UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2005/ESP
29 March 2006

ENGLISH ONLY

Report of the individual review of the greenhouse gas inventory of Spain submitted in 2005*

* In the symbol for this document, 2005 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2005 greenhouse gas (GHG) inventory submission of Spain, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 3 October to 8 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Ms. Mirja Kosonen (Finland) and Mr. Jim Penman (United Kingdom); Energy – Ms. Sumana Bhattacharya (India), Mr. Christov Christo (Bulgaria) and Mr. Hugh Saddler (Australia); Industrial Processes – Mr. Jochen Harnisch (Germany) and Mr. Stanford Mwakasonda (Republic of South Africa); Agriculture – Mr. Samuel Adejuwon (Nigeria) and Mr. Leonard Brown (New Zealand); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Hector Ginzo (Argentina) and Mr. Zoltan Somogyi (Hungary); Waste – Mr. Carlos Lopez (Cuba) and Mr. Takashi Morimoto (Japan). Mr. Carlos Lopez and Mr. Jim Penman were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of Spain, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

3. In its 2005 submission, Spain submitted a set of common reporting format (CRF) tables (with some data missing) for the years 1990–2003 and a national inventory report (NIR). Where needed the expert review team (ERT) also used additional information provided during the review and referred to previous review reports. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2003, the most important GHG in Spain was carbon dioxide (CO_2), contributing an estimated 82.5 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 9.2 per cent, and nitrous oxide (N_2O), 6.9 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 1.4 per cent of the overall GHG emissions. The Energy sector accounted for an estimated 77.8 per cent of the total GHG emissions in 2003, followed by Agriculture (11 per cent), Industrial Processes (7.9 per cent), Waste (2.9 per cent) and Solvent and Other Product Use (0.42 per cent).

5. Total GHG emissions amounted to 402,287 Gg CO_2 equivalent in 2003 having increased by 42 per cent since 1990. CO_2 emissions increased by about 45.3 per cent, CH_4 by 33.1 per cent, N_2O by 15.2 per cent, HFCs by 106.5 per cent and SF_6 by 341.0 per cent. Emissions of PFCs decreased by an estimated 70 per cent. These trends are plausible given the growth of the Spanish economy and action to

[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified. Spain has not provided the tables of the common reporting format for LULUCF as required by decision 13/CP.9 using the land use categories of the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Instead it has used the common reporting format tables for Land-use Change and Forestry as contained in the common reporting format adopted by decision 18/CP.8, which are based on the categories of the Intergovernmental Panel on Climate Change *Revised 1996 Guidelines for National Greenhouse Gas Inventories*.

mitigate PFC emissions. Net removals from Land-use Change and Forestry (LUCF) corresponded to about 10 per cent of total national emissions in 2003.

6. CO_2 was responsible for 87 per cent of the increase in total national emissions between 1990 and 2003. CH_4 was responsible for 8 per cent of the increase, N_2O for 3 per cent, HFCs for 2 per cent and SF_6 for 0.2 per cent. The decrease in emissions from PFCs corresponded to about 0.5 per cent of the increase in total emissions between 1990 and 2003.

D. Key categories

7. Spain reports a tier 1 level and trend assessment for 2003 as part of its 2005 submission. The Party's assessment is more disaggregated than that of the secretariat[2], leading to 24 and 26 key categories for the level and trend assessments, respectively, compared with the secretariat's 20. Although the key categories identified by the Party and by the secretariat are generally similar, there are some differences, for example, Petroleum Refining is a key category according to the Party's analysis but not in the secretariat's categorization. The NIR provides more detailed methodological descriptions for key categories, but it is not obvious that key source analysis has been used systematically for prioritizing choice of methodologies or improvements to the inventory.

E. Main findings

8. The inventory is largely complete apart from the LUCF sector, which only has estimates for category 5.A Changes in Forest and Other Woody Biomass Stocks. The emissions estimates and trends are reasonable but in many cases are not transparent, either methodologically or in the activity data (AD), emission factors (EFs) or other parameters used. Adherence to 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) can therefore be difficult to assess. This NIR contains an account of an emerging national inventory system and quality assurance/quality control (QA/QC) data management procedures, although neither is yet complete. This submission also contains the results of an extensive data collection exercise on large point sources and takes advantage of data becoming available under the European Union (EU) Emissions Trading Scheme (ETS). There appears to be a continuing need to improve coordination between the agencies which provide the data used for the estimation of emissions. The NIR should make more obvious the use of key category and uncertainty analyses for methodological choice and in the Party's strategy for improving its emissions estimates.

F. Cross-cutting topics

1. Completeness

9. The inventory covers all gases and sectors, although not always completely, particularly in the LUCF sector, for which coverage is restricted to category 5.A Forest and Other Woody Biomass Stocks. Emissions of CO_2 from limestone and dolomite and of CH_4 from ethylene and styrene production have been added to the inventory for the first time in response to the results of previous reviews. There is no formal evaluation of completeness and the NIR provides no specific information on geographical coverage.

[2] The secretariat identified, for each Party, those source 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 and Uncertainty Management in National Greenhouse Gas Inventories*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the year 1990. 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.

2. Transparency

10. In general it is possible to understand the approach taken to emissions estimation but the ERT was not always able to follow the details. Exact bibliographic references to sources of information are usually not provided. The preliminary description of the Spanish national GHG inventory system is welcome, but the institutional and legal basis and the respective responsibilities of the organizations involved need additional clarification. The NIR does not follow the structure set out in 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 revised UNFCCC reporting guidelines).

3. Recalculations and time-series consistency

11. Spain has recalculated the emissions time series for the period 1990–2002 to use information from a questionnaire directed to large industrial point sources, and other information becoming available in connection with the ETS. The recalculations also reflect new AD in the Agriculture and LUCF sectors. The recalculations have resulted in decreases of 0.25 and 0.29 per cent, respectively, in the 1990 and 2002 inventories. The previous estimate (in Spain's 2004 submission) was that emissions in 2002 were 40.47 per cent higher than those of the base year (1990). The recalculated estimates are that emissions in 2002 were 40.42 per cent higher in 2002 than in 1990. Therefore, although the recalculations are extensive at the source category level, the trend in emissions is not greatly affected. This is because the new energy data have been used mainly to recalculate emissions by sector, rather than to recalculate the national total. The NIR anticipates that further revisions may be needed because the national energy balance for 2002 was not available in time for preparation of the 2005 submission.

4. Uncertainties

11. There is a tier 1 uncertainty analysis for the years 2001 and 2002. Country-specific information, taken particularly from fuel analysis and survey data, has been used to supplement the default uncertainty ranges in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), although references are not provided. At present it is not obvious that the uncertainty analysis is being used systematically to help with methodological choice or to prioritize further improvements in the inventory.

5. Verification and quality assurance/quality control approaches

12. The NIR provides a status report of QA/QC arrangements but not yet a full plan. Making greater use of bottom–up data (e.g. from the ETS) will increase the need for formal QA/QC arrangements. There is no description of independent peer reviews or audits.

6. Follow-up to previous reviews

13. The ERT noted the progress made by Spain in making use of plant-specific data, the development of institutional arrangements and QA/QC, and the inclusion of new sources.

G. Areas for further improvement

14. The ERT identifies the following cross-cutting issues for improvement. The Party should:

(a) Improve the transparency of its reporting, including by providing bibliographic references, listing EFs, and providing national energy balances and worksheets;

(b) Link its key category analysis to the choice of methodology;

(c) Complete the development of a QA/QC management system, including better arrangements for internal data exchange;

(d) Fill remaining gaps, especially in the LUCF sector, and report on LULUCF using the revised CRF tables.

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

II. Energy

A. Sector overview

16. In 2003, the Energy sector accounted for 77.75 per cent of total national GHG emissions. Emissions from the sector had increased by 47.15 per cent since 1990 (from 212.6 Tg in 1990 to 312.8 Tg in 2003). This was mainly caused by increases in Stationary Combustion and Transport, of 38.5 per cent and 74.5 per cent, respectively. Transport contributed 24.4 per cent to total national emissions. Energy sector emissions increased by 6.7 per cent from 2001 to 2002, but by less than 0.1 per cent from 2002 to 2003.

17. In general, the NIR is not transparent for the Energy sector. There is no detailed discussion of the AD, methodologies or EFs applied. Supporting documentation and references are not provided. The calculation methods used for the key Energy categories are reported in the NIR and are consistent with the IPCC good practice guidance, but EFs for specific activities are not reported. The ERT encourages the Party to report the EFs.

18. The inventory covers all significant Energy sector sources for all years and all gases, but the NIR addresses only the key categories and greenhouse gases. The ERT encourages the Party to extend the NIR to cover all source categories, GHG precursors and sulphur dioxide (SO_2).

19. The recalculations performed for the Energy sector are extensive, but are not documented in the NIR. They are based on new AD and EFs for the different economic sectors, reflecting in particular information from a survey that was used to estimate AD for each sector. This was supplemented with information becoming available from the ETS. As a result of the recalculations, the estimates of emissions for recent years have decreased as follows: by 1.3 per cent for 2000, 1.0 per cent for 2001, and not changed for 2002; the estimates for base year (1990) emissions have decreased by 0.5 per cent compared to the previous submission.

20. The ERT noted that the uncertainty analysis has been extended to cover key categories by primary fuel type for every end-use sector following the IPCC tier 1 recommended method.

B. Reference and sectoral approaches

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

21. CO_2 emissions from fuel combustion have been calculated using both the reference approach and the sectoral approach. There is a difference of 0.32 per cent in the CO_2 emissions estimates for the year 2003 between the two approaches. The NIR explains the fluctuations in the differences between the two approaches over the years. Transparency could be improved by use of the documentation box in table 1.A(c) to define what “Other” fuels are, although this can be deduced from the NIR.

22. There is a difference of approximately 15 per cent between the figures for coal production in the International Energy Agency (IEA) statistics and the data reported in the CRF for 2003. The Party advises that the difference is caused mainly by the use of different calorific values to convert original

production data from mass to energy units; in particular, the CRF uses a country-specific value for bituminous coal which differs from the calorific value of imported bituminous coal. The overall calorific value for bituminous coal is therefore a weighted average of the values for domestic and imported coals.

2. International bunker fuels

23. Spain defines international bunker fuels as the quantities of fuel reported in the national energy balance tables as allocated to international marine bunkers and international aviation. Domestic maritime traffic is defined as all voyages where both port of origin and port of destination are in Spain. The NIR should provide an explanation of how the Ministry of Industry, Tourism and Trade, which compiles the energy statistics, applies methods that are consistent with the IPCC good practice guidance to separate domestic and international consumption.

3. Feedstocks and non-energy use of fuels

24. In table 1.A (d) Spain reports that it uses default carbon (C) storage ratios. The quantities of feedstock fuels reported are large (162 PJ naphtha, 118 PJ other petroleum products, 22 PJ petroleum coke, 20 PJ natural gas) and the total quantity of CO_2 not emitted calculated by this method is correspondingly large (18.5 Mt). This must give rise to a high level of uncertainty. It is not clear why plants with such high levels of fuel consumption are not included in the list of large point sources for which data are collected directly from the plant (NIR p.4). The use of actual plant-specific data on carbon stored would improve the estimates significantly.

25. It is not possible to reconcile the differences in energy consumption between the reference and the sectoral approaches, as shown in table 1.A(c), with the quantities of energy used as feedstocks and other non-energy uses, as shown in table 1.A(d). It is also unclear how the data in table 1.A(d) for natural gas relate to the CO_2 emissions from ammonia production reported in table 2(I) s1.

26. To address the points raised in paragraphs 25 and 26 it is recommended that Spain include major chemical and other plants where fuels are used as feedstocks and carbon is stored in long-lived products within the scope of its survey of large point sources for the collection of energy consumption and emissions data, and that the quantities of C stored that are collected by such surveys be used in future in completing table 1.A(d) and other relevant CRF tables.

C. Key categories

1. Energy industries: Liquid fuels – CO_2

27. As reported in previous 2004 review, for Public Electricity and Heat Production the ratio of estimated emissions to AD for liquid fuels is unusually high and variable from year to year. This remains the case despite the recalculations and needs explanation. The Party considers that this is probably caused by the procedure used to allocate total emission figures, provided by the utilities and considered to be accurate, to the individual fuel types. The ERT recommends that the Party seek to obtain activity and emissions data from the utilities that is disaggregated by fuel type.

2. Manufacturing industries and construction: Liquid fuels – CO_2

28. For Iron and Steel and Non-ferrous Metals, the ratio of emissions to fuel input and their inter-annual variations are unusually high. The high share and annual variability in the amount of petroleum coke (EF 98.89 t/TJ) combusted in conjunction with the liquid fuels is the main reason for this. In the case of Non-ferrous Metals, the emissions from fuels combusted are allocated to this source category and emissions from preparation and use of anodes to the Industrial Processes source category 2.C.3. The ERT recommends that the NIR include more information about these matters.

3. Manufacturing industries and construction: Solid fuel – CO_2

29. For Iron and Steel, the ratio of emissions to solid fuel use is unusually high, varying from 140 t/GJ in 1990 to 135 t/GJ in 2003. The Party advises that the reason for this is the high consumption of blast furnace gas and steel plant furnace gas, though this cannot be established from the NIR. It also appears that most of the CO_2 emissions from iron and steel production are reported under Fuel Combustion, and a smaller quantity is reported under Industrial Processes, but the basis on which emissions are allocated between the two sectors is not transparent. Spain is recommended to provide in the NIR information on the method used (including assumptions) to estimate all emissions from iron and steel production, including the EFs for the individual fuels used by the industry.

30. The ratio of emissions to solid fuel use reported for Non-ferrous Metals, Chemicals, Pulp, Paper and Print, and Food Processing, Beverages and Tobacco are all very high for 2003, although less so for the base year (1990). The NIR is not transparent as regards the particular types of solid fuel used by these industries. Spain provided additional information during the review which increased the transparency of the inventory, but still did not explain why the values are so high. The ERT recommends that Spain review the EFs applied to estimate emissions from the solid fuels used in these industries and provide more information in its next submission.

4. Road transportation: Liquid fuels – General

31. The Road Transport source category is the most detailed and the best-described part of Spain's Energy sector inventory. Activity data are in mass units and CO_2 emissions are calculated on a stoichiometric basis from the average carbon content of each transport fuel type. Estimates of non-CO_2 emissions are based on a very detailed model of Spanish road transport. The NIR reports consumption as tonnes instead of kilotonnes; this should be corrected, but does not affect the total emissions estimates.

5. Other sectors: Solid fuels – CO_2

32. The ratio of emissions to solid fuel use is very low, and there an apparent discrepancy with the very high ratio in the Manufacturing and Construction source category. The NIR provides no information about the particular types of solid fuel used in this source category, but the Party advises that use of gas works gas, with an EF of 52 Mg CO_2/TJ, is a contributing factor. It is recommended that this information be included in the NIR.

6. Fugitive emissions from solid fuels

33. The fugitive emissions reported from solid fuels appear to be complete, but more detailed documentation is needed in order to improve transparency. Activity data have been derived from various sources, including the IEA, national institutions such as the Ministry of Economy and the Ministry of Science and Technology, the coal-mining companies, and the Spanish electricity network. However, these linkages are not brought out clearly in figure 2.1.1 of the NIR. The distribution of AD between mining and post-mining activities in both underground and surface mining is not very clear from table 1.B.1. The NIR mentions that the EFs applied are based on type of coal and the extraction technique, but no information is provided on how these differing EFs have been applied. The ERT recommends further disaggregation of the AD reported by coal type, and the provision of additional information about the associated EFs.

7. Fugitive emissions from oil and gas

34. The estimates of fugitive CH_4 appear to be complete, but are not well documented. The CRF table for the year 2003 does not show the reporting units for each activity. The ERT assumed that they are the same as those reported in the CRF for 1990. It is not clear why emissions of N_2O from flaring in

oil refineries have not been estimated, taking into account that such emissions from flaring in natural gas re-gasification plants have been estimated. The IPCC default EF could have been used for this purpose. The NIR uses the quantity of gas actually flared as the AD for flaring associated with natural gas re-gasification plants.

D. Non-key categories

1. Civil aviation: Liquid – General

35. Consumption of aviation gasoline is reported as "not occurring" ("NO") for all years up to and including 1996. Since there would have been some use of aviation gasoline this seems to be incorrect. Emissions may have been estimated elsewhere; Spain should correct the notation key to "not estimated" ("NE") or "included elsewhere" ("IE") as appropriate.

2. Road transportation: Gas, Biomass – General

36. Activity data and emissions for natural gas and biomass are reported as "NE", but the NIR provides no explanation for this. In response to inquiry, the ERT learnt that the amounts of biofuel used for road transportation are negligible and that amounts to natural gas are larger, but that statistics are unavailable. These reasons for not estimating them should be explained in the NIR and Spain should consider whether it would be possible to gather sufficient to enable estimating of emissions from natural gas use in road transportation.

3. Road transportation: Other Fuels – General

37. The consumption of 3.24 PJ of liquefied petroleum gas (LPG) in 2003 is reported under this heading. This amount is then added into Other Fuels at the top of table 1.A (a) s1, whereas it should be added into Liquid Fuels. This problem is caused by the template for the CRF tables. As this will affect the reconciliation between sectoral and reference approaches, it is recommended that it be explained in the documentation box of Table 1.A(c).

4. Other transportation: Liquid – General

38. The consumption of 4.34 PJ and CO_2 emissions of 283 Gg in 2003 are reported for this source, but the NIR provides neither an explanation of what the activity is nor the fuel type. The Party advises that this source category is pipeline transportation, for which LPG is the main fuel. The ERT recommends that a brief description and explanation be provided in the NIR.

5. Other: All fuels – General

39. The NIR (p. 76) notes that there is no differentiated reporting of emissions from military use of energy. All emissions from this source are reported as "NE". The NIR should state whether military use of energy is included under the Transport subcategory or is not reported at all.

III. Industrial Processes and Solvents and Other Product Use

A. Sector overview

40. In 2003, the Industrial Processes and Solvents and Other Product Use sectors contributed 8.3 per cent (7.9 per cent and 0.4 per cent, respectively) to Spain's total GHG emissions. Emissions from the two sectors increased by 15.6 per cent and 25.8 per cent, respectively, from 1990 to 2003.

41. The CRF includes estimates of most gases and emission sources from the Industrial Processes sector, as recommended by the Revised 1996 IPCC Guidelines. Potential emissions of HFCs, PFCs and SF_6 are not provided, mainly because of the current lack of information on imports and exports per gas. In some cases

the notation keys have not been used or have been used incorrectly. As observed in the 2004 review, CRF tables 7 and 9 have not been completed. Spain is encouraged to provide emissions for the sources that are not estimated, and to complete tables 7 and 9, making use of the notation keys as appropriate.

42. As a result of recalculations performed for all years in the period 1990–2002, estimates of emissions of CO_2 from the Industrial Processes sector are almost 15 per cent higher than those reported in the 2004 submission. In general, the main reasons for the recalculations were changes in AD becoming available because of the requirements of the EU ETS. In particular, significant recalculations concern CO_2 emissions from mineral products and the iron and steel industry. Spain provided further explanation that the recalculations were because of extensive information collected which made it possible to calculate CO_2 emissions from decarbonisation. Minor recalculations have been performed for the other gases.

43. The NIR should be transparent as to where emissions are accounted for and which specific method has been applied.

B. Key categories

1. Cement production – CO_2

44. The NIR does not provide clear information on the method of data collection or the calculations for cement clinker production. Spain is encouraged to provide information on how data obtained from the industrial associations are representative of all companies in the sector, how QA/QC issues are taken into consideration, and how the IPCC good practice guidance has been applied for this key category.

2. Iron and steel production – CO_2

45. In clarifying appropriate location of emission from Iron and Steel activities, the Party explained that emissions from the combustion of fossil fuels in external units, such as blast furnaces cowpers and sinter furnaces burners, have been reported under the Energy sector, while the emissions originating from the internal processes where carbon can act as a fuel and a reduction agent have been allocated under the Industry sector, having been estimated as the net difference between flows of inputs and outputs in such processes. Incineration of waste gases from iron and steel industry are appropriately reported under the Waste sector. The Party is encouraged to be clearer in the NIR on allocation to give assurance that omission or double counting have been avoided between the Industrial Processes, Energy and Waste sectors.

3. Limestone and dolomite use – CO_2

46. Although the NIR is unclear, Spain has explained to the ERT that CO_2 emissions from limestone and dolomite consumption use are from glass manufacturing, frits of glass, brick and tiles and magnesium production. For subsequent submissions the Party is considering including emissions from the use of limestone for environmental pollution control purposes. The ERT encourages transparency in the NIR to give assurance that omission or double counting have been avoided.

4. Nitric acid production – N_2O

47. During the 2003 review, the ERT recommended that Spain establish direct contact with the production plants in order to verify the EF of 7 kg per tonne of production, but no further information has been provided in the NIR. Spain is encouraged to use the IPCC good practice guidance for this key category.

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

48. Information on the consumption of halocarbons and SF_6 in semiconductor manufacturing is currently lacking. The methodology used for Refrigeration and Air Conditioning seems to be mainly based on a complex extrapolation from previous years and should be described more clearly.

6. Production of halocarbons and SF_6 – HFC-23

49. Spain has explained to the ERT that the significant decline in HFC-23 emissions after 2001 was due to the introduction in 2001 of a system for recovery and storage of HFC-23. This explanation should be added to the NIR.

7. Aluminium production – PFCs

50. Significant emission reduction of PFCs from aluminium production from 1990 to 2003 was explained by the Party to be due to decreased number of anode effect (AEF) per pot due to improved aluminium production processes. This explanation should be added to the NIR.

C. Non-key categories

1. Ammonia production – CO_2

51. In 2003, as in 2002, the ratio of CO_2 emissions to production (0.92 t CO_2/t ammonia) is lower than the IPCC default (1.5–1.6 t CO_2/t ammonia). The NIR does not provide supporting information on the AD, EFs or methods used. The Party should investigate the possible causes of the difference and report on it in its next NIR.

2. Ferro-alloy production – CO_2

52. The AD reported for 2001, 2002 and 2003 are constant at 232.88 KT, which the ERT understands from the Party to be an extrapolation due to lack of data. Spain should investigate whether data can be made available in future for the missing years, or, if data become available in future, whether interpolation would provide a better estimate than keeping the level constant. Another possibility would be to use a driver to estimate emissions. The IPCC good practice guidance discusses approaches to providing missing data.

3. Soda ash production and use – CO_2

53. The CRF provides data on this source but the NIR does not document how the emissions have been derived. This should be rectified in future submissions.

4. Solvent and other product use – N_2O

54. N_2O use in anesthetics was reported to be the only source of emissions and notation keys have been used to indicate coverage.

IV. Agriculture

A. Sector overview

55. In 2003, the Agriculture sector produced 44.4 Gg CO_2 equivalent of GHG emissions. This represents 11.0 per cent of Spain's total GHG emissions and an increase of 7.0 Gg or 18.8 per cent from the 37.4 Gg CO_2 reported for 1990. Emissions from enteric fermentation increased by 17.91 per cent between 1990 and 2003. The NIR notes that the main drivers for this are increases in the numbers of non-dairy cattle (59.6 per cent) and swine (48.4 per cent). Spain identified six key categories in the

Agriculture sector: CH_4 from Enteric Fermentation, CH_4 and N_2O from Manure Management, Direct and Indirect Emissions of N_2O from Agricultural Soils, and Animal Production. The secretariat's analysis identified the same categories although not necessarily in the same order according to the level or trend criteria.

56. Spain uses a data management system to estimate emissions and has completed all the CRF tables with either estimates or the notation keys. The only omissions are the additional information tables, which the ERT encourages Spain to complete for its next submission. However, the information provided in the NIR to support its estimates for key categories, in particular the information on the use of the national methodology and country-specific EFs, is not sufficiently transparent for review. The 2003 review noted that additional information on methodology was supplied to the ERT at that time, and the 2005 ERT recommends that this be included in Spain's future NIRs. The NIR also lacks supporting information for the non-key categories Rice Production and Field Burning of Agricultural Residues.

57. Emissions for many categories have been recalculated from updated AD, including milk production, livestock populations, area of cultivated crops, grassland and rice, and the amount of sludge. The impact of these recalculations is minor. A tier 1 uncertainty analysis including the Agriculture sector is reported in the NIR. The NIR reports that the analysis is based on values given in the Revised 1996 IPCC Guidelines and on assumptions made by the inventory working team. Spain should continue to refine the uncertainty analysis by including more country-specific data on uncertainty ranges, where available.

B. Key categories

1. Enteric fermentation – CH_4

58. The main sources of CH_4 emissions from this activity are non-dairy cattle, with 46 per cent of the emissions from enteric fermentation, followed by sheep with 29 per cent. A tier 2 methodology is used for this significant subcategory. There has been a 55 per cent increase in emissions from non-dairy cattle and also a significant increase in emissions from swine. The ratio of emissions to stock for dairy cattle increased between 1990 and 2003 in line with increased productivity. However, the ratio for non-dairy cattle declined from 61 to 59 kg/head/year. The IPCC default is 48 kg/head/year. The trends in animal numbers are understandable but the tier 2 methodology and required inputs are not described transparently in the NIR. During the review Spain improved the transparency of its report by providing additional explanations and information. The ERT recommends that Spain provide these details in its future NIRs, including information on animal weights.

2. Manure management – CH_4

59. Swine are the main source of CH_4 emissions in this activity, representing 86 per cent of the emissions from manure management in 2003. Other animals contributing to CH_4 emission from manure management include non-dairy cattle (with 5 per cent), dairy cattle (with 3.9 per cent) and poultry (with 4 per cent). There is a gradual increase in CH_4 emission from manure management, rising from 6,221 to 8,667 kt of CO_2 equivalent between 1990 and 2003. The increase is the result of the increase in emissions contributed by swine due to the large increase in their numbers.

3. Manure management – N_2O

60. The treatment of manure by solid storage and dry lot is responsible for almost 95 per cent of manure management emissions and is a major source of N_2O emissions in Spain. N_2O emissions from this activity have remained relatively constant, going from 1,632 to 1,607 kt of CO_2 equivalent between 1990 and 2003, despite an increase in animal numbers. This is explained by shifts in manure treatment

strategies towards those with lower EFs, but no quantitative justification is given in the NIR. The ERT encourages Spain to provide this.

61. Nitrogen excretion (Nex) values are determined from the Revised 1996 IPCC Guidelines for a Near East and Mediterranean climate and applying age-related correction factors as per table 4.14 of the IPCC good practice guidance. The ERT encourages Spain to include in its next NIR additional information on the calculation process, especially the number of livestock in each age class.

4. Direct emissions from agricultural soils – N_2O

62. Direct emissions of N_2O from agricultural soils are dominated by emissions from the application of nitrogenous fertilizers (71.0 per cent of emissions in this category). AD come from the Spanish National Association of Fertilizer Manufacturers. As noted in the 2004 review, Spain uses country-specific values for $Frac_{GASF}$ (0.07) and $Frac_{LEACH}$ (0.15). In response to the previous review, Spain noted that the value for $Frac_{LEACH}$ was based on expert opinion taking into account the low rainfall in Spain. The 2005 NIR contains a brief explanation of the country-specific values; however, the ERT considered that the information provided is not sufficient to make it possible to assess whether those country-specific values are reasonable. The ERT encourages Spain to include more detailed information to support the use of the country-specific values in its next NIR.

63. Spain uses a country-specific value for $Frac_{GASM}$ (0.36) compared to the IPCC default value of 0.2. In the CRF, $Frac_{GASM}$ appears to be calculated from the sum of the nitrogen excreted per animal waste management systems (AWMS) (excluding paddock, range and pasture) from table 4.B(b) and the nitrogen (N) input to soils from AWMS (table 4.D). Spain notes that a country-specific methodology has been used and subsequently advised the ERT that the NH_3 emissions are calculated from the EMEP/CORINAIR methodology. The NIR does not provide sufficient information for transparent calculation and the ERT recommends that Spain include additional information in the NIR to clarify the methodology.

5. Indirect emissions from agricultural soils – N_2O

64. Spain uses IPCC default EFs for atmospheric deposition and N leaching and run-off. The same issues as are mentioned above relating to $Frac_{LEACH}$, $Frac_{GASF}$ and $Frac_{GASM}$ for direct N_2O emissions also apply to this category.

6. Animal production – N_2O

65. Spain reports a different total in table 4.B (b) for the pasture, range and paddock AWMS N input to soils than in table 4.D for animal production. Spain advised the ERT that the animal production value in 4D has been reduced for volatisation ($1\text{-}Frac_{GASM}$). The ERT encourages Spain to include information to support their calculation, and to show its consistency with the IPCC good practice guidance. Spain uses the IPCC default value of 0.02 kg N_2O-N/kg N. There is no information in the NIR as to whether Spain has assessed the applicability of this default value to the national circumstances. The ERT encourages Spain to include this information and work towards determining a country-specific EF.

C. Non-key categories

Field burning of agricultural residues – CH_4, N_2O

66. Spain reports AD for pulses and sugar cane but "NE" for parameters and emissions. Field burning of pulses does not occur in Spain, in which case the notation key "NO" would be appropriate. Where sufficient country-specific data for CH_4 emissions from sugar cane burning are not available, the ERT recommends the use of the IPCC default values.

V. Land Use, Land-use Change and Forestry

A. Sector overview

67. The LUCF sector is estimated to be a net sink, with removals of 3.2 and 10 per cent of total non-LUCF CO_2 equivalent emissions in 1990 and 2003, respectively, making LUCF a key category.

68. The estimates are based on calculations for categories 5.A Changes in Forest and Other Woody Biomass Stocks and 5.E Other (the NIR does not provide a methodology for the latter, which is estimated to be a very small source of emissions). Categories 5.B Forest and Grassland Conversion, 5.C Abandonment of Managed Lands and 5.D CO_2 Emissions and Removals from Soils are not estimated due to lack of reliable basic data. Emissions from soils and deforestation, and carbon stock changes in the dead organic matter pool, are not reported. The uncertainty of the emissions and removals is only partially reported: the relative error of the volume stock estimate is stated to be 10 per cent at 95 per cent confidence.

69. Spain is encouraged to use the 2003 LULUCF CRF tables (as required by decision 13/CP.9) in its next submission, rather than the LUCF CRF reporting tables contained in decision 3/CP.5.

B. Sink and source categories

Changes in forest and other woody biomass stocks – CO_2

70. The emissions estimates for this category are based on two forest inventories (with central years of 1990 and 2000). The forest area is estimated to have increased by about 41 per cent between 1990 and 2003, from 13,904,660 ha to 19,586,724 ha. Total net removals increased by an estimated 344 per cent over the same period. These are very high increases, which require further explanation and/or verification.

71. The methodology applied in the forest inventories is not described in detail in the NIR. It is reported that data are not yet available for a number of provinces in the country, so that data from provinces where data have been measured have been used to obtain estimates for provinces with no measured data. Also, interpolation and extrapolation have been used to obtain estimates for the various inventory years.

72. The inventories report the volume stock of trees; however, no definition of volume is provided in terms of tree compartments involved or in terms of the biomass expansion factors (BEFs). Moreover, it is not clear from the NIR whether increment has been measured or calculated from subsequent volume stock estimates. If the latter is the case, then emissions from harvesting wood should not be added to the calculations, because the estimated net removals from the volume stock changes already include these emissions. The implied carbon uptake factor (t C/ha/yr) values seem rather low, as earlier reviews reported. The NIR should explain the definitions used and how the methodologies have been applied in a manner consistent with them.

73. In Spain, as in other Mediterranean countries, fire may burn large areas of forest, but emissions from fires are not reported. Estimates of emissions from fires are needed in order to obtain balanced removals and emissions estimates.

74. Spain reported in the previous NIR that values based on expert judgement were used for converting volume data to biomass. In the latest NIR, two sources of BEFs have been used to translate forest inventory information into emissions and removals estimates: a study producing data from measurements taken in a province within the country (Catalonia); and the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry*, from which default data are taken. It is to be noted that

the Catalonia values are applied for the entire country; this requires verification because of the possible differences in tree allometry within the country. Also, for some species, the BEF for another species is used because species-specific data are lacking. The ERT recommends that Spain assess what data are available and whether better use might be made of the information, given the likelihood of variation across the country.

75. The NIR does not provide a definition of the BEFs used, and it is therefore not clear which biomass compartments of the trees are expanded. Nor is it clear whether all aboveground biomass compartments are included in the forest biomass in chapter 7.5 of the NIR, or whether belowground biomass and non-tree vegetation are also included. Finally, the wood density values included for each species in the reported BEF values are not clear, and it is therefore impossible to judge whether the BEF values reported have been correctly applied.

VI. Waste

A. Sector overview

76. In 2003, the Waste sector contributed 2.9 per cent of total national GHG emissions. CH_4 emissions from this sector represented 27 per cent of the total CH_4 emissions in the inventory. Over the period 1990–2003, total CO_2 equivalent emissions from this sector increased by 61 per cent, mainly due to the increase in CH_4 emissions from solid waste disposal on land. Emissions have been estimated for most of the source categories except for the incineration of industrial waste. The descriptions of methods and parameters used are not always transparent. Recalculations performed in this sector have resulted in a decrease of the emissions estimates compared with the previous (2004) submission. Spain has introduced several improvements in the present inventory submission, but some of the issues identified in previous reviews have not been addressed.

B. Key categories

1. Managed solid waste disposal sites: Municipal waste disposed on land – CH_4

77. Emissions of CH_4 from this source category amounted to 352.1 Gg in 2003. The source was selected as a key category on both level and trend assessment. The first-order decay (FOD) method has been applied, with some revisions and modifications of the parameters used in the calculation. Of these changes the most significant, because of its effect on the emissions estimates, is the revised k value (now 0.05, consistent with the IPCC good practice guidance). The ERT understands that Spain is undertaking research to improve understanding of the different waste streams and the relationship to half life. The length of the data series used for the emission estimates should be specified. The IPCC good practice guidance states that it is usually necessary to include data for between three and five half-lives in order to achieve an acceptably accurate result.

78. Until 1989, the amount of municipal solid waste (MSW) disposed annually at solid waste disposal sites (SWDS) was calculated by multiplying population by an estimated annual MSW generation rate. Although the NIR does not provide historical data on the amounts of MSW landfilled since 1989, Spain provided this information in response to an enquiry during the review. According to the NIR the amount of CH_4 recovery increased greatly, from 0 Gg in 1990 to 2,074 Gg in 2003. This increase appears to be very high. In response to an enquiry during the review, the Party also provided corrected data for the period 1992–2003 which showed that the figures reported in the NIR were not those for CH_4, but amounts of waste deposited in the waste disposal sites which recover biogas. The ERT understands that this will be corrected in Spain's future inventory submissions, and the methodology used for estimating the amount of CH_4 recovered should be described clearly in the NIR.

79. The CRF provides information on the industrial and domestic sludge incinerated, but it is not clear whether all sludge generated was incinerated or if some part was deposited in SWDS. Spain stated to the ERT that sludge generated was both incinerated and disposed in SWDS, and the sludge disposed was included in the amount of solid waste disposed used for estimating CH_4 emissions from SWDS. The ERT recommends that Spain provide this information on the destination of sludge and data handling of sludge disposed in estimating CH_4 emissions from this category in the NIR.

2. Waste-water handling – CH_4

80. This source category was selected as a key category by level assessment. Emissions of CH_4 from industrial waste-water handling amounted to 29.2 Gg in 2003, and emissions of CH_4 from domestic and commercial waste-water handling amounted to 68.9 Gg. The methodology used is derived from the Revised 1996 IPCC Guidelines and the EMEP/CORINAIR guidelines. The sources of the AD used are documented in the NIR, although information is not provided on the ratios of industrial and domestic/commercial waste water treated according to the different types of handling system, and it was not possible for the ERT to establish whether any part of industrial waste water was released into domestic sewers. EFs for domestic/commercial waste water and sludge handling have been estimated using the IPCC default value for maximum methane producing capacity (Bo). Explanations are needed to support some of the parameter values (e.g. methane conversion factor for each waste-water system, methane conversion factor for each sludge handling system). Spain provided the information on these parameters, and the ERT encourages Spain to provide this information in future NIRs to improve transparency.

3. Waste incineration – CO_2

81. In 2003 emissions of CO_2 from this source amounted to 177.8 Gg, and Waste Incineration was selected as a key category by the trend assessment. Incineration of industrial waste has been excluded owing to the difficulty of obtaining information on this activity. Spain is encouraged to rectify this in its future submissions. The NIR explains that emissions from the incineration of agricultural products are included in 4.F Field Burning of Agricultural Residues. However, the position is not entirely clear because these emissions do in fact appear to be incorporated in CRF table 6.C and in the totals reported for this sector. Spain should report emissions from the open burning of agricultural wastes under the Agriculture sector.

C. Non-key categories

1. Waste-water handling – N_2O

82. The estimated N_2O emissions (3.64 Gg) correspond to the discharge of human sewage into aquatic environments and have been estimated following the method given in the Revised 1996 IPCC Guidelines. Information should be provided in the Waste section of the NIR, if necessary cross-referenced to the LUCF section, as to whether some part of sewage sludge was applied to soils, and emissions from municipal waste-water treatment plants should be estimated.

2. Waste incineration – N_2O and CH_4

83. In 2003, emissions from this source amounted to 0.16 Gg N_2O and 4.85 Gg CH_4 (of which 4.82 Gg arose from agricultural residues, which should not be reported in this category). The methodology and EFs applied are taken from the EMEP/CORINAIR Guidebook. The information provided on this source category in the NIR and the CRF is very limited: for example, it was not possible for the ERT to establish whether the EF used for N_2O takes into account incinerator type. The ERT recommends that Spain improve the transparency of its reporting on this method and include information on the EFs and underlying assumptions in its NIR.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

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UNFCCC. 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/2004/8. Available at: <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

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UNFCCC secretariat. Status report for Spain. 2005. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2005_status_report_spain.pdf>.

UNFCCC secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2005. FCCC/WEB/SAI/2005. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2005_part_i_final.pdf>.

UNFCCC secretariat. Spain: Report of the individual review of the greenhouse gas inventory submitted in the year 2004. FCCC/WEB/IRI/2004/ESP. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2004_irr_desk_review_spain.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Antonio Ferreiro Chao, coordinator of the technical assistance to the Ministry of Environment for the compilation of national emissions inventories, and included additional material on the methodology and assumptions used, and underlying data.

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