the various types of forests, soil types and regions. In addition, the ERT reiterates

[32] FCCC/ARR/2010/ESP, paragraph 118.

recommendations from previous reviews[33] that the Party use higher tier methods for dead wood, litter and soil organic carbon, because the IPCC good practice guidance for LULUCF excludes the use of tier 1 methodologies when the stock change method is used.

152. During the review week, the ERT learned that, although changes in carbon stocks and emissions are estimated at the provincial level for each of the 50 provinces in the country, they are reported in an aggregated manner for all provinces and forest types. In order to improve transparency, the ERT encourages Spain to report disaggregated information in the NIR in future annual submissions.

153. To estimate carbon stocks in biomass Spain uses a biomass expansion factor (BEF), the definition of which is different from that of the IPCC BEF. The Party's BEF results from the multiplication of two parameters included in equation 3.2.3 of IPCC good practice guidance for LULUCF (D and BEF_2). The ERT recommends that Spain report these two parameters in a disaggregated manner in the NIR of its next annual submission, to improve the transparency of its reporting.

Land converted to forest land – CO_2

154. In 2009, this category was responsible for 22.7 per cent of total net removals in the LULUCF sector, up from 0.5 per cent in 1990. Carbon stock changes in living biomass (above-ground and below-ground) were estimated by using the default method with country-specific parameters (tier 2). With the exception of other land converted to forest land, changes in carbon stock changes were also estimated using a tier 2 method, and those in dead organic matter were reported as "NE", when resulting from croplands, grasslands, or other lands, supported by the argument that these pools are not net sources of carbon. Spain is encouraged to improve the accuracy of the inventory by providing estimates for the dead organic matter carbon pools, in its next annual submission.

155. The ERT noted that the coverage of land area for this category is still incomplete, because the inventory only includes lands under intensive management (i.e. with human inducement of the land use change). The ERT recommends that the Party improve the completeness of the inventory by including estimates of changes in carbon stocks and GHG emissions for lands that were converted to forest land without intensive management.

156. Spain did not use specific information on the mix of species and growth rates of trees for the areas of lands converted to forest. Instead, it was assumed that these areas had the same mix of species and growth rates as those in the areas of forest land remaining forest land characteristic of the provinces where they are located. The ERT considers that this assumption introduce large uncertainties to the estimates of carbon stock changes, and strongly recommends that Spain develop and use in the inventory a more accurate characterization of these lands, in its next annual submission.

157. As a follow-up of the previous review, and for the first time in its 2011 submission, the Party based its estimates of carbon stock changes in mineral soils on data collected by a survey of soil profiles in all 50 provinces. Reference values for soil organic carbon content were derived for forest land in each province, and these values were used to estimate changes in soil organic carbon stocks resulting from land conversion to forest. The ERT notes, however, that administrative boundaries are not necessarily a factor in determining reference soil organic carbon contents, and encourages Spain to derive more suitable values taking account of other parameters such as soil type, topography and land cover, using the existing database of measurements over nearly 2,000 soil profiles, and revise the estimates accordingly for its next annual submission.

[33] FCCC/ARR/2010/ESP, paragraph 113.

Cropland remaining cropland – CO_2

158. In 2009, this category was responsible for 11.1 per cent of total net removals in the LULUCF sector, up from 4.9 per cent in 1990. Carbon stock changes in living biomass (above-ground and below-ground) were estimated using a tier 2 method. Carbon stock changes in mineral soils were estimated using a tier 1 method with country-specific reference values for soil organic carbon (Spain reports this as tier 2, but the ERT is of the view that the method is actually tier 1, because the stock change factors chosen correspond to IPCC defaults), and those in dead organic matter were reported as "NE" with the supporting argument that they are in neutral balance. The ERT encourages Spain to develop a tier 2 method for mineral soils and to revisit the assumption of no changes in dead organic matter, and the ERT recommends that the Party improve the transparency by providing documentation to demonstrate that there are no changes in carbon stocks in this pool. However, if the Party can confirm that the assumptions made are correct, the ERT recommends that Spain report this pool as "NO", instead of "NE", in its next annual submission.

159. The ERT noted that the coverage of land area for this category is incomplete, because it only includes lands with permanent crops. The ERT recommends that the Party improve the completeness of its inventory by providing in the inventory estimates of changes in carbon stocks and GHG emissions for lands with temporary crops and fallow.

160. The ERT identified some deviations from the IPCC good practice guidance for LULUCF in the application of the method for estimating changes in soil organic carbon pool, as follows:

(a) Cropland area was not stratified by production systems, as needed in order to choose the stock change factors suitable for each combination of practices;

(b) There is a lack of consistency between the soil depths associated with the country-specific reference values for soil organic carbon (1 m) and those of the IPCC stock change factors (0.3 m), which may result in an overestimation of changes in soil organic carbon (either removals or emissions);

(c) There is no tracking of the continuous presence of the management practices over time and, while this is not strictly against the requirements of good practice, it impairs the accuracy of estimates.

161. Therefore, the ERT strongly recommends that Spain, in its next annual submission, stratify areas under cropland following the IPCC good practice guidance for LULUCF, and resolve the inconsistency of soil depths between the reference soil organic carbon contents and the IPCC stock change factors. The ERT also encourages the Party to collect data on the continuous presence of management practices over time.

3. Non-key categories

Land converted to settlements – CO_2

162. Land converted to settlements was responsible for the emission of 553.87 Gg CO_2 in 2009, which represents an increase of 13.0 per cent with respect to emissions from this category in 1990 (490.23 Gg CO_2). The land-use change cropland to settlements was responsible for 47.8 per cent of the emissions, whereas conversions from other land and from forest land represented 31.7 per cent and 19.3 per cent of the emissions, respectively. Spain assumed that all losses in carbon stocks of biomass, dead wood (for forest land only) and soils (for forest land only) associated with this category occurred in the year of conversion, and that all of the biomass and dead wood, and 20 per cent of the soil organic carbon, are lost when lands are converted to settlements.

163. The area of land converted to settlements remained constant throughout the time series from 1990 to 2009 at 20.47 kha per year. This is explained by the fact that data on land cover were collected only for two years of the time series. The Party explained during the review that, due to the features of spatial resolution in the maps that are used as the main basis for determining land use changes (the land cover maps from the European programme CORINE (Coordination of Information on the Environment)), the areas of settlements and of land converted to settlements have a relatively high uncertainty. The ERT encourages Spain to improve the accuracy of its estimation of the areas of land that have been converted to settlements by collecting more recent information on AD for the whole time series.

CO_2 emissions from liming of agricultural soils – CO_2

164. Spain reported that the application of lime on agricultural land did not and does not occur in the country. However, during the review week the ERT received an indication that calcium carbonate residues from the sugar industry were applied to soils (see para. 112 above). If that is the case, and if these emissions are not included in the industrial processes sector, this would be an underestimation of GHG emissions. The ERT encourages Spain to revisit the assumption that liming of agricultural soils does not occur, and in particular the use of carbonate residues from the sugar industry, and, if deemed necessary, report emissions for this category in CRF table 5(IV) and in the NIR in its next annual submission.

Biomass burning – CO_2, CH_4 and N_2O

165. Emissions from biomass burning in controlled fires are reported as "NE". During the review week, Spain explained that these fires are normally not reported and therefore, no official statistics are available covering the areas of land and types of forests that were subjected to this practice. The ERT considers that this causes an underestimation of emissions, and the ERT recommends that Spain collect information on AD to enable the estimation of this category in future annual submissions.

4. Areas for further improvement

Identified by the Party

166. The Party stated that it plans to implement the following improvements:

(a) To estimate changes in the carbon stocks of dead organic matter (litter and dead wood) in forest land, which are currently reported as not being net sources;

(b) To develop information for estimating changes in the stocks of soil organic carbon in forest land remaining forest land;

(c) To include the area of herbaceous crops in the estimations of changes in carbon stocks and GHG emissions, taking into account the following management systems: integrated agriculture, ecological agriculture and conservation agriculture;

(d) To develop country-specific stock change factors for soil organic carbon under cropland;

(e) To improve the quality of AD for perennial crops, which are currently not included in the estimates;

(f) To improve the accuracy of estimated carbon stock changes in areas of land converted to grassland;

(g) To prepare estimates of emissions and removals of CH_4 and N_2O in wetlands remaining wetlands, and to collect new information on possible extraction of peat, currently assumed to be not occurring;

(h) To develop methodologies for the quantification of changes in carbon stocks currently not estimated in lands converted to settlements;

(i) To develop research for quantifying the increases in biomass in land converted from cropland and grassland to woodland.

Identified by the expert review team

167. The ERT recommends that Spain:

(a) Reduce the number of categories and pools currently reported as "NE";

(b) Enhance the consistency of reporting within the CRF tables, in particular for HWP and deforestation;

(c) Refine the procedure for estimating uncertainties in order to obtain values that more closely reflect reality;

(d) Improve the characterization of land use and land-use changes in all categories for the whole time series, including the period before 1990, and include the stratification of cropland and grassland by production systems, vegetation cover and other factors;

(e) Increase the tier level used to estimate carbon stock changes of dead wood, litter and soil organic carbon in the categories forest land remaining forest land and land converted to forest land;

(f) Improve information on the mix of species and growth rates for areas of land converted to forest land;

(g) Improve the transparency: by reporting carbon stock changes and GHG emissions in a disaggregated manner, taking into account geographical regions (e.g. provinces), types of vegetation cover and management and/or any other factor deemed appropriate; and by reporting BEF values in a manner consistent with the IPCC good practice guidance for LULUCF;

(h) Estimate and report emissions from controlled fires;

(i) Improve the completeness of the inventory for cropland remaining cropland: by providing estimates of emissions for temporary crops and fallow; by stratifying areas under cropland; and by resolving the inconsistency of soil depths;

(j) Revisit the assumption that liming of agricultural soils does not occur, and in particular the use of carbonate residues from the sugar industry.

F. Waste

1. Sector overview

168. In 2009, emissions from the waste sector amounted to 16,266.51 Gg CO_2 eq, or 4.4 per cent of total GHG emissions. Since the base year, emissions have increased by 112.6 per cent. The key driver for the rise in emissions is the increase in the amount of solid waste generated and disposed of on land, resulting in an increase in emissions from solid waste disposal on land of 6,956.15 Gg CO_2 eq, or 139.3 per cent since the base year. Another substantial cause of the increase was emissions from the category wastewater handling, which have increased by 1,254.72 Gg CO_2 eq, or 54.2 per cent since the base year. Within the sector, 73.5 per cent of the emissions were from solid waste disposal on land, followed by 21.9 per cent from wastewater handling and 4.5 per cent from sludge spreading at treatment plants. The remaining 0.1 per cent were from waste incineration.

169. Spain has made recalculations for the waste sector between the 2010 and 2011 submissions following changes in AD and EFs. The impact of these recalculations on the waste sector is an increase in emissions of 0.8 per cent for 2008, and no recalculations were made for 1990. The main recalculations took place in the following categories:

(a) Solid waste disposal on land (69.27 Gg CO_2 eq);

(b) Other – sludge spreading (42.15 Gg CO_2 eq);

(c) Waste incineration (6.51 Gg CO_2 eq).

170. The inventory of the waste sector is complete, and information is presented in a transparent manner. The NIR includes specific information for this sector on QA/QC measures (see para. 175 below), uncertainty analysis, recalculations and planned improvements.

171. However, the ERT found some inconsistencies in the time series that are mostly the result of the basic AD (e.g. step changes resulting from changes in waste management practices) and also due to the fast evolution in waste management practices, and, therefore, recommends that Spain develop efforts to improve the consistency of its reporting for its next annual submission.

172. The ERT also found that the uncertainty of the waste sector is relatively high, which is mainly due to the use of default EFs and/or the use of extrapolations. Further, the inventory of Spain is dependent on a combination of official statistics and data from voluntary surveys. The ERT recommends that Spain enhance the arrangements of the national system to increase the level of responses to surveys, which the ERT believes can be done since the MARM is responsible for this sector.

2. Key categories

Solid waste disposal on land – CH_4

173. To estimate CH_4 emissions from solid waste disposal on land, Spain uses the tier 2 method (first-order decay method) and, as explained in the NIR, collects data on solid waste disposal in managed landfills from questionnaires on landfill activities and from statistical information contained in the publication entitled "Environment in Spain".[34] The ERT concludes that calculations for this category are in accordance with the IPCC good practice guidance and comparable with other Parties. However, the ERT notes that Spain makes substantial use of IPCC default values for the parameters used in calculations ((e.g. MCF, fraction of degradable organic carbon dissimilated (DOCf) and the methane generation rate constant (k)). Given that this is a key category, the ERT encourages Spain to enhance the level of accuracy and the country-specific nature of the parameters used in its next annual submission.

174. QC for this category is enhanced by the harmonization of national data with data from the autonomous communities, performed annually. The ERT commends the Party for its efforts to ensure the quality of the inventory.

175. The previous review report[35] encouraged Spain to provide information on emissions from biomethanization[36] and to estimate its emissions. The ERT notes that information on this activity was not included in the Party's submission. During the review week, Spain

[34] "*Medio Ambiente en Espana*", in the Spanish original.

[35] FCCC/ARR/2010/ESP, paragraph 121.

[36] According to information provided by Spain, biomethanization refers to a process whereby biogas is produced though a process of anaerobic treatment of organic waste with energy recovery.

informed the ERT that it has already requested information on this issue and plans to include it in its next annual submission.

176. The ERT reiterates the recommendations in the previous review report,[37] that were not yet resolved by the Party, namely that the Party: update the trend of the time series of composition of wastes and calculated degradable organic carbon (DOC) values in the period 1997–2009, which is kept constant; and update the assumptions related to the depth of solid waste disposal sites (50 per cent deep and 50 per cent shallow) and the amount of waste that is burned.

Wastewater handling – CH_4 and N_2O

177. Spain estimates calculations from the industrial (chemical and food industries) and residential commercial wastewater fractions. The ERT concludes that these calculations are in accordance with the IPCC good practice guidance and are comparable with those of other Parties. The ERT notes, however, that Spain makes extensive use of default IPCC parameter values or EFs from other international references such as the EMEP/EEA. Given that this is a key category, the ERT encourages Spain to enhance the level of accuracy and the country-specific nature of the parameters used in its next annual submission.

178. The ERT notes that the Party's estimates of N_2O from human protein consumption are for the country as a whole and encourages the Party to obtaining data to enable the geographical differentiation of estimates.

179. In relation to the recommendations in the previous review report,[38] that Spain provide more information on point sources of industrial wastewater treatment (e.g. type and GHG emission process), Spain clarified to the ERT that the EFs for this activity are based on the volume of wastewater treated and that it will focus on retrieving information on point sources from the industrial plants in question (i.e. petroleum refineries and pulp/paper plants).

Other (waste) – CH_4

180. The ERT notes that CH_4 emissions from sludge spreading are reported under the category other in CRF table 6. The ERT recommends that, in its next annual submission, Spain include these emissions under wastewater handling to enhance comparability.

181. This category is a key category in level and trend according to the tier 2 analysis. The ERT notes that the existence of this category is improbable, due to the high cost and low efficiency of its practice. On the other hand, the estimates are uncertain given that they are based on non-verifiable reports and that data are calculated on the basis of a very conservative approach, EFs that are most probably outdated (CH_4 EF based on the CORINAIR90 emission factor guidebook) and parameters (such as the humidity content) that are uncertain. Spain recognizes this situation in the NIR and states that it plans to revisit the references to methodologies and EFs for its next annual submissions. The ERT supports these proposed actions.

182. However, the ERT notes that emissions from sludge sent to landfills or used in agriculture should not be included under this category, but reported under solid waste disposal on land or agricultural soils. Spain acknowledged this finding at the time of the review and informed the ERT that sludge spreading is a drying technique, and during drying, sludge emits some pollutants (CH_4 and NMVOC) in addition to the emissions when deposited in landfills or agriculture soils. The ERT recommends that Spain review the AD, methodology and EF for this category and review the allocation of emissions under wastewater handling for its next annual submission.

[37] FCCC/ARR/2010/ESP, paragraphs 123–125.
[38] FCCC/ARR/2010/ESP, paragraph 126.

3. Non-key categories

Waste incineration – CO_2 and N_2O

183. Waste incineration without energy recovery is not a significant category in Spain, accounting for less than 0.1 percent of total waste GHG emissions. Emissions result from clinical waste, sewage sludge and waste incinerated without energy recovery and, in 2009 (12.49 Gg CO_2 eq), emissions were reduced to 85.9 per cent of emissions in 1990 (88.38 Gg CO_2 eq), due to the increase of the energetic use of waste incineration and changes to management practices.

184. Spain has recalculated CO_2 emissions from this category taking into consideration the percentage of carbon with fossil fuel origin, in the follow-up of the recommendations in the previous review report. The ERT welcomes the improvements made by Spain.

4. Areas for further improvement

Identified by the Party

185. Spain has identified the need for further improvement in AD collection and verification regarding biogas generation and recovery, waste composition, waste treatment, biomethanization, wastewater discharged and its organic load and for sludge management data. Spain also plans to make a bibliographic research of sludge management EFs.

Identified by the expert review team

186. The ERT encourages Spain to:

(a) Develop country-specific EFs and parameters, particularly those regarding solid waste disposal on land and wastewater handling;

(b) Include information on biomethanization in the NIR;

(c) Revise the estimates of CH_4 from sludge spreading.

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

187. Spain submitted estimates for afforestation, reforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol. The Party has elected the activities forest management and cropland management under Article 3, paragraph 4, of the Kyoto Protocol. It chose to account for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the first commitment period.

188. The ERT concluded that the Party's reporting is generally in accordance with reporting requirements: Spain provided supplementary information on KP-LULUCF activities, in accordance with the requirements outlined in paragraphs 5 to 9 of the annex to decision 15/CMP.1. The ERT concluded that this information is complete when the additional information that the Party provided during the review week is included (see paras. 190 and 191 below for further details). Information corresponding to years 2008 and 2009 and to the base year (1990) was reported in KP-LULUCF CRF tables and in the NIR, following the annotated outline of the NIR. The reporting of Spain clearly distinguishes these activities from sources listed in Annex A to the Kyoto Protocol. The ERT recommends that Spain include the additional information provided to the ERT during

the review week in its next annual submission, in order to ensure that it is complete and in accordance with reporting requirements.

189. The geographical locations of the boundaries of areas that encompass the units of land subject to afforestation/reforestation, deforestation, forest management and cropland management activities are specified at national boundary level, and these areas are identified using the reporting method 1 from the IPCC good practice guidance for LULUCF. The definitions of forest and the land identification system used to determine the areas subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, are in accordance with the IPCC good practice guidance for LULUCF.

190. However, during the review week, the ERT noted that the documentation for demonstrating that the afforestation and reforestation activities were human induced was not sufficient to comply with the reporting requirements in the annex to decision 15/CMP.1, and requested that the Party provide additional evidence. In response to this question raised by the ERT, Spain explained that only areas for which there was a clear financial incentive for afforestation or reforestation were considered, and provided acceptable documentation for this claim. Therefore the ERT concluded that this issue is in accordance with reporting requirements.

191. Spain did not provide in the NIR an explanation on how it ensures that reforestation activities occurring on deforested lands are distinguished from afforestation/reforestation activities on other land classes. During the review week, the Party explained that reforestation activities occurring on deforested lands did not occur in the country. Nevertheless, while acknowledging the reasonability of the explanation, the ERT considers that the possibility exists for the development of reforestation activities on land classified as deforestation, and therefore, encourages the Party to ensure that the national system has the capacity to identify such activities in the next annual submission.

192. Spain has performed a key category analysis for KP-LULUCF activities in accordance with the IPCC good practice guidance for LULUCF (section 5.4), with the result that afforestation/reforestation, forest management and cropland management were identified as key categories (identified as the following LULUCF categories: forest land remaining forest land, conversion to forest land, cropland remaining cropland, conversion to grassland and conversion to settlements).

193. Recalculations were made for the KP-LULUCF activities corresponding to years 1990 and 2008. Given that Spain uses the same information for forest categories for the Convention (LULUCF sector) and the Kyoto Protocol (KP-LULUCF activities), recalculations for 2008 meant that estimates of carbon stock changes were affected by the same percentages as those given already given for: land converted to forest land (with reference to afforestation/reforestation), which accounted for a 37.7 per cent decrease in net removals; and forest land remaining forest land (for forest management), which accounted for a 52.4 per cent decrease in net removals. For deforestation, net emission estimates were reduced by 43.5 in the year 2008. Net removals in cropland management were increased by 14.9 and 50.6 per cent, for the years 2008 and 1990, respectively.

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

Afforestation and reforestation – CO_2

194. Spain reports an area under afforestation and reforestation of 1,091.91 kha in 2009 and net removals of 6,545.24 Gg CO_2 which corresponds to an implied stock change factor of 6.0 Mg CO_2/ha. Afforestation and reforestation in units of land harvested since the beginning of the commitment period are reported as "NA". There is consistency between the areas and removals reported under the Convention and those reported under Article 3,

paragraph 3, of the Kyoto Protocol, and the same comments and recommendations made for land converted to forest land apply to this activity (see paras. 144–157 above).

Deforestation – CO_2

195. Spain reports, in KP-LULUCF CRF table NIR-2, a total area under deforestation of 10.81 kha in 2009 and corresponding net emissions of 107.10 Gg CO_2 eq, which is due to conversion of forest land to settlements only. In CRF table 5(KP-I)A.2 Spain reports an area of 0.54 kha under deforestation, which is the area converted in one year, arguing that all emissions from this activity, which arise from losses of carbon stocks in biomass, dead organic matter and soil organic carbon, are conservatively assumed to occur within one year. The implied stock change factor is 198.23 Mg CO_2/ha. The ERT strongly reiterates the recommendations in the previous review report,[39] that Spain include the cumulative area of lands under deforestation since 1990 in CRF table 5(KP-I)A.2 in accordance with the mandatory requirement under the Article 7 reporting guidelines and to enhance the comparability with other reporting Parties and with the IPCC good practice guidance for LULUCF.

196. The ERT notes that the area of annual deforestation remains constant throughout the time series due to the fact that only two points in time are used to characterize the time series from 1990 to 2009. The ERT encourages the Party to improve the characterization of land use in line with recommendations given in paragraph 151 above.

197. The ERT concluded, from the information in the NIR and during the review week, that the current system of representation of land use does not enable an adequate tracking of deforested land areas for estimates of carbon stock changes and emissions of GHGs on those lands to be prepared with accuracy. The ERT recommends that Spain collect information related to deforested lands (e.g. uses, management practices), particularly for those that were not converted to settlements, and use this information to improve the estimates in its next annual submission.

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

Forest management – CO_2

198. Spain reported an area under forest management of 12,576.92 kha for 2009, and associated net CO_2 removals of 18,629.21 Gg CO_2 This corresponds to an implied stock change factor of 1.48 Mg CO_2/ha. The net removal in 2009 is much larger than the cap established under decision 16/CMP.1 for forest management in the commitment period (12,283.33 Gg CO_2). The ERT noted that there is consistency between the areas and removals reported in the LULUCF sector under the Convention and under Article 3, paragraph 4, of the Kyoto Protocol. Therefore, the same comments and recommendations made for forest land remaining forest land in the LULUCF section of this report apply to this category (see paras. 150–153 above).

Cropland management – CO_2

199. Spain reported an area under cropland management of 20,494.34 kha for 2009 (21,207.96 kha for 1990), and associated net removals of 2,999.71 Gg CO_2 eq (711.55 Gg CO_2 eq in 1990). This corresponds to an implied stock change factor of 0.15 Mg CO_2/ha (0.03 Mg CO_2/ha in 1990). The same comments and recommendations made for cropland remaining cropland in the LULUCF section of this report apply to this category (see paras. 158–161 and 164 above). In addition, the ERT strongly recommends

[39] FCCC/ARR/2010/ESP, paragraph 193.

that Spain stratify the areas of cropland according to the IPCC good practice guidance for LULUCF, section 4.2.8.2.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

200. Spain 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 included in the SIAR on the SEF tables and the SEF comparison report.[40] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

201. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements set out in paragraph 88(a–j) of the annex to decision 22/CMP.1. 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

202. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate. The ERT reiterates the encouragement, contained in the SIAR, that Spain report, in the next annual submission, on changes made in its registry database, infrastructure and/or procedures to support a user authentication mechanism in 2011, as suggested by the ITL Administrator's Change Advisory Board.

Calculation of the commitment period reserve

203. Spain has reported its in its 2011 annual submission. Spain reported that its commitment period reserve has not changed since the initial report review (1,499,576,336 t CO_2 eq), as it is based on the assigned amount and not the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

204. Spain reported that there are no changes in its national system since the previous annual submission. 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.

4. Changes to the national registry

205. Spain reported that there are changes in its national registry since the previous annual submission. These changes include: update of contact details for the registry

[40] The SEF comparison report is prepared by the international transaction log (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.

administrator; assessment by external auditors and reinforcement of security measures in place to avoid unauthorized manipulation of the registry and "phishing"; changes to the publicly accessible information in accordance with the European Union's norms (European Commission regulation (EU) No. 920/2010), where all information relative to an account's authorized representatives is considered confidential by default.

206. The ERT concluded that the Party's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

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

207. Spain reported that there are changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, since the previous annual submission. Spain has reported on the following items:

(a) The adverse effects of the subsidies to the use of national coal in electricity production: support to measures will be allowed in the EU until 2018, but statistical information shows that coal used in electricity production has decreased over recent years;

(b) The ongoing cooperation with developing countries for the transfer of technology and developments of the non-energy use of fossil fuels; and for the transfer of technologies resulting in lower GHG emissions. Actions include collaboration with China (storage of CO_2) and countries in the North Africa region (transport sector, solar, wind and biomass renewable energy uses);

(c) Work to increase the capacity and efficiency of fossil fuel production and use by developing countries, in particular a collaboration with China for the construction of a new gasification plant;

(d) Cooperation with developing countries that are dependent on fossil fuels exports to diversify their economies;

(e) The minimization of the adverse effects due to an increase in the use of biofuels in agriculture production and sensitive ecosystems, which will be addressed by the European Union directive 2009/28/EC.[41]

208. The ERT concluded that the information provided is generally complete and transparent. However, the ERT considers that the following information has not been provided: estimates of the possible adverse effect of the agricultural policy of the EU. The ERT recommends that Spain include this information in its next annual submission.

III. Conclusions and recommendations

209. Spain made its annual submission on 14 April 2011. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry and minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

210. The ERT concludes that the inventory submission of Spain has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission

[41] Directive 2009/28/CE from the European Parliament and Council, 23 April 2009.

is complete and the Party has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as complete in terms of categories and gases.

211. 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.

212. The Party's inventory is in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, and it is of general high quality.

213. The Party has made recalculations for the inventory between the 2010 and 2011 submissions in response to the 2010 annual review report and in order to lift adjustments applied in the 2010 submission's review and following changes in AD, methodologies and EFs. The impact of these recalculations on the national totals is an increase in emissions of 0.1 per cent for 2008. The main recalculations took place in the following sectors/ categories:

(a) LULUCF categories, in particular forest land, cropland and settlements;

(b) The energy sector, in particular the categories transport, other sectors, manufacturing industries and construction and fugitive emissions from fuels;

(c) Consumption of halocarbons and SF_6 in both the industrial processes sector and the solvent and other product use sector.

214. The ERT concluded that reporting of activities under Article 3, paragraph 3 and 4, of the Kyoto Protocol, is in accordance with the requirements outlined in paragraphs 5 to 9 of the annex to decision 15/CMP.1, and complete taking into account the additional information provided during the review week.

215. The Party has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions in a manner consistent with the LULUCF sector. The impact of these recalculations on each KP-LULUCF activity was major for the following activities:

(a) Afforestation/reforestation: 37.7 per cent decrease of net removals in 2008;

(b) Deforestation: the net emission estimates were reduced by 43.5 per cent for 2008;

(c) Forest management: 52.4 per cent decrease of net removals in 2008;

(d) Cropland management: net removals were increased by 14.9 per cent and 50.6 per cent for the years 2008 and 1990, respectively.

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

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

218. The national registry continues to perform the functions set out in the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

219. Spain has reported information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, as requested in chapter I.H of the annex to decision 15/CMP.1, in its NIR. The ERT concluded that the information

provided is transparent and generally complete: information has not been on the possible adverse effect of the agricultural policy of the EU.

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

(a) Enhance the QA/QC system by: reporting annually on the outcome of annual QA/QC procedures in the NIR; proceeding with the planned independent review of the inventory in order to enhance QA measures and, in general, implement QA activities on a regular basis; increasing efforts to use more information from the EU ETS verifiers' reports from regional governments, and to use it to improve the accuracy of the inventory and for QA/QC activities;

(b) Continue efforts to increase transparency by providing the underlying explanations for the trends in AD or emissions, in terms of technological and economic changes; and by finding alternative ways to report confidential AD and emission estimates without violating the existing rules on confidentiality;

(c) Prioritize the list of improvements and identify, in the NIR, which will be implemented for its next annual submission (see para. 56 above);

(d) Enhance the institutional arrangements for the national system so that data available at the regional level can reach the inventory team, and so that QA/QC activities are made to that data.

221. In the course of the review, the ERT formulated a number of recommendations relating to the specific sectors. The key recommendations are that Spain:

(a) Include in the NIR the national energy balance, as it is submitted to the IEA and Eurostat, and a comparison of the same data to the CRF data;

(b) Continue to develop efforts aimed at ensuring consistency between the energy balance used for preparing the inventory and the national official energy balance sent to Eurostat and IEA;

(c) Continue with efforts to determine the various non-energy uses of fuels such as natural gas and petroleum coke;

(d) Enhance the transparency of reporting for the industrial processes sector by including the background data that supports the justification of trends (e.g. cement production, lime production and aluminium production);

(e) Revisit the assumptions that CO_2 emissions from lime produced in sugar mills do not occur;

(f) Enhance the transparency of reporting in the agriculture sector by explaining the assumptions used to derive country-specific parameters and EFs, and by improving explanations on how the time series of livestock numbers are derived;

(g) Continue with efforts to improve the completeness of its reporting of the LULUCF sector, by including emission estimates for missing categories, or parts of categories, and pools;

(h) Continue with efforts to improve the accuracy of the representation of historical and current land-use data in accordance with IPCC good practice guidance for LULUCF, and improve the methodological level and completeness of this sector;

(i) Include the additional information on KP-LULUCF activities that was provided to the ERT during the review week in its next annual submission, in order to ensure that it is complete and in accordance with requirements;

(j) Enhance the system for tracking of deforested land areas.

IV. Questions of implementation

222. 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 Spain 2011. Available at <http://unfccc.int/resource/docs/2011/asr/esp.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2011. Available at <http://unfccc.int/resource/webdocs/sai/2011.pdf>.

FCCC/ARR/2010/ESP. Report of the individual review of the greenhouse gas inventory of Spain submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/esp.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 the Party

Responses to questions during the review were received from Ms. Marta Muñoz Cuesta (Ministerio de Medio Ambiente y Medio Rural y Marino), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Spain:

Benito, A., Pindado, S. & N. Van Oosten. 2008. *Desarrollo de un modelo para la cuantificación de las emisiones originadas por el transporte aéreo español. Informe final.* Universidad Politécnica de Madrid. ETSI Aeronáuticos. Departamento de Infraestructura, Sistemas Aerospaciales y Aeropuertos.

SENASA. 2009. *Sostenibilidad de la aviación en España. Informe 2009*. (Sustainability in Aviation in Spain 2009) Observatório de la sostenibilidad en la aviación.

Murillo, J.C.R. 1994. *The carbon budget of the Spanish forests.* Biogeochemistry 25: 197–217, 1994. Kluwer Academic Publishers.

MARM. Year. *Caracterización de Sistemas de Gestión de Deyecciones. Sector Aves de Puesta*. Ministerio de Medio Ambiente y Medio Rural y Marino.

MARM. Year. *Caracterización de Sistemas de Gestión de Deyecciones. Sector Porcino Intensivo*. Ministerio de Medio Ambiente y Medio Rural y Marino.

MMA. 2007. *Acuerdo por el que se estabecen los mecanismos de obtención de información para la aplicación en España del sistema de inventário nacional de emisiones contaminantes de la atmosfera.* Ministerio de Medio Ambiente.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management systems
BEF	biomass expansion factor
C	confidential
C_2F_6	hexafluoroethane
C_4F_{10}	perfluorobutane
CH_4	methane
CaO	calcium oxide
CF4	tetrafluoromethane
CKD	cement kiln dust
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
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
EU	European Union
EU ETS	European Union emissions trading scheme
FAO	Food and Agriculture Organization
F-gas	fluorinated gas
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 = 10^9 joule)
HFCs	hydrofluorocarbons
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
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
MCF	methane conversion factor
Mg	megagram (1 Mg = 1 tonne)
MgO	magnesium oxide
Mt	million tonnes
Mtoe	million tonnes of oil equivalent
N	nitrogen
NA	not applicable
NCV	net calorific values
NE	not estimated
NFI	national forest inventories
NO	not occurring
NO_X	nitrogen oxides

N_2O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change
VS	volatile solids