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Report on the in-depth review of the third national communication of Portugal

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

A. Introduction

1. Portugal ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 21 December 1993. It signed the Kyoto Protocol to the UNFCCC on 29 April 1998 and ratified it, as did the other members of the European Community (EC), on 31 May 2002. The UNFCCC secretariat received the first national communication of Portugal (NC1) in 1994, the second (NC2) in 1997 and the third (NC3) in 2003.[1]

2. The Ministry of Urban Affairs, Spatial Planning and the Environment (MCOTA) coordinated the preparation of the NC3 with inputs and involvement from officials in other ministries[2] as well as from private companies (such as Ecoprogresso) that had been contracted to provide specific research support. Preparations for the NC3 began in 2001 and were completed almost one year later. Although non-governmental organizations (NGOs) did not take part in the preparation of the NC3, they are consulted on an ongoing basis and actively participate in discussions on Portugal's National Climate Change Programme (Plano Nacional para as Alterações Climáticas – PNAC).

3. The in-depth review of the NC3 was carried out between May 2004 and December 2004, and included a visit to Lisbon from 10 to 14 May 2004. The members of the review team were Mr. José Roberto Moreira (Brazil), Mr. Sergio Gonzalez (Chile), Mr. Thomas Gueret (France) and Ms. June Budhooram (UNFCCC secretariat, coordinator). During the visit, the team met officials from the MCOTA and other ministries, agencies and departments as well as representatives from business and environmental NGOs.

B. National circumstances

4. Portugal is situated in the western part of the Iberian Peninsula. Its total area is 91,906 km^2, and includes the autonomous regions of the Azores and Madeira archipelagos. With 1,450 km of coastline, the climate varies from north to south with annual average temperatures ranging from 7° C in the central interior highlands to 18° C on the southern coast. The hottest month, August, experiences temperatures of 17–28° C and the coldest month, January, has a temperature range of 8–14° C.

5. Forests cover about 36 per cent of total land area and agricultural land about 45 per cent, one of the highest shares in the European Union (EU) on a per capita basis, although overall the proportion of agricultural land has been declining since Portugal became a member of the European Community (EC) in 1986.

6. Portugal is a parliamentary republic, based on its constitution of 1976, which was amended in 2001. Continental Portugal is divided into five administrative regions (North, Centre, Lisbon and the Tagus Valley, Alentejo and Algarve) and 18 districts. In 2000, the estimated population was 10.3 million and population density was 109 inhabitants per km^2. The Lisbon and Porto areas account for one third of the population and approximately 50 per cent of the country's gross domestic product (GDP). Portugal's population grew by 5.1 per cent from 1990 to 2002 (see table 1).

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[1] The submission due date for NC3 was 30 November 2001 (decision 11/CP.4).

[2] These included the Ministries of Economy (including Energy and Industry), Agriculture and Fisheries and Rural Development, Public Works, Transport and Housing, Science and Higher Education, and Foreign Affairs, as well as representatives from the autonomous regions.

7. In the 1990s, the country diversified its economy from an agriculture-based to an increasingly service-based economy. Over the past decade, many enterprises have been privatized and several key sectors of the economy have been liberalized. This, in part, has led to rapid economic growth and important structural changes, which have resulted in GDP growing by 34.6 per cent between 1990 and 2002, with the economy performing above the EU average in this period. The per capita GDP was around USD 15,700 in 2002, compared to the EU average of about USD 23,000.

Table 1. Main macroeconomic indicators and GHG emissions for Portugal

	1990	2001	2002	Change 1990–2002 (%)	Growth rate 1990–2002 (%/year)	Change 2001–2002 (%)
Population (millions)	9.9	10.3	10.4	5.1	0.4	1.0
GDP (billions USD 1995 PPP)[a]	121.3	162.5	163.3	34.6	2.5	0.5
TPES (Mtoe)[b]	17.7	25.4	26.4	49.2	3.4	3.9
Electricity consumption (TWh)	25.4	42.7	44.5	75.2	4.8	4.2
GDP per capita (thousands USD 1995 PPP)	12.3	15.8	15.7	27.6	2.1	-0.6
TPES per capita (kgoe)[c]	1.8	2.5	2.5	38.9	3.0	0.0
CO_2 emissions without LUCF (Tg)[d]	44.1	64.4	67.5	53.1	3.6	4.8
GHG emissions without LUCF (Tg CO_2 eq.)	58.4	78.6	82.0	40.4	2.9	4.3
GHG emissions/removals by LUCF (Tg)	5.57	–0.88	–1.61	–128.9	–	83.0
CO_2/capita (Mg)	4.5	6.2	6.5	44.4	3.2	4.8
CO_2/GDP (kg per USD 1995 PPP)	0.36	0.40	0.41	13.9	1.1	2.5
GHG/capita (Mg CO_2 eq.)	5.9	7.6	7.9	33.9	2.5	3.9
GHG/GDP (kg CO_2 eq. per USD 1995 PPP)	0.48	0.48	0.50	4.2	0.4	4.2

Note: The data for population, GDP, TPES, and electricity are from *Energy balances of OECD countries, 1999–2000*, OECD/IEA, Paris, 2002. Greenhouse gas (GHG) data are taken from updated inventory data provided during the review, which correspond to the 2004 annual inventory submission.

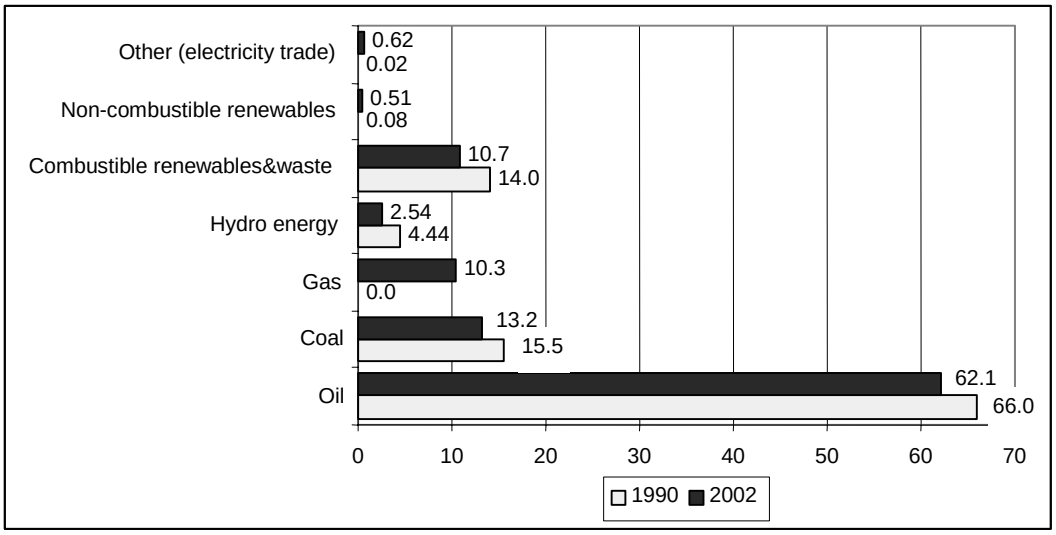
[a] Calculated using the method of purchasing power parities (PPP).

[b] Millions of tonnes of oil equivalent.

[c] Kilograms of oil equivalent.

[d] One teragram (Tg) is equal to 1,000 gigagrams (Gg) or one million tonnes (Mt).

Figure 1. Structure of primary energy supply in Portugal in 1990 and 2002



8. Portugal has few energy resources and imports 90 per cent of its energy needs. It has become increasingly dependent on imported fossil fuels, as proven reserves of coal are quite small (30 million tonnes in 1999). Portugal's energy policy continues to focus on liberalizing energy markets, assuring security of energy supply, improving energy efficiency and mitigating environmental problems, and in particular on shifting to cleaner sources of fuel. Consistent with these objectives, Portugal has increased

its effort to improve energy efficiency and diversify energy sources; in particular, it introduced natural gas for electricity generation in 1997, and since then the use of gas has expanded considerably (see figure 1).

C. Environmental policies

9. Since the preparation of the NC2, Portugal has been successful on many fronts in strengthening its institutional framework for environmental issues in general and climate change in particular. As a member of the EC, Portugal is required to translate and reflect European Community environmental legislation into its national legislation. Portugal has made a commendable effort in this regard, in that most of the European Community directives on the environment have been translated into national law. At the same time, it has strengthened the implementation of regulatory instruments such as the motor vehicle tax, and personal income tax credits for installing energy equipment based on renewable energy. Environmental concerns have also been integrated into land-use planning.

10. Protection for the environment is enshrined in the constitution and is designated as a task of the State. Since its creation in 1990, the ministry in charge of environmental issues has evolved from the original Ministry of the Environment and Natural Resources (MARN) into the Ministry of the Environment and Land Use Planning (MAOT) in 2000. In 2001 its name changed to MCOTA. In parallel, the Climate Change Committee (CAC), an interministerial body, was also created in 1998 in order to integrate environmental issues with overall Government policy. To this end, the CAC includes representatives from the Ministries of Economy (including Energy and Industry), Agriculture and Fisheries and Rural Development, Public Works, Transport and Housing, Science and Higher Education, and Foreign Affairs, as well as representatives from the autonomous regions. The Instituto do Ambiente (Institute for the Environment) oversees and coordinates all issues relating to climate change on behalf of MCOTA.

11. An important achievement of the CAC was the preparation of the Climate Change National Strategy and its implementation document, the PNAC, in 2001. The PNAC is the first national programme developed to provide details on how Portugal will reduce its emissions of greenhouse gases (GHGs), from a "business as usual" scenario, by approximately 21 million tonnes of carbon dioxide (CO_2) equivalent in order to meet its emissions reduction target under the Kyoto Protocol (the "Kyoto target").

12. Another important development since the NC2 has been the strengthening of the role of local authorities in implementing policies and measures. These authorities also promote awareness of climate change in order to bring about a change in attitudes to energy consumption by small and medium-sized enterprises as well as by civil society.

13. In the first policy document to introduce a target to limit GHG emissions in Portugal,[3] the country aimed, by 2000, to limit growth in emissions of CO_2 to 40 per cent compared to 1990. The latest inventory data (see section II on GHG inventory information) indicate that CO_2 emissions in 2000 were 44.7 per cent above the 1990 level. Within the European Community burden-sharing agreement for emissions reduction under the Kyoto Protocol, Portugal is required to limit the growth of GHG emissions to 27 per cent compared to 1990 levels in the first commitment period 2008–2012, while at the same time achieving above-average economic growth to meet the convergence requirements of the EU. According to the 2004 inventory submission, in 2002 GHG emissions were 40.4 per cent above the 1990 level.

[3] National Programme for Limiting Emissions of CO_2 and other Greenhouse Gases – 1996.

II. GREENHOUSE GAS INVENTORY INFORMATION

14. The inventory data presented in the NC3 cover the period 1990–2000. They were prepared using the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (published by the Intergovernmental Panel on Climate Change (IPCC) and hereinafter referred to as the Revised 1996 IPCC Guidelines) complemented by the EMEP/CORINAIR methodology, as well as country-specific methods for calculating emissions, where available. The inventory covers all major sources and sinks, as well as all direct and indirect gases, included in the Revised 1996 IPCC Guidelines. The inventory includes estimates for CO_2, methane (CH_4), nitrous oxide (N_2O), and the fluorinated gases – perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) – as well as GHG sinks. The information on PFCs and SF_6 available in the inventory is less complete than the information on HFCs. The base year used is 1990 for CO_2, CH_4 and N_2O and 1995 for PFCs, HFCs and SF_6. During the review, the team was provided with detailed information on the inventory series that was submitted to the UNFCCC secretariat in 2004. This assisted the review team in understanding the ongoing process of improvements made to the GHG inventories since the preparation of the NC3. In general, the inventory in the NC3 is presented in accordance with the UNFCCC guidelines.[4]

A. Inventory preparation

15. ***Organizational arrangements***: The Institute for the Environment is responsible for planning, overall coordination, calculation of emission estimates, compilation, submission to the UNFCCC and to the European Commission, and archiving of the national GHG inventory. The institute compiles and updates the national GHG emissions/sinks inventory series, using activity data provided by ministries, Government agencies and private-sector sources. The institute is also responsible for selecting the methodological approach and emission factors applied to each sector; this is done systematically in consultation with experts from relevant ministries and agencies.

16. With regard to activity data, the main source of all data for all the sectors was the National Institute of Statistics, complemented when necessary by other agencies, such as the General Directorate of Energy (energy, industrial processes, use of solvents and other products); the Regional Air Inventories (energy); the General Directorate of Terrestrial Transportation; the Road Institute; the Ministry of Agriculture; the General Directorate of Forests; and the National Institute for Waste and National Institute of Water (waste). Surveys of large point sources and large combustion plants were also conducted to obtain activity data for energy and industrial processes.

17. ***National Inventory System***: The review team was informed of a proposal to create a national system (Sistema Nacional de Inventário das Emissões Antropogénicas por Fontes e Remoção por Sumidouros de Poluentes Atmosféricos – SNIERPA) in preparation for the coming into force of the Kyoto Protocol, to estimate GHG emissions by sources and removals by sinks and air pollutants. The following issues under SNIERPA will be enforced by law: (a) the institutional arrangements under which Portugal produces its national inventory; (b) the steps needed to integrate the reporting requirements of different air pollutants; (c) the routine and institutional procedures for accessing information; (d) a methodological development plan; and (e) a standardized procedure for quality assurance and quality control of the inventories.

18. ***Coverage***: The inventory presented in the NC3 can be assessed as complete in terms of coverage from 1990 to 2000, activities, gases, and territory. Notable exceptions include: emissions of N_2O from solvent and other product use; fluorinated gases from fire extinguishers and semiconductor production; CO_2 capture from abandonment of managed lands; CO_2 emissions/removals from soils; CH_4 and N_2O

[4] Document FCCC/CP/1999/7.

emissions from forest and grassland conversion; and N_2O from waste-water handling. In the part of the inventory relating to land-use change and forestry (LUCF), the Azores and Madeira islands were excluded. Emissions from biomass and international bunker fuels were not presented in the NC3, although they have been included in the 2004 inventory submission to the UNFCCC secretariat.

19. ***Methodology***: The CORINAIR methodology and tier 2 methods from the Revised 1996 IPCC Guidelines were applied to the energy sector. For industrial processes, CORINAIR and IPCC default methods were applied. The mass balance method was used for solvent and other product use, and a combination of the IPCC tier 2 method and default methods for agriculture. The IPCC default method was used for LUCF, and the mass balance method was combined with IPCC default methods for the waste sector.

20. Emission factors used in the inventories were mainly taken from published sources, such as the Revised 1996 IPCC Guidelines and the EMEP/CORINAIR emission factor handbook,[5] and complemented by country-specific values for CH_4 and N_2O emissions from manure management, CH_4 emissions from rice cultivation, and CH_4 emissions from solid waste disposal on land and waste-water handling.

21. ***Recalculations***: Since the NC3 there have been some recalculations and modifications which were introduced for the 2004 inventory submission. In the energy sector the main modifications were a revision to the national energy balance; changes in emissions estimates from combustion processes; revised emissions from road transport owing to the application of a new transport model; and revised data for domestic air traffic emissions. Emission factors were updated for industrial processes and for solvent and other product use as well as for agriculture.

22. There have been major modifications to the LUCF category since the NC3, mainly resulting from access to more reliable data.[6] In the case of waste the recalculations are the result of revised activity data and a change in the parameters used for solid waste disposal and waste-water handling and incineration. According to Portugal's inventory experts these modifications have resulted in a more accurate and reliable inventory, although some issues still require a rigorous assessment; for example, current activity data and emission factors have resulted in an underestimation of the emissions of fluorinated gases and an overestimation of CO_2 emissions for forest fires. The review team was informed that these would be addressed in the near future.

23. Although no formal procedures have been defined, even for the 2004 inventory submission, some procedures are in place for ensuring accuracy of the activity data, documentation of methodology and emission factors, and archiving information. Uncertainty estimates are not available in the NC3, but national experts explained that some qualitative assessments, based on expert judgement, have been made, mainly to assess the uncertainty of the activity data. The national inventory team expects to have the first quantitative uncertainty estimates by the end of 2004. The difference between the data in the NC3 and the 2004 inventory submission for 1990 and 2000 by gas is presented in table 2.

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[5] During the review, the team was informed about the use of a major number of sources of emission factors, such as USEPA AP-42, in the energy and industrial processes sectors.

[6] The modifications for LUCF include: (a) exclusion of the sectors 5.B. Forest and Grassland Conversion and 5.C. Abandonment of Managed Lands, due to unreliable activity data; (b) inclusion of forest fires affecting managed lands; (c) methodological changes in sector 5.A. Changes in Forest and other Biomass Stocks, including changes in conversion/expansion rates, supported by a study by the Institute of Agronomy, and annual disaggregation of harvest.

Table 2. Comparison of emission estimates in the NC3 and the 2004 inventory, by gas

	1990 emissions Gg CO_2 equivalent		Change in 1990 emissions (%)	2000 emissions Gg CO_2 equivalent		Change in 2000 emissions (%)
	NC3	Inv–2004	From NC3 to Inv–2004	NC3	Inv–2004	From NC3 to Inv–2004
CO_2	44 109	44 130	–4.8	63 150	63 842	1.1
CH_4	12 903	8 450	–35.5	13 134	8 584	–34.6
N_2O	7 937	5 782	–27.2	8 258	5 870	–28.9
HFCs	0.0	0.0	0.0	0.0	24	
PFCs	0.0	0.0	0.0	157	0	
SF_6	0.0	0.0	–0.0	1	6	600
GHGs without LUCF	**61 197**	**58 362**	**–4.6**	**80 484**	**78 646**	**–2.3**

Note: Inv–2004 = figures from the 2004 inventory submission.
The GHG totals may differ slightly from the sum of gases because of rounding.

B. Overall emission trends

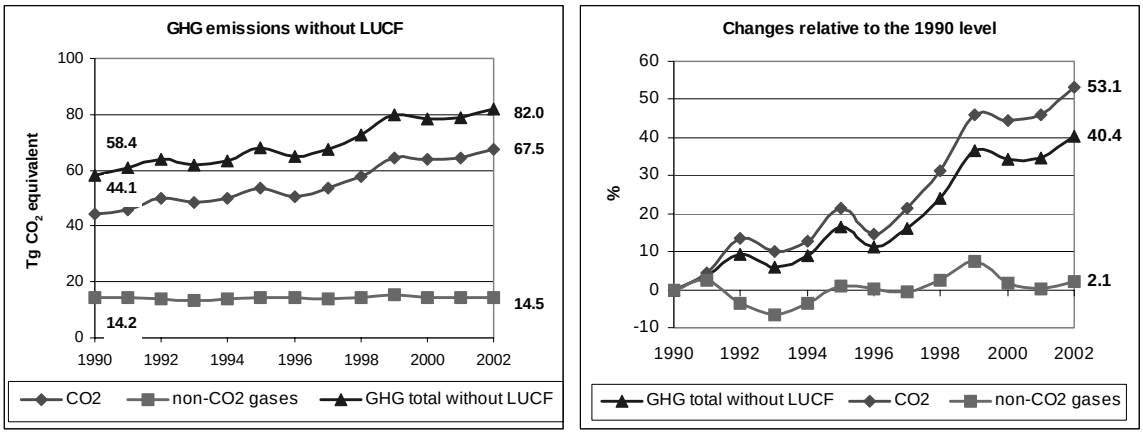
24. According to the 2004 inventory submission, the total GHG emissions increased by 40.4 per cent between 1990 and 2002 without CO_2 removals by sinks, and by 25.8 per cent with the inclusion of removals from LUCF. As table 3 and figure 2 indicate, CO_2 (excluding emissions/removals by LUCF) increased by 53.1 per cent, N_2O increased by 5.5 per cent and CH_4 decreased by 0.9 per cent. HFCs increased considerably, more than tenfold from 1995 to 2002.

Table 3. GHG emissions by gas, 1990–2002

	Tg of CO_2 equivalent													Change 1990–2002
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	(%)
CO_2	44.1	46.0	50.1	48.5	49.8	53.5	50.6	53.5	57.9	64.4	63.8	64.4	67.5	53.1
CH_4	8.45	8.81	8.26	8.01	8.17	8.65	8.42	8.42	8.79	9.02	8.58	8.23	8.37	–0.9
N_2O	5.78	5.75	5.47	5.31	5.54	5.73	5.84	5.74	5.78	6.22	5.87	6.01	6.10	5.5
HFCs	–	–	–	–	–	0.005	0.005	0.006	0.011	0.018	0.030	0.043	0.056	1 103[a]
GHG total without LUCF	**58.4**	**60.6**	**63.9**	**61.9**	**63.5**	**67.9**	**64.8**	**67.7**	**72.5**	**79.7**	**78.3**	**78.6**	**82.0**	**40.4**

Note: Discrepancies in totals are due to rounding errors.
Source: This table uses the data from the 2004 inventory submission to the UNFCCC.
[a] The change is calculated relative to 1995.

Figure 2. Trends in the main GHG emissions of Portugal, 1990–2000



25. An increase in emissions of CO_2 can be attributed to an increase in the consumption of oil and gas for electricity generation and fuel use in transport. The latter is the result of a marked increase in car ownership; the number of vehicles per thousand inhabitants grew from 287 in 1992 to 447 in 1998,

accompanied by a drop in rail transport and collective road transport. Fuel use in the transport sector grew by 33 per cent in the decade.

26. The marginal change in CH_4 emissions between 1990 and 2002 is a result, on one hand, of an increase in the CH_4 produced at landfill sites, many of which are not equipped with gas recovery systems, and, on the other hand, of a decrease in CH_4 emissions from agriculture due to a decline in cattle numbers. An increase in the population of pigs, which accounts for 87 per cent of livestock in Portugal, also contributed to CH_4 emissions.

27. Emissions of N_2O increased between 1990 and 2002, mostly owing to the increase in the number of cars with catalytic converters.

C. Key sectoral trends in GHG emissions

28. Table 4 presents GHG emissions by major sectors for the period 1990–2002. The energy sector remains the key contributor to the GHG total, increasing its share of the total GHG emissions (without LUCF) from 70.3 per cent in 1990 to 80.0 per cent in 2002. Emissions from the energy sector increased by almost 60 per cent from 1990 to 2002. Agriculture was the second largest contributor to GHG emissions, accounting for 14.9 per cent of total emissions in 1990 but for only 9.8 per cent in 2002. Between 1990 and 2002 emissions from the sector as a whole decreased by 7.4 per cent. Emissions from the waste sector accounted for 5.8 per cent of total emissions in 1990 and 4.9 per cent in 2002. Overall emissions from the sector increased by 18.8 per cent in the period.

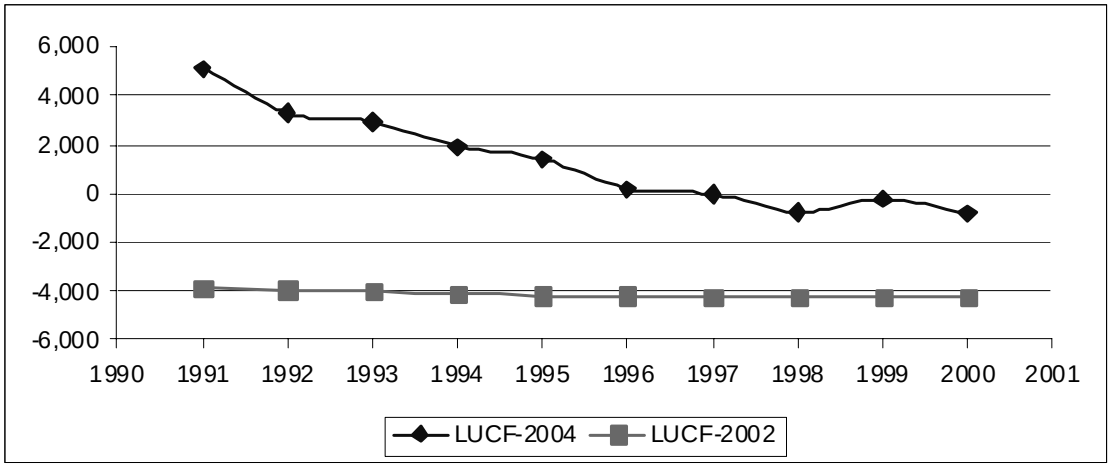
29. Notable changes occurred in the sink capacity: from 1990 to 1995 the LUCF sector was a net source of GHG emissions, but it started to act as a GHG sink in 1996. The sink capacity increased from almost zero in 1996 to about 1.6 Tg CO_2 equivalent in 2002. This important change in sink capacity was identified only recently and was presented in the 2004 inventory submission; see comparative LUCF data in figure 3.

Table 4. GHG emissions/removals by sector, 1990–2002

	Tg CO_2 equivalent													Change from 1990 to 2002
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**(%)**
1. Energy	41.1	43.0	47.4	45.8	46.4	49.7	47.0	49.3	53.4	60.9	60.0	60.2	65.6	59.8
A1. Energy industries	16.3	16.9	20.0	18.0	17.1	19.7	15.7	16.4	18.9	25.0	21.3	21.5	24.9	53.2
A2. Manuf. industries	9.3	9.7	9.9	9.7	10.1	10.1	10.4	11.2	10.9	10.6	11.4	10.8	10.2	9.6
A3. Transport	10.7	11.3	12.2	12.7	13.2	13.9	14.6	15.2	16.6	17.5	19.1	20.0	20.5	91.8
A4-5. Other	4.6	4.9	5.0	5.2	5.4	5.3	5.7	5.7	6.1	6.7	7.1	6.8	7.0	50.2
B. Fugitive emissions	0.23	0.22	0.25	0.26	0.50	0.61	0.55	0.68	0.70	0.81	0.76	0.93	1.01	342.9
2. Industrial processes	4.48	4.43	4.19	4.03	4.84	5.55	5.30	5.95	6.16	5.82	5.62	6.07	6.07	35.5
3. Solvents	0.22	0.24	0.24	0.24	0.25	0.26	0.28	0.29	0.29	0.29	0.29	0.31	0.31	40.8
4. Agriculture	8.71	8.64	8.18	7.92	8.08	8.06	8.12	8.00	8.11	8.30	8.11	8.10	8.07	–7.4
5. LUCF	5.57	4.32	3.05	2.77	1.83	0.87	–0.02	–0.11	–1.11	–0.43	–1.25	–0.88	–1.61	–128.8
6. Waste	3.37	3.49	3.62	3.76	3.86	3.97	4.07	4.17	4.27	4.51	4.17	3.95	4.00	18.8
TOTAL with LUCF	**63.9**	**64.9**	**66.9**	**64.6**	**65.3**	**68.8**	**64.8**	**67.6**	**71.4**	**79.3**	**77.1**	**77.8**	**80.4**	**25.8**

Note: Discrepancies in totals are due to rounding.

Figure 3. Evolution of CO_2 emissions from LUCF in the 2002 and 2004 inventory submissions



D. General comments on the inventory

30. The review team is of the view that Portugal is on track to address the above-mentioned problems with the implementation of the SNIERPA, which would provide for the systematic collection, monitoring and verification of inventory data, giving rise to an improvement in the quality of the inventory.

31. At the same time, the review team notes that the inventory team urgently needs to be strengthened to meet the needs for inventory preparation and reporting under the Kyoto Protocol. The inclusion of sectoral experts from the Government as well as from the private sector may provide more support to improve the collection and quality of activity data needed to estimate emissions and removals, and also to increase the acceptance of the data produced by all stakeholders. There is also a need to establish the official links required for the specific tasks in the preparation and timely delivery of the inventory with all relevant ministries and agencies that are required to provide information.

32. The review team encouraged Portugal to implement a quality assurance and quality control plan, as well as its uncertainty assessment, as soon as possible, given its importance in improving the quality (in terms of accuracy, precision, reliability) of the annual estimates of emissions and removals.

33. The review team recognized that the specific methodological improvements that are planned for the future, at each sector level, will lead to substantial improvement of the GHG inventory. In the energy sector, the improvements include better data integration, road traffic fleet characterization, and inclusion of water-borne navigation and air traffic. In the industrial processes and solvent use sector, improvements are related to assessing carbon content in ores, monitoring data, more HFC emission sources and improved activity data. In the agriculture sector, planned improvements are related to the application of the tier 2 methodology for enteric fermentation, harmonization with the Food and Agriculture Organization of the United Nations (FAO) database, improving emission factors for manure management and improved activity data and conversion factors for estimating soil emissions. For the LUCF sector, improvements are related to improving conversion/expansion factors and collecting activity data in the LUCF categories by using, for example, remote sensing techniques. For the waste sector, improvements include refining activity data (periodical, direct collection) and improved conversion factors.

34. For the LUCF sector, there are two issues of particular concern that have to be addressed by the national inventory team: validity and transparency of country-specific emission factors and

disaggregated activity data to fulfil requirements of the different categories of the sector. It has to be recognized that LUCF is one of the sectors of the inventory that is least supported by activity data, and that the direct collection of data is very expensive. The use of remote sensing techniques, such as satellite images associated with geographical information systems, could provide an alternative way – indirect, but precise and systematic – to collect periodic activity data on annual land use and land-use changes, forest surface area, biomass density per unit of surface, and even agricultural lands.

35. Further work on the inventory could include strengthening the archiving and documentation procedures, to ensure the reproduction of the history of the GHG inventory data on the one hand and the transparency of the GHG inventory on the other. A concise and transparent protocol to archive files (inventory files, supporting information, decision-taking acts) should be defined and strictly followed.

36. In addition, the national inventory team could elaborate a protocol on how to deal with confidential information, which is mainly – but not uniquely – related to industrial processes, to give entities the assurance that the data they provide to the inventory team are treated in the strictest confidence.

37. Portugal's inventory is close to being complete. The review team encourages the national team to fill the few gaps that remain, such as including the Azores and Madeira islands in the LUCF inventory, and some gases emitted by certain categories. The review team estimates that the completeness of Portugal's inventory is a goal that can be achieved with a minor additional investment of financial resources. Finally, the inventory team needs to invest efforts in validating the models applied to estimate emissions and removals in the transport sector, and in strengthening data collection by the statistical agencies.

III. POLICIES AND MEASURES

38. The NC3 complies with most of the UNFCCC reporting requirements on policies and measures, demonstrating a marked improvement in reporting compared to the NC2. The classification of policies and measures (as implemented, adopted or planned) followed the UNFCCC guidelines. The quantitative impacts of individual policies and measures were reported for most sectors, except forestry.

39. The tables suggested by the guidelines for reporting on the main policies and measures for each sector were available in the NC3 for all sectors, albeit with varying degree of completeness. At the same time, paragraph 16 of the UNFCCC guidelines requires that the NC3 include information on the cost of policies, and the cost-effectiveness and benefits of mitigation measures that are implemented for reasons not relating to climate change. Portugal did not report on such measures, nor on those polices that may lead to an increase in GHG emissions. The review team is of the view that in the future a more detailed description of the policies could be presented, including interactions between policies and measures, non-climate and other benefits, and international cooperation.

40. During the review substantial information was made available to the review team on developments in policies and measures that took place after the submission of the NC3, to help gain a better understanding of the suite of policies and measures adopted by the Government in meeting its GHG mitigation commitments. These are discussed in detail below.

A. Policy framework and objectives

41. The CAC was restructured in 2001, after the submission and review of the NC2. The set of policies and measures presented in the NC3 was based on those considered in the framework of the design of the PNAC (see paragraph 11), which was a collaborative effort under the coordination of the Institute of the Environment, on behalf of the Ministry of Urban Affairs, Spatial Planning and the

Environment, and other ministries. The review team observed that the consultation of civil society, especially environmental NGOs and business and industry NGOs, has markedly improved during the process of preparing the PNAC. The PNAC was prepared over a period of two years (from late 2001 until December 2003), after which it was officially adopted by the CAC.

42. The PNAC can be considered as the most comprehensive overview of policies and measures prepared to date as part of Portugal's national climate strategy, in order to achieve the country's national GHG reduction target.

43. The first version of the PNAC, which outlined the general steps that may be required to meet the national target under the Kyoto Protocol, was prepared in 2001. This version was reviewed in 2002 to include sectoral studies and findings on the most cost-effective options for selecting national policies to limit the growth of emissions. The third and final step in the implementation of the PNAC is the identification of additional measures. The emission baseline studies for the PNAC indicate that total GHG emissions will increase by 54–63 per cent between 1990 and 2010. This translates into the need for a reduction of 16–21 Mt CO_2 equivalent from the "business as usual" scenario. The PNAC therefore consists of two blocks of policies and measures. The first is a "reference or immediate" block comprising measures that will lead to an emissions reduction of 7.6–8.8 Mt CO_2 equivalent, which will be put in place by 2005. These measures include improving energy efficiency, promoting the use of renewables, vehicle tax reform, and modernization of the transport infrastructure, in particular railways.

44. In the longer term, Portugal expects to achieve further reductions of 6.7–7.0 Mt CO_2 equivalent. To this end, the PNAC identifies an "additional" block comprising a set of new measures with specific sectoral reduction strategies. On a sectoral basis, transport will account for 43 per cent of the reduction, agriculture and livestock 32 per cent, energy 23 per cent and forestry 2 per cent. Anticipated reductions from the carbon tax and emissions trading are not included in this block. The remaining reduction of 1.7 to 5.6 Mt CO_2 equivalent is expected to be achieved through two Kyoto Protocol flexibility mechanisms, namely joint implementation (JI) and the clean development mechanism (CDM) and through additional policies and measures. A national allocation plan working group has been appointed to define the use of credits from the mechanisms and prepare guidelines for the participation of entities. The PNAC also includes a process of regular review of the performance of GHG emissions in order to assess and evaluate progress towards the GHG reduction target, to identify those policies and measures that have not performed as expected and to strengthen the policies and measures portfolio as required.

45. The monitoring of progress will be backed by several valuable sector-related databases (general system for inventories – SNIERPA), a transport information system, a waste management database and others, as needed. Integration of these databases in a unique framework is not planned at this stage, but, in the opinion of the review team, it could be a valuable step forward in the future.

46. The review team was informed that the adoption and implementation of the PNAC by the Parliament would be subject to finalization of the country's national allocation plan for the EU emissions trading scheme, scheduled to come into force in January 2005, and a decision by the Government on the adoption of a carbon tax.

47. The review team expressed some concern about the availability of adequate funding for monitoring and projection tools, in light of a reduction in public funding for research and in personnel for dealing with data management. For example, the Bureau of Economic Studies and Prospects (GEPE) of the Ministry of Economy has been replaced by a smaller unit, the Cabinet for Strategy and Studies (GEE). The review team also noted that the need to produce reliable data in the inventories and to map these against the basket of policies and measures and the projection of emissions is an indispensable step in implementing a credible climate strategy. The review team further noted that, with the recalculations

of inventory data in the 2004 submission to the UNFCCC, estimates in the PNAC on emissions reductions should be considered with some caution; this lends support to the urgency of putting in place an effective data management system on GHG emissions.

48. From a policy point of view, the policies and measures portfolio has changed broadly between the NC2 and the NC3, becoming more comprehensive and more consistent. This improvement has been confirmed by the PNAC. The most important change consists of the general outline of a carbon-related tax, which is foreseen as a major lever of GHG emission reductions, although the time frame for its implementation is yet to be decided. However, the review team noted that this is a major policy shift in Portugal, from the NC2 to the NC3, from purely voluntary measures to fiscal measures.

49. Other main changes come from the Energy Efficiency and Endogenous Energy (E4) programme for development of renewable energies and combined heat and power (CHP), and the strengthening of energy efficiency policies in all sectors. The package of measures is presented in a comprehensive manner by sector (except for agriculture), which was not the case for the NC2. The presentation of the policy framework in the PNAC is clear and transparent. The review team commended the national team on the preparation and early implementation of the PNAC, while pointing out that it could be improved further if measures were more precisely organized by gas.

B. Energy

50. In 2002, emissions from the energy sector made up some 80 per cent of Portugal's total GHG emissions. Emissions from this sector were about 60 per cent greater in 2002 than in 1990. The main GHG in this sector is CO_2 (80 per cent), followed by CH_4 (20 per cent). The impact of policies and measures undertaken in energy production and transformation is important in this context.

51. Despite a high level of production of hydropower and biomass, Portugal only produces around 10 per cent of the energy that it consumes. The energy policy in Portugal, as well as having as its goal the reduction of GHG emissions, is intended to reduce the final cost of energy for the consumer and to ensure the diversity and security of the energy supply.

52. Primary energy consumption rose about 50 per cent between 1990 to 2002, from 17.7 to 26.4 Mtoe. Over the same period final energy consumption grew even faster, by more than 60 per cent. As GDP also increased between 1990 and 2002, the energy intensity of the Portuguese economy has remained at roughly the same level (see table 1). This trend emphasizes the need to strengthen action towards energy efficiency and the full implementation of policies and measures in this sector, and in high-energy-consuming end-use sectors.

53. One notable shift in recent years has been a marked reduction in Portugal's dependence on oil, declining from 76 per cent in 1970 to 62 per cent in 2002 – still substantially higher than the International Energy Agency average of 41 per cent. The introduction of natural gas in 1997, and its rapid growth since then, can be considered as one of the main contributors to limiting the growth of GHG emissions in the sector. Natural gas accounted for 10.3 per cent of the energy balance in 2002 and is expected to account for more than 20 per cent in 2010 (replacing mostly oil and coal).

54. In 2001, the Government approved a new National Energy Plan, which aims to reduce the country's dependence on imported fuel and reduce the environmental impact of power generation. One important feature of the plan is that it will reduce future growth in GHG emissions as a result of the construction of a natural gas network that links to the existing European–Algerian pipeline. This project will be implemented with the support of EUR 2.3 billion from the EU. Portugal also plans to construct a liquid natural gas terminal and underground storage for gas.

55. Another priority of the National Energy Plan is to promote renewable energy, particularly wind power. Almost 50 per cent of the Plan's overall budget of EUR 5 billion will be allocated to the development of renewable energy. Portugal currently has an installed capacity of 200 MW of wind power, but its potential capacity is estimated at 2,000 MW.

56. Since the NC2, efforts to liberalize the electricity market have continued. A decision has been taken to create an Iberian electricity market and to fully liberalize the electricity market. The effects of this policy on GHG emissions have not been quantified, but it is possible that if there is an increase in the importation of electricity, emissions will be reduced.

57. Because of the prevailing climatic conditions, the need for heating in Portugal is on average rather low, but there is a broad range of mean winter temperatures in different parts of the country. There are some health concerns linked to insufficient heating levels and low energy performance of dwellings. One of the main measures in this area is the strengthening of building codes. A National Programme for Energy Efficiency, with a budget of EUR 4 million, was established in 2000 to address these concerns. A key activity of the programme is the revision of the Regulations on the Characteristics of the Thermal Parameters of Buildings and the Regulation of Energy Systems in Buildings, which were introduced in 1991. The review team noted that even though this measure was described in the NC3 as being "in implementation", it is not expected to come into force before 2009, which is the latest authorized date for transposition of this part of the EU Directive on energy efficiency for buildings. The other actions introduced by this directive will also be implemented at a later date, running the risk of not delivering GHG mitigation effects for the first commitment period of the Kyoto Protocol (2008–2012).

58. The high growth rate of energy demand both in air conditioning and in specific electricity uses is a major concern for limiting the GHG emissions. The EU Directive on energy services is intended to involve energy utilities in energy efficiency, which has often proved to be a cornerstone of successful demand-side management programmes in other countries.

C. Transport

59. The transport sector accounted for 25.0 per cent of total GHG emissions in Portugal in 2000, compared with 18.3 per cent in 1990. This increase is mainly due to the increase in energy demand in the sector, which has been growing faster than the rate of economic growth. The transport sector is the second largest source of emissions in Portugal. The increase in the road vehicle fleet accounted for 70 per cent of GHG emissions, given that the national transport system relies heavily on private road transport.

60. Under the PNAC a number of measures have been proposed for this sector to decouple the growth in demand for transport from economic growth. As mentioned earlier, the most notable is a fiscal measure to reformulate the current vehicle tax by creating a Single Circulation Tax for all vehicles. As car ownership is expected to increase in the future, the Government is pursuing a policy to improve energy efficiency in light passenger vehicles as part of EU-wide voluntary agreements with the European Automobile Manufacturers Association, and with the associations of Korean and Japanese car manufacturers. A shift in transport modes from road to rail is also anticipated in the PNAC, by improving the current rail infrastructure as well as by promoting collective urban transport and increasing the efficiency of intercity freight transport.

61. The Regulation for the Management of Energy Consumption in Transport (RGCT) was introduced in 1991. It applies to public and private transport companies whose energy consumption exceeds 500 toe per year. The RGCT requires these companies to carry out energy auditing and publish a plan for the rationalization of their energy use every three years. The Directorate-General for Energy

monitors the audit results and plans when the companies apply for financial support. This policy is expected to lead to some energy savings and reductions in GHG emissions.

D. Industry

62. Industrial processes accounted for around 7.4 per cent of total GHG emissions in Portugal in 2000 compared with 7.7 per cent in 1990. There are two key groups of policies and measures in the industry sector: voluntary agreements and direct or indirect financing in specific sectors.

63. The energy consumption in Portugal's industrial sector is partly driven by the energy-intensive industries – cement, pulp and paper, iron and ore, and production of nitrogenous fertilizers – which account for 65 per cent of total consumption.

64. The main policy for reducing energy consumption in the sector is the Management Regulations for Energy Consumption (RGCE), which was introduced in 1982. The Government continues to monitor the results of these regulations. It applies to industrial installations whose energy consumption exceeds 1,000 toe equivalent per year and to industrial equipment with a power rating (or nominal energy consumption) of more than 0.3 toe per hour.

65. The EU emissions trading programme is also an important policy for reducing GHGs in this sector. By March 2004, 224 installations representing 43 per cent of national CO_2 emissions had been identified for eligibility to participate in the EU emissions trading programme, including power stations, cogeneration facilities and refineries.

E. Agriculture

66. The agriculture sector accounted for 9.8 per cent of total GHG emissions in Portugal in 2002 compared to 14.9 per cent in 1990. There was also a decrease in emissions by 7.4 per cent between 1990 and 2002. Trends influencing this reduction include a slight reduction in the number of cattle, and a slight decline in the consumption of nitrogen fertilizer.

67. Portugal's NC3 includes a description of policies and measures for the agriculture sector in the relevant chapter. National experts explained that this decline was the main reason for the lack of structured measures dedicated to the issue of reduction of GHGs in this sector. However, the intensification of agriculture in Portugal is an ongoing process and measures would be particularly efficient if implemented at an earlier stage. Some agricultural activities will contribute to increases in GHGs, such as increases in livestock population (pigs) and CH_4 from rice cultivation.

F. Land-use change and forestry

68. Portugal has a total forest area of 3.3 million ha, of which 87 per cent is privately owned, 3 per cent is publicly owned, and 10 per cent is lying fallow. Over 85 per cent of the total number of plots have an area of less than 5 ha. The NC3 notes that the expansion of woodland areas will play an important part in meeting the country's Kyoto commitment, given that annual forest growth is estimated at 2 per cent and this will result in the absorption of atmospheric CO_2.

69. The Plan for Sustainable Development of Portuguese Forests (Council of Ministers Resolution number 27/99) includes the framework for forest development. Most of the policies in this sector have either been adopted recently or are in an early stage of development. They include the RURIS programme for the afforestation of agricultural land. This policy has other benefits, including the improvement of soils and prevention of desertification. Regional forestry planning will also prepare guidelines for sustainable forest management and the expansion of CO_2 sink capacity. Economic

incentives for private owners will also be provided, to encourage the expansion of forest cover by tree planting and rehabilitation of forests.

G. Waste management

70. The waste sector accounted for 4.9 per cent of total GHG emissions in 2000, compared to 5.8 per cent in 1990. Emissions increased by 18.8 per cent between 1990 and 2002 but are expected to decline in the future, as landfill sites are equipped with CH_4 recovery systems. In 1990 Portugal had the lowest per capita waste production among EU countries (350 kg per capita per year).

71. Most of the emissions originating from this sector are from solid waste management, and CH_4 is the most important GHG from the sector. Municipal solid waste production increased rapidly between 1990 and 2000 (+20 per cent at 429 kg per capita per year), which seems consistent with the growth in GDP (+34 per cent over the decade) and the reported increase of 13 per cent in CH_4 emissions of the sector. However, it is believed that this large increase may have been due to an error in activity data and may be recalculated in the future.

72. The policies and measures for waste management include comprehensive measures for reducing waste production, re-use and recycling (the so-called "3Rs"), energy recovery and disposal, to be implemented mostly between 2006 and 2015. Improvements in waste management are already under way, with closure of most open dumps, modern landfill disposal and enforcement of recycling, but effective actions to reduce the production of waste have still to be accurately designed before coming into force.

H. General comments on policies and measures

73. Portugal faces significant challenges in reducing the emissions in key sectors and in meeting its GHG target, as emissions are already far above the Kyoto target and still on a rapidly increasing trend. The contribution of policies and measures to the mitigation of GHG emissions as presented in the NC3 appears to be generally sound, and these policies and measures could fill much of the gap in the Kyoto target, as outlined in the PNAC. However, some uncertainties remain in relation to the implementation of these policies and measures, including funding, timelines for implementation and the overall effectiveness and cost-effectiveness of the proposed measures. Some important measures are expected to be implemented soon with regard to emissions trading and the CDM, as a result of political support for these projects, as well as others such as the improvement in the regulations for building codes and energy certificates. The introduction of a carbon tax is still not certain.

74. Regular review of the implementation and strengthening of policies and measures, as proposed in the PNAC, seems likely to be a positive step that should contribute significantly to raising awareness of strengthened policies and their accelerated implementation.

75. Assessment of the effect and prioritization of the measures could be enhanced, especially with regard to measures decided at the EU level. For those policies and measures, estimated reductions in GHG emissions are provided in the NC3 for the EU as a whole, which makes it difficult to understand the impact of these measures in Portugal. Furthermore, these measures are listed in a separate table with information displayed in a manner that is different from other tables, and the precise steps and time frame for transcription into national legislation are not detailed.

76. Information on the cost of policies and measures could be useful for national policy-making, especially if defined by type (public costs including state, cities, other local authorities; costs for the end-user and other actors; pay-back period when relevant).

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Methodologies and coverage of projections

77. The NC3 contains a set of projections for two reference scenarios (high and low) and two "with additional measures" scenarios (short term and medium/long term) for total GHG emissions to 2010. It also contains a graphical representation of the mitigation effects of the PNAC on emissions under each scenario. The NC3 includes general information on some of the assumptions, and the data used for preparing the projections were consistent with the inventory data in the NC3.

78. In the presentation of projections, the NC3 deviates from the requirements set forth in the UNFCCC guidelines. The review team noted the following deviations:

(a) There was no discussion of the methodological framework by which the projections were prepared (paragraph 42 of the guidelines). There was no description of the models applied, and their strengths and weaknesses

(b) Projections were not presented for 2005, 2010, 2015 and 2020 as required by the guidelines (paragraph 37). Instead, projections were presented for the 2000–2015 and the 2015–2025 periods for key economic sectors. This approach made it difficult for the review team to evaluate how the country will meets its Kyoto target during the period 2008–2012

(c) Projections for international bunkers were not provided

(d) The NC3 does not provide an estimate of the total effects of policies and measures compared to the situation in the absence of such policies (paragraph 42). A discussion of the sensitivity of projections and an explanation of the behaviour of key variables were also missing.

79. The national projections team explained that these deviations were due to the fact that Portugal, in preparing its PNAC, was also in the process of assessing and discussing a robust methodology that would suit the needs of the country in projecting GHG emissions in a comprehensive manner, as well as one that best represents the policy mix strategies contemplated in the PNAC. During the visit, a set of new projections was made available to the review team, with the measures of the PNAC incorporated. For this reason the discussion below centres on these new projections[7] which provide a closer approximation of where Portugal stands in terms of its future GHG emissions.

80. The new emission projections are presented for all six GHGs (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) for the year 2010 only. Emissions of individual GHGs are presented in Mt CO_2 equivalent and projections are consistent with the 2002 inventory submission.

81. The new projections provided during the in-country mission comprise three sets of projections:[8] the low/high scenario "with measures"; and the low/high scenario "with additional measures" and the low/high scenario "without measures". The low and the high scenarios of each set of projections are based on the application of two different assumptions for GDP growth.

82. Projections contain data for most sectors, including industry and civil construction, residential and services, waste, agriculture, energy supply, transport, and forests and forest products.

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[7] "Programa Nacional para as Alterações Climáticas", available only in Portuguese at the time of the review.

[8] These data sets were derived from a presentation by the Grupo de trabalho on "Projeccão de emissões 2010 vs Objectivo de Quioto", May 2004.

83. The MCOTA has overall responsibility for development of GHG emission projections, relying to a large extent on support from other specialized Government departments and agencies and universities and research centres. The MCOTA prepares the overall projections for CO_2 emissions, and these are derived from simple spreadsheet calculations by estimating the amount and type of primary energy required for the future and the respective emission factors. Details of these calculations and the assumptions used were not available at the time of the review.

84. The MEDEE model has been used to determine energy consumption in the residential sector. This model is used to project energy demand as a function of socio-economic development. The model provides possible future levels and composition of energy demand, based on a set of different assumptions for economic growth rather than on a single forecast. Estimates for the land use, land-use change and forestry (LULUCF) sector are derived from a spreadsheet model developed for the Institute of the Environment. The model uses land-use data derived from periodic surveys, supplemented by census data on agricultural land use. This method guarantees coherence between the data used for preparing the inventory and the projections. The Institute also develops scenarios for carbon uptake by afforestation.

B. Scenario definitions and key assumptions

85. The three sets of projections are prepared using a method that correlates past observed economic performance with growth in several sectors of the economy. Using figures for potential GDP growth as a starting point, the Ministry of Economy developed growth rates for each economic sector using input–output tables to check the consistency of sectoral growth rates. A list of sectoral growth rates was provided to the review team. Using historical energy consumption data for each sector, it was then possible to evaluate future energy requirements on the basis of some assumptions about how the future will differ from the past.

86. No written description of the details of calculations, or strengths or weaknesses of the methodological approaches, was provided. As a result it was not clear to the review team whether the future energy requirement by sector assumes historical energy intensity, or if there is any provision for technological advances in this area. For all scenarios, the energy price is kept constant and the oil price is assumed to be USD 25/bbl. The "with additional measures" scenario was not obtained from modelling techniques: rather, it was prepared by deducting the estimated emission reductions due to the additional measures from the "with measures" projections.

87. The key assumptions for the baseline scenarios are GDP growth of 4.2 per cent annually between 2001 and 2015 for the high scenarios and 2.8 per cent a year for the low scenarios, although by 2010 population will be 3.5 per cent above the level for 2000. The base year for emission projections is 2000. Projections are presented for the year 2010 and in a graphical form for all years between 2001 and 2010, assuming a linear variation.

C. Projected emission trends and effects of policies and measures

88. Based on inventory data and information received during the review mission on how Portugal intends to meet its Kyoto target, a comparison was made of the GHG projections for all sets of projections – the reference "with measures", the "with additional measures" scenario as well as the high/low scenarios "with measures" and "with additional measures" (see table 5).

89. In interpreting the data presented in table 5, it should be noted that values for LULUCF are not included in the projections due to the high levels of uncertainty of data from the sector. The experts from Portugal noted that LULUCF data would be taken into account in the GHG emissions projections after

greater certainty of these estimates is achieved. For this reason, the LULUCF data are not included in the base year nor in the commitment period 2008–2012.

90. It should be noted that the data for the 1990 emissions used in preparing the projections differ from the latest inventory figures, given that the projections were prepared before finalizing the inventory information that was provided to the expert review team during the country mission. In order to ensure consistency with national documents, the figure of 59.4 is used instead of 58.4.

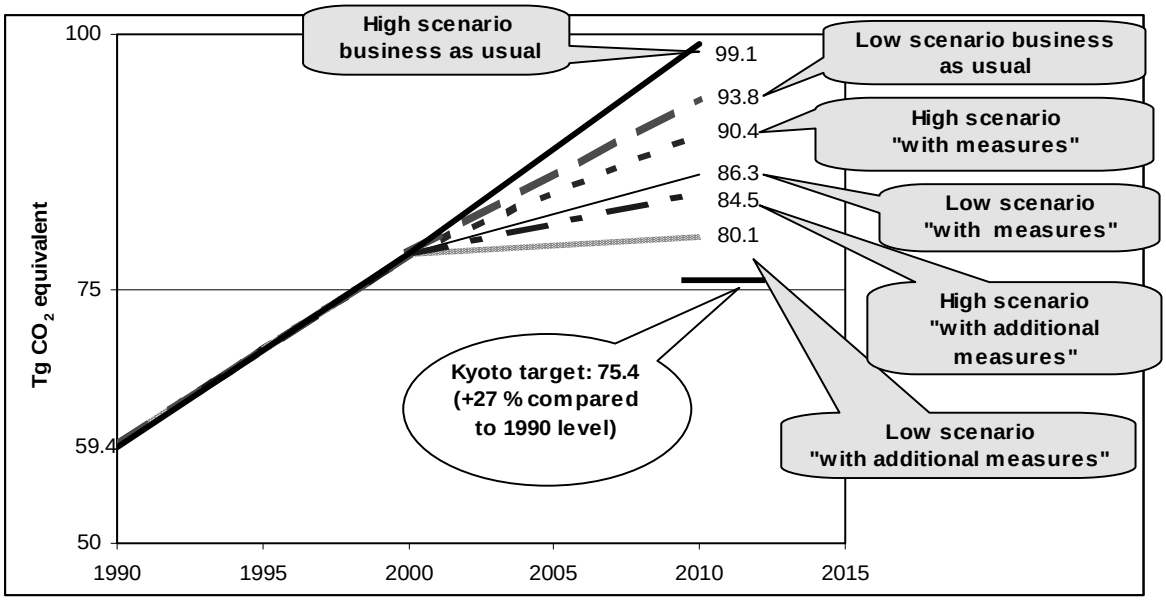
91. Figure 4 below presents a comparison of the projections for total GHGs using the revised scenario. This comparison indicates that with the implementation of the additional measures identified under the PNAC, Portugal may well be on track to meet its Kyoto Protocol target of 75.4 CO_2 equivalent by the commitment period 2008–2012.

Table 5. GHG projections (without LUCF) for Portugal, in Tg CO_2 equivalent

	1990	2000	2010
Low scenario "with measures" (from 'os resultados')	59.4	78.4	86.3
High scenario "with measures" (from 'os resultados')	59.4	78.4	90.4
Low scenario "with additional measures" (from 'os resultados')	59.4	78.4	80.1
High scenario "with additional measures" (from 'os resultados')	59.4	78.4	84.5
Low scenario business as usual (without measures)			93.8
High scenario business as usual (without measures)			99.1

Source: Programa Nacional para as Alterações Climáticas.

Figure 4. Comparison of projected GHG emissions (without LULUCF) by scenario



Note: The revised scenario is used in this figure.
The Kyoto target has been calculated as follows: 59.4 x 1.27 =75.4 CO_2 equivalent.

92. The two sectors that make the largest contributions to mitigation and to meeting the Kyoto target are energy supply, where the major measure is the use of renewable sources of electricity generation (3.7 and 3.3 Tg CO_2 equivalent for high and low scenarios) mainly through a significant increase in wind installed capacity (3,750 MW in 2010 compared to 101 MW in 2001), and transport (2.4 and 2.7 Tg CO_2 equivalent for low and high scenarios) where many measures have similar quantitative results. Table 6 shows expected mitigation results for most sectors of the economy in 2010.

93. The reference scenarios projections include a wide range of currently implemented and adopted policies. In the energy supply sector, measures such as the E4 programme (see paragraph 49), the MAPE revision (support measures for the good use of energy potential and rational consumption) and the P3E programme (energy efficiency in buildings) are included as targets for energy efficiency improvements. Diversification of energy sources includes a shift to natural gas, an increase in the use of renewables for electricity generation (E-RES) and solar heating. Other measures involve a revision of taxes and a simplification of licensing procedures for E-RES. In the transport sector major policies and measures are designed for organization of the transport system; restructuring the tax system; and increasing investments in transport infrastructure in order to reduce traffic jams and to improve the rail and sea transport networks in order to encourage a modal shift in freight transport. A detailed set of policies and measures were presented to the review team with CO_2 mitigation quantification for the year 2010 (see table 6). Based on the success of all policies and measures, the reference scenarios projection anticipates that in 2010 Portugal's GHG emissions will be reduced by 8.8 and 7.6 Mt CO_2 equivalent for the high and low scenarios, respectively.

Table 6. Mitigation effect of measures for the "with measures" projection for 2010

Sector	Mt CO_2 equivalent		Percentage of total	
	High	Low	High	Low
Energy supply	4.27	3.68	50	50
Transport	2.70	2.41	31	32
Agriculture	–0.14	–0.25	–2	–3
Forests	0	0	0	0
Residential and service	0.51	0.47	6	6
Industry/construction	1.13	1.0	13	13
Total	**8.77**	**7.63**	**100**	**100**

Note: The mitigation effect is defined as the difference between the 'business as usual' and the reference (with measures) scenario. Discrepancies in totals are due to rounding.

94. The PNAC, on which the new projections are based, contains a comprehensive set of additional measures that are included in the "with additional measures" scenario. These measures have been identified for several sectors. Table 7 presents a breakdown of the contribution of individual policies and measures aggregated by sector. The substantial mitigation contribution expected from the transport sector in "with additional measures" scenarios is very clear. More than 50 per cent of CO_2 equivalent reduction will result from policies and measures implemented in this sector. Migration from private to public transportation, improvements in automobile efficiency, improvements in the transportation of merchandise and other measures are expected by 2010. The next major mitigation contribution is from the energy supply sector, where wind electricity generation is expected to have the largest impact, followed by better use of electricity, more cogeneration and others. The participation of the agriculture sector is mainly in the form of better use of livestock residues, while the forest sector is expected to be used further as a CO_2 sink. Establishment of a carbon tax has been considered, but its contribution to emissions mitigation is not yet accounted.

95. The "with additional measures" projection includes the following planned policies and measures: (a) in energy supply, efficiency improvements in electricity generation, a further increase in cogeneration units, better efficiency in the use of electricity, further use of renewable sources of energy, (b) in transport, further reductions in fuel consumption due to the introduction of a carbon tax; the introduction of more efficient cars, an improvement in the freight system and the use of more public transport, (c) in the agriculture sector, better storage of livestock residues and an increase in their use for energy production, (d) in forestry, to improve the sink capacity of forests. It is expected that these policies and measures will reduce GHGs by 6.7 and 7.0 Mt CO_2 equivalent by 2010, for the high and low scenarios respectively (see table 7). Further reductions are foreseen through the use of Kyoto flexibility mechanisms.

96. Based on the "with additional measures" projection, the national GHG emissions are expected to decline with respect to reference scenarios projections, and they will remain below the level of +27 per cent compared to 1990, as required for Portugal by the Kyoto Protocol, with the use of flexibility mechanisms.

97. All of the projected scenarios contemplate the implementation of several policies and measures, but the success of some of them in reducing GHG emissions is strongly dependent on the approval of a carbon tax. Considering the difficulty in relying on political decisions, and the absence of a detailed programme for the implementation of most of the policies and measures, it was difficult for the review team to assess the certainty of the implementation of the additional measures. However, the review team is confident that, as with the activities that are in the pipeline for improving the projections exercise and speeding up the implementation of the PNAC, officials will be able to adjust the plan as needed to ensure that the Kyoto Protocol target is met.

Table 7. Mitigation effect of additional measures for the "with additional measures" projection for 2010

	Mt CO_2 equivalent		Percentage of total	
Sector	**High**	**Low**	**High**	**Low**
Energy supply	1.23	1.64	18	24
Transport	3.56	3.41	53	49
Agriculture	1.11	1.11	17	16
Forests	0.80	0.80	12	11
Residential and service	n. q.	n. q.	n. q.	n. q.
Industry/construction	n. q.	n. q.	n. q.	n. q.
Total	**6.69**	**6.97**	**100**	**100**

Note: n. q. = not quantified.

D. General comments on GHG emission projections

98. In general, the new projections presented to the review team during the visit indicate that there have been vast improvements in the exercise of preparing projections and matching the suite of policies and measures to meet GHG commitments. The review team recognizes the improvement made in the quality of projected estimates for GHG emissions. A large number of actors have been involved at several stages of the evaluation of GHG emission projections, a process that has worked very well due to the successful collaboration between the MCOTA and other ministries and research institutions to ensure consistency with the reporting requirements, an achievement highly commended by the review team. Most importantly, the projections are consistent with the inventory and they serve as a tool to validate the overall effect of mitigation measures.

99. Even though the methodology applied for the projections is still unclear and there is a lack of models, the review team commended Portugal for the work that it has done in preparing, for the first time, a comprehensive set of projections. The projections team has also been able to forecast emissions up to 2020, with an evaluation of the mitigation potential for each measure and gas. The review team noted small differences in the data presented by the different groups responsible for projecting specific sectors and reiterated the need for coordinating the data set used by all entities involved in any future revision of the projections to ensure consistency in assumptions and in data input.

100. Projections data are now regularly checked and verified by comparing trends in actual historical emissions with future emission estimates. If there is a significant variation, project methodologies and assumptions are revised accordingly. The review team recommends that the projection methodologies be verified using a combination of bottom-up and top-down approaches.

101. The new projections meet most of the requirements of the reporting guidelines on projections, including the incorporation of the total and by-sector effect of policies and measures. Most policies and

measures in the "with additional measures" scenario are being implemented by other countries, and the review team believes that such policies and measures can be successfully implemented in Portugal in order to meet its Kyoto target. At the same time, the review team observes that the target set for some of the policies and measures may not be fully achieved because of the short time available before the start of the commitment period (2008–2012). Also, financial constraints may affect the timely installation of new, cleaner sources, such as gas and cogeneration facilities.

102. The review team believes that the success of individual policies and measures should be monitored to ensure that measures are achieving their projected GHG mitigation effects, especially in the transport sector, which is projected to experience large GHG emissions reduction in the reference scenarios and in "with additional measures" projections. The modelling tool developed by the Ministry of Economy to correlate GDP growth with sectoral growth should be better described and presented in a way that can be easily adjusted to evaluate the annual emissions performance.

103. The policy that requires most careful evaluation is the introduction of the carbon tax. The review team expresses some reservations on the role of the tax in meeting GHG reductions in the light of potential political considerations for its adoption and the lengthy procedures required for bringing it into operation. Another important exercise that could be conducted by the national team is cross-checking between the projected dates of implementation of additional measures and the complete time schedule for the planning, licensing, installation and commissioning of the planned electricity generation plants based on renewable sources (e.g. hydro and wind) to see whether they are compatible in meeting GHG targets and time frames.

104. The new projections present sensitivity of the estimates only to GDP growth rates. The review team believes that this could be a serious limitation of the exercise because it becomes very difficult for a third party to assess how changes in other factors, such as oil prices, could affect emissions. Variation in GDP covers a modest range of values, because the low-growth scenario assumes a value of 3 per cent until 2005 and 2.5 per cent from 2005 to 2010, while the high-growth scenario assumes 3.5 and 4 per cent, respectively. According to information provided to the team during the review, Portugal's economic growth was around 1 per cent during 2001–2003, which may reduce the probability of a high-growth scenario. Nevertheless, Portugal's energy planners were concerned by the growth of energy demand observed in the transport sector in recent years, which, with the GDP assumptions, could affect total GHG estimates by ±5 Mt CO_2 equivalent in 2010, which is less than the difference between the "with additional measures" scenario and the Kyoto target.

105. Energy demand and emission projections are sensitive to changes in energy prices. The review team recommends that the sensitivity of assumptions to projected oil and gas prices be applied to all three projection scenarios.

106. Although the presentation of a "without measures" scenario is not mandatory, the review team is of the opinion that preparing such a scenario would help greatly in understanding the contribution of different policies and measures implemented by the Government in previous years. A breakdown of the projections by gas would also be useful to understand and track how various policies and measures are impacting on their trends. In addition, even though presenting projections of the indirect GHGs (carbon monoxide, nitrogen oxides and non-methane volatile organic compounds, as well as sulphur oxides) is not mandatory, in light of the progress made in reducing emissions of these gases, the review team suggested that they be included in order to give an overall picture of emissions.

107. The review team recognizes the significant efforts made by Portugal to include scenarios for the non-CO_2 GHGs gases in its new projections. Considering that they represent more than 15 per cent of the country's GHG emissions and their direct quantification involves much less precise data, it would be

useful in the future to have a detailed plan of action of the specific measures with sources, dates, and expected emissions reductions presented in tabular form (e.g. projected development of livestock, land use, waste management). For clarity, the reference and "with additional measures" projection curves should be identified. It would also be helpful to clearly distinguish between the base year and the reference year, and the base year used as a starting point for the CO_2 emissions projection.

108. In the reference scenarios projection, GHG emissions are significantly above Portugal's Kyoto target but in the "with additional measures" scenario the national Kyoto target seems likely to be met. In spite of this, the review team suggests that the national projections experts prepare scenarios and assess compliance in meeting the national target of +27 per cent, using the exact rules governing the Kyoto Protocol in the case of changes for LUCF for 2008–2012.

109. The significant amount of emission reductions assumed in the "with additional measures" scenario when compared with the reference scenario (in particular for the high-growth one) implies that Portugal may probably rely more than currently anticipated on the use of flexibility mechanisms. Also, considering that the final evaluation of this effort in the period 2008–2012 will essentially be a compliance or no-compliance judgement, it might be useful for Portugal to plan its carbon emission target with a safety margin, allowing for the possibility of poor performance of some of the policies and measures. In line with this approach, the review team proposes that the uncertainty of future carbon emission results be incorporated as a planning tool to estimate the safety margin. This would be useful in assessing the country's strategy of moving to a low-carbon economy in the coming years.

V. VULNERABILITY AND ADAPTATION

110. The NC3 complies in general with the UNFCCC reporting guidelines on vulnerability assessment, climate change impacts and adaptation measures, and is much more comprehensive than the NC2 in terms of coverage of issues and in using the recommended guidelines. It assesses by sectors the most relevant environmental impacts of projected climate change on Portugal in general, and on ecological and socio-economic systems in particular. The following sectors have been assessed as the most vulnerable to the impacts of climate change: water resources, coastal zones, agriculture, energy supply and demand with changes in climatic conditions and agriculture, forestry and fisheries. Vulnerability is expressed in terms of both physical and economic impacts.

111. Considerable research has been conducted since the NC2 in estimating climate change impacts through the Climate Change in Portugal – Scenarios, Impacts and Adaptation Measures (SIAM) study. This study has two basic objectives: the first is to study the impacts of climate change scenarios developed from regional climate models and global circulation models such as HadCM2 and the HadCM3 as well as socio-economic scenarios (using data from the IPCC Third Assessment Report as a basis); the second is to use the findings of the scenarios analysis to prepare a national strategic plan on adaptation.

112. Given that adaptation will be studied in the second phase of the SIAM (SIAM II), adaptation measures were not included in NC3. This phase will define adaptation measures and assess their costs and benefits. The SIAM project is a commendable effort by Portugal in both strengthening the institutional role of the Institute for the Environment in coordinating and supporting this research effort, as well as providing a very good example of a Party included in Annex I to the Convention (Annex I Party) incorporating adaptation measures into mainstream planning and policies on climate change. The SIAM I project involved around 50 researchers from various national institutes and from diverse disciplines. Wider stakeholder involvement is anticipated for the SIAM II phase and for defining follow-up action on SIAM as a whole.

113. In addition, with the collaboration of the Ministry of Education and the Ministry of Environment, data produced by SIAM can be used as a basis to prepare educational materials on impacts and adaptation for schools. Such studies can also contribute enormously to the international body of knowledge on what vital steps can be taken to adapt to climate change.

VI. FINANCIAL RESOURCES AND TECHNOLOGY TRANSFER

114. In comparison with the NC2, this chapter of the report is more comprehensive and generally complies with the UNFCCC guidelines in terms of improved coverage and in the presentation of information using table 4 of the UNFCCC guidelines. There were three exceptions: a clear definition of "new and additional" was not provided, although in discussions with the national experts they highlighted that Portugal's contribution to the Global Environment Facility (GEF) and to the USD 410 million Special Climate Change Fund in the near future are considered new and additional funding to climate change. Also, the NC3 did not include a description of adaptation in bilateral aid nor the tables for detailing specific instances of technology transfer.

115. The Portuguese Institute for Development Assistance (IPAD) defines Portugal's development assistance policy in collaboration with the Ministry of Foreign Affairs. Among other projects, IPAD manages bilateral environmental projects. The Ministry of Science and Higher Education (MCES) also arranges bilateral agreements that relate specifically to promoting scientific and technological cooperation with developing countries and countries with economies in transition. The Ministry of Industry and Trade finances scientific and technological cooperation programmes in the energy sector. The private sector is also active in the transfer of low-impact technologies and implementation of projects on integrated resource management. The Inter-Ministerial Committee for Cooperation coordinates the ministries on national policy for cooperation.

116. Official Development Assistance (ODA) from Portugal was estimated at EUR 294 million in 2000. While ODA represented 0.30 per cent of GNP in 1990, it accounted for 0.26 per cent of GNP in 2000. It appears to be on the rise again, given that in 2002 ODA represented 0.27 per cent of GNP. The Government has committed itself to meeting the European Community goal of 0.33 per cent of GNP by 2006. Portugal also supports the GEF, with contributions of USD 5.1 million between 1997 and 2000. Portugal has also been successful in meeting its funding commitments to multilateral agencies since the NC2.

117. Around 10 per cent of Portugal's development assistance goes to Portuguese-speaking African countries – Angola, Cape Verde, Guinea, Mozambique and São Tomé and Príncipe – and East Timor. Other countries that have benefited from ODA include Argentina and Brazil.

118. A new initiative by IPAD that was highlighted to the review team was the preparation of an Annual Action Plan for Implementation on Asia, Caribbean and Pacific (ACP) Countries and a working group on adaptation. Each of the main partners will be allocated a three-year assistance programme and an indicative budget for international cooperation, starting in 2004, and in future they will be required to provide detailed annual reports on projects. The review team highlighted the need for increased efforts to integrate information on private-sector activities in technology diffusion, and the importance of reporting on success stories.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

119. The review team noted remarkable progress in reporting on this topic compared to the NC2; the amount of information provided has increased considerably. The NC3 generally complies with reporting requirements, and contains a comprehensive description of the research activities carried out through a number of national programmes.

120. The Foundation for Science and Technology (FCT) is responsible for funding most of Portugal's research and development projects. The FCT supports its activities through research grants, Government funding and cooperation agreements with partner organizations. Research and development spending from the Government represented approximately 1.5 per cent of the state budget in 2000. This is a clear indication of the Government's commitment to research in general. Although there are no specific figures on spending relating to climate change, research spending increased by a little over 10 per cent between 1995 and 2000, a remarkable achievement for Portugal. This increase in expenditure is a manifestation of the importance of research for Portugal in areas such as the impacts of climate change, including the SIAM studies and studies on the hydrological cycle and its effects on the economy. The EU is also an important funding source for research and development projects.

121. Portugal actively participates in international research and observation efforts, such as the International Geosphere–Biosphere Programme, the European Organisation for the Exploitation of Meteorological Satellites, the World Climate Research Programme and the Global Climate Observing System. The review team noted that Portugal could play an important role in developing research programmes on the Iberian Peninsula because of its geographical location. After discussions with national experts, it was recognized that in order to be more effective in the ongoing measurement of climate variables, the network of meteorological stations should be redesigned to reflect national circumstances better.

VIII. EDUCATION AND PUBLIC AWARENESS

122. The NC3 reports on these issues comprehensively, and in general it meets the reporting requirements. It lists Portugal's participation in international efforts as well as domestic activities in the area of education, training and public awareness. The review team also commended the excellent coordination between the Ministry of Education and the MCOTA in defining curricular requirements and other associated topics for introducing climate change education into the primary, secondary and higher educational systems. In terms of formal education, the Government has taken a very proactive approach in designing an innovative, multi-level approach to education and awareness by integrating policies on schools, curriculum development and the teachers' network as one coherent policy tool.

123. The Government's strategy for educating the general public on climate change has also included supporting the infrastructure to supplement educational campaigns with teacher training programmes, encouraging the active involvement of local authorities and funding the national and international initiatives and activities of NGOs. From its discussions with NGOs, the review team concluded that while Portugal has taken a slow and measured approach to public awareness of climate change, NGOs have made substantial progress in raising the awareness of the public. At the same time, the review team noted that some challenges lie ahead for Portugal in educating the public on energy efficiency, such as how to counteract advertising and consumer trends and the need to meet the EU convergence requirements. Another challenge is finding a balance between teacher training on climate issues and several other training needs, and ensuring that other key stakeholders are not sending conflicting messages on how to address impacts of, and adaptation to, climate change.

IX. CONCLUSIONS

124. Portugal's NC3 represents a considerable improvement over its NC2. With respect to adherence to the guidelines, while most of the information required was presented in the NC3, the degree of completeness varied depending on the subject, with the section on projections deviating considerably from the reporting guidelines. Remarkable improvements were noted in the preparation of inventory data, the discussion of inventory trends and the preparation of a new set of projections in the context of the national climate plan (PNAC). The NC3 has also expanded its presentation of vulnerability and

adaptation issues and is more consistent than the NC2 with the guidelines for financial resources and technology transfer and education, training and public awareness.

125. Some areas for further improvement were identified. In the area of inventories, there are issues of concern that have to be addressed by the national inventory team: validity and transparency of country-specific emission factors and disaggregated activity data to fulfil requirements of the different categories of the GHG inventory. This is particularly important in light of the shift of the LUCF sector from being a source in the NC3 to being a sink in the latest inventory submission to the UNFCCC. The review team recognized that the direct collection of activity data for this sector is expensive. The use of remote sensing techniques, such as satellite images associated with geographical information systems, could provide an alternative option – indirect, but precise and systematic – to collect periodic activity data on annual land use and land-use changes, forestry surface area, biomass density per unit of surface, and even agricultural lands.

126. In the reporting of policies and measures, the review team noted that an evaluation of costs for GHG mitigation measures would have been useful for determining the extent to which flexibility mechanisms under the Kyoto Protocol may be used in the future, as this will be determined by the cost of domestic policies and measures. Some uncertainties remain with respect to the implementation of these policies and measures, including the time frame. Portugal faces substantial challenges in reducing the emissions in key sectors, such as transport and energy production.

127. Between 1990 and 2002, overall emissions (in accordance with the 2004 inventory submission, excluding LUCF) increased by 40.4 per cent, from 58.4 to 82.0 Mt CO_2 equivalent. Within the European Community burden-sharing agreement for the Kyoto Protocol, Portugal is required to limit the growth in its GHG emissions in the period 2008–2012 by 27 per cent compared to its 1990 emissions.

128. In the reference scenario projection, GHG emissions are significantly above Portugal's Kyoto target, but in the "with additional measures" under the PNAC, Portugal's emissions are maintained at a level of 80.1 Tg CO_2 equivalent in the period 2008–2012 compared to its target under the Kyoto Protocol of 75.4.Tg CO_2 equivalent in that period. Measures under the reference scenario are expected to yield reductions of 7.6–8.8 Mt CO_2 equivalent, while the measures presented under the "with additional measures" scenario are expected to yield 6.7–7 Mt CO_2 equivalent. The use of JI, CDM and sinks is also considered. In spite of this, the review team suggests that the national projections experts prepare scenarios and assess compliance in meeting the national target of +27 per cent, using the exact rules governing the Kyoto Protocol with respect to the case of changes in LULUCF during the period 2008-2012.

129. Since the NC2, Portugal has strengthened its institutional framework on climate change policy. The review team was impressed by the increase in collaboration among Government institutions and the private sector in preparing inventories and the PNAC. The PNAC is the first national programme developed to provide details on how the country will reduce its emissions by approximately 21 million tonnes of CO_2 equivalent to meet its target. The review team expressed some concern with regard to the availability of adequate funding for monitoring and implementing the PNAC in a time frame compatible with the 2008–2012 compliance period. The review team also noted the need to produce reliable data in the inventories and map these regularly against the basket of policies and measures and the projections of emissions in order to ensure the timely implementation of a credible climate strategy.

130. Even though, in absolute terms, Portugal's ODA has been increasing, it represented 0.30 per cent of GNP in 1990 and 0.26 per cent in 2000. It appears to be on the rise again, given that in 2002 ODA represented 0.27 per cent of GNP. The Government has committed itself to meeting the European Community goal of 0.33 per cent of GNP by 2006. Portugal also plays a positive role in

supporting the progress of a number of Portuguese-speaking countries on international environmental issues in general and on climate change in particular.

131. Significant research has been conducted since the NC2 in estimating climate change impacts. One commendable achievement has been the Climate Change in Portugal – Scenarios, Impacts and Adaptation Measures programme. The review team highlighted this initiative as an excellent example of an Annex I Party incorporating adaptation measures into mainstream planning and policies on climate change.

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