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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF PORTUGAL SUBMITTED IN THE YEAR 2001[1]

(Desk review)

EXECUTIVE SUMMARY

1. This report contains the findings of the desk review of the greenhouse gas (GHG) inventory submitted by Portugal for the year 2001. For this review, the expert review team (ERT) examined Portugal's common reporting format (CRF) for 1990–1999, as well as the draft synthesis and assessment (S&A) report, status report and preliminary key source analysis[2] prepared by the UNFCCC secretariat.

2. The review was limited by the absence of a national inventory report (NIR). One of the principle findings of the ERT is that it is very important for Portugal to supply an NIR in its future submissions.

3. While recognizing that the scope of the review was limited by missing information, the ERT concluded that the CRF data reflected an inventory that was largely complete and appeared to be of good quality. Only a few emission sources were not estimated, as described in more detail in the sector-specific sections below, and for several sources, Portugal used higher tier methods.

4. It was not possible to assess the extent to which the IPCC good practice guidance had been implemented, because of the absence of documentation for the CRF. Portugal is encouraged fully to implement the IPCC good practice guidance. In addition, Portugal did not provide a key source analysis, nor any information about quality assurance/quality control (QA/QC) procedures. The ERT encourages Portugal to initiate work in both of these areas and to provide appropriate documentation in its NIR.

[1] In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not to the year of publication. The number (1) indicates that for Portugal this is a desk review report.

[2] The UNFCCC secretariat had identified, for each individual Party, those source categories which are *key sources* in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance). Key sources according to the tier 1 trend assessment were also identified for those Parties which provide a full CRF for the year 1990. The key sources presented in this report are based on the secretariat's preliminary key sources assessment. They might differ from the key sources identified by the Party itself.

I. OVERVIEW

A. Introduction

5. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, requested the secretariat to conduct, during the trial period, individual reviews of GHG. inventories for a limited number of Parties included in Annex I to the convention (Annex I Parties) on a voluntary basis, according to the UNFCCC guidelines for the technical review of GHG inventories from Parties, hereinafter referred to as the review guidelines.[3] The secretariat was requested to coordinate the technical reviews and to use different approaches to individual reviews, including desk reviews, centralized reviews and in-country reviews

6. The review of Portugal took place from 14 November 2001 to 8 March 2002. The desk review was carried out by a team of nominated experts from the roster of experts. Experts participating in the review were Ms. Dina Kruger (Generalist, USA), Mr. Javier Hanna Figueroa (Energy, Bolivia), Dr. Hugh Saddler (Energy, Australia), Ms. Irina B. Yesserkepova (Industrial Processes, Kazakhstan), Mr. William Kojo Ageymang Bonsu (Industrial Processes, Ghana), Mr. Luis Gerardo Ruiz Suarez (Agriculture, Mexico), Ms. Pascale Collas (Land-Use Change and Forestry, Canada), Mr. Francois Wencelius (Land-Use Change and Forestry, France), Ms. Maria Paz Cigaran (Waste, Peru), and Mr. Charles Russell (Waste, New Zealand). The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat). Ms. Dina Kruger and Ms. Irina B. Yesserkepova were lead-authors of this report.

7. In accordance with the UNFCCC review guidelines, a draft version of this report was submitted to the Government of Portugal for comments, which were then considered and incorporated, as appropriate, into the final report.

B. Inventory submission and other sources of information

8. Portugal did not submit an NIR in 2001.

9. In its 2001 submission, Portugal submitted CRF tables for the years 1990 to 1999.

10. Portugal did not submit any other sources of information for purposes of review. The ERT used the draft S&A report 2001, the preliminary key source analysis and the status report prepared by the secretariat. The ERT also used Portugal's response to the draft S&A report.

11. Other sources of information used during the review include: the preliminary guidance for experts participating in the individual review of GHG inventories, the UNFCCC reporting guidelines[4] and the review guidelines.

C. Emission profile, trends and key sources

1. Emission profile

12. Portugal has a fairly typical emission profile for an Annex I Party. The most important GHG is CO_2, (carbon dioxide) which in 1999 accounted for 72.3% of total emissions,[5] followed

[3] For the UNFCCC review guidelines and decision 6/CP.5, see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122 respectively.

[4] 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 (FCCC/CP/1999/7), are referred to in this report as the UNFCCC reporting guidelines.

by CH_4 (methane) at 16%, and N_2O (nitrous oxide) at 10.8%. By sector, energy accounted for 68.6% of total emissions, agriculture 15%, industrial processes 6.9% and waste 9.1%.

2. Emission trends

13. Tables 1 and 2 provide data on Portugal's emission trends over the period 1990–1999 by gas and sector, respectively. Over the period, CO_2 emissions (without land-use change and forestry (LUCF)) increased by 31%, and N_2O emissions increased by 12%. CH_4 emissions declined over the period by 1.5%. The energy sector had the highest growth rate, at 32%, followed by the industrial processes sector at 16% and the waste sector at 13%. In 1999, emissions from agriculture were 0.6% below their 1990 level.

Table 1. GHG emissions by gas, 1990–1999 (Gg CO_2 equivalent)

GHGs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent									
Net CO_2 emissions/ removals	40,140	41,807	45,449	44,162	44,594	47,399	45,748	47,977	51,069	53,190
CO_2 emissions (without LUCF)[a]	44,134	45,927	49,693	48,531	49,089	52,019	50,386	52,633	55,743	57,882
CH_4	12,881	12,897	12,751	12,463	12,707	12,678	12,655	12,737	12,703	12,686
N_2O	7,628	8,156	8,012	7,847	7,765	8,119	8,143	8,256	8,477	8,578
HFCs	0	0	0	0	0	0	0	0	0	0
PFCs	0	0	0	0	0	157	157	157	157	157
SF_6	0	0	0	0	0	1	1	1	1	1
Total (with net CO_2 emissions/ removals)	60,650	62,861	66,212	64.472	65,066	68,354	66,703	69,128	72,407	74,612
Total (without CO_2 from LUCF)	64,644	66,980	70,456	68,841	69,561	72,974	71,341	73,784	77,081	79,304

[a] LUCF = land-use change and forestry

Table 2. GHG emissions by sector, 1990–1999 (Gg CO_2 equivalent)

GHG SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent									
1. Energy	41,273	43,068	47,008	45,720	46,318	49,009	47,437	49,156	52,472	54,420
2. Industrial processes	4,743	4,714	4,552	4,582	4,420	5,017	4,962	5,527	5,390	5,513
3. Solvent and other product use	271	286	279	279	279	279	279	279	279	279
4. Agriculture	11,969	12,416	12,010	11,540	11,743	11,832	11,746	11,827	11,963	11,894
5. LUCF[a]	-3,994	-4,119	-4,244	-4,370	-4,495	-4,620	-4,638	-4,656	-4,674	-4,692
6. Waste	6,387	6,496	6,608	6,722	6,800	6,838	6,971	6.995.43	6,977	7,198
7. Other	0	0	0	0	0	0	0	0	0	0

[a] LUCF = land-use change and forestry

D. Key sources

14. Portugal did not conduct a key source analysis as part of its 2001 submission. The secretariat conducted a preliminary tier 1 key source analysis which identified 16 key source

[5] In this report, the term "total emissions" refers to the aggregate national emissions based on CO_2 equivalents excluding land-use change and forestry, unless otherwise specified.

categories
(level assessment) which are listed in table 3.

Table 3. Key sources Portugal: level and trend assessment (UNFCCC secretariat)[a]

Key source	Gas	Level assessment %	Cumulative total %	Contribution to trend %
Stationary combustion – oil	CO_2	26.5	27	2.3
Mobile combustion - road vehicles	CO_2	21.2	48	40.7
Stationary combustion – coal	CO_2	14.7	62	10.1
Solid waste disposal sites	CH_4	7.7	70	4.9
Cement production	CO_2	4.7	75	
Manure management	CH_4	3.8	79	9.5
Enteric fermentation in domestic livestock	CH_4	3.0	82	5.9
Indirect N_2O from nitrogen used in agriculture	N_2O	2.2	84	1.5
Animal production	N_2O	2.1	86	2.2
Direct N_2O emissions from agricultural soils	N_2O	2.0	88	1.0
Manure management	N_2O	1.6	90	
Mobile combustion – aircraft	CO_2	1.5	91	1.7
Stationary combustion – gas	CO_2	1.3	92	
Nitric acid production	N_2O	0.8	93	1.0
Mobile combustion - waterborne navigation	CO_2	0.6	94	
Wastewater handling	N_2O	0.6	95	
Non CO_2 stationary combustion – biomass	N_2O			2.1
Mobile combustion - road vehicles	N_2O			2.4
Road paving with asphalt	CO_2			1.6
Non CO_2 stationary combustion – biomass	CH_4			1.4
Ammonia production	CO_2			4.0
Rice production	CH_4			1.1
Waste incineration	CO_2			0.9

[a] see footnote 2 of this report

E. General assessment of the inventory

1. Completeness of reporting

CRF

15. Portugal submitted inventory data for the years 1990–1999 using the CRF of the UNFCCC reporting guidelines on annual inventories. The ERT identified some omissions in the 1999 CRF tables, including:

(a) In table 10 on emission trends, no emissions of HFCs were reported over the entire period. SF_6 and PFC emissions were reported as beginning only in 1995;

(b) *Energy sector:* There were gaps in tables 1.A(b) (sectoral background data for energy: CO_2 from fuel combustion activities - reference approach), and the associated tables 1.A(c) (comparison of CO_2 emissions from fuel combustion) and 1.A(d) (sectoral background data for energy: feedstocks and non-energy use of fuels) were not completed because updated data were not available. However they were completed in all years up to 1998. In addition, there were gaps in tables 1.B.1 (fugitive emissions from solid fuels) and 1.B.2 (fugitive emissions from oil, natural gas and other sources);

(c) *Industrial processes sector:* Sectoral background tables 2(II).C, E and 2(II).Fs2 were not provided for the time series. In addition, no data were reported in table 2(II) for the period 1990–1994, and there was a gap in table 2(I).

NIR

16. Portugal did not submit an NIR as part of its 2001 submission. As a result, the ERT could not assess the analysis underlying the estimates contained in the CRF.

2. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

17. The national inventory submitted by Portugal is not in conformity with the UNFCCC reporting guidelines because it did not include an NIR.

18. The data submitted for 1990–1999 appear to be consistent with the IPCC Guidelines. However, it was not possible to evaluate the emission methodologies to determine whether they are fully consistent with the IPCC Guidelines and good practice guidance, because necessary documentation had not been provided.

3. Cross-cutting issues

Verification and QA/QC approaches

19. No information was provided as to whether the inventory data were subject to any external verification or independent review procedures. In addition, no information was provided as to whether any QA/QC procedures were performed. Self-verification of estimates was not performed for the energy sector using the reference approach in 1999, because the required data were not available at the time of inventory compilation.

Recalculations

20. Recalculations were performed throughout the time series. Most changes were minor, but there were large differences (more than 25%) in CH_4 and N_2O emissions from waste. According to the draft S&A report 2001, changes due to recalculations were reported to be +12.2% for total CO_2 equivalent (with LUCF) and +13.6% (without LUCF). The underlying reasons for recalculations were provided in table 8(b) for some sources, but limited details were available and there was no description of the methods used to perform the recalculations. The ERT recommended that Portugal provide such information in an NIR.

Uncertainties

21. Portugal provided a qualitative uncertainty assessment.

Transparency

22. The lack of an NIR and the limited use of documentation boxes in the CRF resulted in an inventory submission which is not transparent.

F. Areas for further improvement

1. Issues identified by the Party

23. In its response to the draft S&A report, Portugal indicated that it is updating its estimates for GHG emissions from nitric acid production, cement production, ammonia production and

limestone and dolomite use in the industrial processes sector. Portugal also stated that it was updating its emission estimates from solvent and other product use. No additional information on improvements was provided.

2. Issues identified by the ERT

24. The most important improvement needed in Portugal's inventory is the provision of an NIR. Detailed recommendations by sector are provided below, followed by recommendations for cross-cutting improvements.

Energy

25. The ERT recommends further examination of the emission factors used by Portugal for liquid fuels in several subsectors. Portugal should also document the completeness of fugitive emission estimates from natural gas and improve the estimate if necessary.

Industrial processes

26. The ERT recommends that Portugal prepare a complete estimate of emissions from HFCs, PFCs and SF_6. These emissions are growing rapidly in other Annex I Parties; it is likely that they are also increasing in Portugal and could even be key sources. Portugal should also document the estimate of N_2O emissions from nitric acid production, which shows a very erratic trend.

Agriculture

27. The ERT recommends that Portugal provide better documentation of its livestock population characterization and provide more supporting information regarding its use of country-specific information. Several questions were raised in the draft S&A report regarding data and emission factors that were not adequately explained in Portugal's response.

LUCF

28. The ERT recommends that Portugal clarify its treatment of abandonment of managed lands (5.B) and explain why the forest and grassland conversion category is a net sink in Portugal when it is a net source in other Annex I Parties.

Waste

29. The waste sector requires further explanation, which the ERT recommends be made in an NIR. It is not clear how emissions were actually calculated in the solid waste disposal sites (SWDS) source category, and clearer explanations of the other source categories in this sector would add transparency and robustness to the submission. SWDS and wastewater handling are key source categories in the Portuguese inventory and therefore it is recommended that tier 2 methods be used to develop emission estimates.

Good practice

30. In the absence of an NIR, it is not possible to assess the extent to which Portugal has implemented the IPCC good practice guidance. The ERT encourages Portugal to implement the IPCC good practice guidance and to describe its progress in an NIR.

Verification and QA/QC

31. It is not clear whether any QA/QC procedures have been conducted on the inventory. Portugal is encouraged to conduct QA/QC in accordance with the IPCC good practice guidance.

Uncertainty

32. Portugal has not indicated whether any quantitative uncertainty analysis has been performed. The ERT encourages Portugal to conduct uncertainty analysis consistent with the IPCC good practice guidance and to provide information on its activities in an NIR.

Recalculations

33. Portugal has performed recalculations in all sectors in all years. Brief explanatory notes are provided for some of these recalculations in table 8(b), but many recalculations are not explained. There are several instances where the impact of recalculations is large (5–10% or more) and where the magnitude and direction of the recalculation varies substantially throughout the time series. The ERT cannot evaluate the quality or appropriateness of recalculations using the information provided, and strongly recommends that Portugal provide additional explanatory material in an NIR.

Key source analysis

34. The ERT recommends that Portugal conduct a key source analysis following the IPCC good practice guidance. The results should be reported in the NIR and used to prioritize inventory improvements.

II. ENERGY

A. Sector overview

35. In 1999, the energy sector accounted for 66.5% of Portugal's total gross emissions and 72.9% of total net emissions. Emissions of CO_2 from the energy sector, totalling 52,735 Gg represent 99,1% of total net CO_2 emissions and 91,1% of total gross CO_2 emissions.

36. The energy sector includes six key source categories: CO_2 emissions from stationary combustion - oil, CO_2 emissions from mobile combustion - road vehicles, CO_2 emissions from stationary combustion - coal, CO_2 emissions from mobile combustion - aircraft, CO_2 emissions from stationary combustion - gas, and CO_2 emissions from mobile combustion - waterborne navigation.

37. During the period 1990–1999, total CO_2 equivalent emissions from energy increased by 31.2%. By GHG, CO_2 emissions increased by 32.8% over the period, CH_4 emissions decreased by 15.8% and N_2O emissions increased by 23.9%. All the main sectors contributed to this growth, but it was particularly rapid in transport (1.A.3) and, to a lesser extent, in other sectors (1.A.4). Fugitive emissions from fuels are low, but also grew very rapidly during this period.

1. Completeness

38. With some exceptions, the CRF included estimates of most gases and sources from the energy sector, as recommended by the IPCC Guidelines. The exceptions were as follows:

(a) Portugal reported zero emissions for sector 1.A.5 Other from 1995 onward. No explanation was provided as to whether, and if so where, emissions from military activities were

reported. It was also unclear where emissions from the combustion and other oxidation of engine oil and other lubricants (which can be reported here) were in fact reported; it was noted that the assumption is used that 50% of fossil carbon in these products is stored (see table 1.A(d)), consistent with the IPCC Guidelines;

(b) The reference approach table 1.A(b) and associated tables 1.A(c) (comparison of reference and sectoral approaches) and 1.A(d) were not completed because updated data were not available for 1999. These tables were fully completed for 1998 and all earlier inventory years;

(c) In the fugitive emissions sector, small fugitive emissions from the natural gas transmission system were reported, but no emissions were reported from natural gas distribution. It is possible that the emissions reported in the subcategory for transmission may include both transmission and distribution emissions, but no explanation was provided;

(d) Regarding the fugitive emissions sector, in table 7s1 estimates of CO_2, CH_4 and N_2O from solid fuels were stated to be, respectively, partial and not estimated ("NE"), whereas table 1.B.1 (fugitive emissions from solid fuels) contained only zeroes and blank cells. It is understood that the designation in table 7s1 was correct up to 1994, in which year coal mining ceased in Portugal. Similarly, fugitive emissions of these three GHGs from oil and natural gas were reported as incomplete, incomplete and "NE" respectively, but table 1.B.2 contained no cells with "NE" entries, which should be used to indicate lack of completeness.

2. Methodologies, emission factors and activity data

39. Portugal used both the reference approach and the sectoral approach but, as noted above, the reference approach was not completed for 1999 because of data unavailability. Table summary 3s1 stated that a tier 2 method with CORINAIR was used for all combustion sectors except transport (1.A.3), where it was stated only that CORINAIR was used, with no information regarding the tier. Portugal stated that CORINAIR and tier 2 were used to estimate fugitive CH_4 emissions, whereas fugitive CO_2 emissions were reportedly estimated on a mass balance analysis. The latter statement presumably applies, to be precise, to the estimate of CO_2 emissions from petroleum refining, which account for 78% of total reported fugitive emissions from oil and gas.

40. The source of activity data was not specified, but is presumably national energy statistics. All values appear to be consistent with each other and plausible.

41. The CO_2 implied emission factors (IEFs) for solid and gaseous fuels in the various sectors appear to be consistent with IPCC default values. However, this was not the case for liquid fuels, for which CO_2 IEFs in electric power (1.A.1), manufacturing industries and construction (1.A.2) and transport (1.A.3) appear to be too low in many cases. Specific instances are described below and in the following section on key sources (see CO_2 from stationary combustion - oil).

(a) For electric power (1.A.1.a), the value for liquid fuels is very low (lower than the value for diesel as reported in table 1.A(b)). This would imply that little or no fuel oil is used in this subsector in Portugal, which is unlikely given that reported activity is 83 PJ of liquid fuels in this subsector, but possibly correct. It is noted that the draft S&A report 2001 commented on this value and that the Party has responded that the value is within the normal range, which is correct;

(b) For manufacturing industries and construction - chemicals (1.A.2.c), the value for liquid fuels was very low (lower than ethane), which would seem to be incorrect, even if it is

assumed that the 20.2 PJ of liquid fuel used in this subsector was all used as feedstock. The draft S&A report 2001 did not comment on this value;

(c) For transport (1.A.3), the value for diesel was lower than the IPCC default value, whereas the values for gasoline and jet fuel were higher. The draft S&A report 2001 did not comment on this value;

(d) In addition, the draft S&A report 2001 commented on the low value for the liquid fuels IEF in agriculture/forestry/fishing (1.A.4.c). The Party commented that the value is within the normal range. This is quite correct if the main fuel used is liquefied petroleum gas (LPG), which is probable;

(e) Implied CH_4 emission factors for all sectors were generally consistent with IPCC default values, with the exception of a few very high values in transport (1.A.3), such as 9 kg/TJ for jet fuel, 122 kg/TJ for residual oil in navigation and 115 kg/TJ for diesel in navigation;

(f) Implied N_2O emission factors for all sectors were generally consistent with IPCC default values, with the exception of significantly higher values for liquid fuels used in transport and other mobile equipment (in 1.A.4.c).

42. Summary table 3s1 stated that all emission factors for all three gases (including CO_2) are from CORINAIR.

3. Recalculations

43. Updated CRFs were provided for every year back to 1990. Recalculations affected estimated emissions in many sectors in which emissions were reported (for example 1.A.1, 1.A.2, 1.A.3, 1.A.4 and 1.B.2). However, table 8(b) for each year only reported methodology changes affecting categories 1.A.3 and 1.B.2, and did not explain the changes in the other sectors. Some of the recalculations in other subcategories were relatively large (for example 1.A.2 increased by 7.2% for 1997 and 5.6% for 1996). Moreover, the changes did not share a clear pattern (for example 1.A.3 is +8.8% for 1998 and -1.1% for 1996). The lack of consistency in recalculations raises questions as to whether the changes are internally consistent and reliable, and certainly suggests that more extensive and detailed explanation of the methodological changes is required.

4. Comparison between reference and sectoral approaches

44. No comparison can be undertaken because the reference approach was not compiled for 1999 due to the unavailability of the required data at the time of inventory compilation. Inspection of the sheets with parameter values (such as emission factors) but no activity data indicates that the reference approach method closely followed the IPCC Guidelines. It also indicates that CO_2 emission factors were consistent with the values used in the sectoral approach when appropriate allowance is made for oxidation factors.

B. Key sources

1. Stationary combustion: oil – CO_2

Completeness

45. All sub-sources were estimated. However, the reference approach table 1.A(b) and associated tables 1.A(c) and 1.A(d) were not completed because updated data were not available. These tables were fully completed for the 1990 to 1998 inventory years.

Methodologies, emission factors and activity

46. The tier 2 method, based on CORINAIR, was used for all sub-sources, with country-specific emission factors.

47. The source of activity data was not stated, but is presumably official national energy statistics.

48. The IEFs for liquid fuels in the various stationary combustion sectors were low relative to IPCC default values. They also appeared to be low as compared with the individual petroleum product carbon emission factors listed in table 1.A(b), which, in turn, were close to IPCC default values (slightly lower than IPCC default for diesel and residual fuel oil, slightly higher for LPG and gasoline). This suggests that CO_2 IEFs in 1.A.1 and 1.A.2 may in many cases be too low. The main examples are as follows:

(a) For 1.A.1.a, the value for liquid fuels was very low (lower than diesel), which is unlikely given that reported activity in this subsector is 83 PJ of liquid fuels, but possibly correct. It is noted that the draft S&A report 2001 commented on this value and that the Party has responded that the value is within the normal range, which is correct;

(b) For 1.A.2.c, the value for liquid fuels was very low (lower than ethane), which would seem to be incorrect, even if it is assumed that the 20.2 PJ of liquid fuel used in this subsector was all used as feedstock. The draft S&A report 2001 did not comment on this value.

Recalculations

49. Complete recalculations were provided for each year. Significant changes were made affecting energy industries (1.A.1), manufacturing industries and construction (1.A.2) and other sectors (1.A.4) in many years, but no explanation was provided for methodological changes affecting these sectors. The ERT suggests that further clarification is therefore required.

2. Mobile combustion: road vehicles – CO_2

Completeness.

50. All sub-sources of CO_2 from combustion of gasoline and diesel were estimated.

Methodologies, emission factors and activity data.

51. A CORINAIR method was used, with country-specific emission factors. The IEFs for gasoline and diesel (71.10 and 72.45 Gg/PJ respectively) were consistent with the carbon emission factors used in the reference approach (table 1.A(b)), which were 19.4 and 19.9 Gg C/PJ respectively. The diesel value was almost identical with the IPCC default value,

while the gasoline value was slightly higher than the IPCC default value. The source of activity data was not stated, but is presumably official national energy statistics.

Recalculations

52. Complete recalculations were provided for each year. Significant changes were made affecting transport (1.A.3). However, it cannot be determined - because the reporting format is not expressed in terms of key sources - whether the changes in 1.A.3 relate to road transport CO_2 emissions. The explanation provided referred only to international bunkers. The ERT recommends that Portugal provide further clarification.

3. Stationary combustion: coal – CO_2

Completeness

53. All sub-sources were estimated.

Methodologies, emission factors and activity data

54. The tier 2 method, based on CORINAIR, was used for all sub-sources, with country-specific emission factors. The IEFs for solid fuels varied widely between individual sectors in the energy industries and manufacturing industries and construction sectors. Presumably this reflects variations in the mix of different types of solid fuel in the various sectors. Since the reference approach was not completed, there was no information as to which individual solid fuel types are used in Portugal. Overall, IEF values were broadly consistent with IPCC default values. The source of activity data was not stated, but is presumably official national energy statistics.

Recalculations

55. Complete recalculations were provided for each year. Significant changes were made affecting sectors 1.A.1 and 1.A.2 (the sectors in which solid fuels are used) in many years, but no explanation was provided for the changes. It cannot be determined (because the reporting format is not expressed in terms of key sources) whether or not the changes in these sectors relate to emissions from solid fuel combustion. In any case, no explanation for the changes was provided. The ERT suggests that further clarification is therefore required.

4. Mobile combustion: aircraft – CO_2

Completeness

56. All sub-sources of CO_2 from combustion of aviation gasoline and jet fuel were estimated.

Methodologies, emission factors and activity data

57. A CORINAIR methodology was used, with country-specific emission factors. The IEF for jet fuel (72.43 Gg/PJ) was consistent (though not identical with the carbon emission factor used in the reference approach (table 1.A(b)), which was 19.9 Gg C/PJ. This was slightly higher than the IPCC default value of 19.5 Gg C/PJ. The source of activity data was not stated, but is presumably official national energy statistics.

Recalculations

58. Complete recalculations were provided for each year. Significant changes were made affecting sector 1.A.3. Because the reporting format is not expressed in terms of key sources, however, it cannot be determined to what extent the changes in 1.A.3 related to aircraft CO_2 emissions. The explanation provided referred only to international bunkers. The ERT therefore recommends that Portugal provide further clarification.

5. Stationary combustion: gas – CO_2

Completeness

59. All sub-sources were estimated.

Methodologies, emission factors and activity data

60. The tier 2 method, based on CORINAIR, was used for all sub-sources, with country-specific emission factors. The IEF for gaseous fuels was the same in all sectors and consistent with the carbon emission factor for natural gas used in the reference approach. It was also consistent with the IPCC default value for natural gas. The source of activity data was not stated, but is presumably official national energy statistics.

Recalculations

61. Complete recalculations were provided for each year. Significant changes were made affecting sectors 1.A.1 and 1.A.2 (the sectors in which gaseous fuels are mainly used) in many years, but no explanation was provided for methodological changes affecting these sectors. The ERT recommends that Portugal provide further clarification.

6. Mobile combustion: waterborne navigation – CO_2

Completeness.

62. All sub-sources of CO_2 from combustion of residual oil and diesel, were estimated. Use of coal in this sector was reported as not occurring ("NO").

Methodologies, emission factors and activity data.

63. A CORINAIR method was used, with country-specific emission factors. The IEF for diesel, 73.75 Gg/PJ, was higher than that reported for diesel used in road transport, and higher than the carbon emission factor for diesel used in the reference approach, as would be expected from the fact that marine diesel is a slightly heavier product than automotive diesel. The source of activity data was not stated, but is presumably official national energy statistics.

Recalculations.

64. Complete recalculations were provided for each year. Significant changes were made affecting sector 1.A.3. Because the reporting format is not expressed in terms of key sources, it cannot be determined to what extent the changes in 1.A.3 related to navigation CO_2 emissions. The only explanation provided referred solely to international bunkers. Some further clarification would therefore be useful.

III. INDUSTRIAL PROCESSES

A. Sector overview

1. Completeness

65. Almost all CRF tables were reported and the notation keys were used appropriately. However, tables 2(II).C, E and 2(II).Fs1 and 2(II).Fs2 were not completed. Portugal indicated that these tables were not filled in, but did not provide an explanation.

2. Methodologies, emission factors and activity data

66. Portugal used a hybrid of IPCC default and CORINAIR methods to estimate CH_4, N_2O and CO_2 emissions from mineral products (2.A), metal production (2.C) and CH_4 and N_2O emissions from the chemical industry (2.B). A combination of mass balance, IPCC default and CORINAIR methods were used for CO_2 emission estimates from the chemical industry (2.B). A description of the mass balance method was not provided.

67. IPCC default methodologies were used to estimate PFC emissions from metal production. The tier 2 method was, however, employed in estimates of SF_6 emissions from metal production. No emission estimates were reported for PFCs, HFCs and SF_6 under the subcategory 2.F, and table 2IIs1 indicates that 2.F is "NE".

68. No activity data were reported for HFC, PFC and SF_6 emissions from consumption of halocarbons and SF_6. This is a potential key source for most countries, and the lack of activity data indicates that Portugal's total GHG emissions are underestimated.

69. For subcategories 2.A (mineral products), 2.B (chemical industry) and 2.C (metal production), a hybrid of IPCC default and CORINAIR emission factors was used to estimate CH_4, N_2O and CO_2 emissions. Default emission factors were used for PFC emission estimates under 2.C (metal production). As with the methodological evaluation, emission factors for HFCs, PFCs and SF_6 were not provided. Relevant CRF tables were indicated as "not filled" in and no explanation was given.

3. Recalculations

70. Recalculations were reported in the 2001 submission for the period 1990 to 1998. Recalculated years were, however, wrongly reported as 2001 in the CRF tables instead of as the appropriate years (for instance 1996). In addition, no explanations were provided for changes in activity data, methods or emission factors, except for CO_2 emissions from ammonia production. In this case, Portugal indicated in the CRF tables that feedstock data had been used for emission estimates instead of ammonia production when the 2001 submission was prepared.

71. The aggregated nature of the recalculated values does not allow for proper examination regarding the extent of recalculations for key sources. More detailed information needs to be provided in the NIR. There were, however, no abrupt changes in the recalculated values.

B. Key sources

72. Portugal did not perform a key source analysis. However, the preliminary key source analysis performed by the secretariat indicated that CO_2 emissions from cement production, N_2O emissions from nitric acid production and CO_2 emissions from road paving with asphalt were the three key sources in the industrial processes category.

73. Portugal did not estimate emissions from the consumption of halocarbons and SF_6 (PFCs, HFCs, and SF_6). No explanation was provided regarding why these emissions were not estimated. The ERT notes that this is a potential key source due to the potential for rapid growth in emissions, and they should be estimated in future submissions.

1. 2.B.2 Nitric acid production – N_2O

74. The trend in N_2O emissions from this source was very erratic. Emissions decreased from 1992 to 1993 by 16.5%, and by 24.9% between 1993 and 1994. From 1994 to 1995, however, N_2O emissions rose by 59.2%. Portugal has acknowledged this situation and has indicated that it will improve the emission estimates in future reporting. Variations in an activity and their causes should be explained in an NIR.

2. Road paving with asphalt – CO_2

75. CO_2 emissions from road paving was a key source, accounting for 2.4% of national emissions in terms of trend analysis. There is no recommended IPCC methodology for developing an estimate for this source. The ERT recommends that Portugal give special consideration to preparing its estimate, given the significance of this source in the inventory.

IV. AGRICULTURE

A. Sector overview

76. Emissions from the agriculture sector were 11,968.9 Gg CO_2 equivalent in 1990, which represented 19.7% of national emissions. In 1999, emissions were 11,894.2 Gg CO_2 equivalent, representing 15.9%. The sector is responsible for four out of 15 key sources: direct N_2O emissions from soils, indirect N_2O emissions, CH_4 emissions from manure management, and CH_4 emissions from enteric fermentation in livestock.

1. Completeness

77. The inventory for the sector appeared to be mostly complete, but without an NIR to document the analysis completely, a final determination regarding completeness cannot be made. Savanna burning was reported as not applicable ("NA"). CO_2 emission removals from agricultural soils were reported as "NE". Portugal's response to issues raised in the draft S&A report regarding emissions from agricultural residues and the populations of some livestock categories indicates that there may be some pending completeness issues.

2. Methodologies, emission factors and activity data

78. The livestock population characterization (head of different livestock species) was consistent among different sources (that is CH_4 from enteric fermentation, CH_4 from manure management and N_2O from manure management). No explanation was given about how gaps in livestock population data were filled, and so it is unclear whether interpolation or another method was used.

79. A combination of default and country-specific emission factors was used, but their quality and appropriateness cannot be assessed in the absence of additional documentation.

B. Key sources

80. Without an NIR and with little use of the documentation box, very little can be done in addition to the draft S&A report. Some answers to the draft S&A report are too short and do not provide sufficient additional explanation. For example, rather than respond that the country "used official data provided by the National Agriculture Ministry", a direct response to the issue raised should be provided. In addition, sheep population data were too small compared with statistics established by the United Nations Food and Agriculture Organization (FAO). Portugal should explain this wide difference, since FAO data were also provided by the country.

81. With other reviewed countries, in most cases issues raised about the IEFs for livestock emissions were answered by reference to country-specific population distribution between feeding and manure management systems. The significance of country-specific conditions makes it even more essential for Portugal to provide proper documentation.

C. Non-key sources

82. Without an NIR and with little use of the documentation box, very little can be added to the draft S&A report.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

1. Completeness

83. Only table 5 was provided in the CRF. Estimates were not provided for the categories abandonment of managed lands (5.C) and emissions and removals from soils (5.D). Removals from abandonment of managed lands were indicated as "reported elsewhere". The ERT assumes that this category is included under the categories changes in forest biomasss stocks or forest and grasslands conversion. The latter was reported as a net sink, although no information was provided. Explanations should be provided in table 9s1 (see the discussion of forest and grassland conversion in paragraph 90 below).

84. Emissions and removals from soil categories were not estimated due to an insufficient characterization of processes, as indicated in table 9s1.

85. Estimates of non-CO_2 gases were not included in LUCF totals. However, forest fire emissions of CH_4 and N_2O were reported in table 9 as an information item under "additional GHG emissions". Portugal indicated that these emissions were included in LUCF totals in the past, and the rationale for now excluding them is that there is a lack of clear guidance from the IPCC on this issue and it is difficult to assess the origin of forest fires. The ERT recognizes that the IPCC Guidelines does not provide clear guidance on the question of forest fires except for forest clearing or prescribed burns. Non-CO_2 emissions, however, cannot re-enter the C cycle in forests and they are also important greenhouse gases. The ERT therefore encourages Portugal to collect, to the extent possible, fire data distinguishing human-induced from natural fires and to include non-CO_2 emissions from human-induced fires in the national GHG emission totals.

2. Methodology, emission factors and activity data

86. Default IPCC methods and emission factors were used for 5.A and 5.B although no activity data or emission/growth factors were reported.

3. Recalculations

87. As indicated above, non-CO_2 emissions from forest fires were previously reported under LUCF and are now excluded from LUCF totals. No explanation was provided. As a result, in 1990 the LUCF sector was a net sink of 3,994 Gg CO_2 equivalent after recalculation, as opposed to a net sink of 2,750 Gg CO_2 equivalent in previous submissions. This change resulted in an increase of about 45% in the 1990 sink, and an increase of about 31% in 1998.

B. Specific source and sink categories

1. 5.A Changes in forest and other woody biomass stocks

88. Managed forests were reported to be a net sink of 2,757 Gg CO_2 in 1999 and 2,082 Gg CO_2 in 1990. Net removals increased by about 5 to 6% annually between 1990 and 1995 and increased with remarkable steadiness by 0.5% per year from 1996 onwards. A possible explanation is that the 0.5% increase is the result of changes in stocks averaged over a multi-year period. The exact reasons cannot be determined, however, in the absence of any details as to how growth rates were obtained from the forest inventory.

89. Those estimates which presumably represent net removals (for example forest growth less emissions due to mortality, harvesting and so on) should be reported in the net column of table 5, not the gross removals column.

90. Forest fire emissions of CH_4 and N_2O, while not included in LUCF totals, were estimated at 1,244 Gg CO_2 equivalent in 1990 or about 2% of net total national emissions, which is not an insignificant source. This source amounted to 546.34 Gg CO_2 equivalent in 1999 or 1% of net national total emissions.

2. 5.B Forest and grassland conversion

91. This category resulted in net removals whereas it usually leads to net emissions. In the absence of any explanation provided by Portugal, the ERT assumed that category 5.C, abandonment of managed lands (for which an estimate was not reported) may be included under forest and grassland conversion, which could explain the result. Temperate forests amounted to a net sink of 1,934.4 Gg CO_2 in 1999 as compared to 1,912 Gg CO_2 in 1990, an increase of just over 1%.

VI. WASTE

A. Sector overview

92. Emissions from the waste sector represented 9.1% of Portugal's GHG emissions in 1999 and there has been a 12.7 % increase in emissions since 1990. Emissions of the three main GHGs were reported along with the precursor gases in the sectoral report (table 6) which was complete. Tables 6.A (solid waste disposal), 6.C (waste incineration) and the additional information table were completed, as was table 6.B (wastewater handling). There were two key sources within this sector: solid waste disposal on land and wastewater handling.

1. Completeness and transparency

93. An NIR was not submitted; however the sectoral background tables were completed and the correct notation keys used where appropriate. There were some notes embedded in the CRF

documentation boxes, and the summary reports for methods and emission factors used and the completeness tables were filled in.

2. Methodology, emission factors and activity data

94. For CO_2 emissions from waste incineration, a mass balance method was used. The IPCC default methods were used for CH_4 emissions from SWDS, wastewater handling and waste incineration, and the IPCC default methodology was also used for N_2O emissions from waste incineration. Default and country-specific emission factors were used for CH_4 emissions from SWDS and wastewater handling. CORINAIR and IPCC default values were used for waste incineration for emissions of CH_4 and N_2O.

3. Recalculations

95. Recalculation tables were completed for all years. There were substantial differences between the 1999 data and previous submission, ranging from reductions of 50% for CO_2 to reductions of 78% for N_2O in all three reported waste source categories. Although there was some information provided in table 8(b), further explanation is required for these significant differences.

B. Key sources

1. Solid waste disposal sites (SWDS)

Emission trends

96. Methane emissions from this source category have increased by an average of 2.9 Gg a year since 1990; the trend was steady until 1998, when there was a slight decrease (of approximately 1 Gg). However, there was an increase of approximately 4.5 Gg in 1999. This growth represented an annual increment of only 1.1%, with an overall increase of almost 10%. Emissions per capita have increased by 6.1%, the waste generation rate has increased by 41% and the fraction of municipal solid waste (MSW) deposited to SWDS has increased by 10% since 1990, although the profile of what is in the SWDS (composition of landfilled waste) was constant over the period.

97. Emissions per capita were on the high side, although comparable to many Annex I Parties. The large fraction of DOC in MSW was the probable cause of the high emissions, although this is an example of where an NIR would assist transparency. Portugal noted in the CRF that industrial wastes were poorly documented.

Methodology, emission factors and activity data

98. The method used seems to be the default IPCC tier 1 approach; there were, however, a number of inconsistencies in the background tables. The emission factors used were IPCC default values, and activity data (additional information table) were country-specific, differing from the IPCC default values for Portugal. Calculating the MSW per capita gave a total of 3,504.0 Gg (population x waste generation rate per capita per day x 365) of which 99% was sent to SWDS. The total value reported in table 6.A. was 3,114.3 Gg. In addition, no information was provided about the allocation between managed and unmanaged waste disposal sites. A clear explanation of how this calculation was made is necessary.

99. The fraction of DOC in MSW did not seem to match the figures used in the waste composition and it is recommended that this be further explained.

100. The large amount of industrial waste disposal to land requires further explanation and details.

2. 6.B Wastewater handling

Emission trends

101. Methane emissions from this source have increased by 16.5% since 1990 and represented 0.6% of Portugal's emissions in 1999. The increase has been steady and suggests that it matched the increase in economic and population growth in the country over this period.

Methodology, emission factors and activity data

102. The default IPCC method was used, along with default and country-specific emission factors. Activity data for industrial wastewater were not included. Based on the documentation box for SWDS, this is presumed to be because there were no data available providing sufficient detail.

C. Non-key sources

1. Waste incineration

Emission trends

103. Emissions from waste incineration increased by 1333% from 1990 to 1999, the major part of this increase occurring between 1998 and 1999 (approximately 0.2% of total emissions). There was no explanation for this in the recalculation tables; in the in-depth review of the second national communication of Portugal (FCCC/IDR.2/POR), however, there was a clear explanation. In 1999, Portugal's first incineration plant was commissioned for Lisbon and the surrounding area, with a capacity of 600 kt per year. This was confirmed by the Portuguese response to the draft S&A report.

Methodology, emission factors and activity data

104. The mass balance method was used for calculating CO_2 emissions, and the IPCC default method for emissions of CH_4 and N_2O. IPCC default and CORINAIR emission factors were used, although which emission factors applied to the two sub-sources was unspecified. The activity data were reported; a clearer explanation could have been provided, however, since this was a new source and the method used was not transparent.

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