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COMPLIANCE COMMITTEE

CC/ERT/ARR/2009/27  
27 April 2009

**Report of the individual review of the greenhouse gas inventories of Spain  
submitted in 2007 and 2008**

**Note by the secretariat**

The report of the individual review of the greenhouse gas inventories of Spain submitted in 2007 and 2008 was published on 24 April 2009. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2008/ESP contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.





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**Report of the individual review of the greenhouse gas inventories of Spain  
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\* In the symbol for this document, 2008 refers to the year in which the 2008 inventory was submitted, and not to the year of publication.

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## I. Overview

### A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Spain, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session,<sup>1</sup> the focus of the review is on the most recent (2008) submission. The review took place from 22 to 27 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Philip Acquah (Ghana) and Ms. Katarina Marečková (European Community); energy – Mr. Luis Conde Alvarez (Mexico), Ms. Erasmia Kitou (European Community) and Mr. Steven Oliver (Australia); industrial processes – Mr. Riccardo De Lauretis (Italy) and Ms. Natalia Parasyuk (Ukraine); agriculture – Mr. Michael Anderl (Austria) and Mr. Marcelo Rocha (Brazil); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Carlos López (Cuba) and Mr. Davor Vešligaj (Croatia). Mr. Acquah and Mr. Vešligaj were the lead reviewers. The review was coordinated by Mr. Javier Hanna (UNFCCC secretariat).

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

### B. Inventory submission and other sources of information

3. The 2008 inventory was submitted on 16 April 2008. Spain resubmitted the common reporting format (CRF) tables on 27 May 2008 and the national inventory report (NIR) on 1 August 2008. The 2008 submission contains a complete set of CRF tables for the period 1990–2006 and an NIR. This is in line with decision 15/CMP.1. Spain indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.<sup>2</sup> In its 2007 submission, Spain included a complete set of CRF tables for the period 1990–2005 and an NIR. Where needed, the expert review team (ERT) also used previous years’ submissions, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

### C. Emission profiles and trends

4. In 2006 (as reported in the 2008 annual inventory submission), the main GHG in Spain was carbon dioxide (CO<sub>2</sub>), accounting for 83.0 per cent of total GHG emissions<sup>3</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (8.7 per cent) and nitrous oxide (N<sub>2</sub>O) (6.9 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 1.4 per cent of the total GHG emissions in the country. The energy sector accounted for 78.1 per cent of the total GHG emissions, followed by agriculture (10.7 per cent), industrial processes (8.1 per cent), waste (2.8 per cent) and solvent and other product use (0.3 per cent). Total GHG emissions amounted to 433,339.36 Gg CO<sub>2</sub> eq and increased by 49.5 per cent between the base year<sup>4</sup> and 2006, which was mainly as a result of the increase in emissions from the energy sector (by 59.1 per cent) and from industrial processes (by 25.9 per cent). In 2005 (as reported in the 2007 inventory submission), total GHG emissions amounted to 440,649.10 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008

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<sup>1</sup> FCCC/SBI/2007/34, paragraph 104.

<sup>2</sup> Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

<sup>3</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>4</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

annual inventory submission) were similar to those in 2005 (2007 inventory submission). The trends for the different gases and sectors are reasonable.

5. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

#### **D. Key categories**

6. Spain has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by the Party and that performed by the secretariat<sup>5</sup> produced different results, owing to the different levels of disaggregation used by the Party and the secretariat. Spain performed and reported separately its key category analysis for all sectors excluding LULUCF in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and did so separately for the LULUCF sector in accordance with the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The following key categories were identified in the 2008 submission but not in the 2007 submission: public electricity and heat production (other fuels) – CO<sub>2</sub>; other sectors – CH<sub>4</sub>; forest land – CO<sub>2</sub>; biomass burning – CH<sub>4</sub> and N<sub>2</sub>O; and wastewater handling – N<sub>2</sub>O.

7. Spain intends to implement a tier 2 key category analysis that will include categories of the LULUCF sector in its next annual submission as part of its planned improvements. The ERT noted that Spain has reported a key category analysis for the LULUCF sector in the NIR but not in CRF table 7. In addition, no detailed information on this analysis has been provided in the NIR. The ERT recommends that Spain provide a key category analysis in full accordance with the IPCC good practice guidance for LULUCF and include this information in the NIR and CRF table 7 in its next annual submission in order to improve transparency and consistency between the NIR and the CRF. Spain uses its key category analysis to prioritize resources within the framework of its quality assurance/quality control (QA/QC) plan and to identify areas of the inventory that require further improvement.

#### **E. Main findings**

8. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

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<sup>5</sup> 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*. 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. 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.

**Table 1. Greenhouse gas emissions by gas, 1990–2006**

Greenhouse gas	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	228 507.96	228 507.96	255 601.04	307 742.47	334 657.26	351 949.50	368 262.59	359 627.22	57.4
CH <sub>4</sub>	28 031.35	28 031.35	31 048.52	35 805.20	37 545.64	37 490.31	37 397.00	37 516.03	33.8
N <sub>2</sub> O	27 795.13	27 795.13	26 542.49	32 647.08	32 426.76	31 393.66	29 705.75	30 075.24	8.2
HFCs	4 645.44	2 403.18	4 645.44	8 170.02	5 032.78	4 679.87	5 006.09	5 549.63	19.5
PFCs	832.51	882.92	832.51	411.71	267.31	272.04	244.41	247.63	–70.3
SF <sub>6</sub>	108.34	66.92	108.34	204.60	207.66	254.00	271.63	323.62	198.7

<sup>a</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

**Table 2. Greenhouse gas emissions by sector, 1990–2006**

Sector	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
Energy	212 562.65	212 562.65	241 071.05	289 486.43	315 098.54	332 084.13	347 559.39	338 281.26	59.1
Industrial processes	28 546.48	26 313.21	27 417.26	34 683.45	32 722.74	32 871.60	34 336.97	35 094.60	22.9
Solvent and other product use	1 387.89	1 387.89	1 343.65	1 674.15	1 591.85	1 514.41	1 476.02	1 513.25	9.0
Agriculture	40 330.18	40 330.18	39 877.02	47 761.71	48 323.12	47 199.80	44 881.76	46 181.38	14.5
LULUCF	–26 930.79	–26 930.79	–28 096.68	–31 900.38	–32 845.54	–33 049.24	–33 071.62	–33 001.51	22.5
Waste	7 093.52	7 093.52	9 069.35	11 375.34	12 401.16	12 369.44	12 633.34	12 268.87	73.0
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	262 989.93	260 756.67	290 681.65	353 080.70	377 291.87	392 990.14	407 815.87	400 337.86	52.2
<b>Total (without LULUCF)</b>	289 920.73	287 687.46	318 778.33	384 981.08	410 137.41	426 039.38	440 887.49	433 339.36	49.5

*Abbreviations:* LULUCF = land use, land-use change and forestry, NA = not applicable.

<sup>a</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.



9. During the review, the ERT raised questions about the presentation in the NIR of the inventory preparation process with regard to the time schedule of the inventory compilation process, the link between national and local inventories, and the overview table on institutional arrangements/responsibilities. In response to these questions, Spain described its unique inventory preparation process, which is consistent with its derived 19 regional inventories, and follows a double approach: top-down (making estimates at the national level and then allocating them to the regional and provincial levels) and bottom-up (making estimates at province level and then aggregating them to the regional and national levels). The ERT noted the complexity of Spain's inventory compilation process and the fact that the Party has instituted a national working group on harmonization of inventory data within the national system in order to address the challenges of institutional cooperation and administrative arrangements, particularly with regard to the energy sector. The ERT encourages Spain to continue making improvements to its inventory by progressively developing and implementing its national QA/QC plan.

10. The ERT noted that Spain has not used data from the European Union emissions trading scheme (EU ETS) as a potential QA/QC procedure for verifying the plant-specific information obtained from statistical questionnaires, which is currently used for the preparation of the national inventory. The ERT encourages Spain to use data from the EU ETS as a QA/QC procedure for applicable categories as part of its improvement plans to reduce uncertainty.

11. The ERT commends Spain on its mandatory regulations on the reporting of inventory data, which have had an effect on the availability and supply of data for the preparation of the inventory and on the transparency of the reporting in the NIR.

12. Spain has made major improvements to the completeness of its inventory by reporting on some categories in the LULUCF sector for the first time, namely non-CO<sub>2</sub> emissions from biomass burning (forest land) and CO<sub>2</sub> removals from land converted to grassland. Spain has reported a land-use change matrix containing information on forest land and other land uses, including the areas for all these land uses. Spain has also collected data regarding afforestation activities. The ERT noted that for all sectors there are categories that are reported as not estimated ("NE") in the CRF tables. The ERT recommends that Spain identify the categories reported in CRF table 9(a) that can be estimated using the tier 1 methods and default emission factors (EFs) provided in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance in order to improve the completeness of its inventory in its next annual inventory submission and avoid identification of potential problems regarding these categories in the future.

13. The ERT identified large inter-annual variations in EFs and activity data (AD), especially in the energy and industrial processes sectors (e.g. for aviation and marine bunkers, and the EFs of carbonate-rich raw materials). The ERT noted Spain's improvement plans and encourages the Party to investigate and reduce the uncertainty of its emission estimates for these categories.

14. In response to recommendations made in the previous review report, Spain has made a number of improvements to its inventory regarding transparency, the reallocation of emissions in accordance with the IPCC good practice guidance, disaggregation, accuracy, completeness and time-series consistency. Specific improvements made since the 2006 inventory submission include: the estimation of emissions for previously missing categories in the LULUCF and waste sectors; the referencing of sources of information in the NIR; the description of the institutional framework and QA/QC activities; and the revision of AD that were previously provisional, partial or missing, particularly in the energy sector. Spain has improved the level of detail of methodological descriptions in the NIR for all sectors, especially in terms of the rationale for recalculations of the time series and the consistency of reporting information in the NIR and in CRF tables 7, 8(a) and 8(b).

## F. Cross-cutting issues

### 1. Completeness

15. Spain has improved the completeness of its inventory by including data on the categories of the LULUCF sector based on the work of the land uses and climate changes working group (GT-USCC in Spanish), which comprises representatives from various relevant institutions from the sector. Spain has made efforts, as in the previous submission, for providing emission estimates for additional relevant categories in the waste sector, such as open burning of waste in unmanaged solid waste disposal sites, which accounted for approximately 5.2 per cent of sectoral emissions in 2006.

16. However, the ERT noted that Spain has reported the following categories as “NE”: biomass emissions in the reference approach; CO<sub>2</sub> and CH<sub>4</sub> emissions from oil exploration and distribution in the energy sector; potential emissions of HFCs, PFCs and SF<sub>6</sub> in the industrial processes sector; and emissions and removals for some categories in the LULUCF sector (e.g. cropland remaining cropland, grassland remaining grassland, wetlands remaining wetlands, and settlements). Spain explained that potential emissions of HFCs, PFCs and SF<sub>6</sub> were not estimated owing to a lack of specific information on foreign trade flows (imports and exports) by gas type.

17. The ERT recommends that Spain estimate emissions for the categories currently reported as “NE”, particularly those categories for which IPCC methodologies are available. For instance, Spain can make use of the implementation of the European Community directive on fluorinated gases (F-gases) within the framework of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases to estimate and report potential emissions from the consumption and production of HFCs, PFCs and SF<sub>6</sub>. This directive requests that all producers, importers and exporters of F-gases report to their respective countries and to the European Commission the amount of the gases produced, imported and exported annually, distinguished by type of substance. The implementation of this directive would make the relevant AD available in order to estimate potential emissions and improve the calculation of actual emissions.

### 2. Transparency

18. Spain has improved transparency in its 2008 submission by following many of the recommendations from previous reviews. For instance, Spain has improved the referencing of its sources of information in the NIR, the description of the institutional framework and the description of its QA/QC activities. The ERT recommends that Spain continue its efforts to further increase the transparency of reporting for the LULUCF sector by revising its estimates of CO<sub>2</sub> removals under forest land remaining forest land when a new set of data on carbon stock becomes available from the future national forestry inventory and by providing the disaggregation of the CO<sub>2</sub> EF for the various types of solid waste combustion in the energy sector.

### 3. Recalculations and time-series consistency

19. The ERT noted that recalculations reported by Spain for the time series 1990–2005 have been undertaken to take into account various changes/improvements recommended in the previous review report. The major changes include: methodological revisions, correction of errors and revision of AD that were previously provisional, partial or missing, in particular data on the energy balance. In response to recommendations made in the previous review report, the rationale for these recalculations has been provided in the NIR and summarized in CRF table 8(b). This has improved transparency and the consistency between the NIR and the CRF in the 2008 submission in comparison with the 2006 submission.

20. The impact of these recalculations was not very significant, resulting in an increase in the total estimated emissions by 0.11 per cent for 1990 and by 0.05 per cent for 2005.

#### 4. Uncertainties

21. Spain has provided an uncertainty analysis for each category and for the inventory overall based on the tier 1 method and in accordance with the IPCC good practice guidance. However, the ERT noted that Spain has not followed the recommendation made in the previous review report that it include the LULUCF sector in its uncertainty analysis and, therefore, the ERT reiterates this recommendation. The ERT observed that Spain has not updated its uncertainty analysis for the inventory year 2006. Spain explained that the AD for 2006 are provisional and it is likely that they would increase uncertainty. The ERT recommends that Spain update its uncertainty analysis on an annual basis. The overall uncertainty reported in the 2008 submission for the inventory year 2005 is 10.9 per cent according to the level assessment and 12.3 per cent according to the trend assessment. The ERT noted that this uncertainty is higher than the 7.0 per cent for the level assessment and 8.9 per cent for the trend assessment reported in the 2007 submission for the inventory year 2004. Spain explained that this difference was due to the revision of the uncertainty estimates for the AD used in the estimation of N<sub>2</sub>O emissions for the category direct soil emissions.

#### 5. Verification and quality assurance/quality control approaches

22. Spain has elaborated and implemented a QA/QC plan in accordance with the IPCC good practice guidance. This includes source/sink category-specific QC procedures (tier 2) for key categories and general QC procedures (tier 1) for categories that have been recalculated following methodological changes and categories for which higher-tier methods have been used.

23. The NIR contains a comprehensive description of QC procedures that are to be implemented annually in accordance with the IPCC good practice guidance. Information on QC activities and the results of these activities is collected and archived in the inventory statement of source document database (EFDI in Spanish). Part of the QC checks is performed automatically in an Oracle database, which contains all of the inventory information (AD, EFs and emissions) and part is conducted through a comparison of actual data with data from the previous submission. From the QA/QC plan presented in the NIR, it is not clear which procedures are implemented in the annual inventory reporting cycle. To increase transparency, the ERT recommends that Spain provide a sample of the completed tier 1 QC tables in the annex to its next annual inventory submission. The ERT invites Spain to provide in its next NIR a list of key categories for which tier 2 QA/QC procedures are applied.

#### 6. Follow-up to previous reviews

24. Following the recommendations made in the previous review report, Spain has undertaken a number of revisions that have resulted in major improvements to the inventory and increased the transparency of the reporting. The Party has also undertaken recalculations, particularly for the agriculture sector. In the waste sector, the recalculations undertaken have improved the 2007 and 2008 inventory submissions compared with the 2006 submission. Following recommendations from previous review reports, the level of detail of the methodological descriptions in the NIR has improved for all sectors, especially in terms of the rationale for the recalculations of the time series and the reporting of information in the NIR and in CRF tables 7, 8(a) and 8(b). The ERT noted that Spain has not used data from the EU ETS as a QA procedure to verify the plant-specific information obtained from statistical questionnaires, which are the traditional sources of AD and EFs, as recommended in the previous review report. The ERT encourages Spain to consider using data from the EU ETS as a QA procedure for applicable categories as part of its improvement plan for its next annual inventory submission.

### **G. Areas for further improvement**

#### 1. Identified by the Party

25. The 2008 NIR identifies several areas for improvement. Spain indicated that it plans to use tier 2 methods for its key category analysis and to some extent for the uncertainty analysis (for the agriculture

sector). Spain also indicated that it plans to include the LULUCF sector in its key category analysis in its next inventory submission. In addition, Spain plans to include information on verified emission data from the EU ETS as part of the plant-level QA/QC procedures for the industrial processes sector.

26. Furthermore, Spain plans to continue improving carbon accounting in the LULUCF sector in order to: allocate pasture land to a land-use category that is more appropriate than the category other lands under which it is currently reported; estimate changes in carbon stocks in living biomass for cropland remaining cropland and estimate carbon in soil deposits and dead organic matter; and collect the data and information required for reporting activities under Article 3, paragraph 3, of the Kyoto Protocol (afforestation, reforestation and deforestation) and Article 3, paragraph 4, of the Kyoto Protocol (forest management and cropland management).

## 2. Identified by the expert review team

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

- (a) The completeness of the inventory should be improved by estimating emissions for categories currently reported as “NE” for which IPCC methods are available;
- (b) The transparency of the information regarding the national system should be improved by including, for example, overview tables and information provided to the ERT during the centralized review, such as the completed tier 1 QC tables, in the annex to its next inventory submission, as well as a list of key categories for which tier 2 QA/QC procedures have been applied;
- (c) Uncertainties of estimates should be reduced by implementing the detailed national QA/QC plan in order to address the challenges posed by the complexity of the national system. This could be achieved by continuing to strengthen the national working group on harmonization of inventory data, particularly for the energy and industrial processes sectors, in order, for example, to address the large inter-annual variations of EFs in several categories in these sectors;
- (d) The QA/QC activities should be further improved by using more independent experts, who are not directly involved in compiling the inventory, for peer review activities as part of Spain’s QA procedures;
- (e) Summaries of additional information provided in response to comments made by the ERT during the centralized review should be provided in the next annual inventory submission; for instance, explanations for the inter-annual fluctuations in implied emission factors (IEFs) in several categories and descriptions of emission trends and QA/QC checks for relevant sectors, such as the industrial processes sector;
- (f) The consistency between information provided in the CRF tables and the NIR should be improved by providing adequate explanations in the documentation boxes to the CRF tables.

28. Recommended improvements relating to specific source/sink categories are presented in the relevant sector chapters of this report.

## **II. Energy**

### **A. Sector overview**

29. In 2006, the energy sector accounted for 338,281.26 Gg CO<sub>2</sub> eq, or 78.1 per cent of total GHG emissions. Emissions from the sector increased by 59.1 per cent between 1990 and 2006. The key driver for the rise in emissions was the substantial increase in emissions from transport (88.8 per cent),

manufacturing industries and construction (51.2 per cent) and energy industries (50.8 per cent) between 1990 and 2006. Spain attributes this trend to a high economic growth rate. The fact that emissions from energy industries increased less than emissions from the other two categories is attributed to the increasing use of a fuel mix with a lower carbon intensity. Within the energy sector, 34.6 per cent of GHG emissions were from energy industries, followed by 32.1 per cent from transport, 20.9 per cent from manufacturing industries and construction, and 11.2 per cent from other sectors. Fugitive emissions from fuels accounted for 1.2 per cent of energy-related GHG emissions, of which 0.3 per cent were from solid fuels and 0.9 per cent from oil and natural gas.

30. The following categories have been reported as “NE”: CO<sub>2</sub> emissions from coal mining and handling (underground and surface mines); CH<sub>4</sub> and CO<sub>2</sub> emissions from oil – exploration and oil – distribution of oil products; CO<sub>2</sub> emissions from oil – production and oil – transport; N<sub>2</sub>O emissions from oil – exploration and oil – refining and storage; CH<sub>4</sub> and CO<sub>2</sub> emissions from natural gas – exploration and natural gas – other leakage (in residential and commercial sectors); CO<sub>2</sub> emissions from natural gas – production/processing; and CH<sub>4</sub> and CO<sub>2</sub> emissions from venting – oil. The ERT recommends that Spain make efforts to estimate emissions for the categories that are currently missing, in particular those categories for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide methodologies. The ERT also recommends that Spain provide clear and consistent information on the rest of the categories reported as “NE”, in the completeness table (CRF table 9(a)) and the NIR of its next annual inventory submission.

31. In general, coverage of the energy sector in the NIR is transparent and comprehensive. Spain has provided detailed descriptions of EFs at the plant level and a clear description of methodologies. AD for the 2006 inventory were obtained from questionnaires from the Ministry of the Environment and Rural and Marine Affairs (MARM), which provided plant-specific data. Where the coverage of categories in an industry branch is complete, the data from the questionnaires have been used to compile the inventory. Data from the International Energy Agency (IEA) and Eurostat have been used to fill gaps. For the category manufacturing industries and construction, AD obtained from questionnaires have been supplemented by data from industry associations. To improve transparency, the ERT recommends that Spain, in its next NIR, elaborate on its decision-making process with regard to how the data from the questionnaires are rationalized with other data in cases where the coverage of data from the questionnaires is not complete. For manufacturing industries and construction, the ERT recommends that Spain provide, in the NIR of its next annual inventory submission, references for any published sources of AD obtained from industry associations and details of how these data are used in the compilation of the inventory.

32. Emission trends and time series have been discussed in section 3.1 of the NIR. However, there is little discussion at the disaggregated category level regarding time-series consistency or fuel reallocation issues that may have been introduced into the 2006 inventory, as a result of the inclusion of AD from questionnaires from the MARM in the 2006 inventory that increases the potential for inconsistencies in the AD time series. The ERT recommends that Spain provide information on the integration of these data into its inventory estimates and on the approach used to ensure consistency across categories in the time series, in its next annual inventory submission.

33. For the category other sectors (1.A.4), Spain has provided in the NIR emission estimates that are disaggregated by category for the commercial/institutional, residential, and agriculture/forestry/fisheries categories, but AD for these categories have been provided at an aggregated level. In response to questions raised by the ERT during the review, Spain provided a table showing AD disaggregated by category and fuel type. The ERT recommends that Spain include this table in its next NIR in order to clarify how changing fuel mixes affects the IEFs over time.

34. The description and analysis of trends in the NIR tend to be general in nature, lacking detail and an explanation of the underlying drivers. This is the case particularly for the category manufacturing industries and construction, for which a trend analysis has been provided at the category level only. This

issue was also noted in the previous review report. The ERT recommends that Spain provide in its next NIR a trend analysis at a more disaggregated level, including an explanation of trends at the disaggregated category level for manufacturing industries and construction, and other relevant categories.

35. The improvements that Spain plans to make to its inventory with regard to the energy sector, as described in the 2008 submission, include the Party's intention to conduct a review of its balance of liquid fuels in cooperation with the Ministry of Industry, Tourism and Trade (MITYC). This will include quantifying a sectoral breakdown of liquid fuel consumption and non-energy fuel use, in response to recommendations made in the previous review report, in order to address apparent inconsistencies between the data from the IEA/Eurostat and the bottom-up data on liquid fuel consumption for the navigation, residential, and agriculture/forestry/fisheries categories which is used to compile the inventory. The ERT recommends that Spain proceed with the implementation of these plans and report on progress and outcomes in the NIR of its next annual inventory submission.

36. Spain has provided clear explanations of its recalculations as well as an effective graphical representation of the impact of these recalculations on the emission time series as part of its discussion of categories in the NIR. The ERT commends Spain for this approach. Although the recalculations were numerous and performed for all years (1990–2005), the impact of the recalculations did not exceed 0.05 per cent for any year. The rationale for these recalculations included: a review of the CO<sub>2</sub> EF for the combustion of natural gas in turbines and engines for the years 1992–2005; a minor review of the CO<sub>2</sub> EF for aviation kerosene applied in the landing and take-off cycles; and the reallocation of combustion emissions with energy recovery of biogas in landfills from the waste sector to the energy sector. The ERT noted that some detailed explanations of recalculations have not been reported in CRF table 8(b). The ERT encourages Spain to report in detail on its recalculations in the appropriate CRF tables for ease of reference by the ERT, in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines), in its next annual inventory submission.

## **B. Reference and sectoral approaches**

### **1. Comparison of the reference approach with the sectoral approach and international statistics**

37. CO<sub>2</sub> emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For 2006, there is a difference of 0.19 per cent between the emission estimates calculated using the reference approach and the sectoral approach. In general, the difference between the estimates calculated using the two approaches is less than 2 per cent, with the exception of 1996, 1997 and 1998 for which there are differences of up to 2.61 per cent (1997). Spain has provided an extensive discussion of the reasons for these differences in annex 4 to its NIR, although explanations for the differences greater than 2 per cent for 1996, 1997 and 1998 have not been provided in the documentation box to CRF table 1.A(c). The ERT recommends that Spain provide in the documentation box to CRF table 1.A(c) a brief explanation of the reason for any differences greater than 2 per cent between estimates calculated using the two approaches.

38. Problems are apparent in the reporting of energy conversion factors in CRF table 1.A(b) for the reference approach, where the conversion factors for most fuels are approximately 3 orders of magnitude less than they should be. The natural gas conversion factor has been reported as close to zero. However, the apparent consumption reported is correct. During the centralized review, Spain explained that it assumes that there is a technical problem with the CRF Reporter software. The ERT recommends that Spain investigate this issue and solve it, liaising with the secretariat, where necessary. The ERT also recommends that Spain incorporate a final QC check after the CRF tables have been completed using CRF Reporter software, prior to submitting the inventory.

39. Fuel consumption data reported by Spain in the CRF tables correspond closely with the data from the IEA for all years.

## 2. International bunker fuels

40. Large inter-annual changes (increases) in the CO<sub>2</sub> emissions from aviation bunkers are evident for the periods 1990–1991, 1991–1992 and 1993–1994 (19.2 per cent, 18.7 per cent and 14.5 per cent, respectively). The 2006 value for these emissions is 191.8 per cent higher than the 1990 value. Similarly, there were large inter-annual changes in CO<sub>2</sub> emissions from marine bunkers for the periods 1995–1996 and 1996–1997 (46.0 per cent and 23.3 per cent, respectively). The 2006 value for these emissions is 127.7 per cent higher than the 1990 value. During the centralized review, Spain explained that emissions from aviation bunkers are driven by the use of jet kerosene, while emissions from marine bunker are dependent upon the use of diesel/gas oil and residual fuel oil, for which the AD are sourced from the IEA and Eurostat. The ERT noted that there is no section in or annex to the NIR in which bunker activities (aviation and marine) have been discussed. The ERT recommends that Spain include a discussion of bunker AD and emissions, providing a brief analysis of the trends and drivers, in its next annual inventory submission.

## 3. Feedstocks and non-energy use of fuels

41. In the previous review report it was indicated that the compilation of the information on non-energy use of fuels and related data sources had not been explained transparently and, therefore, the previous ERT recommended that Spain undertake a study in order to improve the transparency of the information provided in the NIR and to resolve discrepancies associated with liquid fuel consumption. The ERT noted that Spain has stated in the NIR its intention to carry out a methodological review, as part of its planned improvements, in order to prepare a balance of liquid fuels (including non-energy fuel use) in cooperation with the MITYC. The ERT recommends that Spain carry out the study and report the results and/or progress of this in its next NIR, with the aim of explaining the inventory compilation processes for the non-energy use of fuels and documenting data sources.

## C. Key categories

### 1. Stationary combustion: gaseous fuels – CO<sub>2</sub>

42. The CO<sub>2</sub> IEFs for gaseous fuels in the public electricity and heat production category vary greatly over the 1990–2006 period, ranging from 50.48 t/TJ to 69.04 t/TJ. For the years 1993, 1995 and 1996, the IEFs are among the lowest of the reporting Parties, whereas for the years 1999 and 2000 they are among the highest of the reporting Parties. In its response to previous review stages, Spain explained that this is a consequence of using different mixes of gaseous fuels (natural gas, synthetic gas from coal gasification and residual gases from oil refineries). The ERT recommends that Spain explain the drivers for this variability in the CO<sub>2</sub> IEFs for gaseous fuels in its next annual inventory submission.

43. The CO<sub>2</sub> IEFs for gaseous fuels in the manufacturing industries and construction category in 1990 (55.17 t/TJ) and 1991 (54.57 t/TJ) are among the lowest of the reporting Parties. In its response to previous review stages, Spain explained that these CO<sub>2</sub> EFs have been derived mainly from data on the composition of natural gas supplied by the country's main company for natural gas transmission and that it has identified an error in its plant-specific data for 1990 and 1991. The ERT recommends that Spain correct this error in its next annual inventory submission.

### 2. Coal mining and handling – CH<sub>4</sub>

44. The CH<sub>4</sub> IEFs for the category coal mining and handling – underground mines for the period 1990–2006 (3.57–4.24 kg/t) are among the lowest of the reporting Parties and are lower than the IPCC default range (4.5–16.75 kg/t). Spain has listed mean values for its CH<sub>4</sub> EFs by coal type in the NIR, based largely on a study conducted by the technological mining equipment research association (Asociación de Investigación Tecnológica de Equipos Mineros), which used measurements of the firedamp gas concentration taken from different Spanish coal basins. The ERT recognizes that the CH<sub>4</sub> content of different types of coal does display considerable inherent variability as a result of factors such

as geological controls acting over a wide range of spatial and temporal controls. However, the ERT recommends that Spain provide background information in the NIR of its next annual inventory submission in order to explain why its CH<sub>4</sub> EFs are relatively low in comparison with the IPCC default range of values.

45. Spain has stated in the NIR that no information was available regarding the installation of degasification systems in underground mines or the amount of CH<sub>4</sub> recovered to be used later for energy or flaring. The ERT recommends that Spain undertake a study to determine the extent of degasification activities and CH<sub>4</sub> recovery and flaring, as well as to assess the possible impacts of these activities on GHG emissions in the fugitive and stationary combustion categories, and that it report on the progress or results of this study in its next annual inventory submission.

### 3. Oil and natural gas – CO<sub>2</sub>

46. CO<sub>2</sub> emissions from venting and flaring display considerable inter-annual variations: for venting from 1996 to 2006 (with changes ranging from –69.9 per cent to 313.2 per cent); and for flaring, from 1995 to 1996 (increase by 10.3 per cent), from 1996 to 1997 (increase by 13.5 per cent), from 2002 to 2003 (decrease by 19.6 per cent), from 2003 to 2004 (increase by 18.7 per cent) and from 2005 to 2006 (increase by 14.8 per cent). In its response to previous review stages, Spain explained that the trend in CO<sub>2</sub> emissions is highly dependent upon the activity rate of oil flaring in crude oil refining. However, this does not explain the underlying change in the AD, which appears to be data on crude oil refining (not reported in CRF table 1.B.2). The ERT recommends that Spain provide an analysis of these trends in its next annual inventory submission, explaining the drivers that influence the national trends in emissions from crude oil refining and associated flaring.

## **III. Industrial processes and solvent and other product use**

### **A. Sector overview**

47. In 2006, the industrial processes sector accounted for 35,094.60 Gg CO<sub>2</sub> eq, or 8.1 per cent of total GHG emissions, and the solvent and other product use sector accounted for 1,513.25 Gg CO<sub>2</sub> eq, or 0.3 per cent of total GHG emissions. Emissions from the industrial processes sector increased by 33.4 per cent between 1990 and 2006 and emissions from the solvent and other product use sector increased by 9.0 per cent between 1990 and 2006. The key driver for the rise in emissions in the industrial processes sector was the increasing trend in cement production. Most of the emissions came from mineral products, which accounted for 64.7 per cent of the sectoral emissions, while consumption of halocarbons and SF<sub>6</sub> accounted for 14.6 per cent, metal production for 11.7 per cent, chemical industry for 6.6 per cent and production of halocarbons and SF<sub>6</sub> for 2.5 per cent of sectoral emissions.

48. Estimates for all gases and categories in the industrial processes sector have been included in the CRF tables, as recommended by the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The following categories have been reported as “NE”: potential emissions of HFCs, PFCs and SF<sub>6</sub>; CO<sub>2</sub> emissions from asphalt roofing; CO<sub>2</sub> emissions from road paving with asphalt; CH<sub>4</sub> and N<sub>2</sub>O emissions from ammonia production; and CH<sub>4</sub> emissions from ferroalloys production.

49. The emission estimates are consistent across the time series and the EFs have been used consistently and are comparable with those reported by the other Parties. The methodologies, AD and EFs used have been reported in detail. Basic data for this sector are available at a highly disaggregated level and in most cases have been collected on a plant-by-plant basis. In some cases, the appropriate notation keys might have not been used (e.g. CH<sub>4</sub> and N<sub>2</sub>O emissions from other mineral production reported as “NE” instead of not applicable (“NA”). The ERT recommends that Spain clarify its use of such notation keys in its next annual inventory submission. Estimates of potential emissions from the consumption and production of halocarbons have not been provided, mainly because of the current lack of information on imports and exports per gas. Spain is encouraged to find out whether data for 2007 have been collected in the country within the framework of the European Community directive on



F-gases in order to continue in its efforts to collect reliable data to help estimate potential emissions of F-gases and to improve the use of the notation keys in line with the UNFCCC reporting guidelines.

50. The general QA/QC procedures that are used for the inventory as a whole have been applied for this sector. QA/QC for this sector could be improved by comparing the basic information collected for the inventory with the information collected and reported within the framework of the European Community directives, decisions and regulations referring to the EU ETS,<sup>6</sup> the European pollutant emission register<sup>7</sup> and statistical production data.<sup>8</sup> Spain indicated that it plans to include basic information on verified data from the EU ETS in its next inventory submission.

51. There were no major differences between the 2007 and 2008 inventory submissions, except for the reallocation of emissions from incineration of waste gases from the iron and steel industry from the waste sector to the industrial processes sector, as recommended in the previous review report. The methodology, AD and EFs used to estimate these emissions have been reported in detail in the NIR.

## **B. Key categories**

### **1. Cement production – CO<sub>2</sub>**

52. AD and the main information on EFs were collected directly from the Spanish Cement Association. The methodology has been well explained in the NIR. In response to the recommendations made in the previous review report, Spain has provided in the NIR a more detailed explanation of the emission trends, comparing data on production and emissions with energy data for the sector. Spain has reported in the NIR that it plans to include basic information on verified data from the EU ETS in its next inventory submission. The ERT encourages Spain to use data from the EU ETS in accordance with the IPCC good practice guidance in order to improve its emission estimates.

### **2. Consumption of halocarbons and SF<sub>6</sub> – HFCs, PFCs and SF<sub>6</sub>**

53. In 2006, emissions of HFCs, PFCs and SF<sub>6</sub> from this category amounted to 5,123.09 Gg CO<sub>2</sub> eq, or 1.2 per cent of total national emissions. A description of the methodology used for emission estimates for each activity that involves the consumption of these gases has been provided in the NIR. Spain is planning to improve its emission estimates by reviewing the AD and parameters used to estimate emissions with a focus on the refrigeration and air conditioning equipment category. Spain is encouraged to continue with its planned improvements by looking for other possible sources of information, involving other ministries and industry contacts, for its next annual inventory submission.

### **3. Limestone and dolomite use – CO<sub>2</sub>**

54. Spain has reported in the NIR that CO<sub>2</sub> emissions from limestone and dolomite consumption come from the manufacturing of glass, brick and tiles, magnesium production and the use of limestone for environmental pollution control purposes in energy production plants. The NIR reports in detail the methodology, as well as the AD and EFs used to estimate these emissions. Spain plans to further investigate the coefficients of carbonate-rich raw materials, with the aim of reducing the high level of variability in and uncertainty of the EFs used. Spain is encouraged to investigate this issue and reduce the uncertainty of its emission estimates in this category for its next annual inventory submission.

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<sup>6</sup> Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council directive 96/61/EC.

<sup>7</sup> Commission decision of 17 July 2000 on the implementation of a European pollutant emission register (EPER) according to Article 15 of Council directive 96/61/EC concerning integrated pollution prevention and control (IPPC).

<sup>8</sup> Council Regulation (EEC) No 3924/91 of 19 December 1991 on the establishment of a Community survey of industrial production (PRODCOM Regulation).

#### 4. Iron and steel production – CO<sub>2</sub>

55. Emissions from the combustion of fossil fuels in external units, such as blast furnace coppers and sinter furnaces burners, have been reported under the energy sector, while emissions from the chemical reactions where carbon is used as a reducing agent have been allocated to the industrial processes sector. The industrial processes emissions are estimated to be the net difference between flows of inputs and outputs in the process of iron and steel production. In response to a recommendation made in the previous review report, incineration of waste gases from the iron and steel industry has been removed from the waste sector and has now been reported under the category iron and steel production, resulting in the recalculation of the whole time series. Spain intends to carry out further investigations and reviews in collaboration with the relevant industrial associations in order to improve the carbon balance and its estimates of industrial process emissions in electrical furnaces. Spain is encouraged to continue its efforts to improve these emission estimates and the allocation of non-energy emissions in the industrial process sector in its next annual inventory submission.

#### 5. Nitric acid production – N<sub>2</sub>O

56. In the previous review report, it was recommended that Spain establish direct contact with the production plants in order to verify the country-specific average EF of 7 kg N<sub>2</sub>O/t production, which was supplied by the Chemical Industry Federation of Spain (Federación Empresarial de la Industria Química Española). In the NIR it is stated that this EF has been verified to be representative of some plants. Spain has reported in the NIR that it plans to estimate emissions using a higher-tier method, collecting AD and EFs from all plants. Spain is encouraged to collect such information in order to verify the average EF for this key category and to use the newly acquired information to make its estimates for this category, including the relevant recalculations, in its next annual inventory submission.

### **IV. Agriculture**

#### **A. Sector overview**

57. In 2006, the agriculture sector accounted for 46,181.38 Gg CO<sub>2</sub> eq, or 10.7 per cent of total GHG emissions. Emissions from the sector increased by 14.5 per cent between 1990 and 2006. The key driver for this rise in emissions was the increase in emissions from enteric fermentation and manure management, which was to a large extent due to the fact that there was a large increase in the size of the populations of some animal species (e.g. the populations of non-dairy beef cattle and swine rose by 54.3 per cent and 62.4 per cent, respectively, between 1990 and 2006).

58. Within the agriculture sector, 42.1 per cent of emissions were from agricultural soils, followed by 29.0 per cent from enteric fermentation and 27.6 per cent from manure management. The remaining 1.4 per cent was from rice cultivation and the field burning of agricultural residues.

59. The information reported in the NIR is transparent and complete and important studies have been referenced. For each category, there is a brief discussion of uncertainties, consistency, QA/QC and recalculations. Most of the AD come from the Food and agriculture statistics yearbook and the monthly bulletins of agrarian statistics (both published by the Ministry of Agriculture, Fisheries and Food).

60. Several improvements were made to the inventory estimates (e.g. the inclusion of the nitrogen (N) in the olive and grapevines in the emission estimates for the agricultural soils and field burning of agricultural residues categories (as recommended in the previous review report); the updating of data on crop surface and total produce; the updating of data on agricultural use of fertilizer and compost; and the updating of data on the poultry and swine populations), which led to specific recalculations in the 2006 submission. In general, the recalculations for 2005 resulted in an increase of 0.3 per cent in the estimated emissions compared with the previously reported values. In response to comments made in the previous review report, Spain has improved the consistency of the time series by: (1) recalculating the estimated emissions from the burning of cuttings from the pruning of olive trees and grapevines as part of the

burning of agricultural waste; (2) conducting a minor review of the N content of manure applied for the fertilization of agricultural soils; and (3) reviewing, in the case of information regarding the new agro-alimentary statistical yearbooks, the activity variables for agricultural crops in 2004 and 2005.

## **B. Key categories**

### **1. Enteric fermentation – CH<sub>4</sub>**

61. In 2006, enteric fermentation accounted for 13,382.77 Gg CO<sub>2</sub> eq, or 3.1 per cent of total GHG emissions. Emissions from this category increased by 13.6 per cent between 1990 and 2006. The main reason for this was the 51.5 per cent increase in emissions from non-dairy cattle owing to an increase in their population. In 2006, most of the emissions from enteric fermentation came from non-dairy cattle and sheep (accounting for 45.6 per cent and 30.3 per cent of emissions, respectively).

62. A tier 2 approach was used for cattle and sheep (a good description of the country-specific parameters used for the estimation of EFs has been provided in the NIR), while a tier 1 approach using IPCC default EFs was used for other animals. The approach adopted is in line with the IPCC good practice guidance.

63. Inter-annual changes in the emissions can be explained mainly by the trends in the animal populations, with the exception of dairy cattle, for which the changes in EFs also influence the trends of emissions. The EFs for this category have increased by 34.4 per cent since 1990 (from 72.31 to 97.15 kg CH<sub>4</sub>/head per year), owing mainly to the increase in the parameter of milk-producing energy per head, simultaneously affected by the increase in milk production and the decline in the number of dairy cattle in Spain.

64. Spain is carrying out a study on a large-scale global review of the methodology used for its estimates. During the centralized review, the Party explained that the study is focused on the input/output feeding balance for each animal type, which will allow the Party to estimate net energies, N and other parameters required to calculate emissions. Therefore, Spain expects to be able to apply a tier 3 methodology once the study is finished. The ERT welcomes this initiative and recommends that Spain report the results of this study in its next annual inventory submission.

### **2. Manure management – CH<sub>4</sub>**

65. This category accounted for 9,737.79 Gg CO<sub>2</sub> eq in 2006, or 2.2 per cent of total GHG emissions. Emissions from this category increased by 56.3 per cent between 1990 and 2006. The increase in emissions and the inter-annual trends can be explained by the increase and the trends in the number of animals. Emissions from swine represent 90.2 per cent of the total emissions from this category.

66. A tier 2 approach was used for cattle and swine, while a tier 1 approach was used for other animals. In both cases, Spain adapted (“softened”), on the basis of continuous temperature variation, the methane conversion factor (MCF) and EF functions proposed by the IPCC to avoid large inter-annual variations between provinces with a mean temperature of around 15°C. As indicated in the previous review report, the ERT considers this to be an appropriate method given the national circumstances of Spain.

### **3. Manure management – N<sub>2</sub>O**

67. This category accounted for 2,998.46 Gg CO<sub>2</sub> eq in 2006, or 0.7 per cent of total GHG emissions. Emissions from the category increased by 21.7 per cent between 1990 and 2006. Both the increase in emissions and the inter-annual trends can be explained by the increase in the number of animals. Solid storage systems account for 96.0 per cent of the total emissions from this category.

68. The methodology from the IPCC good practice guidance has been applied using country-specific parameters (N excreted by different types of animals) and expert judgement, because Spain considers that

the IPCC default values are not representative of the distribution of manure management systems in Spain and because there are no statistics or bibliographic references that contain precise data on the percentage use of each treatment system in the country. Spain explained during the centralized review that, in order to obtain specific national information about animal waste management systems, it has carried out a number of surveys. These surveys were carried out in some representative regions of the country and their results will be extended to apply to the entire national territory using expert judgement. The ERT welcomes the effort made by Spain in this regard and recommends that Spain report on the results of this study in its next annual submission.

#### 4. Agricultural soils – N<sub>2</sub>O

69. In 2006, agricultural soils accounted for 19,423.44 Gg CO<sub>2</sub> eq, or 4.5 per cent of total GHG emissions. Emissions from this category increased by 1.7 per cent between 1990 and 2006. Most of the emissions came from indirect emissions (nitrogen leaching and run-off) and direct soil emissions (synthetic fertilizers) (accounting for 34.9 per cent and 27.6 per cent of emissions, respectively).

70. The methodology from the IPCC good practice guidance has been used correctly with country-specific parameters, specifically related to the fractions of N volatilized as ammonia (NH<sub>3</sub>) and nitrogen oxides (NO<sub>x</sub>) that are obtained by calculating the emissions for the air pollutants inventory using the EMEP/CORINAIR methodology.

71. In response to recommendations made in the previous review report, Spain has included emissions from crop residues from grapevines and olive trees, and performed recalculations in line with the IPCC good practice guidance for the entire time series. The impact of these recalculations on this category was a 0.2 per cent increase in estimated emissions for 2005.

### C. Non-key categories

#### Field burning of agricultural residues – CH<sub>4</sub> and N<sub>2</sub>O

72. This category accounted for 338.66 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Emissions from this category decreased by 37.1 per cent between 1990 and 2006. Inter-annual changes can be explained by the variation in the burning of cuttings from the pruning of olive trees and grapevines caused by the inter-annual changes in their respective production. Following recommendations made in the previous review report, CH<sub>4</sub> and N<sub>2</sub>O emissions from the burning of residues from olive trees and grapevines have now been included in the inventory and recalculations have been undertaken in line with the IPCC good practice guidance for the whole time series, resulting in an increase of 2,407.3 per cent in the total estimated emissions from this category for 2005.

## V. Land use, land-use change and forestry

### A. Sector overview

73. In 2006, the LULUCF sector was a net sink of 33,001.51 Gg CO<sub>2</sub> eq. Removals from the sector increased by 22.5 per cent between 1990 and 2006. The key driver for this change was the increase in living biomass in land converted to forest land.

74. The 2008 submission shows major improvements in terms of the reporting on the LULUCF sector. For the first time the areas of land for all categories have been reported in the CRF tables and land-use changes for some categories which were previously not included in the inventory have also been reported. The ERT welcomes these improvements and encourages Spain to continue its improvement process in order to be able to report emissions and removals from all the relevant categories as soon as possible. The Party has explained in the NIR that some QA/QC procedures were conducted for the LULUCF sector. Uncertainty estimates have not been provided, but Spain has reported its intention to include this information in its next inventory submission.

75. Spain has provided a land-use change matrix for the first time, including information on land uses other than forest land, as well as reporting on its planned improvement to allocate pasture land to a more appropriate land-use category than the category other land under which it has currently been reported. The ERT noted the ongoing work to estimate the change in carbon stocks in living biomass in cropland remaining cropland and encourages Spain to collect information on woody biomass removed, as this information is needed to apply a tier 1 approach. The ERT also encourages Spain to select an appropriate default value for the carbon stock change factor for the relevant land uses or for a change of land use in the category land converted to grassland and to provide estimates of emissions/removals in its next annual inventory submission.

76. The ERT noted with concern that Spain has reported estimates for only forest land, land converted to grassland and biomass burning in forest land remaining forest land for the LULUCF sector. This could create major problems with regard to Spain's reporting in 2010 of mandatory activities under Article 3, paragraph 3, of the Kyoto Protocol, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol (forest management and grassland management). During the centralized review, the ERT highlighted a number of issues with regard to the national system being able to ensure that land areas subject to LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol are identifiable. The ERT recommends that Spain report a complete inventory for the LULUCF sector, effectively address the issues relating to the national system being able to cover activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol and report thereon in its next annual submission. In response to questions raised by the ERT during the centralized review, Spain explained that the inventory data are being developed to enable the Party to report on these activities in its next annual submission. The ERT recommends that Spain implement as a priority its improvement plans in order to obtain the data necessary for the reporting of information under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

## **B. Key categories**

### **1. Forest land – CO<sub>2</sub>**

77. Spain used the stock change method with data obtained from the second and third National Forest Inventory (NFI2 and NFI3, respectively). A constant annual increment value was applied for the whole time series, calculated from the difference between the two data sets from NFI2 and NFI3. Spain assumed that the area of forest land remaining forest land remained unchanged since 1990. Thus, removals under forest land remaining forest land have been reported using the same value for the entire period 1990–2006. The ERT noted that using the interpolation and extrapolation methods with just two data sets has a significant impact on the resulting emission estimates when using the stock change method. The ERT recommends that Spain either improve the method used to construct the time series by taking into account the trends in the data relating to forests, such as harvesting volume and age class distribution of forest, or switch to the gains and losses method if a third stock data set is not expected to be obtained in the near future.

78. Spain has obtained data on afforestation activities since the previous submission and informed the ERT during the centralized review that it should be possible to reassess the deforestation data when new land-use data become available. The ERT welcomes this development and encourages Spain to continue improving its collection of data relating to afforestation, reforestation and deforestation activities.

### **2. Biomass burning – CH<sub>4</sub> and N<sub>2</sub>O**

79. Spain has reported non-CO<sub>2</sub> emissions from biomass burning under forest land remaining forest land for the first time in its 2008 submission. The ERT welcomes this improvement.

### **C. Non-key categories**

#### **Biomass burning – CO<sub>2</sub>**

80. Spain has reported CO<sub>2</sub> emissions from forest fires as included elsewhere (“IE”) and explains and provides the CO<sub>2</sub> emission estimates in the form of additional information in appendix 3 to the NIR. This is because carbon losses owing to natural disturbances are already covered by the stock change method used for forest land remaining forest land. The methods that Spain has applied do not capture removals by regrowth after natural disturbances. Spain has not reported CO<sub>2</sub> emissions associated with natural disturbance events in line with the IPCC good practice guidance for LULUCF. The ERT recommends that Spain report CO<sub>2</sub> emissions associated with natural disturbance events in line with the IPCC good practice guidance for LULUCF in its next annual submission.

## **VI. Waste**

### **A. Sector overview**

81. In 2006, the waste sector accounted for 12,268.87 Gg CO<sub>2</sub> eq, or 2.8 per cent of total GHG emissions. Sectoral emissions increased by 73.0 per cent between 1990 and 2006. Most of the emissions came from solid waste disposal on land, which accounted for 66.8 per cent of the sectoral emissions, while wastewater handling accounted for 27.9 per cent, other (sludge spreading) for 5.2 per cent and waste incineration for 0.1 per cent.

82. Spain has made several improvements to its inventory in its 2008 submission since the 2006 submission, in response to recommendations made in the previous review report. In particular, the ERT noted that recalculations of the entire time series were carried out following the reallocation of emissions from the waste sector to the appropriate IPCC categories, which improved the comparability of the sectoral emissions. The improvements include: (1) the removal of emissions from the burning of forestry waste from the waste sector, as these emissions are already taken into account in the LULUCF sector; (2) the reallocation of combustion emissions with energy recovery of biogas in landfills from the waste sector to the energy sector; (3) the reallocation of emissions from flaring of natural gas in integrated steel plants from the waste sector to the industrial processes sector; and (4) the review of historical series of variables for AD and parameters of EFs for managed landfills owing to the availability of new information from statistical questionnaires on each landfill. Spain also obtained site-specific values for degradable organic carbon and CH<sub>4</sub> recovery parameters in order to reduce the uncertainty of its estimates of emissions from solid waste disposal sites. However, the ERT observed that the information in the documentation boxes of the CRF tables has generally not been provided and, therefore, recommends that Spain provide the additional information and explanations in these documentation boxes in its next annual inventory submission.

### **B. Key categories**

#### **1. Solid waste disposal on land – CH<sub>4</sub>**

83. Spain applied the IPCC first order decay (FOD) model (tier 2 method) from the IPCC good practice guidance to estimate CH<sub>4</sub> emissions from managed solid waste disposal sites and the unburned waste disposed in unmanaged solid waste disposal sites. Spain has provided in the NIR detailed information on the AD and their sources, the characteristics of the FOD model and the variables used in the calculation. Emissions from industrial waste were assumed to be negligible. In response to questions raised by the ERT during the centralized review, the Party provided additional information on the procedures used (interpolation and extrapolation) to reconstruct the model data since 1970 and the time series.

84. The ERT noted that the use of extrapolation method is not recommended for long periods, especially when the waste composition varies as a result of changes in consumption habits and disposal

practices. Therefore, the ERT recommends that Spain investigate the possibility of applying other methods suggested in the IPCC good practice guidance (e.g. the surrogate method) which could better reflect the effect of changes in consumption habits and disposal practices over long periods and improve the reconstruction of the time series used to estimate emissions. The ERT recommends that Spain report the outcome of this investigation and, if possible, new estimates in its next annual inventory submission. Furthermore, the ERT recommends that Spain provide a justification for the assumptions made regarding the industrial solid waste disposal sites, especially if the disposal of degradable organic matter of industrial origin takes place.

85. The ERT noted that Spain assumed a coefficient of open burning for the reduction of waste volume in unmanaged solid waste disposal sites that changes over the inventory period. The selection and use of this coefficient has not been appropriately documented in the NIR. In response to the questions raised by the ERT during the review, the Party explained that the rough estimate of the AD for the amount of open burning of waste was derived from expert judgement and from actually observing the burning practice, which has become increasingly controlled and restricted owing to the risk of fire. The ERT recommends that Spain use formal expert elicitation, such as the protocols suggested in the IPCC good practice guidance, together with other methods for the reconstruction of the time series and the estimation of the amount of waste that is burned openly. The ERT also recommends that the Party improve the way in which it determines the amount of waste that is burned openly and that it document this in its next annual inventory submission.

## 2. Wastewater handling – CH<sub>4</sub>

86. Emissions of CH<sub>4</sub> from domestic/commercial wastewater were determined using the method provided in the Revised 1996 IPCC Guidelines for both water treatment and sludge treatment systems. Information on the values and sources for the parameters and data used in the estimations has been provided in the NIR. In response to questions raised by the ERT during the centralized review, Spain submitted additional information on this category, including the fraction of wastewater uncollected (identified as the fraction of wastewater treated on site for domestic/commercial wastewater), and, in addition, the Party explained that the MCF was assumed to be zero.

87. The ERT noted that the information provided in the NIR on wastewater treatment systems and discharge pathways in the country is limited and recommends that Spain provide information on the quantitative distribution of the total wastewater generated between the fractions of wastewater collected and uncollected, as well as the fractions of wastewater untreated and treated, including the types of treatment on site (latrine, septic tanks or industrial on-site plants). Furthermore, the ERT recommends that Spain incorporate the additional information and clarifications provided during the review into its next annual inventory submission.

## C. **Non-key categories**

### 1. Wastewater handling – N<sub>2</sub>O

88. N<sub>2</sub>O emissions from human sewage were estimated following the method included in the Revised 1996 IPCC Guidelines. Spain applied a country-specific EF of 0.19 kg N<sub>2</sub>O-N/kg sewage N produced instead of the value recommended in the Revised 1996 IPCC Guidelines (0.01 N<sub>2</sub>O-N/kg sewage N produced). In the additional information provided during the review, Spain informed the ERT that this country-specific EF was a typing error in the CRF, but the emission estimates are correct. Other emission parameters were based on IPCC default values. The ERT noted that Spain has reported the emissions for this category incorrectly under the category other (waste) in the NIR, but reported them correctly in CRF table 6.B. In the additional information provided during the review, Spain informed the ERT that allocating these emissions to the category other in the NIR was a mistake and that it would correct this mistake in its next annual inventory submission.

## 2. Waste incineration – CH<sub>4</sub> and N<sub>2</sub>O

89. Spain has explained in the NIR that emissions from the incineration of all sludge from wastewater treatment have been included in this category. The ERT noted that Spain has reported the application of certain quantities of sludge under the agriculture sector. The ERT recommends that Spain verify the methodology and AD used in order to identify any potential double counting of emissions derived from sludge. The ERT also recommends that Spain improve the information provided in the NIR with regard to the sludge generation and disposal practices used in the country and the allocation of emissions between sectors in its next annual inventory submission.

## **VII. Other issues**

### 1. Changes to the national system

90. Spain has not reported on any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the review, the Party confirmed that no changes to the national system have taken place.

### 2. Changes to the national registry

91. Spain has not reported on any changes to its national registry in the 2008 submission. In response to questions raised by the ERT during the review, the Party confirmed that no changes to the national registry have taken place.

### 3. Commitment period reserve

92. Spain has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the review, Spain reported that its commitment period reserve has not changed since the initial report review (1,499,576,336 t CO<sub>2</sub> eq). The ERT agrees with this figure.

## **VIII. Conclusions and recommendations**

93. Spain has submitted a complete set of CRF tables for the years 1990–2006 and an NIR. The inventory is generally in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance and is complete in terms of years, geographical coverage, sectors and gases, except for the LULUCF sector. During the course of the centralized review, the ERT formulated a number of recommendations relating to the completeness and transparency of the inventory and noted the complexity of Spain's national inventory compilation process. The ERT encourages Spain to continue improving its inventory by progressively developing and implementing the national QA/QC plan. The key recommendations are that Spain:

- (a) Improve completeness by estimating categories reported as “NE” using IPCC tier 1 methods, default EFs and/or AD, where applicable;
- (b) Improve information on parameters that result in significant changes in IEFs, particularly in the energy sector, and explain large inter-annual variations, particularly regarding the carbon content of fuels in most categories, in order to reduce the uncertainty of the estimates for this sector;
- (c) Implement further planned improvements with regard to institutional cooperation and administrative arrangements based on the QA/QC plan under the national system, particularly in the energy sector;
- (d) Further improve institutional cooperation on the reporting of AD for the energy sector in order to resolve the apparent problem of inconsistency between the data sources from the different providers (ministries, departments and agencies) so as to reduce the uncertainty



of AD and country-specific EFs;

- (e) Obtain plant-specific data reported under the EU ETS for the industrial processes and energy sectors in order to be able to compare this data with the data from statistical questionnaires as part of QA/QC checks and the verification process to reduce uncertainty;
- (f) Increase transparency of the implemented QA/QC procedures by providing a sample of the completed tier 1 QC tables in the annex to its next inventory submission as well as a list of key categories for which tier 2 QA/QC procedures have been applied.

## **IX. Questions of implementation**

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

Annex

**Documents and information used during the review**

**A. Reference documents**

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 2007. FCCC/ASR/2007/ESP. Available at <<http://unfccc.int/resource/docs/2007/asr/esp.pdf>>.

Status report for Spain 2008. FCCC/ASR/2008/ESP. Available at <<http://unfccc.int/resource/docs/2008/asr/esp.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <<http://unfccc.int/resource/webdocs/sai/2007.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <<http://unfccc.int/resource/webdocs/sai/2008.pdf>>.

FCCC/ARR/2006/ESP. Report of the individual review of the greenhouse gas inventory of Spain submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/esp.pdf>>.

FCCC/IRR/2007/ESP. Report of the review of the initial report of Spain. Available at <<http://unfccc.int/resource/docs/2007/irr/esp.pdf>>.

**B. Additional information provided by the Party**

Responses to questions during the review were received from Mr. Antonio Ferreiro Chao (Análisis Estadístico de Datos, S.A.) and Mr. Juan José Rincón Cristóbal (Análisis Estadístico de Datos, S.A.), including additional material on the methodology and assumptions used. The following documents were also provided by Spain:

Key category analysis – Calculation tables. Excel file.

Ministerio de Agricultura, Pesca y Alimentación. 2003. *Estimación de Emisiones de Gases Efecto Invernadero - Agricultura. Criterios utilizados*. PDF file.

Ministerio de Medio Ambiente Rural y Marino, Madrid. 2008. *Anuario de Estadística Agroalimentaria 2007*. Available at <<http://www.mapa.es/es/estadistica/pags/anuario/introduccion.htm>>.

Ministry of Environment and Polytechnic University of Valencia. 2006. *Methodology for the estimation of atmospheric emissions from the agrarian sector for the national emission inventory*. PDF file.

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