UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2005/PRT
22 February 2006

ENGLISH ONLY

# Report of the individual review of the greenhouse gas inventory of Portugal 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 Portugal, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 10 to 15 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Mr. Ignacio Sánchez García (Spain) and Mr. Audun Rosland (Norway); Energy – Mr. Scott McKibbon (Canada), Mr. Hristo Vassilev (Bulgaria) and Mr. Hongwei Yang (China); Industrial Processes – Mr. Menouer Boughedaoui (Algeria) and Mr. Manfred Ritter (Austria); Agriculture – Mr. Sergio González (Chile) and Ms. Lilian Portillo (Paraguay); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Charalampos Petsikos (Greece) and Ms. María José Sanz Sánchez (Spain); Waste – Mr. Seungdo Kim (Republic of Korea) and Ms. Tatiana Tugui (Republic of Moldova). Mr. Sergio González and Mr. Audun Rosland were the lead reviewers. The review was coordinated by Mr. Sergey Kononov and Ms. Astrid Olsson (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 Portugal, 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, Portugal submitted a complete set of common reporting format (CRF) tables for the years 1990–2003, including the LULUCF CRF tables as required by decision 13/CP.9, and a national inventory report (NIR). Where needed the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other information (see the annex to this report).

## C. Emission profiles and trends

4. In 2003, the most important GHG in Portugal was carbon dioxide ($CO_2$), contributing 79.2 per cent to total[1] national GHG emissions expressed in $CO_2$ equivalent, followed by methane ($CH_4$), 14.9 per cent, and nitrous oxide ($N_2O$), 8.0 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride ($SF_6$) taken together contributed 0.1 per cent to the overall GHG emissions in the country. The Energy sector accounted for 73.0 per cent of total GHG emissions, followed by Agriculture (10.2 per cent), Industrial Processes (8.2 per cent) and Waste (also 8.2 per cent). Total GHG emissions amounted to 81,157 Gg $CO_2$ equivalent in 2003 and had increased by 36.7 per cent between 1990 and 2003, mainly driven by growth in the production and use of energy. The trends for the different gases and sectors appear to be reasonable and well explained in the NIR.

## D. Key categories

5. Portugal has reported a key category tier 1 analysis, both level and trend assessment, including a quality assessment, as part of its 2005 submission. The key category analyses performed by the Party

[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.

and by the secretariat[2] produced similar results. Portugal has performed a more disaggregated analysis and included some more categories due to a quality assessment, such as HFCs and $SF_6$ emissions (from Consumption of Halocarbons and $SF_6$). Portugal has included the LULUCF sector in its assessment of the key categories, but not entirely according to Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as IPCC good practice guidance for LULUCF). The ERT recommends that Portugal follow that guidance when including LULUCF in its key category analysis. Portugal is also encouraged to implement a tier 2 key category analysis and to use it to prioritize the development of the inventory. During the review, Portugal informed the ERT that it plans to implement a tier 2 method for the determination of key categories in the preparation of its next inventory.

## E. Main findings

6. The ERT finds Portugal's inventory in general both transparent and comprehensive. Portugal has established a well-functioning institutional arrangement for the preparation of the inventory, including a quality assurance/quality control (QA/QC) plan. The CRF and the NIR include sufficient information for a thorough review of the methodologies and assumptions used. However, the structure of the NIR is not fully consistent with the structure outlined 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). Furthermore, some emission categories are not included, such as Soda Ash Production and Use – $CO_2$; Natural Gas Transportation – $CH_4$; Solvent and Other Product Use – $N_2O$; and Potential Emissions of HFCs, PFCs and $SF_6$.

## F. Cross-cutting topics

### 1. Completeness

7. Portugal's inventory is generally complete in terms of geographical coverage and coverage of sources and gases. Portugal has provided the LULUCF reporting tables as required by decision 13/CP.9. However, the LULUCF sector does not include emissions and removals from the two autonomous regions of Madeira and the Azores Islands. The ERT encourages the Party to initiate studies to estimate emissions and removals of GHGs from the whole national territory.

8. Some sources are not estimated ("NE") in the inventory, the most important being Solvent and Other Product Use – $N_2O$; and Potential Emissions of HFCs, PFCs and $SF_6$. With regard to LULUCF, the NIR and the CRF only provide estimates for Forest Land. Emissions and removals from other LULUCF categories are reported as "NE" or not occurring ("NO"). The ERT encourages Portugal to investigate the possibility of estimating emissions for all the source categories reported as "NE". During the review, Portugal informed the ERT that it plans to include many of these categories in next year's submission.

### 2. Transparency

9. The ERT finds the NIR and the CRF in general both transparent and comprehensive. The NIR follows the structure set out in the revised UNFCCC reporting guidelines and includes information on

[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.

emissions, key categories, the methods and data sources used, the completeness of the inventory, uncertainty estimates, and general QA/QC and verification procedures. However, the ERT recommends that Portugal give a more comprehensive description of the QA/QC procedures, including subsections on QA/QC and verification, in the sectoral chapters.

10. There are some inconsistencies between the NIR and the CRF with regard to the descriptions of methodologies used. For example, for Solid Fuels the NIR states that a tier 1 methodology was used, while table Summary 3 in the CRF states that a tier 2 methodology was used. Similar inconsistencies can be found for Consumption of Halocarbons and $SF_6$. The ERT recommends that Portugal describe the methodologies consistently in the NIR and the CRF in its future submissions.

11. The CRF uses the notation keys extensively but not always correctly and consistently. For example, Portugal uses "0.00" frequently as a notation key to show emissions that are less than 0.005 Gg. However, it should be used only if the estimate is an actual zero. Otherwise a number, even if very small, or "NE" or "NO", should be reported, depending on the situation. Portugal plans to correct this in its next submission. Further, data related to Soda Ash Production and Use is reported as included elsewhere ("IE") and "0.00" in Table 2(I).A-G, while Table 9 states that this source is not estimated ("NE"). Portugal is recommended to clarify this inconsistency in its next submission.

### 3. Recalculations and time-series consistency

12. Portugal has recalculated the time series 1990–2002 to take into account changes in methodology, emission factors (EFs) and activity data (AD). The major changes include: the revision of AD from large point sources; the updating of energy data for cement production; changes to the method and AD used for agriculture soils; and changes to the method, EFs and AD used for solid waste disposal.

13. The rationale for these recalculations is provided in table 8(b) of the CRF. A chapter on the implications of the recalculations is included in the NIR, but without any explanations of the reasons for the different recalculations as recommended by the revised UNFCCC reporting guidelines. In the ERT's judgement, however, the recalculations are sufficiently justified in the CRF. However, the ERT recommends that Portugal include this information in the NIR as well.

14. The effect of the recalculations is an increase in the estimates of total emissions in 1990 and 2002, by 2.6 per cent and 5.1 per cent, without LULUCF, respectively. The recalculations accentuate the increasing trend, from 41.0 per cent over the period 1990–2002 according to the 2004 NIR to 44.4 per cent over the same period in the 2005 NIR.

### 4. Uncertainties

15. Portugal has performed an uncertainty analysis using the tier 1 level and trend assessments as set out in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The uncertainty assessment is described and documented in the NIR. However, the ERT recommends that Portugal include a more systematic description of how it uses its uncertainty analysis to prioritize further improvements. During the review, Portugal informed the ERT that the uncertainty analysis has already led to improvements in the methodology for estimating emissions of the fluorinated gases (F-gases) (HFCs, PFCs, $SF_6$) and $CH_4$ from manure management.

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

16. Portugal has developed a plan for QA/QC as an integral part of the National System, under Article 5.1 of the Kyoto Protocol for the Inventory of Emission by Sources and Removals by Sinks of Air

Pollutants (SNIERPA). The NIR includes a short summary on that QA/QC plan. Portugal plans to give detailed information on the new QA/QC procedures in its next submission.

6. Follow-up to previous reviews

17. The methodologies used for some categories have been improved compared to last year's submission, e.g. changed methods for road transportation to correct for duplication of $CO_2$ emissions estimates from NMVOC evaporative emissions and changed method and use of AD for agriculture soil. Portugal has developed a QA/QC plan, performed a tier 1 uncertainty analysis and revised the level of disaggregation in its key category analysis, as recommended by the 2004 in-country review.

### G. Areas for further improvement

1. Identified by the Party

18. The key improvements identified by Portugal are greater completeness and a tier 2 key category analysis including LULUCF.

2. Identified by the ERT

19. The ERT identified the following cross-cutting issues for improvement:

(a) Improvement in the completeness of the inventory, such as $CH_4$ from natural gas transportation and potential emissions of HFCs, PFCs and $SF_6$;

(b) More extensive use of higher-tier methods for key categories, depending on available resources and AD;

(c) A more comprehensive description of the QA/QC procedures, including subsections on QA/QC and verification, in the sectoral chapters;

(d) Correct use of the notation keys in the CRF.

20. Recommended improvements relating to specific source/sink categories are presented in the relevant sectoral sections of this report.

## II. Energy

### A. Sector overview

21. In 2003, total GHG emissions from the Energy Sector amounted to 59,270 Gg $CO_2$ equivalent, making it the largest source of GHG emissions in Portugal, with 73.0 per cent of the national total. The Transport and Energy Industries categories each contributed 24.8 per cent to total national GHG emissions, followed by Manufacturing Industries and Construction with 13.4 per cent. Energy sector emissions increased by 46.7 per cent between 1990 and 2003. In 2003, emissions from the Transport sector for the first time slightly exceeded those from Energy Industries, making Transport the largest source of emissions in the Energy sector.

22. The reporting is transparent. Detailed information on the emissions estimates is provided in the NIR for most of the source categories with a few exceptions: only aggregated data are reported for a few source categories in Manufacturing Industries for confidentiality reasons. The CRF covers all sources and gases in the Energy sector. The methodology, AD and EFs used for the estimates of all source categories are described in the NIR.

23. Recalculations have been done for the whole time series and are explained in the CRF. The recalculations result in decreases in the estimates of base year (1990) emissions of $CO_2$, $CH_4$ and $N_2O$ from the sector – by 1.6 per cent, 6.2 per cent and 1.0 per cent, without LULUCF, respectively – while for the year 2002 they result in an increase in $CO_2$ emissions, by 0.5 per cent, and decreases in emissions of $CH_4$ and $N_2O$, by 13.0 per cent and 4.7 per cent, respectively.

24. Portugal mentions in the NIR that a tier 2 method was applied to the estimates of key categories in the Energy sector where the AD were collected through a bottom–up approach from large point sources. However, IPCC default EFs have been used in most cases. The ERT encourages Portugal to consider using country-specific EFs at least for the key source categories.

## B. Reference and sectoral approaches

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

25. $CO_2$ emissions from fuel combustion have been calculated using the reference and the sectoral approaches. For the year 2003, there is a difference of 6.7 per cent in the $CO_2$ emissions estimates between the reference and the sectoral approaches. For the time series as a whole, the difference between the two approaches ranges from 3.1 per cent to 10.9 per cent. Portugal explained that the use of a bottom–up method and possibly incomplete coverage of emissions from lubricants in the sectoral approach are the main reasons for the difference; however, it was not clear to the ERT how these two reasons can be responsible for such a difference between the two approaches. The ERT encourages Portugal to provide more information that can explain the differences between the two approaches.

26. For fuel consumption, the difference between the two approaches is most apparent in the case of liquid fuels. All fossil fuels in Portugal are imported, and the emissions estimates are therefore very sensitive to the statistical errors of fuel import/export, which are usually larger than the other statistical errors.

### 2. International bunker fuels

27. Data on international and domestic aviation and navigation fuel consumption are collected by the General-Directorate of Geology and Energy (DGGE) in its energy statistics, and the domestic/international split is available for the whole time series.

28. There is an inconsistency in the information given on fuel quantities for international bunkers: the fuel quantities reported in table 1.A(b) do not correspond to those given in table 1.C for gasoline and jet kerosene. The values given in table 1.A(b) are only 4.4 per cent and 45.4 per cent of those given in table 1.C for gasoline and jet kerosene, respectively. During the review, Portugal explained that different definitions of international/national bunkers are used in tables 1A(b) and 1C. In addition, Portugal has reported consumption of lubricants as “NE” in table 1.C, while consumption data are provided in table 1.A(b). The ERT recommends that Portugal improve the consistency of the CRF tables for its next submission.

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

29. All crude oil is imported in Portugal, but Portugal also imports and exports secondary fuels such as gasoline, lubricants and naphtha. Because large amounts are exported, the quantities of feedstocks and non-energy use of some fuels shown in table 1.A (d) are much higher than the apparent consumption shown in the reference approach, table 1.A (b).

## C. Key categories

### 1. Stationary Combustion: oil, coal, gas – $CO_2$

30. Portugal calculates emissions from large power stations and oil refinery plants through a bottom–up approach using plant-specific AD where possible. Smaller power stations are grouped together and their emissions estimated using aggregated AD from the DGGE statistics. In both cases, IPCC default EFs have been used. Where applicable, the ERT recommends that Portugal use its country-specific EFs for these key source categories.

### 2. Mobile Combustion: Road vehicles – $CO_2$, $N_2O$

31. Portugal uses a model to calculate GHG and air pollutant emissions from road transportation. A sharp change in the fuel consumption of diesel oil for road transportation occurred between 1990 (76,887 TJ) and 2003 (179,021 TJ) – an increase of 132.8 per cent over the period, resulting in an increase in $CO_2$ emissions by 132.3 per cent. Gasoline consumption for road transportation increased only by 43.9 per cent, from 64,005 TJ in 1990 to 92,128 TJ in 2003. During the review, Portugal explained that the volume of road transportation has increased dramatically in the country and the number of vehicles per person has been steadily growing. Diesel fuel consumption has increased, in particular due to a rapid increase in the number of diesel-fuelled vehicles, particularly light-duty vehicles (LDVs) which are also used as passenger cars; at the same time, gasoline consumption has increased much less because gasoline-fuelled vehicles may be driving fewer miles or because old passenger cars may be being scrapped at a faster rate than older vehicles in the national fleet as a whole. The ERT recommends that Portugal include such explanations in its NIR.

### 3. Mobile Combustion: Waterborne Navigation – $CO_2$

32. The $CO_2$ implied emission factor (IEF) for gas/diesel oil for Navigation decreased by 1.7 per cent from 1990 to 2003 (from 75.4 to 74.1 t/TJ), which is a larger change than in other countries. During the review Portugal explained that this is the result of a reporting error: part of the residual fuel oil used in national navigation is erroneously reported as gas/diesel oil, which has a higher EF (76.6 kg/GJ). The ERT recommends that Portugal improve the estimates by allocating fuel consumption in this category correctly.

### 4. Fugitive emissions: Oil and natural gas – $CO_2$, $CH_4$

33. There is no oil and natural gas production in Portugal. All the fugitive emissions in this category arise from the downstream processes after exploration. Emissions from a few subcategories have not been estimated (the notation key "NE" is used for natural gas leakage at industrial plants and power stations, in the Residential and Commercial sectors, and for the venting and flaring of oil and gas). When resources are available, Portugal is encouraged to report these estimates in order to improve the completeness of its Energy sector inventory. Portugal is also encouraged to either provide data or notation keys in the empty cells in the CRF table 1.B.2.

## D. Non-key categories

### Fugitive emissions: Coal Mining and Handling – $CH_4$

34. The only two coal mines in Portugal were closed in 1992 and 1994, so there have been no fugitive emissions from coal mining and handling since 1994. However, the ERT noted that $CH_4$ emissions from abandoned mines may still continue after mine closure, even if the mines are sealed, as the IPCC good practice guidance recognizes. The ERT encourages Portugal to estimate these emissions when the IPCC method for abandoned mines becomes available.

# III. Industrial Processes and Solvent and Other Product Use

## A. Sector overview

35. In 2003, emissions from the Industrial Processes sector in Portugal were 43.9 per cent higher than in 1990 and amounted to 6,641 Gg $CO_2$ equivalent, or 8.2 per cent of total national emissions. The main emission sources in the sector were Mineral Products and Chemical Industry, contributing 63.2 and 35.3 per cent, respectively, to total sectoral emissions. Between 1990 and 2003 emissions increased by 24.4 per cent for Mineral Products and 94.1 per cent for Chemical Industry. Emissions from Solvent and Other Product Use increased by 44.7 per cent from 1990 to 2003, 318 Gg $CO_2$ equivalent in 2003.

36. The CRF includes estimates of most gases and sources from this sector. Not included are potential emissions of HFCs, PFCs and $SF_6$. Actual emissions of PFCs have not been estimated, and only partial estimates of actual emissions of HFCs have been provided for a number of source categories. $CO_2$ emissions from asphalt roofing and $N_2O$ emissions from solvent and other product use are reported as not estimated. The ERT encourages Portugal to proceed with the improvements it plans and to provide estimates for these sources.

37. Extended information is given in the NIR following up on previous review findings. The ERT acknowledges the improvements that have been made to the transparency of the methodology used for estimating sources that are based on operator reports which include confidential data.

## B. Key categories

### 1. Cement Production – $CO_2$

38. Portugal uses an IPCC tier 2 method to estimate emissions from cement production based on clinker consumption and a default lime (CaO) content of 64.6 per cent. The ERT encourages Portugal to use a country-specific CaO content as indicated in the NIR section on further improvement.

39. The NIR states that the data on clinker production for 2002 were revised after more accurate data were received from operators. During the review, Portugal informed the ERT that the revision of the data on clinker production for 2002 was done because in the previous submission the data were a forecast made from incomplete information. The ERT encourages Portugal to report on data improvement in its next NIR, including information on how the revised data may have affected the time series consistency.

### 2. Ammonia Production – $CO_2$

40. Portugal uses an IPCC tier 2 method based on feedstock consumption (vacuum residual fuel oil). The CRF, however, does not provide ammonia production as the AD because data on feedstock consumption and ammonia production are confidential. The changes in production of the only domestic ammonia plant cause considerable inter-annual changes in the $CO_2$ emissions. To avoid breaches of confidentiality, the NIR only presents the trend of ammonia production relative to 1990. This trend corresponds well to the trend in emissions, thus giving a good example of increased transparency despite the confidentiality of production data.

### 3. Nitric Acid Production – $N_2O$

41. Following up on previous review findings, the NIR presents updated AD and a revised EF based on measurements from one nitric acid plant. The revised EF is used for the two other production sites in Portugal as well. However, contrary to the IPCC good practice guidance, this does not account for the abatement technology employed at each facility, and this may lead to emissions being overestimated. The ERT recommends that Portugal develop country-specific EFs by obtaining plant-level data for all three plants, as the Party plans to do.

### C. Non-key categories

1. Ferroalloys Production – general

42. The methodology is based on the assumption of constant production for all years since 1990 and on an IPCC default EF. The ERT supports Portugal in its plans to revise the production data and individualize ferroalloys by considering specific emission sources.

2. Consumption of Halocarbons and $SF_6$ – HFCs, PFCs, $SF_6$

43. Several emission sources are not yet included in this category – Aerosols, Solvents, Fire Protection, and Potential Emissions of HFCs, PFCs and $SF_6$. The ERT encourages Portugal to estimate these emissions.

## IV. Agriculture

### A. Sector overview

44. In 2003, GHG emissions from the Agriculture sector amounted to 8,295 Gg $CO_2$ equivalent, or 10.2 per cent of total national emissions (compared to 15.0 per cent in 1990). In 2003, the sector accounted for 38.7 per cent of national $CH_4$ emissions and 67.1 per cent of national $N_2O$ emissions.

45. The CRF tables include estimates for all emission sources. A complete set of tables is reported for all years. The Party's key category analysis by sector produced results comparable to the secretariat's analysis, the differences depending on whether categories are level and/or trend assessed.

46. The NIR is well structured, although a more detailed description of country-specific methodologies is needed. The ERT encourages Portugal to estimate emissions from cattle and sheep using a tier 2 method.

### B. Key categories

1. Enteric Fermentation – $CH_4$

47. Portugal has estimated emissions using a tier 1 method along with default EFs (referenced to Western Europe, temperate climate and developed country conditions) for all livestock categories.

48. Some differences between the information in the inventory and the data of the Food and Agriculture Organization of the United Nations (FAO) were found for populations of sheep, horses, mules and asses. For sheep, lambs seem not to be included in the AD – an issue that has been addressed in previous reviews. Portugal noted that this correction has not been applied because it is not clear whether the default EF allows for the seasonal variation in sheep numbers, and the issue is still being discussed under the Methodological Development Plan. The ERT encourages Portugal to resolve this issue in time for its next submission.

2. Manure Management – $CH_4$

49. For $CH_4$ emissions, Portugal has applied an IPCC tier 2 method along with a mixture of country-specific and default EFs. Portugal has included the impact of climatic conditions (temperate and cool) in its emission estimates.

50. The $CH_4$ IEFs for the different animal species differ significantly from the IPCC default EFs. Portugal explained that it uses country-specific values for quantities of manure produced per animal and animal waste management system (AWMS) share. Even so, the ERT encourages Portugal to include a more detailed description of the methodology and the supporting data in its next submission.

### 3. Manure Management – $N_2O$

51. For $N_2O$ emissions, Portugal used a tier 2 method together with country-specific and default EFs. The nitrogen (N) excretion rates for dairy and non-dairy cattle, sheep and poultry differ significantly from the IPCC default values, and Portugal explains in the NIR that these rates are being revised. The ERT welcomes this effort and encourages Portugal to continue this work.

### 4. Agricultural Soils – $N_2O$

52. $N_2O$ emissions from agricultural soils have been estimated using a tier 1 method and IPCC default EFs. Country-specific values were used for $Frac_{NCRO}$, $Frac_{NCRBF}$; $Frac_{BURN}$, $Frac_{GASF}$, $Frac_{NCRBF}$, and $Frac_R$. The ERT encourages Portugal to use the fraction values consistently along the time series.

53. The IEFs for N-fixing crops and crop residues also differ significantly from the default values, although Portugal reports the use of default EFs. The $N_2O$ IEF for leaching and run-off in 2000 is reported as 0.02 kg $N_2O$/kg N instead of 0.025 kg $N_2O$/kg N, which is the default value reported for the other years. The ERT encourages Portugal to use the default fraction values consistently along the time series and to develop country-specific fraction values provided resources are available.

### 5. Rice Production – $CH_4$

54. Portugal has used a tier 1 method and a country-specific EF. The estimate of the country-specific EF made by expert judgement is not documented in the NIR. The ERT encourages Portugal to improve its reporting by including supporting information for the expert judgements.

# V. Land Use, Land-use Change and Forestry

## A. Sector overview

55. In 1990, the LULUCF sector was a net source of emissions, amounting to 6,058 Gg $CO_2$ equivalent, and accounted for 9.3 per cent of total national GHG emissions. Over the period 1990–2002, emissions from the sector decreased and removals increased, making the sector a net sink of 1,208 Gg $CO_2$ equivalent, or 1.4 per cent of total GHG emissions, in 2002. In 2003, an exceptionally large forest area was burnt by wildfires, making the sector a source of 7,076 Gg $CO_2$ equivalent in 2003.

56. Portugal has used the CRF tables, as required by decision 13/CP.9, to report estimates of carbon stock changes and non-$CO_2$ emissions, but has not fully implemented the IPCC good practice guidance for LULUCF. The CRF and the NIR only provide estimates for category 5.A Forest Land (and its subcategories). Emissions and removals from the other LULUCF categories are either reported as not estimated or not occurring. However, emissions and removals from Forest Land have been estimated only for the living biomass pool. The ERT encourages Portugal to use the IPCC good practice guidance for LULUCF and to expand its estimates to cover all required source/sink categories.

57. Uncertainty estimates and QA/QC procedures have not been reported. In the key category analysis only $CH_4$ and $N_2O$ emissions from wildfires have been included. The ERT encourages the Party to initiate QA/QC procedures, estimate uncertainties and perform a key category analysis including the LULUCF categories according to the IPCC good practice guidance for LULUCF.

## B. Sink and source categories

### Forest Land

58. The net emissions/removals from this category have been calculated, consistently with the IPCC methodology, as the difference between removals from growth increment and emissions from harvest.

59. Activity data are derived from the national forest inventories conducted by the General Direction for Forestry Resources (DGRF) of the Ministry of Agriculture, Rural Development and Fisheries (MADRP) and from the Institute for Financing and Support of Development of Agriculture and Fisheries (IFADAP). Emission/removal factors have been derived from the FAO, the DGRF and the IPCC. However, it is difficult to reconstruct the emissions and removals estimates on the basis of the information provided in the NIR. In the interests of greater transparency, Portugal is encouraged to provide more information on the AD and emission/removal factors used.

60. To reflect the impact of forest wildfires on $CO_2$ emissions, Portugal has assumed that all biomass burnt was removed through harvesting as salvaged wood, and accordingly included $CO_2$ emissions from wildfires as emissions from harvesting. This assumption may result in $CO_2$ emissions from wildfires being underestimated, since not all biomass burnt is harvested. Portugal considers that to assume a complete release of the $CO_2$ from the biomass burnt into the atmosphere would result in double counting, since some of these emissions are also reported as emissions from harvesting. However, because an exceptionally large area was burnt in 2003, Portugal has reported $CO_2$ emissions assuming that the whole biomass in the burnt forest areas was released into the atmosphere. The use of a different methodology for the year 2003 than for the period 1990–2002 results in an inconsistency in the time series. The ERT suggests that the Party initiate a study to estimate the harvested wood (or the proportion of the harvested wood) coming from burnt areas in order to be able to use a single methodology for the whole time series that neither overestimates nor underestimates the emissions.

# VI. Waste

## A. Sector overview

61. In 2003, GHG emissions from the Waste sector amounted to 6,633 Gg $CO_2$ equivalent, or 8.2 per cent of total national emissions. The source categories reported are Solid Waste Disposal on Land (73.3 per cent of emissions from Waste), Waste-water Handling (21.0 per cent) and Waste Incineration (5.7 per cent). In 2003, $CH_4$, $CO_2$ and $N_2O$ emissions represented 85.9, 5.3, and 8.9 per cent, respectively, of emissions from the Waste sector. From 1990 to 1999, emissions from the Waste sector increased by 41.7 per cent but then decreased and in 2003 were 27.1 per cent above their 1990 level.

## B. Key categories

### 1. Solid Waste Disposal on Land – $CH_4$

62. The first-order decay (FOD) method (tier 2) has been used. The AD are country-specific; both country-specific and IPCC default values are used for the EFs. The k ($yr^{-1}$) used is higher than the IPCC default. The ERT recommends that Portugal improve the accuracy of the k value by analysing the decomposition patterns of organic wastes in landfills.

### 2. Waste-water Handling – $CH_4$

63. $CH_4$ emissions have been calculated using the IPCC methodology. For domestic and commercial waste water, the amount of sludge is assumed to be 20 per cent of total organic waste. $CH_4$ emissions from the sludge generated in the industrial waste-water treatment plants have not been estimated; the ERT recommends that Portugal estimate them.

### 3. Waste-water Handling – $N_2O$

64. $N_2O$ emissions from human sewage have been calculated using the IPCC methodology and default EFs, and FAO data for protein intake. To avoid double counting, N from sewage should be

reduced by the amount of sewage N that is applied to soils in the form of sewage sludge. The ERT encourages Portugal to develop country-specific $N_2O$ EFs for Wastewater Handling.

4. Waste Incineration – $CO_2$

65. $CO_2$ emissions from the incinerators have been estimated using the IPCC methodology and country-specific EFs. Since it is expected that some incinerators in Portugal may be equipped with energy recovery systems, the $CO_2$ emissions resulting from the incinerators should not be included under the Waste sector, but under the Energy sector. No information on $CO_2$ emissions from the incineration of sludge and hazardous wastes has been submitted. The ERT recommends that Portugal report these emissions in the next submission.

### C. Non-key categories

Waste Incineration – $N_2O$

66. $N_2O$ emissions have been estimated as a product of the amount incinerated and a country-specific EF. The $N_2O$ EF should take into account the characteristics of incinerators and types of waste. The ERT suggests that Portugal further develop its country-specific EF for $N_2O$ by measuring $N_2O$ emissions from the different types of incinerators and waste.

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/>.

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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. 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. Portugal: Report of the individual review of the greenhouse gas inventory submitted in the year 2004. FCCC/WEB/IRI/2004/PRT. Available at <http://unfccc.int/resource/webdocs/iri/2004/prt.pdf>.

## B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Teresa Costa Pereira and Mr. Vitor Góis (Institute of the Environment).

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