PORTUGAL's 2001
THIRD NATIONAL COMMUNICATION UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

MINISTRY OF URBAN AFFAIRS,
SPATIAL PLANNING AND THE ENVIRONMENT

Foreword

Dear Reader

I have the honour to present the Third Portuguese National Communication under the United Nations Framework Convention on Climate Change.

Human interference in the climate system is upon us, and the IPCC Third Assessment Report has demonstrated so.

Since the late 80's the international community has decided to tackle this problem, which has been named the most serious global environmental problem of the 21st century. The UNFCCC lays the ground for a global effort, lead by industrialized nations but shared also by developing countries. It's Kyoto Protocol, a landmark in International Environmental Agreements, sets challenging commitments to all Parties, but in particular to Annex B Parties. Although challenging, these commitments will not be sufficient to avoid dangerous human interference in the climate system and the expected negative impacts. In Portugal, the results of scientific studies show that the greatest impacts are to be expected on coastal zones and on water resources. These two sectors are vital for the Portuguese economy and for the well being of the Portuguese people.

Portugal is fully committed to accomplish its target as defined by the European Community "Burden Sharing Agreement." The Climate Change National Programme defines policies and measures with that aim, with a clear preference on those based on the use of renewable energy sources and on energy efficiency. The programme also envisages the use of flexibility mechanisms, in particular the European Emissions Trading Scheme.

The entry into force of the Kyoto Protocol will set the pace for a process which will, ultimately, allow for continued social and economic development without depriving future generations of their right to a healthy environment. Portugal is confident that the International Community will follow the path of sustainable development, for which the Kyoto Protocol is one of the most important instruments; for itself and for what it stands for.

Secretary of State for the Environment

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EXECUTIVE SUMMARY

Portugal has ratified the Convention on May 31, 1994. Since the international community agreed on deepening the commitments inscribed in the Convention and, as a result, the Kyoto Protocol was agreed upon. Under the EU burden-sharing agreement Portugal is committed to limiting its emissions to +27% compared to the 1990 level in the first commitment period of the Protocol. Portugal's allowance to increase its emissions is to be seen in the light of the objective of real convergence with the average income level of the EU, which implies that its growth rate needs to be higher then the EU average.

In 2001, Portugal has adopted the Climate Change National Strategy, which contains the principles and objectives that will guide the policy making process to combat climate change. The strategy recognises that additional measures need to be implemented in all activity sectors, mainly transport, energy production and consumption, the services and residential sectors as well as to control emissions from agriculture and forestry. Currently, the Climate Change National Programme is in the final phase of preparation, and is expected to be adopted by the Portuguese Government before the end of the current year.

The inventory data information is based on the GHG National Inventory submitted to the UNFCCC Secretariat relating to the emissions of the year 2000. To improve consistency and comparability, all the information provided, namely in the chapter of national circunstances also relates to the year 2000. However, the projections and the policies and measures information is based on the studies undertaken to prepare the Climate Change National Programme (PNAC).

National circunstances

Geographic, economic and other national conditions affect significantly Portuguese greenhouse gas emissions. They also play a great role in the country's options for abatement measures, in particular the objectives for economic development, which aim at real convergence with the other Members States of the EU.

Portugal is located in the Southeast of Europe with a total area of 91 906 Km^2. The autonomous regions of Madeira (779 Km^2) and Azores (2 330 Km^2), located on Atlantic Ocean are also part of Portugal. .

As other southern European regions, Portugal has a mild Mediterranean climate, with well-known vulnerability to climate impacts, namely to droughts and desertification in the southern part of the country. The most relevant factors conditioning the climate in mainland Portugal are, in addition to latitude (37º - 42º N), its topography and the effect of the Atlantic Ocean. In spite of the fact that the variation in climate factors is rather small, it is still sufficient to justify significant variations in air temperature and, most of all, in precipitation. The mean annual air temperature values vary between 7ºC in the inner highlands of central Portugal and 18ºC in the southern coastal area. Mean annual precipitation in mainland Portugal is around 900 mm, with a major degree of spatial variation with highest values, above 3000 mm, to be found in the highlands of the north-western region (Minho) and the lowest in the southern coast and in the eastern part of the territory, below or around 500 mm (Alentejo e Algarve).

The population of Portugal is around 10.2 million, (increase of 4.6% in relation to 1991), and is expected to maintain around the same growth rate until 2020. The urban areas, such as Lisbon and Oporto, concentrate most of the population and the wealth of the country, and are located usually in the littoral, where around 50% of the population lives.

Portugal is a Member of the EU since 1986 and its economy has grown in the last decade around 34%. In the period 1996-2000 the economic growth is situated around 3.6%/year. However, the GDP per capita is still 75% of the EU average. This indicator illustrates the development effort Portugal needs to converge with the other EU Member States.

In the Portuguese industry sector, the most relevant contributors to greenhouse gas emissions from combustion process and from production process were "the cement production", "the iron and ace production", "the nitrogen compost production" and "the paper and broad production". This set of sub-sectors represents around 65% of the energy consumption by industry. In 2000 the carbon intensity of the industry sector decreased in particular due to the decrease of energy intensity of this sector and the shift to natural gas.

Portugal is currently about 90% dependent upon foreign energy sources (note that inter-annual fluctuation are significant due to a large component of hydroelectricity in the energy mix). In fact, endogenous resources are mainly renewable energy resources, with hydroelectric energy ranking first by far. In 2000, the gross consumption of primary energy in Portugal was 25.5 million tonnes of oil equivalent (Mtoe). Most of the primary energy is currently obtained from petroleum products (around 71% in 2000). Natural gas was introduced in 1997. Holding currently about 9% of share it is foreseen that its share will grow in coming years (23% of share by 2010). Coal was insignificant up to mid-eighties, but now became a significant portion of the primary energy (about 14% by 2000, DGE). The contribution of renewable energies sensu lato, i.e. including large hydroelectric power (larger than 10 MW systems) and wood products, represented about 14% in 2000. In the context of the energy sector the electricity production has a much larger share in the final energy consumption, as a part of the primary energy sources are transformed into electricity (about 17.8% in 2000 compared to15.1% in 1990).

In 1999, the final energy consumption was 19.3 Mtoe (more 27.9% than 1990). Transport and Industry

dominate energy consumption, holding a share of about a third each. The Transport sector has increased its consumption of final energy about 40% compared to 1990. In 1999, the share of final energy consumption in the main activity sectors was, 33% in Industry, 38% in Transportation, 13% in Domestic and 16% in Others sectors (services and agriculture).

The Waste Management System in Portugal has been designed to reduce greenhouse gas emissions. Its framework is established through a set of different action plans that define targets to the management, up to 2005, and others to 2015. Manure management was the sub-sector most contributing to GHG emissions (around 80% in the waste activity sector). The annual waste generation in Portugal from various activities was around 21.5 Mton in 2000. After 1995, the implementation of national legislation related to municipal solid waste management have demonstrated to be a good contribution to limit GHG emissions. 272 open dumps were closed, some of them replaced by landfills (more 22 than in 1995), and promotion of reuse/reduce/recycle (3R's) practices mainly with the co-operation of local municipalities are the most important aspects. The policy for the management of industrial hazardous wastes is still to be fully defined.

The use of land for agriculture accounts around 43% (1999 data) of the mainland Portugal, although this share has decreased since Portugal joined the EU. The main policy framework for the Portuguese agriculture is the Common Agriculture Policy of the EU, which aims simultaneously at integrating environmental concerns with regional agriculture potential and maintaining farmer's economic income and social well-being. Furthermore, its importance in the Portuguese economy is decreasing very rapidly and this evolution is far from having reached the point of equilibrium. Present crop distribution is conditioned by climate, soil type and availability of irrigation water. Yet, social and economic influences are the ones that more strongly determine the type of crops that are grown if all other conditions are met. In recent years the relative contribution of plant and animal production to GVA (Gross Value Added) has changed. The animal production presents a stable evolution with a positive tendency, whereas the plant production decreases.

The forest area in Portugal is of 3.3 million hectares, and represents about 37% of mainland Portugal. The forest area has been increasing. In the last decade it increased more than 10% and the area of tree cover increased over 4%. The abandonment of agriculture allows us to predict a continued increase of the forest area in the future.

Most of the forestland in Portugal is privately owned (around 87%). Only 3% is owned by the State. More than 85% of the individual held plots are on average less than 5 ha, creating serious challenges to forest management and protection. Only 1% of individual held plots occupy more than 100ha. Forestry and forest products processing industries are of great importance to the national economy. 55% of the Portuguese forest is grown for wood production.

Greenhouse gas inventory information

The Portuguese total GHG emissions (without LUCF) were about 84.7 Mton CO_2eq. in 2000, representing an increase of 30.4% compared to 1990 levels. Over the same period:

- carbon dioxide emissions grew 43.2%;
- methane emissions stabilised (+0.02%); and
- nitrous oxide emissions grew about 4.0%.

Portugal adopted 1995 as the base year for fluorinated gases. In 2000 these gases represented about 0.2% of the total GHG emissions. Portugal does not produce these gases, but recognises that their emissions might be underestimated.

The Energy Sector is the biggest contributor to the national total GHG emissions. In 2000 it represented 69.9% of the total emissions (59.2 Mton CO_2eq.), which represents an increase of 43.5% compared to 1990 levels.

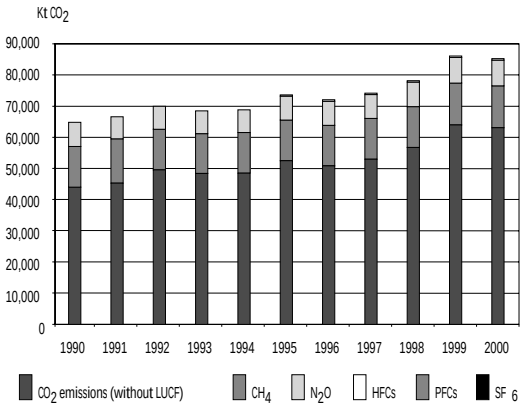

Figure 1 – GHG emissions in Portugal (period 1990-2000)

Policies and Measures

The preparation of the Climate Change National Programme started in 2001 and it is expected to be adopted by the Portuguese Government until the end of 2003. At this moment, considering the emissions trends and the social and economic scenarios for 2010, the reduction efforts must be set between 12.6 and 17.2 Mton CO_2eq.

The National Programme (PNAC) integrates a package of policies and measures for all relevant activity sectors, considering their environmental efficiency and cost effectiveness. The strategy used in the Programme is based on two sets of policies and measures and instruments (sectoral and/or horizontal), susceptible to be quantified: "immediate bloc" to be developed in short term (till 2005) with policies and measures in implementation or in the planning phase (as of mid 2001) and an "additional bloc" to be developed in the medium/long term with new policies and measures. The use of the Kyoto mechanisms is also being considered in the programme.

Some of the measures listed in PNAC are already in place, such as:

- E4 Programme (Energetic Efficiency and Endogenous Energy Programme) – a set of integrated measures to improve energy efficiency and stimulate new and more efficient sources of power generation, including from renewable sources;
- Energy labels, standards and other product-related measures designed to deliver "market transformation" in the energy efficiency of lighting, appliances and other key traded goods;
- Promoting a better energy efficiency in the services and residential sector by improving the energy efficiency requirements of the Building Regulations;
- European level agreements with car manufacturers (ACEA) to improve the technological efficiency of new cars, backed up by changes to vehicle excise duty and the reform of company car taxation;
- The promotion of use the public transportation, mainly in urban areas, together with a modernization and construction of new integrated infra-structures to the public transportation system;
- Modernization of the inter urban infra-structure of the rail transportation;
- Promotion of the modal shift from road transportation;
- Measures in waste management based in a set of different Programmes, aimed at reducing, reusing and recycling the different types of wastes as well as at properly disposing of waste;
- Measures in agriculture and forestry are based in "Plan to a Sustainable Development of Portuguese Forestry" and other Programmes (AGRO, RURIS, AGRIS) that promote a better countryside management, reducing fertiliser use, protecting and enhancing forests and encouraging biomass energy use;
- Measures to prevent forest fires, including installation of support infra-structures and public awareness;

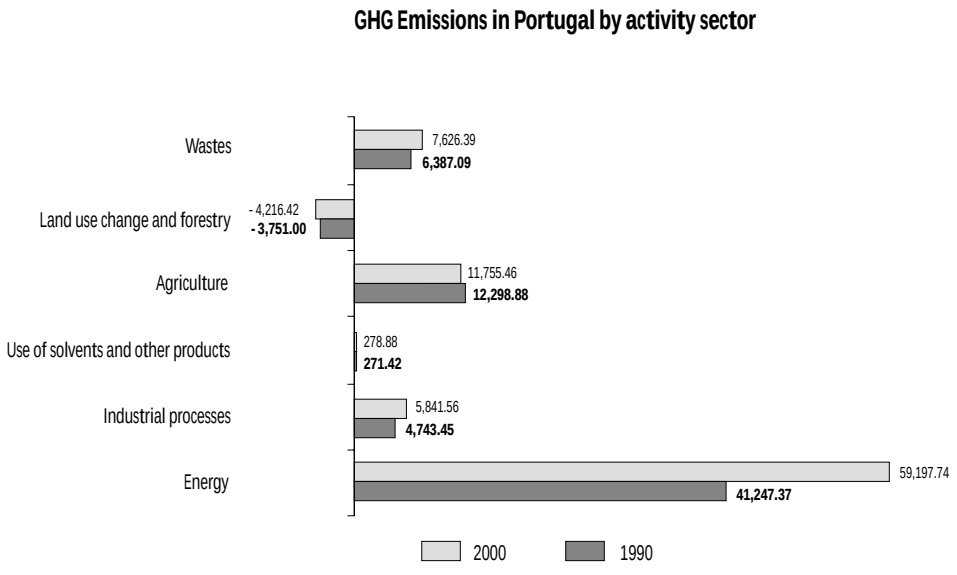

Figure 2 – GHG emissions in Portugal by sector (Kt CO_2 eq.)

Projections

The projections reflect the work developed during the preparation of the Climate Change National Programme (PNAC) and are based in emission estimates for 2000, excluding land use change and forestry. Two scenarios, for the years 2000-2020, are discussed: (a) "reference scenario" ("with measures") that considers the impacts on emissions of implemented policies and measures until mid 2001, and the social and economics scenarios and (b) a scenario "with additional measures".

Under these assumptions the emissions would increase from 64.95 Mton CO_2eq. in 1990 to between 95.1 – 99.7 Mton CO_2eq. in 2010, corresponding to + 46.5 – 53.5% compared to 1990. The reduction efforts must be set then between 12.6 and 17.2 Mton CO_2eq.

The following graphic shows the effect of the additional policies and measures listed in PNAC. Note that these projections don't consider the potential removals from the LUCF sector.

	Inventories		High-end Scenario				Low-end Scenario			
	Mt CO_2eq.		Mt CO_2eq.		% increase relative to 1990		Mt CO_2eq.		% increase relative to 1990	
	1990	2000	2010	2020	2010	2020	2010	2020	2010	2020
1. Energy (combustion and leaks)	41.25	59.20	79.2	91.2	92.1	121.2	74.8	83.9	81.3	103.5
1.1. Energy supply	16.21	22.91	26.5	30.3	63.7	87.1	24.4	26.2	48.5	61.7
1.2. Industry and construction	8.90	10.18	15.1	17.7	69.9	99.4	14.2	15.6	60.1	75.3
1.3. Transport (w/o bunker fuels)	11.41	20.20	29.3	33.4	156.7	192.8	28.5	32.8	149.6	187.3
1.4. Other sectors	4.72	5.90	8.3	9.8	75.1	106.6	8.0	9.3	68.6	97.5
2. Industrial processes	4.74	5.84	5.9	6.9	25.2	45.9	5.8	6.6	22.4	38.5
3. Solvents and other products	0.27	0.28	0.3	0.3	2.7	2.7	0.3	0.3	2.7	2.7
4. Agriculture	12.30	11.76	12.2	12.7	-0.7	3.2	12.2	12.7	-0.7	3.2
5. Changes in land use and forestry (LUCF)	-3.75	-4.22	n.a	n.a			n.a	n.a		
6. Waste and others	6.39	7.63	2.1	2.1	-67.9	67.9	2.1	2.1	-67.9	-67.9
Total (without LUCF)	**64.95**	84.70	**99.7**	113.2	**53.5**	74.3	**95.1**	105.5	**46.5**	
Projections (without LUCF)			High-end Scenario				Low-end Scenario			
Kyoto target (+27% in 2010)	**64.95**		**82.5**	(+27%)			**82.5**	(+27%)		
Reduction effort (Mt CO_2eq.)			**17.2**				**12.6**			

n.a - not available

(Source: PNAC- Measures and Impacts, Nov. 2002, CEEETA/FCT-UNL)

Table ES.1: Greenhouse gas emissions by economic sector in 1990 and 2000, with forecasts for 2010 and 2020

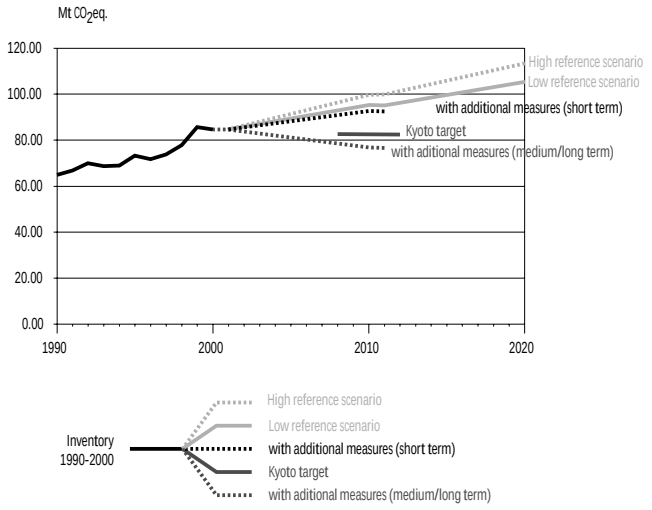

Figure 3 – Comparison of projections based on reference scenarios and some policies and measure foreseen in the PNAC

For compliance purposes, Portugal needs to take into consideration the implementation of the new EU legislation to be developed under the European Climate Change Programme (ECCP), the implementation of the EU Emissions Trading Scheme and the use the Kyoto Mechanisms.

Impacts and adaptation

The first climate change scenarios for Portugal were developed under the SIAM Project ("Climate Change in Portugal – Scenarios, Impacts and Adaptation Measures"), a multi-disciplinary research programme, with the involvement of scientists from different Portuguese Universities, developed with the support of the Foundation for Science and Technology (Ministry of Science), in the years 1999-2001.

This project was the first, and only, integrated and comprehensive study on the impacts of climate change, taking into account scenarios of future climate downscaled to Portugal. The project also aimed at identifying adaptation measures. A second phase of the project, SIAM II, funded by the Environment Ministry will be finalised at the end of 2003 and aims at further understanding the impacts of climate change as well as further considering options for adaptation.

According to the results of SIAM, the anticipated impacts of climate change in Portugal, can be summarised as follows:

- a substantial increase in mean air temperature all over the country, but especially in summer and away from the coast and with greater intensity for maximum temperatures. The land-sea thermal gradient is also significantly increased;
- almost all models project reductions in mean precipitation and in duration of rainy season;
- the change in precipitation and temperatures regime, induced by climate change, will lead to changes in the runoff, aquifer recharge, flood and drought frequency and magnitude, as well as in the quality of the water resources. Focusing on the impacts in the runoff regime, the result of the study indicate a progressive reduction in the annual river runoff during this century, appearing to be small in the northern region of Portugal, but increasingly more significant in the south. This tendency will increase the current spatial asymmetry of water availability in Portugal, which demands greater attention on the water resources management strategies and policies.
- the most relevant impacts of climate change in mainland Portugal coastal zone is sea level rise, that has already risen around 15 cm since the 1900s, and this average trend is expected to increase non-linearly in the near future and especially in the last quarter of this century. The most important impacts are likely to be: (a) increased levels of inundation and displacement of wetlands and lowlands; (b) accelerated coastal erosion; (c) increased storm surge and flooding; and (d) encroachment of tidal waters into coastal basins accompanied by changes of tidal regime and of the sediment budget;
- adaptation measures to agriculture will need to promote an increased efficiency in the use of water, either by more efficient varieties and/or more efficient systems of water distribution and application;
- the major impacts of climate change on forests and biodiversity predict: (a) greater water deficits to plants and animals, which will lead to a possible decline in productivity; (b) meteorological forest fire risk increases substantially in all the country, both in severity and in the length of the fire season; (c) the carbon sink strength in the future may be lower; (d) biotic invasions may be favoured, which will affect local biodiversity.

Financial assistance and technology transfer

Under the Portuguese co-operation policy, support for development programmes, which take into account tackling environmental problems, has increased its importance. Therefore, given the priorities of the Portuguese co-operation policy, most of the funds aimed at protecting environment are "hidden" under other headings such as agriculture, fishing, and industry and, especially, in energy sector, thus making it more difficult to report on specific projects.

For solving global environmental problems, Portugal has contributed in the period 1997-2000 altogether with USD 5.07 million to the Global Environment Facility (GEF).

Through bilateral projects, directly or indirectly related to climate change, Portugal promotes and support activities in different areas such as capacity building and preparation of legislation. Projects related to Energy/Environment, include the promotion of energy efficiency and the use of renewable energy sources. "Portuguese Speaking African Countries" are the most relevant project hosts promoted by Portugal, with priority to projects on capacity building of the public administration and co-operation with scientific communities/universities. Some of the projects implemented by Portugal are co-financed by the European Commission. In this period Portugal contributed with about USD 0.3 million.

Research and systematic observation

Climate related research is carried out in Portugal in several research institutes, universities and organisations. The Ministry of Science, co-financed by the European Commission and the private sector, sponsor most of these studies. However, there is no programme for research on climate change aspects.

In the last few years the interest of scientific community for research on climate change related areas has increased, particularly in climate modelling, impacts and

adaptation, renewable energy technologies, improvement of energy efficiency in combustion and in buildings, carbon sinks, etc.

As regards systematic observation, the National Meteorological Institute is responsible for atmospheric observing systems, with participation in European programmes and international systems like GCOS. The Environment Institute contributes and co-ordinates the air quality monitoring.

During the last four years, mainly through the National Meteorological Institute, Portugal contributes to co-operation projects concerning meteorological technology transfer and education/training, including with the support of the "Agência CRIA" – an international agreement between the Meteorological Institutes of the all Portuguese Speaking Countries and Macao Administrative Region (China).

Education, training and Public Awareness

Climate related topics have been included in environmental education at various levels, often under the wider banner of sustainable development or focus in general environment problems, especially in air quality topics. A range of specific initiatives is being taken forward in partnership with other organisations.

Several non-governmental organisations (NGOs) have been active in climate change issues, as well as the Portuguese Media, particularly during international climate negotiations, which might indicate a higher degree of concern by the Portuguese public

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Chapter 1:
National Circunstances

1.1 – Government Structure

The Portuguese Republic is made up of continental Portugal and two autonomous regions, the archipelagos of Madeira and the Azores. Continental Portugal is split into administrative provinces and districts, all of which are grouped into 5 regions (North, Centre, Lisbon and the Tagus Valley, Alentejo and Algarve).

The government of Portugal has the overall responsibility for ensuring compliance with the commitments agreed internationally within the Framework Convention on Climate Change and the Kyoto Protocol, namely through the establishment of a "Climate Change National Strategy" and the adoption of a "Climate Change National Programme".

The Ministry for Urban Affairs, Spatial Planning and the Environment (MCOTA) is responsible for coordinating the process of defining the national policy for combating climate change, with the involvement of the other Ministries responsible for its implementation. To that effect, the "Climate Change Committee" (CAC) was created in 1998 (Resolution of Ministers Council nº 72/98, of July 4th), and restructured in 2001 (Resolution of Ministers Council nº 59/2001, of May 10th).The CAC includes representatives from the Ministries of the Economy (including Energy and Industries), Agriculture, Fisheries and Rural Development (including Forests), Public Works, Transport and Housing, Science and Higher Education, Internal Affairs, Finance, Education, Foreign Affairs and also representatives from the autonomous regions of Madeira and Azores.

The CAC, a consultative body dependent of the Ministry for Urban Affairs, Spatial Planning and the Environment, performs an important role in the analysis of the integration of climate change issues in the different sectoral policies, assuming responsibility for the drafting of the "Climate Change National Strategy" (approved by the Resolution of Ministers Council nº 59/2001, May 10th), as well as the preparation of action plans and programmes related to Climate Change, namely the "Climate Change National Programme" (PNAC).

In the organizational structure of this Ministry, climate change affairs are a responsibility of the Secretary of State for the Environment, which, in turn, delegates competence in this issue to the Institute for the Environment.

The Assembly of Portuguese Republic, through Law nº 93/2001 of August 20th, created the "National Observatory on Climate Change in Portugal" which will perform the tasks of collection, analysis and dissemination of all the information, studies and research on the risks associated with climate change. However, this institution is yet to start operating.

At the local level, and within the spirit of Local Agenda 21, Local Authorities have a very important role in implementing policies and measures, as well as promoting awareness on issues relating to climate change, as these are the governmental bodies closest to the citizens and also the ones that, can drive significant changes, especially in the behaviour of individuals and small and medium enterprises.

Box 1:
The role of Local Authorities – Almada City Council

Almada City Council is, an exemple of good pratice as it has been developing a Municipal Strategy on Climate Change.

Work undertaken so far has contributed to the identification of needs and the structure for a Greenhouse Gas (GHG) emissions reduction strategy for the city of Almada. The selection of policies and measures leading to GHG reductions is based on a methodological framework comprising six points:

1- Inventory of GHG emitting activities, especially those associated with energy consumption and respective estimates for a base year.

2- Estimations of the trend in GHGs emissions for a year in the future, normally between 2010-2015.

3- Establishment of a reduction objective for GHG emissions. The adoption of a concrete objective and a timeframe for its achievement is essential, not just for the establishment of a policy framework, but also for the planning and implementation of the necessary policies and measures.

4- Development and approval of a Local Action Plan, which combines and summarizes data and information on GHG emissions, defines a timeframe for the GHG reduction objective and identifies a range of policies and measures at local level, which will contribute to the achievement of the objective.

5- Monitoring and verification of the progress on the implementation of GHG reduction actions. The ongoing auditing of the Local Action Plan allows for the identification of new opportunities, fine-tune the measures, estimate the emission reductions and quantify costs, benefits and added value associated to these measures.

6- The public disclosure of the audits has proved to be an incentive tool for the participation of citizens, as well as the added value of local action within the framework of national governance and international initiatives.

The methodology followed emphasizes action at two different levels:

Municipal Level: Activities developed under the responsibility of the Local Authority (e.g. public lighting; fleet; public buildings)

Local level: Activities developed by the local community as a whole (e.g. service, residential and transportation sectors)

1.2 - Geographic and Climate Profile

Portugal is located in the far south-western corner of Europe with roughly 1450 Km of coastline, a series of topographic transitions from north to south, a continental surface area of 91 906 Km^2, and shares a 1200 Km border with Spain. The four major river systems in Portugal, Douro, Tagus, Guadiana and Minho cross this border. National rivers, the most important of which are the Vouga, Mondego and Sado, are smaller and more erratic.

The terrain north of the Tagus is mountainous, with altitudes over 400m and reaching a maximum at 1991m, with the exception of the plains in the Tagus and Vouga basins. The soils are predominantly acidic, though more balanced soils are found in the centre region. In the Alentejo region south of the Tagus, altitude varies within 50-400m and the soils range from predominantly acidic to neutral. The far south, the Algarve, shows a continuous coastal strip of plains (altitude between 0 and 50m), with soil types ranging from acidic in the plateau areas, to neutral and, predominantly, alkaline in the plains.

In addition to the continental territory, there are the two archipelagos of Madeira and Azores in the Atlantic Ocean. Madeira, with a surface of 779 Km^2, is located approximately 1000 Km southwest of continental Portugal, while the Azores archipelago, with a total surface area of 2330 Km^2, is located approximately 1200 Km west.

The factors that most influence the climate in continental Portugal are latitude, relief, the influence of the Atlantic Ocean and distance from the sea. Latitude-wise, Portugal has an extension of just about 5º in latitude; with regards to altitude, the highest values range between 1000m and 1500m, except for Serra da Estrela´s 2000m; in terms of distance to the sea, the farthest regions are roughly 220 Km away from the sea.

Despite the small variation in the climate variables indicated above, there is still a significant variation in climatic characteristics such as air temperature and rainfall.

Spatial variability of climate

Air temperature

The spatial distribution in average annual air temperature, based on observations for the period 1961-1990, is shown in Figure 4. Average annual air temperatures range from 7ºC for the central interior highlands to 18ºC on the southern coast.

Average air temperatures follow seasonal variations, as shown in Figure 5.

The number of days per year with a minimum temperature below 0ºC is highest in the northern and central interior highlands, and insignificant in the coastal

zones. The number of days with minimum temperatures above 20ºC and maximum temperature above 30ºC is highest in the central interior, the eastern part of Alentejo and the coast of Algarve.

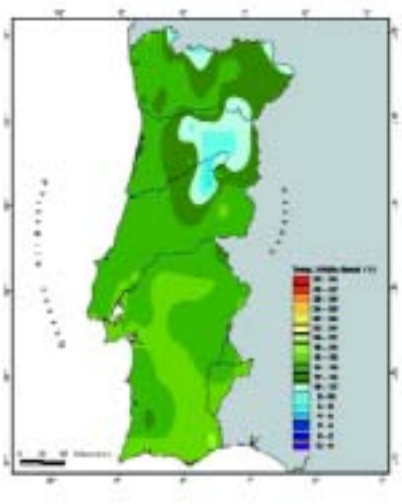

Figure 4 – Mean annual air temperature

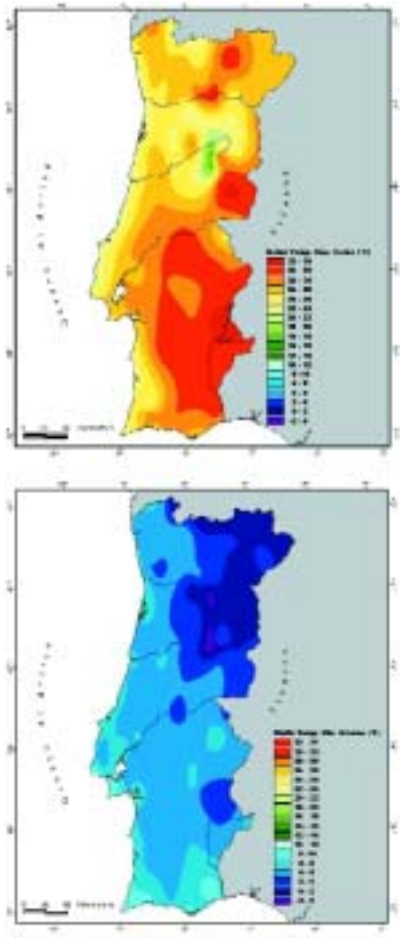

Figure 5 – Mean summertime maximum air temperatures and mean wintertime minimum air temperatures (period 1961-1990)

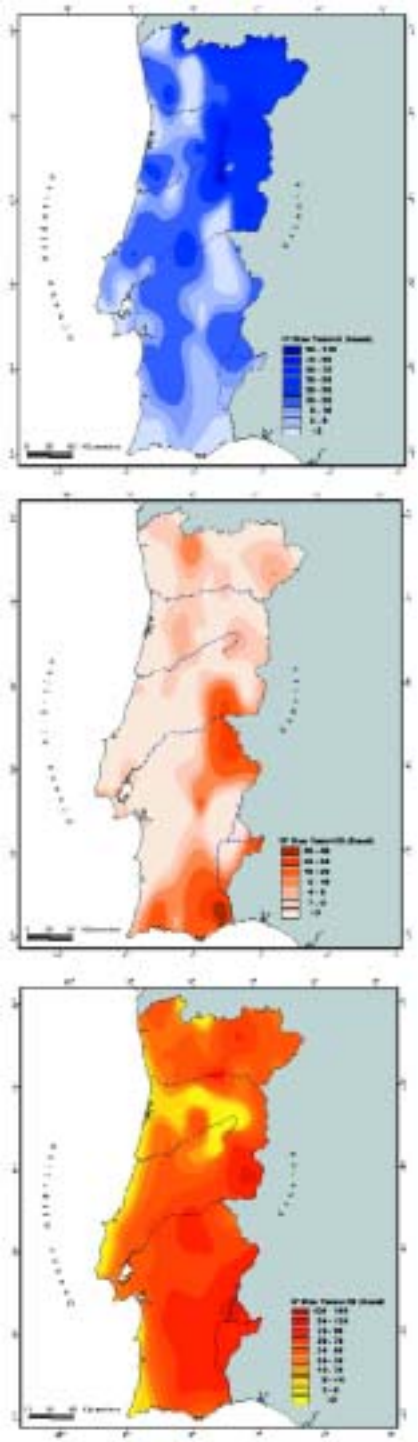

Figure 6 – Number of days per year with minimum temperature below 0ºC and above 20ºC, and number of days per year with maximum air temperature above 30ºC (period 1961-1990)

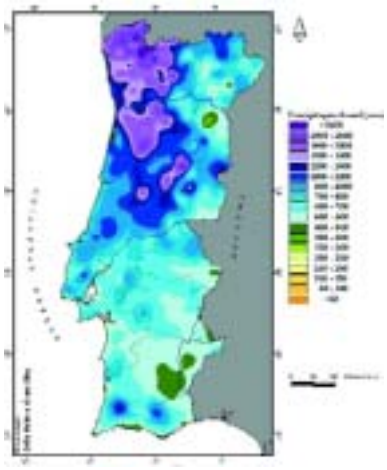

Figure 7 – Mean annual precipitation (period 1961-1990)

Precipitation

The average annual precipitation rate in continental Portugal is approximately 900mm, with considerable spatial variation, the highest values, around 3000mm, recorded in the highlands of the northwest (Minho) and the lowest, around 500mm, in the southern coastal strip and the eastern part of the territory (Figure 7). There is a significant contrast in rainfall between the regions to the north and to the south of the Tagus river.

The highest precipitation occur in the Winter and range between 2165mm in northwest regions and 176mm in Alentejo and Algarve; about 42% of precipitation takes place in this period. The lowest precipitation occurs in the Summer, ranging between 332mm at Gerês (mountain range in the far north) and 12mm in the Algarve, and account for just 6% of the annual total. Precipitation rates are highly variable in the transition months (March to May, October and November).

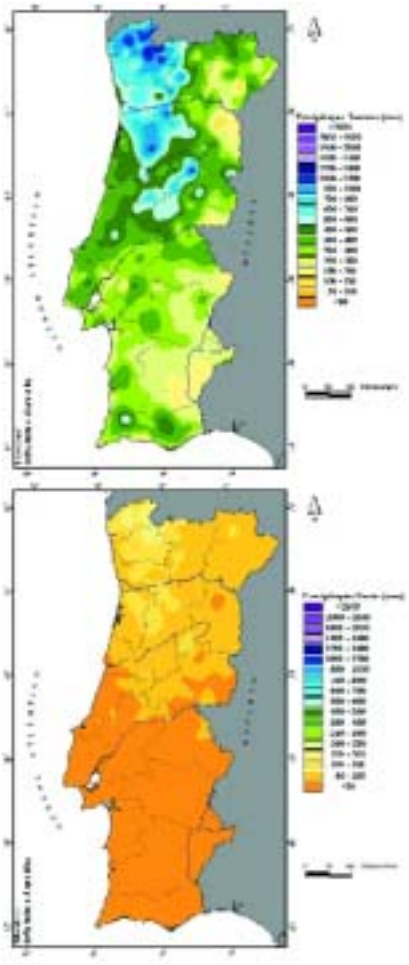

Figure 8 – Mean annual precipitation in winter and in summer (period 1961-1990)

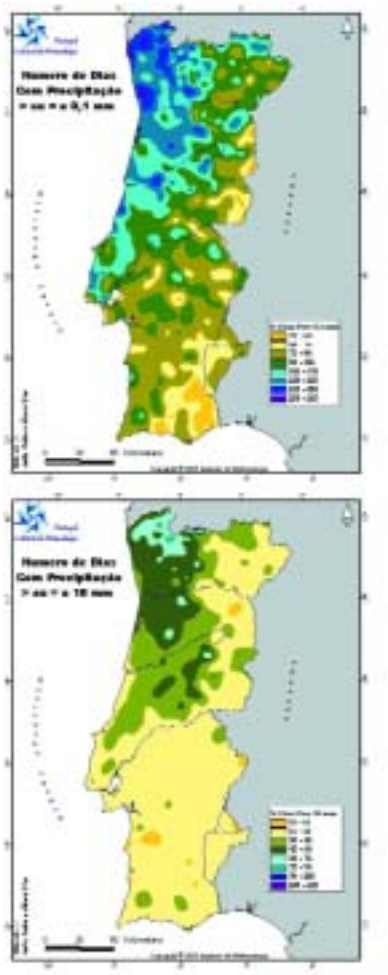

Figure 9 – Number of days per year with precipitation (equal to or higher than 10mm) (period 1961-1990)

The average number of days per year with precipitation equal or above 10mm ranges between 15 and 25 days for the coastal regions of the centre and south and the lowlands of the interior, between 25 and 50 in the northwest region and between 50 and 65 in the highlands.

Incidence of sunlight

The average annual incidence of sunlight generally decreases from south to north and from east to west.

Wind

North and northwesterly winds are predominant along the western coast, while southwesterly winds are predominant along southern coast. Though the occurrence of strong (speed ≥ 36Km/h) and very strong winds (speed ≥ 55Km/h) varies between places, these are most frequent along the west coast and in the highlands. The number of days per year with wind speeds above 36 Km/h ranges between 30 and 50 days on the coast and averages approximately 70 days in the highlands.

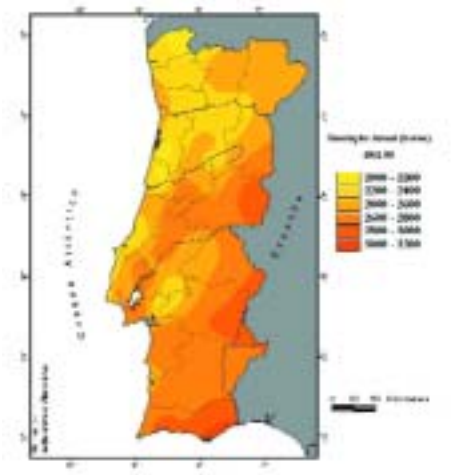

Figure 10 – Mean annual hours of sunlight

Climate trends for continental Portugal

Air temperature

The statistical analysis of climatic time-series of average annual air temperature in continental Portugal for the period 1931 to 2000 shows a warm period in the 1940s, a cold period in the 1970s, and a warming trend since 1972, especially shown by an upward trend in the average annual surface temperature. The time-series analysis of the average annual temperature in Portugal since 1931 shows that 1997 was the warmest year on record and that 5 of the 6 warmest years occurred in the 1990s (Figure 11).

The time-series analysis of the average annual minimum temperature since 1931 shows that 2000 is the 14th consecutive year in which the minimum temperature has a positive increment relative to the average for the period 1961-1990 (Figure 12).

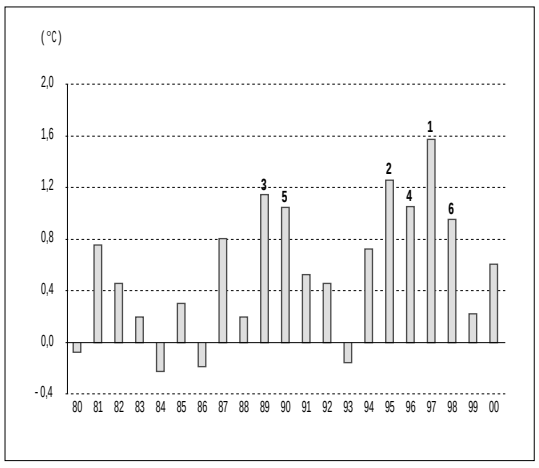

Figure 11 – Mean annual air temperature for continental Portugal – deviation relative to the mean for period 1961 - 1990

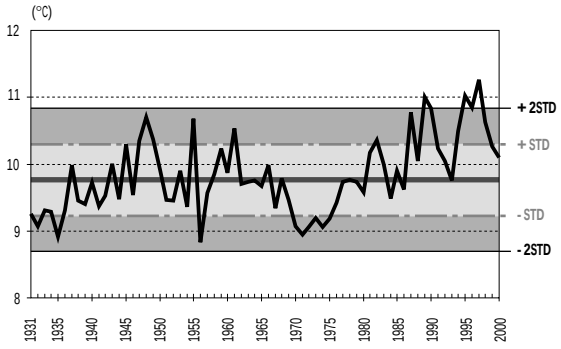

Figure 12 – Variation in the local mean of the mean minimum air temperature in Portugal

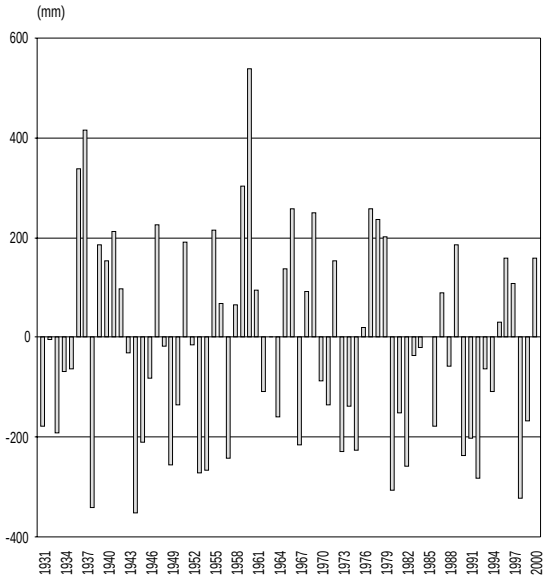

Figure 13 – local mean annual precipitation in continental Portugal – deviations relative to the mean for period 1961-1990

Precipitation

Figure 13 shows the variability in the regional average annual precipitation rates in continental Portugal, in terms of the deviations relative to the mean value for the period 1961-1990.

It should be noted that only 6 of the last 20 years had above average precipitation rates.

North Atlantic Islands of the Azores and Madeira

Azores

The Azores climate is temperate with significant precipitation across all seasons. The average annual air temperature figures in the Azores are higher than those recorded in continental Portugal while the amplitude of the annual variation is smaller than the recorded for the mainland's coast. The average monthly air temperature figures achieve a maximum in August and a minimum in February. There are no observations of days with a minimum temperature below 0ºC in the regions with lower latitudes. The average number of degree-days of warming for a base temperature of 18ºC varies between 583 at Pico (altitude 44m) and 794 at Angra do Heroísmo (altitude 74m); the average number of degree-days of cooling for a base temperature of 20ºC varies between 130 and 200.

The annual precipitation ranges between 800mm and 2200mm. Annual sunlight averages range between 1500h and 1900h. In the Western and Central island Groups the dominant winds blow from the western quarter while in the Oriental Group these are predominately northeasterly winds.

Madeira

Madeira´s climate is temperate, moderately rainy to rainy with precipitation in the winter. The average annual air temperature values for Madeira are higher than those recorded in continental Portugal (between 9ºC and 19ºC). The average monthly figures achieve a maximum in August and a minimum in February. The number of days in the year with a minimum temperature below 0ºC is about 13 in the mountainous regions and nil in the lower latitude regions.

The average number of degree-days of warming for a base temperature of 15ºC varies between 40 and 50, and between 340 and 400 for a base temperature of 18ºC; the average number of degree-days of cooling for a base temperature of 24ºC varies between 7 and 14, and is about 200 for a base temperature of 20ºC (mountainous region not considered). The average annual precipitation ranges between 350mm and 2000mm, in the highlands. As for sunlight, the average annual incidence ranges between 1600h and 2200h.

1.3 – Population and urban profile

The transformations of the last decade did not result in significant demographic changes in Portugal. In the period 1991-2001, the trend in age-structure of the population reflects the general trend of the developed countries, though in a less pronounced way. Forecasts point to a maintenance of a total population around ten million inhabitants, with a reduction of the percentage of citizens of working age, as a result of the increase in life expectancy and decrease in the birth rate.

Data from the 2001 Census estimates a total of 10 318 084 individuals resident in Portugal, a 4.6% growth in population relative to 1991, with 9 833 408 individuals in the mainland (+4.9% relative to 1991), 242 073 individuals in the Azores (+1.8% relative to 1991) and 242 603 individuals in Madeira (-4.3% relative to 1991). According to the same data, the last ten years showed 20% increase in the number of dwellings, and an 18.5% increase in the number of family units such that the average number of individuals per family dropped from 3.1% in 1991 to 2.8% in 2001.

In 1999 the estimated population density was 108.7 inhab/Km^2 in the whole of Portugal; 106.8 inhab/Km^2 in the continent, 105.4 inhab/Km2 in the Azores, and 335.1 inhab/Km^2 in Madeira. The pattern of spatial occupation is characterized by an urban network which is dominated by medium-sized cities and a large number of small clusters of population. The dispersion of population settlements throughout a large part of the territory is such that creates pronounced regional asymmetries. These asymmetries are aggravated by the aging trend in the population, a phenomenon with special incidence in the areas of the interior, leading to a process of desertification in some of these areas.

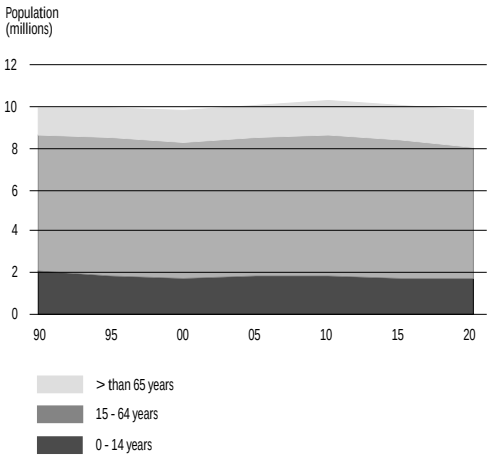

Figure 14 – Trend in age structure from 1990 to 2000, with projection to 2020
(Souce: REA 2000)

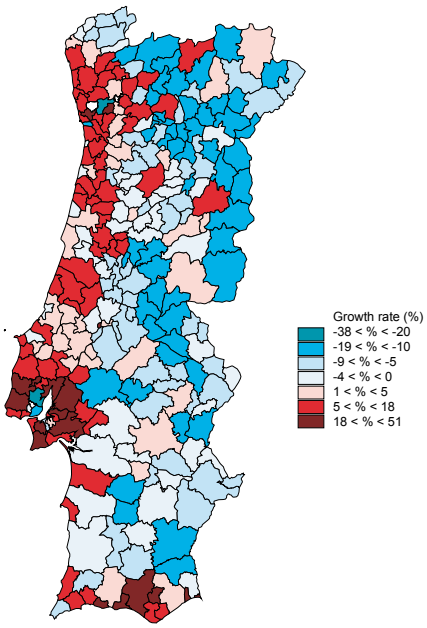

Figure 15 – Variation in population from 1991 to 2001
(Souce: REA 2000)

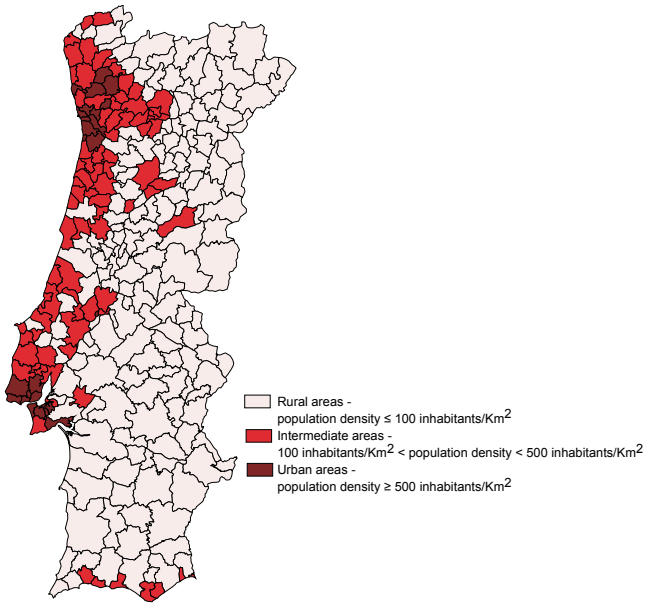

Figure 16 – Urbanisation pressure
(Souce: REA 2000)

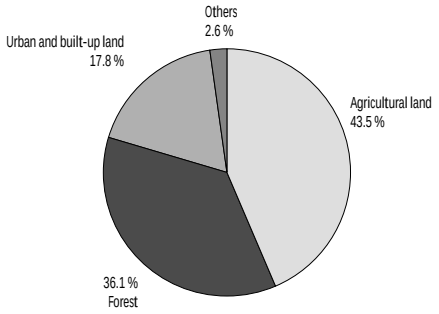

Figure 17 – Land cover based on available data
(Souce: REA 2000)

According to INE[1] data, the variation in the resident population and its associated land occupation (through the growth in the number of buildings and house units) continues to take place mainly on the coast and urban centres. The Portuguese population is increasingly living in urban areas, with the majority (and the most populous) concentrated along the coast.

The built-up area in Portugal – including the residential, industrial, commercial and leisure sectors, as well as roads and other technical infra-structure but excluding random constructions, – has increased significantly between 1990 and 1999, occupying from 15.4% to 17.8% of the territory, respectively. This is one of the highest rates in the European Union, together with the Netherlands and Belgium (information provided by DGOTDU[2] from the OECD/Eurostat questionnaire of 2000, based on a survey carried out in the urban perimeter, parish to parish). The comparison is especially concerning when analysed in per capita terms, whereby Portugal clearly stands out in relation to other countries whose data for 1999 is already available.

Adding to the pressure generated by continuing construction along the coastal strip, especially in the counties that border the seaside – where over 50% of the Portuguese population lives – is the extra pressure caused by the intense seasonal variations in population (the so called "floating population"), especially in the summer season and in regions with significant tourism.

1.4 – Economic profile and Industry

Portugal has been a member of the European Union (EU) since 1986 and its economy, when compared with other small EU economies, has performed well in the last decades in terms of convergence, a process which has been sustained by significant gains in productivity. This process has been slowing, especially in the 1990s, and the tendency is for economic growth rate to converge to the EU average.

The Portuguese economy registered, in the period between 1996 and 2000, a real average growth rate of 3.6% a year (1.1% above the EU average). This was possible due to a sensible economic policy and a favourable economic environment, reinforced by the positive expectations generated by the integration of Portugal in the "Euro Zone". This growth was achieved within a context of low inflation and a reduction of the unemployment rate to levels around 4%.

In 2001, the Portuguese economy slowed, partly influenced by the sluggish performance of the world economy (a weaker external demand led to a drop in exports) and by a fall in internal demand, namely private consumption. Investment slowed down mainly due to slower growth in civil residential construction and business investment.

[1] National Statistics Institute

[2] Direcção-Geral do Ordenamento do Território e Desenvolvimento Urbano / General Directorate for Spatial Planning and Urban Affairs

Despite some convergence, GDP per capita in Portugal is just about 75% of the EU average. This indicator is a clear example of the development effort the country still has to carry out, so that it progressively approaches that of its EU partners. This effort will take place in a decade of fast global change, marked by globalisation, the challenges of European construction such as the enlargement process, a higher saturation of new technologies and the development of an information and knowledge society. It is estimated that the economic growth measured by Gross Domestic Product[3] was about 34% in the last decade. With practically a stable population, such implies that, on average, the Portuguese have increased their level of wealth by a third.

Throughout the different periods in human development, economic growth has been associated with energy consumption. However, the pace of growth in both variables depends on the energy options adopted. In the Portuguese case and, during the 1990s, the growth rate of energy consumption has closely followed the GDP growth rate up until 1996. From 1996 onwards there is an increase in energy intensity caused by a faster growth in energy consumption relative to GDP growth.

The Portuguese economy is still struggling with problems of low productivity and market competitiveness. This occurs because the poles of specialization, despite strong internal changes (upgrading) throughout the last decades, are still significantly centred on those activities which markets are stagnated; such markets do have very dynamic niches but are also very demanding in terms of innovation throughout the supply chain.

Many determining factors will only see changes in the long run and, as such, their short-term impact will be negligible. For example, the substantial improvement of the quality of the labour inputs demands a coordinated change in education at all levels and with professional training as well; also, the development of innovation and technological progress requires more responsiveness in many structures and the promotion of links between university and industry.

In Portugal, the industrial sectors responsible for GHG emissions through combustion and production processes, are principally those relying on the use of inorganic carbon and that consume carbon-based products, those responsible for production of cement, iron and steel, and nitrous compounds (emitting N_2O) and others, paper pulp, alloys, petrochemicals and synthetic polymers.

The following stand out (in decreasing order) among the energy-intensive industrial sub-sectors:
- "Glass and ceramics",
- "Cement and products",
- "Basic metallurgy",
- "Paste, paper and graphic arts",
- "Chemicals, plastics and rubber".

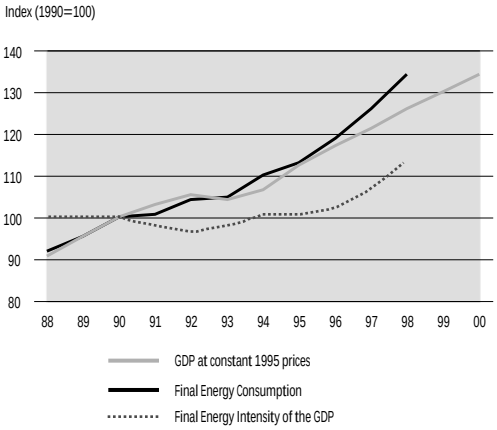

Figure 18 – Energy intensity of the economy
(Source: REA 2000)

[3]GDP at constant 1995 prices. The GDP figures from 1995 to 2000 are in tune with the new European Accounting System (SEC 95) and also include the base change of the National Annual Accounts such that they are not directly comparable with previous years.

Energy (KJ)/VA(ESC.95)	1990	1995	2000	2005	2010
Food and Beverages	22.73	25.88	28.7	25.9	25.46
Cement and products	216.78	241.33	185.98	164.58	157.62
Metal-electro-mechanics	8.87	8.13	10.6	10.62	10.86
Basic Metallurgy (includes SN)	99.99	298.62	110.06	92.54	91.91
Paste, Paper and Graphic Arts	56.8	73.73	59.02	55.17	55.6
Chemicals, Plastics and Rubber	41.63	39.16	40.49	37.83	35.6
Textiles, Clothing, Shoes	23.31	22.46	27.83	27.88	27.56
Glass and Ceramics	366.81	390.85	298.42	283.86	272.85
Other	29.9	26.88	26.77	26.82	26.56
Transformation and extractive industries	**41.14**	**45.57**	**45.67**	**42.44**	**40.93**

Source: National Accounts, INE (1990 e 1995); Energy Demand in Portugal 2000-2020; Industrial Sector, DGE/DSPA/DP (1999); Energy Balances, DGE (1990 e 1995); Energy Consumption Inventories, DGA (1990 e 1995).

Table I-4.1 – Energy Intensity in the Transformation industry (FCT, 2000) (Souce: PNAC 2001,vol. 2)

Emissions (tCO2 equiv)/VA (106 ESC.95)	1990	1995	2000	2005	2010
Food and Beverages	2,421	2,588	3,102	2,804	2,683
Cement and products	48,508	54,583	45,809	43,943	43,394
Metal-electro-mechanics	1,252	1,24	1,7	1,698	1,753
Basic Metallurgy (includes SN)	5,56	19,799	8,9	15,146	14,995
Paste, Paper and Graphic Arts	19,053	20,138	15,544	14,364	14,378
Chemicals, Plastics and Rubber	8,193	10,835	10,355	9,644	9,425
Textiles, Clothing, Shoes	2,802	2,846	(*)	(*)	(*)
Glass and Ceramics	33,51	34,996	25,284	22,717	21,275
Other	9,107	9,87	(*)	(*)	(*)
Transformation and Extractive Industries	**6,942**	**7,725**	**7,147**	**6,97**	**6,762**

(*) Data unavailable

Table I-4.2 – Carbon Intensity in the Transformation indudstry (FCT, 2000) (Souce: PNAC 2001,vol. 2)

This set of sub-sectors represents about 65% of total energy consumption of processing industries, while their contribution to the (gross) value added of the industry is around 45%.

The following stand out among the carbon-intensive sub-sectors:
- "Cement and products",
- "Glass and ceramics",
- "Paste, paper and graphic arts",

In general terms, between 1990 and 1995 there has been an increase in GHG emissions per unit of wealth created in many industrial sectors, especially in those where energy intensity increased. It should be noted that the carbon intensity in the "chemicals, plastics and rubber" sub-sector increased, despite a drop in its energy intensity, as a significant proportion of the raw materials in this sub-sector are petroleum derivates. There was a reduction in carbon-intensity in most sub-sectors in 2000, due to a reduction in energy-intensity of the industrial sub-sectors; the more intensive use of natural gas; and the adoption of less polluting equipment and technologies.

1.5 – Energy

The energy sector, including production, transformation and distribution of energy products (coal, oil and derivates, gas and electricity), represented during the 1990s between 3.5% and 4% of GDP (DGE, 2000); the electricity sub-sector accounted for 70% to 90% of the value added in the energy sector. Similarly, with regards to investment, this sector was responsible for 4.5% to 7.3% of the gross domestic fixed capital formation recorded during the 1990s, with the relative contribution of the electricity sub-sector varying between 44% and 77% of this total.

There was a marked decrease in the contribution of net energy imports in the incoming FOB merchandise between 1990 and 1998, from 8.4% to 4.6% (DGE, 2000). In 2000, there was a strong increase to a 9.5% share of total incoming merchandise due to a significant rise in the average price of crude oil (58% above the 1999 average value).

National Energy Resources

Portugal is poor in fossil energy resources, depending substantially on imports. In 1999, 92% of the energy supply was dependent on external sources, with 71% of the total primary energy consumption covered by imported oil. However, there is a significant renewable energy potential, especially with regards to solar, wind, geothermal, hydro and biomass (woods and waste) energy. Of these, hydro energy potential and biomass use have been significantly exploited; increasing the use of the potential of renewable energy sources (RES) is an essential cornerstone of a policy for sustainable development.

Hydro energy has been a relevant source of electricity production, with a 26.8% share of the total gross electricity production in 2000.

Wind and geothermal energy have become increasingly important: in 1995 these accounted for a gross electricity production of 15 and 42 GWh, respectively, while in 2000 these figures had increased to 168 and 80 GWh, respectively. Geothermal energy accounts for a considerable share of electricity production, and is still expanding.

The assessment of the renewable energy potential is a difficult but necessary task in order to determine the scope of the available resources that can be used in the short, medium and long run. According to data on solar radiation, Portugal receives the equivalent of 140 million GWh in solar energy annually. Similarly, the wave, wind and geothermal resources available theoretically exceed the country´s energy needs. However, technological, economic and environmental factors, as well as some social and institutional obstacles, make it difficult to exploit the full extent of this potential.

In a more realistic short-term vision, estimates suggest likely contributions of RES (large hydro not considered) at around 15% to 20% of final energy consumption (i.e., 3 to 4 Mtoe), by 2010 with electricity produced from RES (excluding hydroelectric stations above 10 MW) contributing with some 7 to 8 GWh in 2010.

Energy production

Given the limited fossil energy resources available in Portugal, the primary energy production in the country is obtained from RES; these have accounted for 100% of the total since 1995 when coal extraction activities were shut down in the Pejão mines. Besides the biomass contribution, a variable quantity of electricity is produced annually from hydro resources and, more marginally, from other resources such as wind.

The increase in national primary energy production for the period 1985-1998 was not very significant, despite important investments in hydroelectric power stations whose capacity was increased by about 54% over that period. Total primary energy production (2.4 Mtoe in 1998) grew at a rate of about 1.7% per year during this period.

Electricity production from RES increased by an average of 0.5% per year relative to primary energy for the period 1985-2000 (comparable years in terms of precipitation). However, correcting for annual variations in precipitation, primary electricity production grew at just 0.13% per year over the same period. This modest increase in production contrasts with the strong increase in installed capacity (an average of about 3% per year over the period).

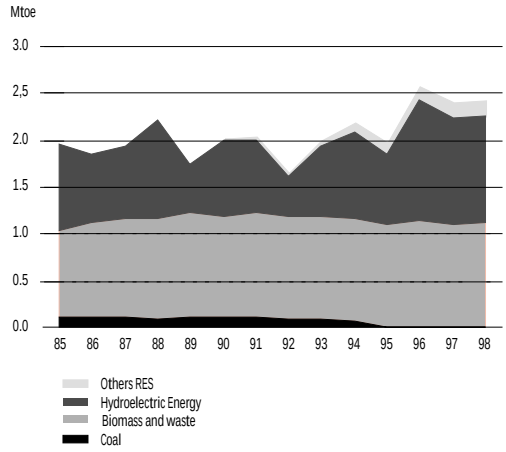

Figure 19 – Trend in production of primary energy
(Source: REA 2000)

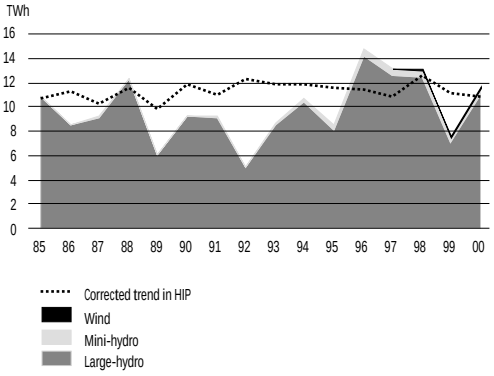

Figure 20 – Trend in generation of electricity from RES (primary energy)
(Source: REA 2000)

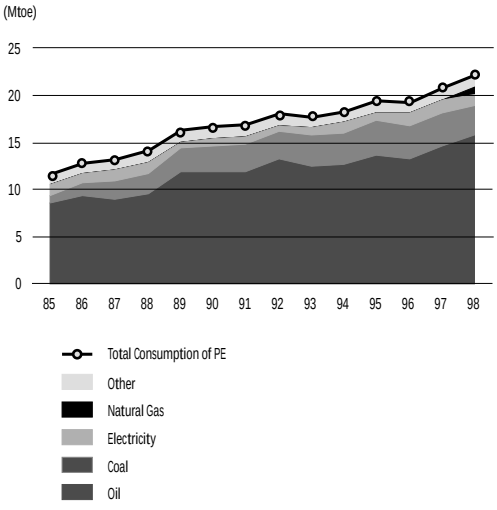

Figure 21 – Trend in consumption of primary energy – total and by source
(Source: REA 2000)

Figure 22 – Trend in proportion of RES to overall primary energy consumption
(Source: REA 2000)

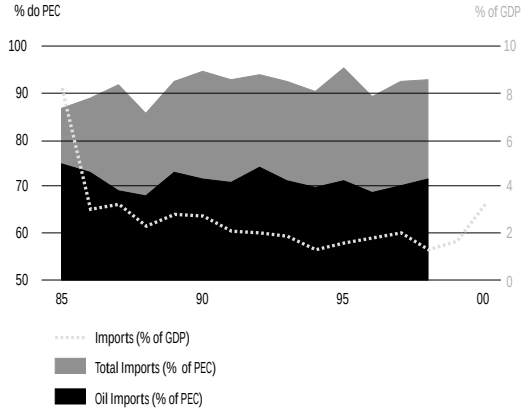

Figure 23 – Trends in energy imports by volume and value relative to primary energy consumption (PEC) and Gross Domestic Product
(Source: REA 2000)

Primary energy consumption

Primary energy consumption registered strong growth in the period 1985-1998 (5.1% per year), with oil and coal accounting for most of the increase. During the 1990s this trend is less accentuated, with growth at an annual rate of 3.7% a year.

Oil consumption has grown at a similar rate to that of total energy consumption. This product still is very important in terms of the structure of the energy supply, with a share of 71% of total consumption in 1998 against 75% in 1985. The changes induced by the introduction of natural gas in 1997, which has contributed to a more diverse structure of supply and a lower external dependence on oil, are yet to show significant impacts.

The contribution of RES to total primary energy consumption has been very irregular due to the pronounced fluctuations in hydroelectric power generation. The 1990s have seen some improvements after the strong negative trend observed in the 1980s. However, the contribution of RES adjusted for the annual variation in precipitation (HPI –hydroelectric productivity index) shows a continuous decrease in the RES` share of the national energy balance.

Despite strong growth in primary energy consumption (from 1.78 to 2.49 toe/capita between 1990 and 2000), Portugal still has the lowest per capita consumption among the 15 EU member-states (average of 3.76 toe/capita).

Currently, Portugal imports over 90% of the primary energy consumed.

Final energy consumption

Final energy consumption is important in order to understand the main factors underlying certain trends , necessary for defining and applying an energy policy oriented towards energy conservation and sustainability.

Final energy consumption has registered strong growth between 1985 and 1998 (4.9% per year), mainly due to consumption of oil products and electricity, with the transport and services sectors accounting for the bulk of energy consuming economic activities.

Though less pronounced, consumption in the 1990s continued to rise steadily, at an average of 3.8% a year (except for the services sector). The consumption of oil products grew faster than the rate of total energy consumption, from 70% to a 73% share of the total energy consumption between 1985 and 1998.

During the 1990s, there was a significant increase in the importance of the Transport sector relative to the Industry sector, with Transport taking the lead in consumption from 1999 onwards. In 1999, the consumption shares of the main sectors of economic activity relative to final energy demand (excluding raw materials and non-energy use of oil) were: 33% for Industry, 38% for Transport, 13% for Domestic, and 16% for other sectors including Services and Agriculture. The weight of Industry and Transport sectors on energy consumption is evident.

In 1999, Portugal´s per capita energy consumption was just 57% of the EU average, thus reflecting a quality of life and mobility through motorized vehicles far below the mean standards across the EU. As a result, a positive trend in energy consumption is expected for the Domestic/Services and Transport sectors.

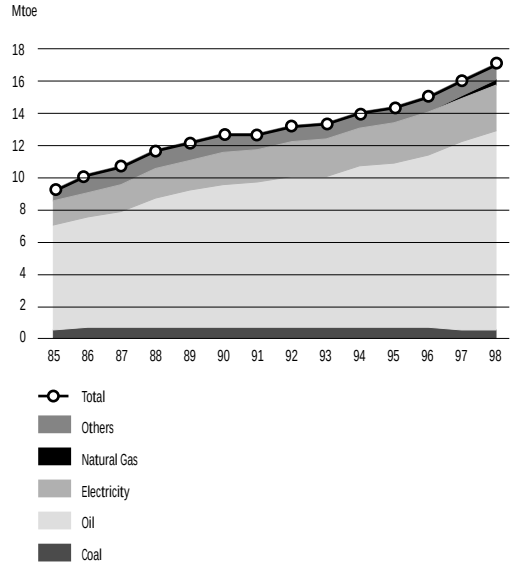

Figure 24 – Trend in final energy consumption, by source
(Source: REA 2000)

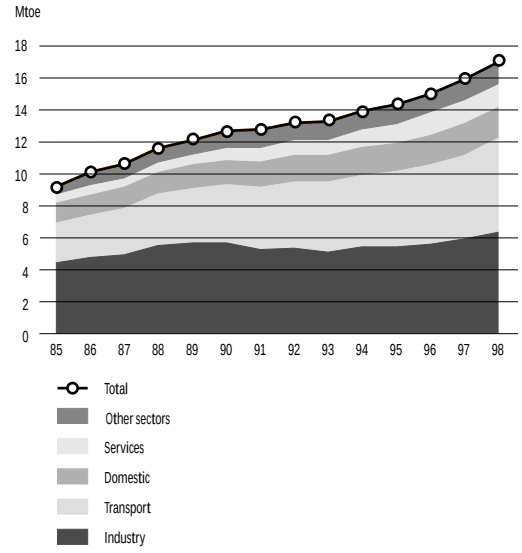

Figure 25 – Trend in final energy consumption, by sector
(Source: REA 2000)

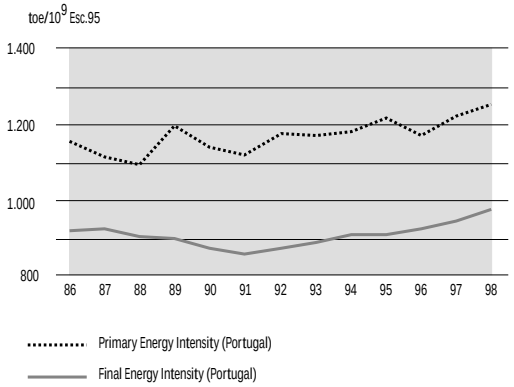

Figure 26 – Trend in energy intensities (primary and final energy relative to GDP)
(Source: REA 2000)

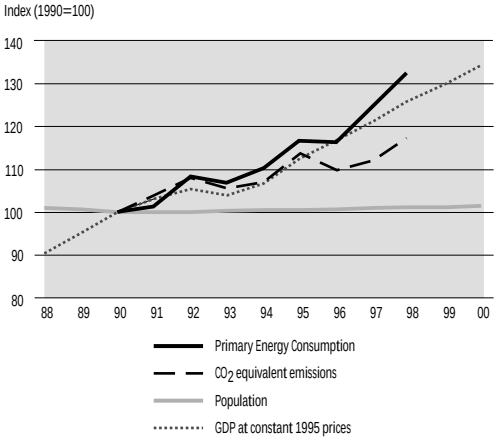

Figure 27 – Trend in wealth expressed in GDP and some environmental impacts (Source: REA 2000)

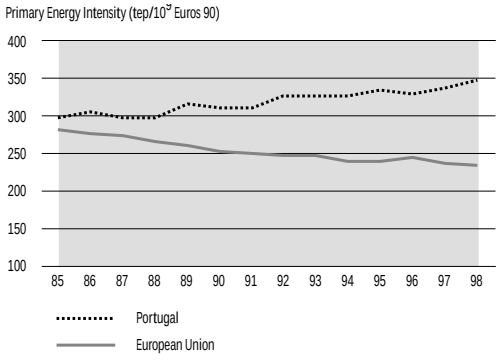

Figure 28 – Comparison of energy intensity: Portugal vs. EU
(Source: REA 2000)

GHGs and energy-intensity

For a given configuration of its productivity, the efficiency and sustainability of the Portuguese economic system can be assessed by its energy- and carbon-intensity. The energy-intensity indicator is generally expressed in terms of the units of energy consumed (primary or final energy) per unit of GDP. The carbon-intensity indicator is expressed in terms of CO_2 emissions or CO_2eq, therefore including other GHGs per unit of GDP.

Throughout the 1990s and until 1996, growth in energy consumption was proportional to that of GDP. From 1996 onwards, energy consumption outstripped growth in GDP, resulting in an increased energy intensity.

Because 85% of primary energy production is accounted for by fossil fuels, growth in GHG emissions has been considerable and diverging from internationally agreed targets. Adoption of measures such as the introduction of natural gas, diversification of energy supply favouring renewable sources, use of co-generation, etc, mean that carbon-intensity may be reduced.

A comparison of the energy-intensity of the economy between Portugal and the EU indicates diverging trends: while the EU has been on a downward path, Portugal has registered constant growth in energy-intensity (relative to both primary and final energy) throughout the 1990s for all sectors of final consumption.

Another important sustainability indicator is the carbon-intensity of the economy, or GHG emissions (6 gases considered under the Kyoto Protocol) for the energy sector per unit wealth created (GDP), as set out in IPCC (Intergovernamental Panel on Climate Change) methodology. This indicator shows Portugal at a disadvantage when compared to the EU. However, in terms of GHG emissions per capita, Portugal was below the EU average in 1998 though some convergence in 1999. Such discrepancy mainly reflects the lower levels of per capita wealth creation relative to the EU average.

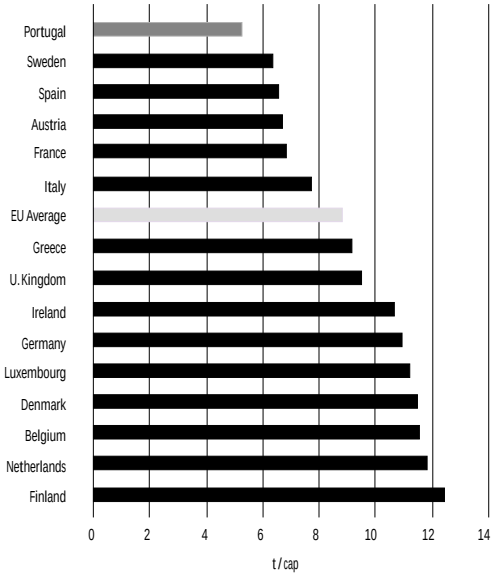

Figure 29 – GHG emissions (GHG related to energy) per capita in 1998
(Source: REA 2000)

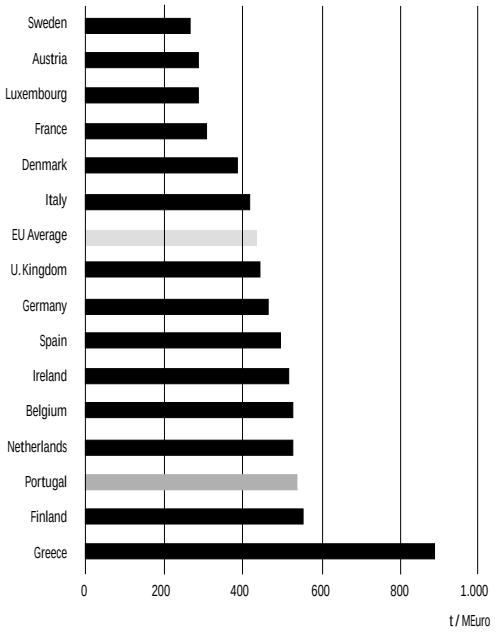

Figure 30 – Carbon intensity (GHG emissions related to energy per unit GDP) in 1998
(Source: REA 2000)

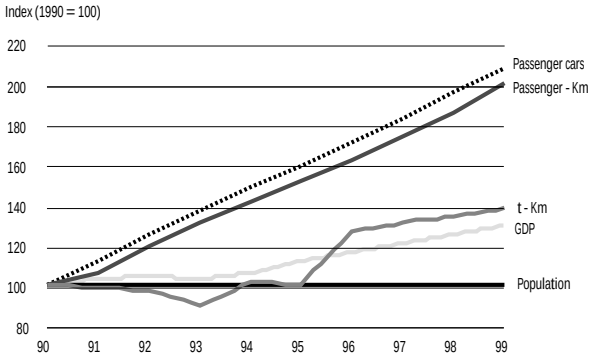

Figure 31 – Trend in transport of passengers and goods
(Source: REA 2000)

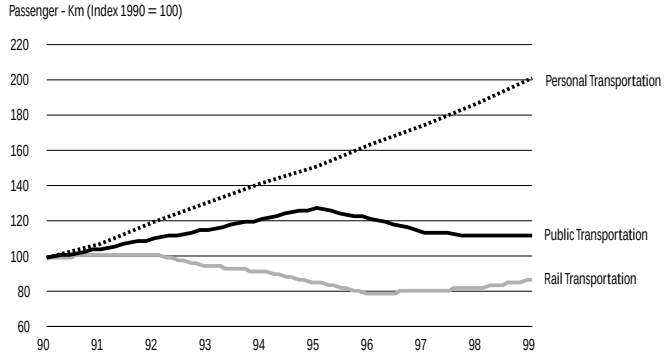

Figure 32– Trend in public and private transport
(Source: REA 2000)

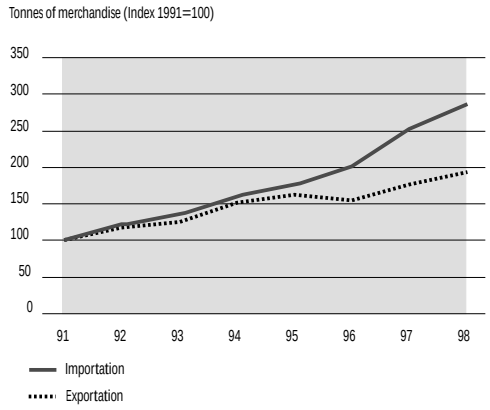

Figure 333 – International road transport of goods
(Source: REA 2000)

1.6 – Transport

The transport sector, which has a key role in the social and economic development of the country, has grown substantially in scale and scope, due to improved mobility of people and merchandise, and upgrades in infrastructure.

The trend in Portugal over the last decade reflects to some degree the trends for the transport sector throughout Europe over the same period.

The fast growth in private consumption observed between 1990 and 1999, favoured by the economic circumstances, led to a significant increase in the number of vehicles in circulation, especially private and multipurpose passenger vehicles. The number of vehicles per thousand inhabitants grew from 287 to 447 between 1992 and 1998, respectively. Furthermore, there was a drop in demand for railway and collective road transport.

The preference by individuals for the option of the use of the automobile in the detriment of the use of public transportation, particularly railway transport, led to a drop in energy-efficiency for this sector. It also resulted in an increase in the emissions of air pollutants and other environmental impacts such as noise and traffic congestion in and around urban centres. At the enterprise level (for example, merchandise transport firms), there has been a preference for road transport to the detriment of rail and maritime means (which account for about 10% of the total merchandise transported), resulting in similar environmental implications.

The increase in mobility of people and goods is one of the most obvious signs of economic development. In Portugal, this increase has had a direct impact on certain key indicators such as international transport of merchandise over land or passenger transport by air.

There have been significant investments in the railway and road transport sectors through the 2nd Community Support Framework (CSF). However, this has not resulted in a desirable increase in demand for railway transportation.

In 1999, the Transport sector was responsible for the highest share of energy consumption, overtaking the Industry sector (33%) for the first time. Several other indicators also show a weak performance, especially with regard to energy-intensity and CO_2 emissions. These trends show the increasing relevance of this sector in the formulation of sensible environmental policies.

Between 1990 and 1998, the growth in energy consumption by the transport sector was consistently greater than the EU average, including the other cohesion countries (Greece, Ireland and Spain), except for Ireland that, from 1996 onwards, took the lead in this indicator.

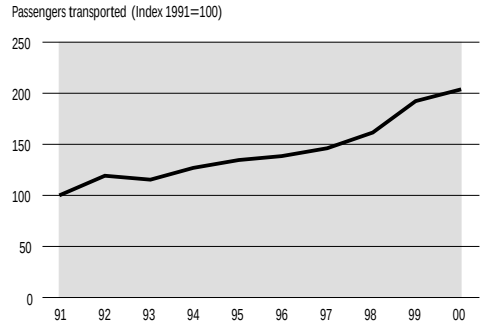

Figure 34 – Passenger transported by air
(Source: REA 2000)

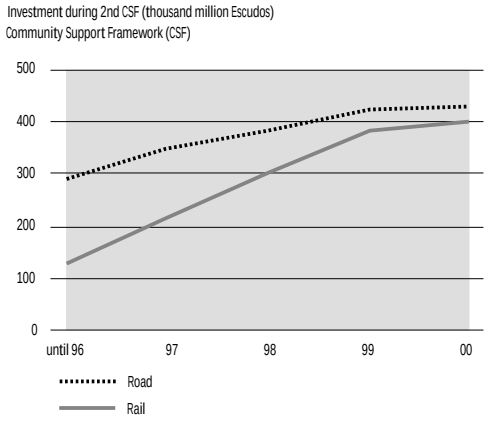

Figure 35 – Investment in transport infrastructure during the 2nd CSF (1994-1999)
(Source: REA 2000)

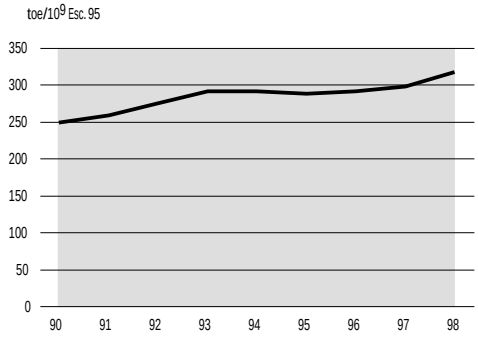

Figure 36 – Energy intensity of the transport sector by unit of GDP
(Source: REA 2000)

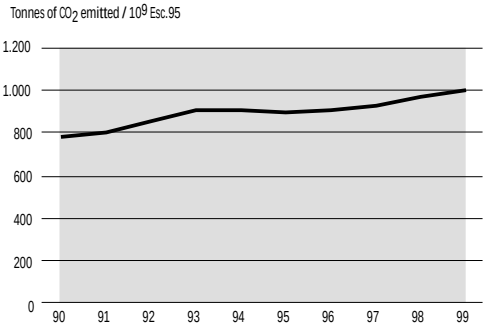

Figure 37 – CO2 emissions intensity in the transport sector by unit of GDP
(Source: REA 2000)

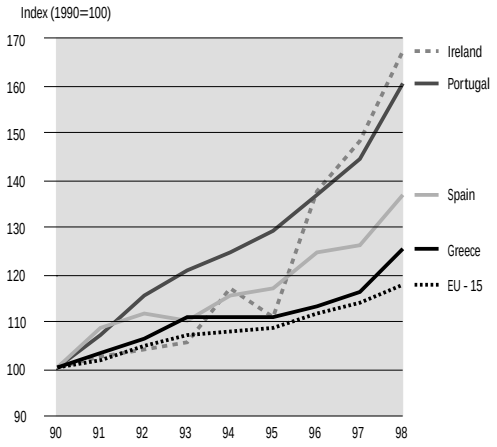

Figure 38 – Trend in energy consumption from transport sector in some EU countries
(Source: REA 2000)

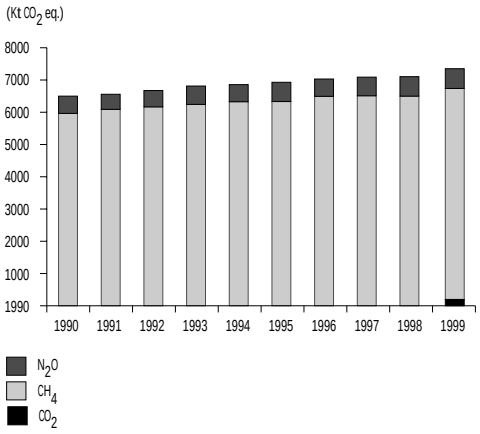

Figure 39 – Trend in GHG emissions in wastes sector (DGA, 1999) (Source: PNAC 2001, vol. 2)

1.7- Waste

The waste sector's contribution towards national GHG emissions is made up of the following components: municipal waste, industrial waste, hospital waste and sludge. Wastewater and livestock waste are also considered due to their GHG emissions. The waste sector is responsible for 14% of the country's total GHG emissions in 1999, methane being the most important gas.

Municipal solid waste represents roughly 3.3% of the total national GHG emissions (2 Mt CO_2eq of a total of 60 Mt CO_2eq in 1990)

The trend in GHG emissions for the waste sector (livestock excluded) for the period 1990-1999 is presented in the figure 39.

Waste sector policy has been designed in a way to effectively reduce GHG emissions, thus showing a strong reduction potential through direct and indirect measures (emissions avoided in recycling and energy production activities). The future for this sector (solid urban, industrial and hospital wastes) is laid out in a set of plans defining goals for waste management until 2005, and in some cases until 2015. Waste management practices take into consideration production prevention (in terms of quantity and hazard level), re-use, recycling, energy recovery and disposal. Economic incentives and public information are decisive factors for achieving the set goals.

Livestock waste, currently representing roughly 80% of the GHG emissions for this sector, has high technical and economic potential for energy recovery and the associated reductions in methane emissions. It is therefore important to promote a market for companies to provide services in this area.

1.7.1 - Municipal Solid Waste (MSW)

In 2000, Portugal produced 4.3 million tonnes of Municipal Solid Waste (MSW), including the Autonomous Regions of Madeira and Azores, equivalent to a per capita yearly average of 429 Kg. This is above the values projected in 1995, perhaps due to improved monitoring and registering techniques used today in contrast to estimations in 1995.

Until 1995, the management of MSW in Portugal involved mostly the simple collection and dumping in over 328 disposal sites, which were the main receptacles of the municipal "systems" at the time; less than 1% of the population had access to recycling stations. There were, however, composting sites and some landfill facilities so that about 26% of MSW had an "acceptable" final destination.

Measures were then adopted resulting from the implementation of the principles of the Municipal Solid Waste Strategic Plan (MSWSP) established in 1996, as well as those laid out in national and European Community legislation. These principles are incorporated in the Municipal Solid Waste Action Plan 2000-2006 (MSWAP).

By late 2000, MSW management in continental Portugal was under the responsibility of 31 MSW management systems and about 88% of the population was covered by MSW treatment infrastructure. In geographical terms, that coverage corresponds to 75% of the continental territory.

As for the Autonomous regions, the Local Authorities of the Azores are in charge of the management of MSW systems and about 36% of the population covered by adequate treatment infrastructure. In Madeira, such management is shared between Local Authorities (collection, storage and disposal) and the Regional Government (treatment, recovery, disposal), with 98% covered by adequate infrastructure.

With regard to treatment and final destination of MSW, there has been a tendency away from dumping sites and towards landfills, incineration, composting and recycling. Energy production from recovered methane gas is foreseen. This trend is evident between 1995 and 2000, as can be seen from the figure and table below.

A comparison of the goals for 2000 laid out in the MSWSP shows that selective collection and composting clearly underperfomed, and Portugal did not achieve its strategic objectives. These shortcomings have been linked to the existing infrastructure, and it is expected that the underlying challenges will be resolved in the short term.

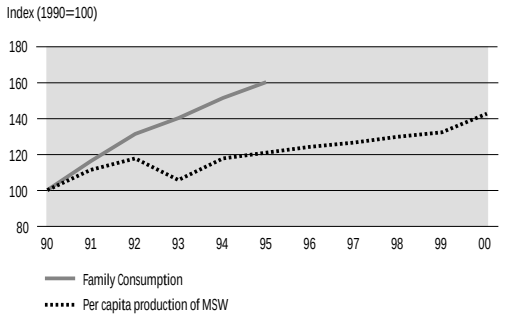

Figure 40 – Trend in production of MSW
(Source: REA 2000)

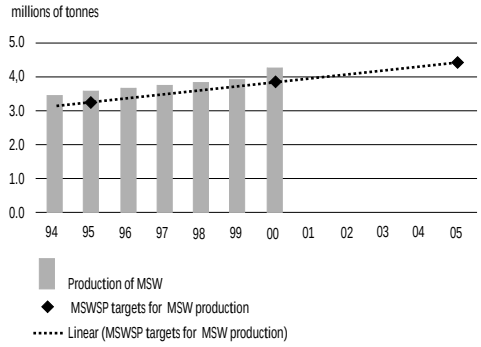

Figure 41 – Production MSW, and MSWSP targets
(Source: REA 2000)

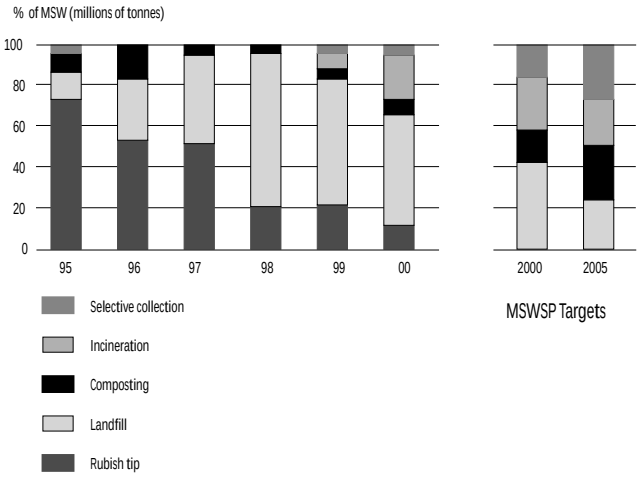

Figure 42 – Processing and final destination of MSW in continental Portugal
(Source: REA 2000)

	1995	2000
% MSW with appropriate destination	26%	88%
No. of active tipping sites	328	56
Landfill sites	13	35
Incinerator	0	2
Composting	5	4
Transfer stations	0	43
Sorting stations	0	14
% of population having access to recycling stations, "eco-centres" and waste sorting stations	<1%	80%

Table 1-7.1- Treatment and final destination
(Source: INR, Municipal Solid Waste Production, 2000)

Destination of organic general industrial waste (1999)	%	Weight (t)
Valorisation	61.6%	3,250,865
Elimination[a]	32.4%	1,711,042
Unknown[b]	5.9%	311,216

a) Industrial Basic Waste deposited in landfill

b) Presumed deposited in landfill after incineration, or in private landfill facilities (eg Portucel, incl. Cutumes)

Table 1-7.2- Final Destination of Industrial Basic Waste
(Source: INR)

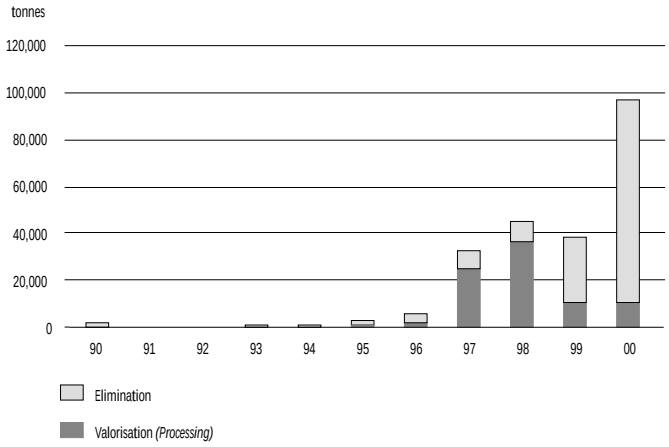

Figure 43 – Amount of exported wastes
(Source: REA 2000)

Despite the development and promotion of selective collection systems throughout the country, this accounts for only approximately 6% of the national MSW total in 2000, with some level of regional differentiation. (INR, 2000).

Portugal is obliged to recycle, of the total packaging waste, 15% of each type, as set out in the EC Directive 94/62.

1.7.2 – Industrial Waste

Industrial waste (IW) can be split into two categories: industrial basic waste (IBW) and industrial hazardous waste (IHW). Available data for 1999, based on records supplied by about 6700 companies, show that there were over 17 million tonnes of industrial waste produced, 99% of which were IBW(INR, 2001). The processing industry was responsible for 70% of the total industrial waste reported. According to these records, organic waste accounted for 30.4% of the total, or 30.6% when considering just IBW. About 61.6% of IBW produced was subject to valorization processes, while 32.4% was subject to simple disposal (mostly in landfill). As for the remaining 5.9%, no specific destination was stated, thus implying some kind of uncontrolled disposal. The table 1.7.2 presents IBW by final destination.

In terms of industrial hazardous waste (IHW), 48% was subject to valorization processes, usually as a fuel for combustion. In terms of disposal, the main destination (52% of the total IHW) was deposition.

The National Plan for Prevention of Industrial Waste (NPPIW) was prepared within the framework of the Strategic Plan for the Management of Industrial Waste (SPMIW) as an integral part of the medium/long-term strategy for management of industrial waste. Its main objective is to promote prevention (including internal reprocessing/recovery) as a means of reducing the quantity and the hazard level of IW.

The goals proposed in the Strategic Plan for Hospital Waste (SPHW) include the upgrading of two incineration units, training activities, conclusion of a database on hospital waste, the revision of legislation and the decommissioning of some incineration units.

Throughout the last ten years, there has been an increasing trend in the quantities of exported waste for reprocessing and disposal due to the absence of national infrastructure for an adequate treatment of hazardous waste.

1.7.3 – Livestock Waste

With respect to GHG emissions from livestock, enteric fermentation and storage, management and treatment of manure are the most significant activities, which the latter depending largely on the quantity of manure produced and its storage conditions. As for the trend in emissions for this sector, there was a 5% reduction between 1990 and 1999. The following figure shows that management of livestock waste is the most important activity in terms of GHGs from waste, usually responsible for over 50% of the emissions (of which methane is the main gas).

In terms of methane emissions due to waste management activities, swine is responsible for the majority (87%), thus creating a potential for biogas recovery.

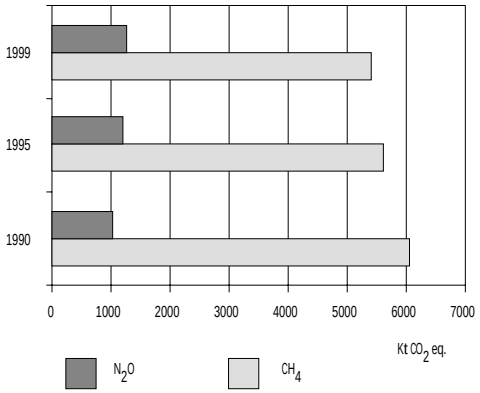

Figure 44 – CH_4 and N_2O emissions from livestock (DGA, 1999)
(Source: PNAC vol.2, 2001)

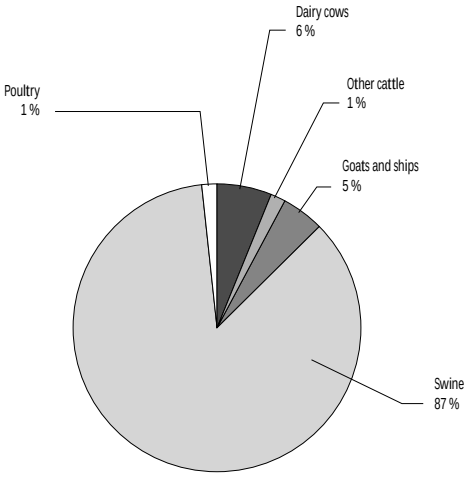

Figure 45 – Breakdown of methane production through waste management, by livestock group
(Source: PNAC vol.2, 2001)

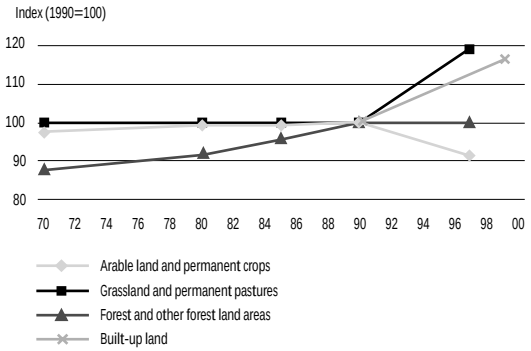

Figure 46 – Trend in land use
(Souce: REA 2000)

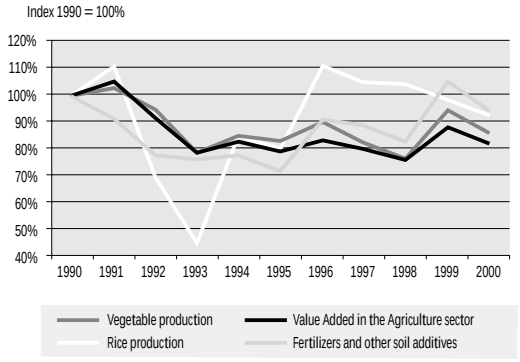

Figure 47 – Trend in some indicators for the agriculture sub-sector, for period 1990-2000
(Souce: PNAC 2002)

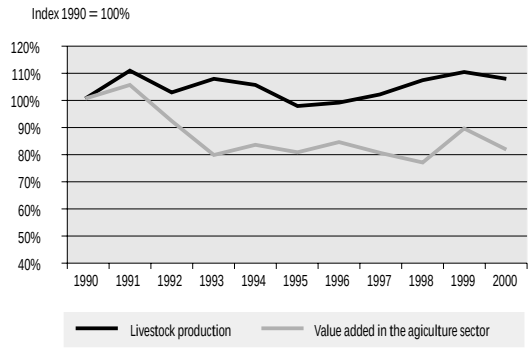

Figure 48 – Trend in some indicators for the agriculture sector and livestock sub-sector, for period 1990-2000
(Souce: PNAC 2002)

1.8 – Agriculture and Livestock

Agricultural land occupies about 43% of the territory (1999 figures) and is ranked amongst the highest in the EU in per capita terms, though this proportion has been decreasing since Portugal joined the European Community in 1986. The increase in land for permanent grassland and pastures representing over 16% between 1970 and 1997, accounting for 10% of the continent's territory in 1998, has partly been a consequence of the implementation of the Common Agricultural Policy.

The trend in economic activity of the farming sub-sector was subject to some instability throughout the last decade, as can be observed in the analysis of crop production, and especially of rice production (particularly rich in methane emissions), in figure 47. This trend in is in large part due to meteorological circumstances. These fluctuations directly affect the real trend in (gross) value added (VA) for the agriculture sector, which has been falling over the period under consideration. More generally, there has been a decrease in the relative weight of the agriculture sector's contribution to the national VA, as is expected in the process of growth and modernization of any economy.

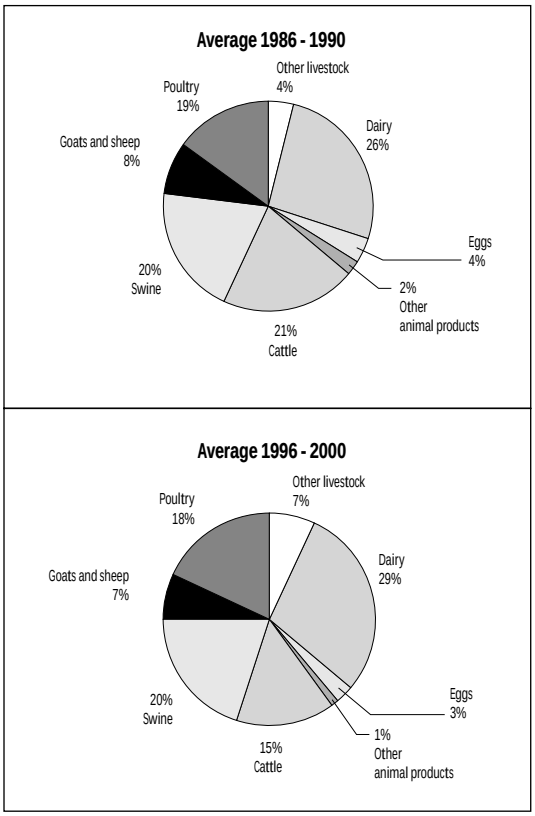

Figure 49 – Breakdown of animal production by base price, periods 1986-1990 and 1996-2000
(Souce: PNAC 2002)

Rice production stands out within the agriculture sub-sector due to its substantial methane emissions, despite representing a very small share of total vegetable production (consistently about 2% during the reference period). The observed fluctuations reflect its high dependence on meteorological conditions. The trend in intermediate consumption (IC) of fertilizers and soil additives – important components in terms of N_2O emissions - follows the trend in crop production.

With regard to livestock, animal farming has shown some stability and a slight positive trend throughout the last decade, against a backdrop of yearly fluctuations in agriculture's VA and the decreasing weight of the agriculture sector in the national economy.

The structure of livestock farming did not undergo many changes in the periods 1986-1990 and 1996-2000, as can be seen in Figure 48. The fall in the share of bovines is noteworthy, explained by structural changes resulting from adaptation to the rules of the milk and meat market, as well as the influence of problems associated with the BSE outbreak (INE, 2000). In comparison, there has been an increase in the relative weight of milk and poultry in overall production.

1.9 - Forestry

Portugal has approximately 3.3 million hectares of woodland, corresponding to over 37% of land cover. Forest cover has increased since the beginning of the twentieth century as a result of the efforts carried out by private and public entities. According to the Plan for Sustainable Development of the Portuguese Forests (PDSFP):
(i) Between 1902 and 1972, forest cover increased by over 800,000 ha, corresponding to an annual average growth of 0.64 ha/year and
(ii) Between 1972 and 1995, there was a 470,000 ha increase, corresponding to a rate of 0.66 ha/year.

These statistics include conifers, chestnut plantations, oak forests and eucalyptus. Over the last decade, such growth has resulted in 10% increase of forest cover and 4% increase in forestation rate. This trend is expected to continue as a result of agriculture policy which is leading to a reduction in agricultural land use.

Private ownership accounts for 87% of the total woodland, public ownership for 3% and 10% is fallow (PDSFP, 1998). Furthermore, over 85% of the total number of plots have an area less than 5 ha, while only 1% of the plots are greater than 100 ha. However, it should be noted that 55% of the woodland area is covered by just 1% of the plots. According to PDSFP, a significant proportion of timber production comes from private land (of small and very small size); this timber is sold while still planted, meaning that, in most cases, there is a physical distance separating the owner from its plot, and that the owner is not economically dependent on forestry plots.

The expansion of woodland area plays an important role in meeting the Kyoto targets. PDSFP sets a 2% annual growth target for woodlands. Increasing forest cover will have a positive impact in the reduction of atmospheric CO_2. Parallel to this role as a carbon sink, woodlands are also important to the nation's economy, society and the environment (depending on their location, composition, management and type of development). Besides supplying raw materials, they also play a part in soil conservation, regulation of the hydrological cycle and biodiversity conservation. The role of woodlands in the carbon cycle, despite not being the main objective of Portuguese forestry policy, is one of the criteria for policy evaluation[4] within a framework of sustainable management and multi-functionality.

[4] Criteria and indicators of the process of "Ministerial Conferences for the Protection of Woodlands in Europe" present in the L2 resolution adopted at the Lisbon Conference in 1998.

1000 ha

	1980 / 1990		1995 / 1998	
Forest species	**Surface**	**% cover**	**Surface**	**% cover**
Pinus pinaster Aiton	1292.9	40	1026.4	31
Pinus pinea L.	34.7	1	78.6	2
Other conifer	34.7	1	44.5	1
Quercus suber L.	656.6	21	719.4	22
Quercus rotundifolia Lambert	535.9	17	463.8	14
Other oak	70.5	2	134.1	4
Eucalyptus globulus Labillardiére	438	14	696.3	21
Castanea sativa L.	29.3	1	40.3	1
Other broadleaf	65.7	2	120.5	4
Other mixed	29	1		
Green areas	5.9	(.)		
Total	3193.2			

Source: National Forest Inventory, 1995

Note: Eucalyptus - 438 000 ha, revised 1992

Table 1.9.1 - Distribution of forest stands, Pure and Mixed, for continental Portugal

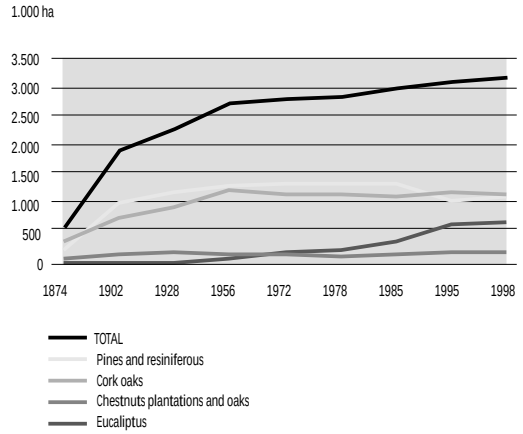

Figure 50 – Forest cover
(Source: REA 2000)

Figure 51 – Forestry production
(Source: REA 2000)

Generally, 55% of the woodlands are directed towards timber production, being composed of conifers (P.Pinaster and other pine species), explored as high forest, and by fast growth broadleaves (eucalyptus) explored in coppice. This corresponds to an annual average production of 6.2 million m^3 of pines (with bark) and 4.5 million m^3 of eucalyptus (for the paper pulp industry). The main objective of the remaining forest is protection or production of non-timber products such as cork .

The intensity of use of forestry resources in Portugal has been decreasing. Despite the growth in forest cover, mainly due to new eucalyptus plantations, the production of forestry products (timber, resin and cork) has been falling. This is due to the fact that 90% of eucalyptus production is directed towards the cellulose industry instead of going into timber production. However, it should be noted that energy recovery from forestry residues is a significant component of energy supply in the paper industry.

Chapter 2 – Information on the GHG Inventory

The estimation of the anthropogenic GHG emissions, quoted in this document, is based on the National Inventory of GHG Emissions (2000), submitted to the UNFCCC Secretariat in April 2002. Additional figures can also be found in the CRF[5] summary tables in Annex A.

2.1 – General assessment

The estimated total anthropogenic GHG emissions in 2000, excludind the carbon absorption resulting from land use change and forestry (LUCF), was 84.7 Mt CO_2 eq.. This represents 30.4% growth in total emissions relative to the 1990 base year.

Land use change and forestry, as a carbon sink, accounted for the absorption of an estimated 4.2 Mt CO_2 eq. in 2000, a 12.4% growth relative to 1990.

According to the categories reported in CRF, the energy sector is responsible for the greatest share of GHG emissions, with a 69.9% contribution of the total emissions (59.2 Mt CO_2 eq). This represents 43.5% growth relative to the 1990 base year.

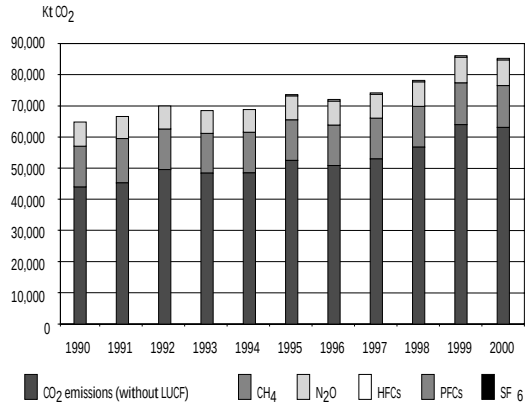

Figure 52 – GHG emissions in Portugal (period 1990-2000)

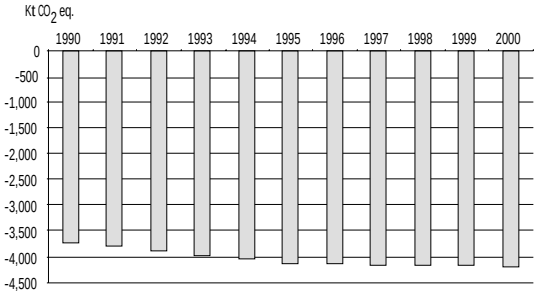

Figure 53 – Removal of GHG by sinks in Portugal (period 1990-2000)

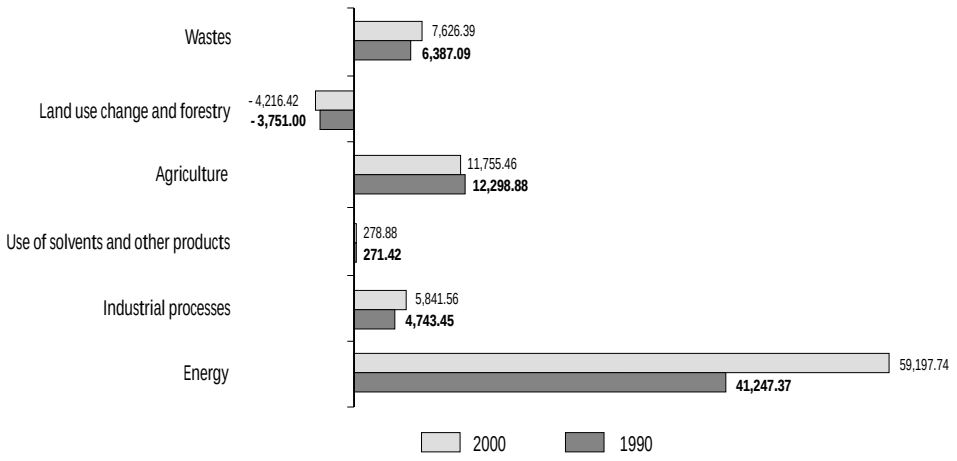

Figure 54 – GHG emissions in Portugal by sector (Kt CO_2 eq.)

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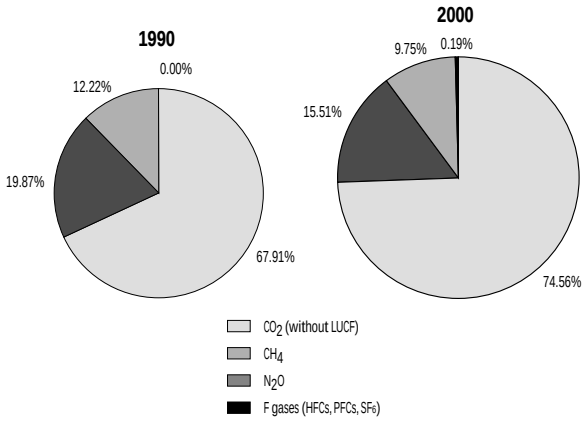

Figure 55 – GHG emissions in Portugal by gas

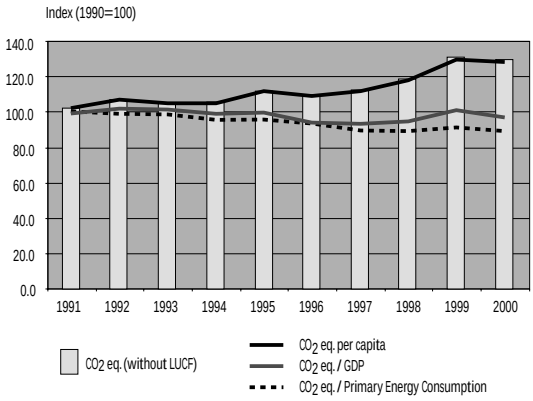

Figure 56 – GHG emissions in Portugal (excluding LUCF)

Carbon dioxide is the most important GHG in Portugal, representing 74.6% of the total emissions in 2000 and with an increase of 43.2% relative to 1990. For the same period of time, methane emissions remained practically constant (0.02% growth) and nitrous oxide emissions grew by 4.0%.

Portugal adopted 1995 as the base year to fluorinated gases (HFCs, PFCs and SF_6). In 2000, they represented approximately 0.2% of the total emission estimates. Although Portugal is not a producer of these gases, it is recognized that the emissions values may be underestimated.

Portugal is one of the Annex I countries with lowest GHG emissions per capita (8.46 Kt CO_2eq. per capita in 2000 compared to the EU average of 11 KtCO_2eq., excluding accounting from land use change and forestry). However, this ratio has experienced fast growth since 1990, and especially since 1995. In terms of the ratio of GHG emissions per unit GDP (constant 95 prices), although there was a decrease in the order of 0.03% by 2000 relative to 1990, Portugal is still among the EU countries with highest levels of carbon intensity. The trend in GHG emissions per primary energy consumption has fallen by 10.6% since 1990, most likely due to the introduction of new forms of primary energy (natural gas and renewable sources) and improved energy efficiency.

2.2 – Methodology and uncertainties

The Portuguese GHG emissions inventory follows internationally agreed methodologies, namely the "Revised 1996 IPCC Guidelines for National GHG" and the "Atmospheric Emission Inventory Guidebook – CORINAIR". There have been ongoing efforts to improve current estimates (better collection and improved raw data), thus allowing for the application of more detailed methodologies. According to UNFCCC requirements, the re-calculations are being done to the whole time series to safeguarded the consistency of the inventory.

The national inventory still does not include a quantification of the uncertainties underlying the emissions estimates, as recommended in IPCC Report on Good Practice Guidance and Uncertainty Management in National GHG Inventories. The current approach to uncertainty estimation consists of a qualitative assessment based on the experience of the national experts responsible for inventory preparation. In the near future, Portugal will be developing a quantitative analysis of uncertainties and a plan of quality assurance and quality control (QA/QC).

2.3 – Pollutant-specific analysis

2.3.1 – Carbon dioxide (CO_2) emissions

In 2000, the carbon dioxide emissions were estimated at 63.15 Mt CO_2 (excluding LUCF, emissions resulting from bunker fuels and from burning biomass), corresponding to 43.2% growth relative to 1990.

The energy sector is responsible for the greatest share of CO_2 emissions, accounting for 90.9% of the total in 2000 against 90.0% in 1990 (despite 44.6% emission growth in this sector).

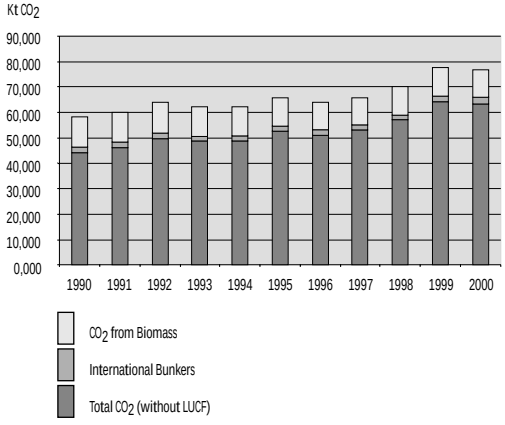

Figure 57 – CO_2 emissions in Portugal

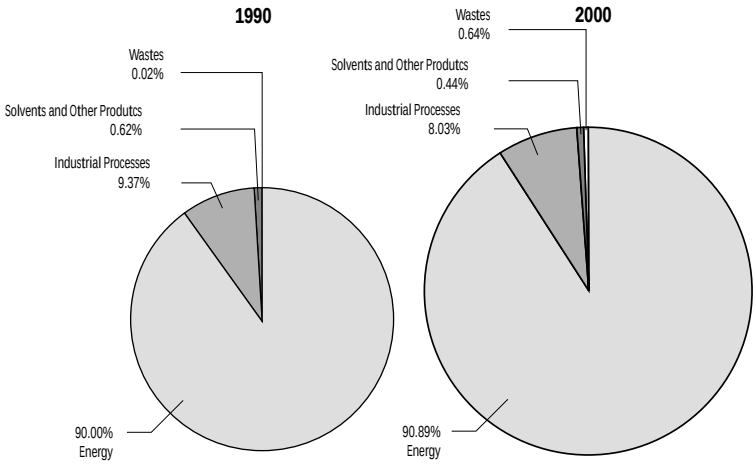

Figure 58 – CO_2 emissions by sector

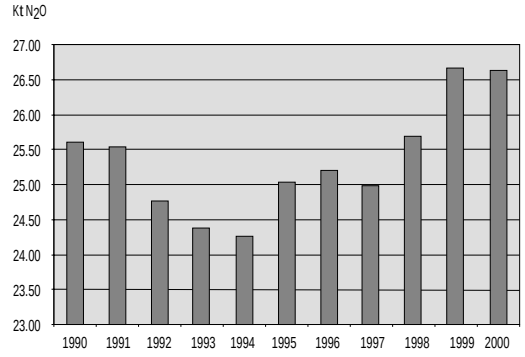

Figure 59 – Trend in N_2O emissions in Portugal

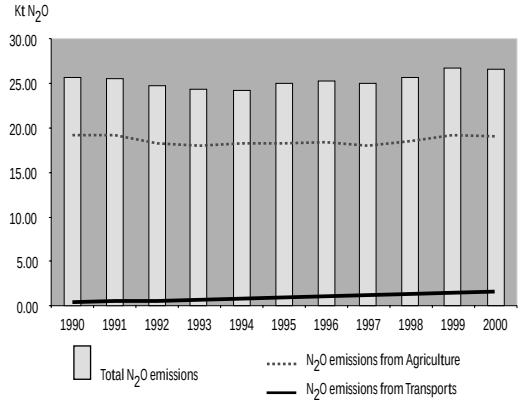

Figure 60 – Trend in N_2O emissions for some sectors

2.3.2 – Nitrous Oxide (N_2O) emissions

In 2000, nitrous oxide emissions were estimated at 26.64 Kt N2O (8.26 Mt CO_2 eq.), corresponding to a 4.1% growth relative to 1990.

Data currently available indicates that the most significant contribution to N_2O emissions comes from the Agriculture sector, mainly from soil use. This represented 71.2% of total N_2O emissions in 2000 against 75.0% in 1990. Thus, there was a slight decrease in the net contribution from this sector. In comparison, the transport sector registered the most significant increase in N_2O, from 1.7% of the total in 1990 (0.44 Kt N_2O) to 6.2% in 2000 (1.64 Kt N_2O). This represents 273% growth relative to 1990. This increase, most notably since 1994, is justified not only by the increase in car ownership at the national level, but also by the introduction of catalytic converters in cars (following the introduction of unleaded petrol in 1993).

The following figures present the relative contribution of the main type of activities towards N_2O emissions in 1990 and 2000.

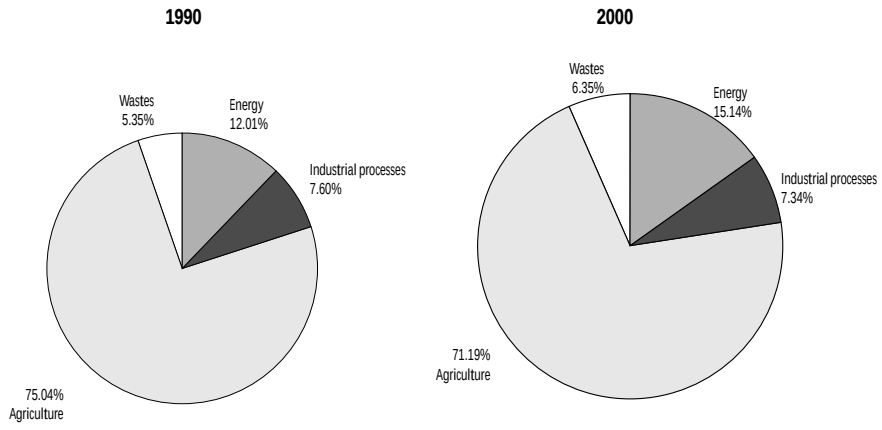

Figure 61 – N_2O emissions by sector

2.3.3 – Methane (CH_4 emissions):

In 2000, total methane emissions were estimated at 625.41 Kt CH_4 (13.1 Mt CO_2 eq.), representing an increase of 1.8% relative to 1990.

The Waste sector is responsible for the single largest contribution to methane emissions (mainly through the deposition of solid waste). This sector represented a 51% share of total methane emissions in 2000, against 46.6% in 1990, thus reflecting 12.5% growth relative to 1990. The Agriculture sector also makes a significant contribution towards methane emissions (through the "enteric fermentation" and "manure management" sub sectors), representing 44.7% and 49.2% of the total in 2000 and 1990 respectively, an 8% decrease in emissions from this sector relative to 1990.

The following figures present the relative contribution of the main type of activities towards CH_4 emissions in 1990 and 2000:

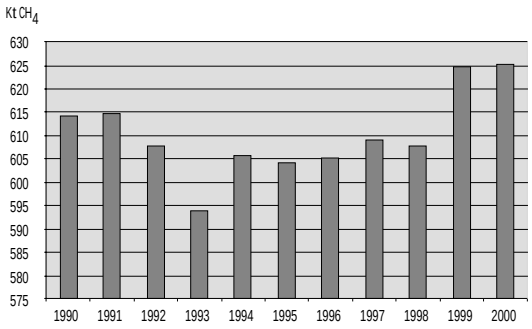

Figure 62 – Trend in CH_4 emissions in Portugal

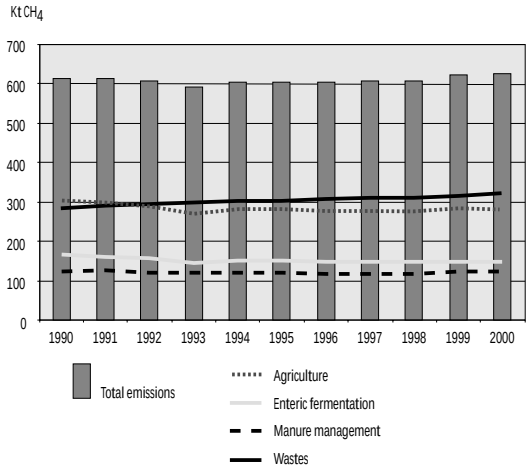

Figure 63 – Trend in CH_4 emissions for some sectors

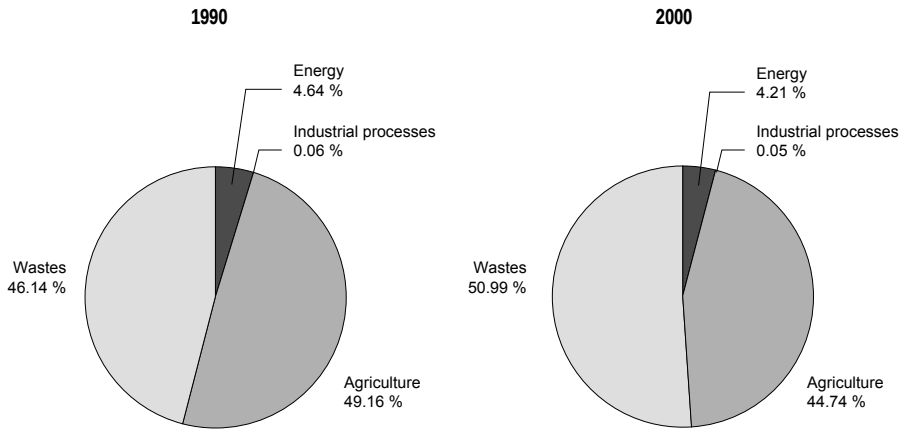

Figure 64 – CH_4 emissions by sector

Chapter 3 – Policies and Measures

3.1 - Introduction

In 2001, the Portuguese Government adopted a "Climate Change National Strategy" defining guidelines for action based on commitments agreed within the scope of the UNFCCC and the Kyoto Protocol, as well as the EU burden sharing agreement. This last agreement limits Portugal to a 27% growth in GHG emissions (relative to 1990 emissions) until the end of the first commitment period set out in the Kyoto Protocol, while above average economic growth is necessary to approach economic convergence with the EU.

This apparently "generous" limit in emissions growth is proving difficult to comply with in practice: total GHG emissions have been growing quickly and by 2000 were 30.4% above 1990 levels.

Portugal is committed to comply with international and EU commitments and, as such, it is in the final stages of the preparation of the "Climate Change National Programme" (PNAC). This technical and political instrument will embody the adopted strategy through a set of policies and measures, and associated instruments, capable of reducing emissions within the specified time frame. These aim at an integrated intervention in the economy taking into account environmental efficacy, economic efficiency, preservation of enterprise competitiveness, generation of employment, and political and administrative feasibility. PNAC is built upon a mitigation strategy composed of two blocs of policies, measures and instruments (sectoral and/or cross-sectoral), and their impacts relative to the reference scenario may be subject to assessments. These blocs are:

- "Immediate bloc" – to be developed in the short term (until 2005) and integrating policies, measures and instruments in the planning and implementation stages, approved in late 2001;
- "Additional bloc" – to be mostly implemented in the medium-term (2005-2008) and integrating new policies, measures and instruments.

Assuming that the trends remain unchanged, the estimates for the reference socio-economic scenarios point at a reduction effort between 12.6 and 17.2 Mt CO_2eq. The impact of use the Kyoto's market instruments is still under assessment.

The following sections will refer to some of the policies, measures and instruments (PAM) being considered under PNAC for intervention in the main sectors of the Portuguese economy.

3.2 – Sector: Energy

National Energy Policy

Portugal is in the process of adapting to the dynamics of the energy markets, taking into account the European context and the trends in market liberalization and globalisation. Such process is being carried out through the on-going privatisation of large national energy producers and distributors, and through the diversification of energy sources, especially with regard to natural gas for consumption (in industry and buildings) and electricity generation.

The introduction of natural gas in 1997 has contributed to the diversification of energy supply, the reduction of external dependency on oil and a reduction in the growth of emissions of CO_2 and other pollutants.

The environmental effects of natural gas consumption are highly relevant in terms of CO_2 emissions reduction, not just because of the partial substitution of oil and coal in the industrial and domestic sectors, but predominantly because of its use as a fuel in power generation.

National energy policy also takes into consideration the European Commission's draft Directive on electricity generation from renewable sources (including large hydro, but excluding non-industrial and municipal waste of non-biomass origin). This proposal sets an indicative target of 22.1% of EU´s energy consumption[6] being met by renewable energy by 2010 (relative to 1995). For Portugal, the reference target is 39% of energy consumption by 2010 .

The Operational Programme for the Economy (POE) contributes to the upgrade of energy infrastructures, the intensification of endogenous energy use (especially renewable sources), and the promotion of energy efficiency through incentives for the rational use of energy.

[6] Gross electricity consumption: domestic electicity productiony plus imports minus exports.

The "E4" Programme (Energy Efficiency and Endogenous Energy) proposes a set of measures promoting an integrated and coherent vision, from supply to demand of energy, with the objectives of improving the economy's competitiveness and modernizing society. One of the key measures is the change in the price structure, with a positive bias towards energy generated from renewable sources. The main vectors of intervention are:

1. Diversification of access to energy sources available in the market, and improved consistency of the services provided by energy suppliers;
2. Promotion of energy efficiency, paying particular attention to opportunities and means of optimising efficiency on the demand side;
3. Promotion of renewable energy, taking into account economic and technical viability as well as environmental constraints.

Name	Objective	GEE Affected	Type of Instrument	State of Implementation	Implementing Entity	Reduction Potential ($MtCO_2$)
Electricity produced from renewable energy sources	Power generation from renewable energy sources (39% of total electricity consumption by 2010)	CO_2, CH_4 and N_2O	Economic Regulator	In Implementation	Ministry of Economy - DGE	2.4 - 2.5
Energy Efficiency in the Power generation sector	Introduction of higher efficiency combined cycle natural gas units (60% instead of 55%)	CO_2, CH_4 and N_2O	Technical	In Implementation	Ministry of Economy - DGE	0.5
Energy Efficiency in the Power generation sector	Reduction of losses from distribution. Reduction of losses from 9.3% to 8.6% of energy provided by the grid by 2010.	CO_2, CH_4 and N_2O		Planning	Ministry of Economy - DGE	0.3
Co-generation	Application of the proposed Directive on co-generated electricity. Target of 18% throughout EU by 2010.	CO_2, CH_4 and N_2O		Planning	Ministry of Economy - DGE	0.5
Application of a demand-side management programme	Annual average growth rate of electricity consumption from 3.6% to 3% forseen between 2000 and 2010	CO_2, CH_4 and N_2O		Planning	Ministry of Economy - DGE	1.0

Table 3.2.1: National Policies and Measures for the Energy Sector

Name	Reduction Potential	Deadline for Implementation	Cost
Co-generation			
New EU co-generation initiative	Up to 65 Mt/year (Including low power units)	Launch in 2002	<20 Euros/t:1-12 Mt/CO2eq. 20-50 Euros/t: 20-50Mt CO2eq.
New Directive on power production from cogeneration		Doubling of power produced by co-generation at EU level from 9% to 18% by 2010.	
Electricity produced from fossil fuels			
Directive on liberalisation of electricity and natural gas markets until 2005	80-120 MtCO2eq/ano (includes 63 Mt CO2 avoided through the substitution of coal-fired power stations by combined cycle natural gas		<20 Euros/t: 88 Mt CO2eq 20-50 Euros/t: 25 Mt CO2eq
Use of more efficient energy systems			
Acceleration of liberalisation process for internal electricity and gas markets • Voluntary agreements with industry based on the IPPC and LCP Directives	100 Mt/year		20-50 Euros/t: 100 MtCO2 eq. (including improved efficiency in power generating systems)
Renewable Energy Sources (RES)			

Table 3.2.2: European Policies and Measures for the Energy Sector

3.3 – Sub-Sector: Domestic and Services

GHG emissions from the domestic and services sub-sector are associated with the thermal behaviour of buildings (namely their heating and cooling needs), energy efficiency of equipment and patterns of behaviour and consumption. They have experienced a significant rise (especially services) with CO_2 being the main gas emitted.

Increased electricity consumption is the main factor of the significant increase in national GHG emissions from the domestic and services sectors. There are three complementary approaches for tackling this problem:

1. Intervening on the supply side by promoting a higher share of low carbon energy in the structure of electricity production (eg. renewable sources), and/or resorting to more energy-efficient technologies (eg. co-generation).
2. Changing the demand profile by promoting energy-efficiency, both in buildings and equipment;
3. Changing the patterns of consumption and behaviour by creating incentives to the rational use of energy.

Name	Objective	GHG Affectted	Type of Instrument	Stage of Implementation	Implementation Body	Reduction Potential ($MtCO_2$)
Regulation on the Thermal Characteristics and Behaviour of Buildings	Establishes an equilibrium between the needs of thermal comfort and the rational use of energy.	CO_2, CH_4 and N_2O	Regulator	In implementation	DGE	
Regulation of Energy Systems for Buildings´ Climatization	Establishes rules and guidelines for the dimensioning of energy consuming systems for climatization of buildings.	CO_2, CH_4 and N_2O	Regulator	In implementation	DGE	
Regulation on Management of Energy Consumption	Determines the reduction plans for energy consumption by businesses and energy intensive consumers.	CO_2, CH_4 and N_2O	Regulator	In implementation	DGE	
Labelling	Promoting behavioural change, towards production and consumption of electrical equipment with higher efficiency levels.	CO_2, CH_4 and N_2O	Information	In implementation	DGE	
Energy Efficiency and Endogenous Energies Programme: Solar Hot Water for Portugal Programme	1.000.000 m^2 in 2010	CO_2, CH_4 and N_2O		In implementation	DGE INETI	0.1 - 0.2
National Programme for Energy Efficiency in Buildings	Revision of existing instruments (RCCTE and RSECE), making energy efficiency requirements more stringent, certification of buildings, more intensive labelling of equipment and adding information to the consumer.	CO_2, CH_4 and N_2O		Planning	DGE INETI	0.6
Dissemination of information to the business sector on the fiscal benefits associated with thermal solar appliactions.			Information	Planning		
Training to policy makers and the public at both national and local levels on good practice in the rational use and conservation of energy in buildings, on technological specifications of labelling, and on demand-side management of energy as well as monitoring and benchmarking processes.			Information	Planning		
Revision of tax incentives to promote use of new equipment	Substitution of 50% of lighting equipment, 20% of total u.a. In 2010 (substitution of incandescent bulbs by low consumption compact fluorescent bulbs)		Fiscal	Planning		0.01
Procurement of energy efficient equipment in the service sector.				Planning		

Table 3.3.1: National Policies and Measures for the Domestic and Services Sub-Sectors

Thus, the policies and measures planned or under implementation for this sector (both at EU and national levels) are mainly focused on the thermal characteristic of buildings, energy efficiency (of buildings and machinery) and the management of energy supply and demand.

Currently, Portugal has access to a set of instruments with variable response capabilities in terms of energy and carbon intensity reduction for this sector. The effectiveness of a GHG reduction instrument can be limited by many factors, among them information" and the level of participation where the instruments are predominantly voluntary; and compliance where they are compulsory.

Of the instruments currently available, the following set is of particular importance : Regulation on the Thermal Behaviour of Buildings (RCCTE); Regulation of the Energy Systems for Acclimatization of Buildings (RSECE); Regulation on the Management of Energy Consumption (RGCE); and the labelling of equipments as an information instrument.

Name	Objectives	Deadline for Implementation	Reduction Potential MtCO2/year
Directive on Energy Efficiency of Buildings	Minimum standards for energy efficiency of new and some renovated buildings; energy certification; inspection and evaluation of heating and cooling systems	Up to 2010	34 - 45
Revision of SAVE 93/76/CEE Directive	Quantification of consumption, audits, financing, and potential energy management systems		15 - 20
Public Initiatives for Energy Efficiency	Coordinate demand and acquisition of energy efficient technology with a view to increasing volume of production and reduction of cost .		25 - 40
Directive on Energy Services	Completing the internal energy market, promoting demand-side energy efficiency. Establishment of targets and support especially to families and small and medium entreprises.	Up to 2010	40 - 55
Technology Procurement Initiative	Introduction of technology with specific energy efficiency characteristics, promoting the convergence between potential consumers and producers of the technolology		15 - 25
Audits System; Initiatives of Good Practice; and Voluntary Agreements		Up to 2010	20 - 35
European Sustainable Energy Agency (ESEA)	Support to and promotion of the role of advisory networks relating to energy, at local, regional and national levels. Progress monitorization, information dissemination campaigns and activities. Education and training. Labelling, minimum criteria and certification. Institutional, financial and other		

Table 3.3.2: European Policies and Measures for the Domestic and Services Sub-Sectors

3.4 – Sector: Transport

The Transport sector is the second largest GHG source, responsible for about 30% of national emissions. These emissions are directly dependent on the structure of the energy consumption of the sector. In 1990, motor vehicles alone were responsible for 70% of the energy consumption of the sector, and it is estimated that this share will increase to 77% in 2010. The maritime and air transport sub-sectors are responsible for 15% and 13% of energy consumption, respectively. The rail sub-sector is relatively insignificant, representing just 2% of energy consumption. However, this sub-sector is faced with the largest growth forecasts, at an annual increase of 7% until 2010.

Potential reductions in this sector could result from the following measures:

- Reformulation of the current Vehicle Tax (IA) within the Special Tax on Vehicles (IEV), and the creation of a Single Tax on Circulation (IC);
- Elaboration and implementation of the National Plan of Logistical Platforms;
- Voluntary agreement with the European Commission and ACEA to promote the increase of fuel efficiency of light passenger vehicles, supported by a tax revision favourable to the renovation of the national vehicle stock.
- Changes in the means of intercity merchandise transport, and reduction in the frequency of empty haul journeys in shot distance distribution.
- Changes in the means of urban transport from private vehicles to public transport.

Name	Objective	GHG Affected	Type of Instrument	Stage of Implementation	Implementing Body	Reduction Potential ($MtCO_2$)
Modernization and construction of light rail transport.	Establishment of a hierarchy of appropriate public transport in the principal metropolitan areas, with a view to integrating collective transport systems.	CO_2, CH_4 and N_2O	Voluntary commitments/ Information/ education	Planning and Implementation	Porto Underground/ Mondego/ Sul do Tejo and Lisbon Underground	
Modernizing infrastructure and the service of conventional rail transport.	Infrastructure appropriate to the needs of different types of transport, expansion, improvement in services rendered and enhancing the attraction of rail transport, thus inverting the negative trend in the use of rail transport.	CO_2, CH_4 and N_2O	Economic/ Unilateral commitments	In Implementation	REFER e CP	
Management of Energy Consumption by the Transport sector.	Reduction of specific energy consumption	CO_2, CH_4 and N_2O	Direct Regulation	In Implementation	Direcção Geral da Energia.	
System of incentives to public road transport of goods.	Minimise the environmental impact of public road transport of goods (ex. improving efficiency through minimising number of empty-haul journeys, removal from service of older vehicles)	CO_2, CH_4 and N_2O	Economic	Implemented and in Implementation	Direcção Geral dos Transportes Terrestres	
In the city wthout your car	Reduction in use of private cars in urban areas	CO_2, CH_4 and N_2O	Information / Education	MCOTA; Local Authorities		
National Network of Logistical Platforms	Promote efficiency and intermodality of transport	CO_2, CH_4 and N_2O				
Reduction fo the specific emissions of CO2 from automobiles		CO_2	Voluntary Agreements	In Implementation		0.4

Table 3.4.1: National Policies and Measures for the Transport Sector

Although still not quantified, there is both technical and economic potential for GHG emissions reduction in the transport sector.

The implementation of an effective and consistent reduction strategy requires designing a long-term policy integrating all means of transport. Such policy (under development) implies an improvement in the intrinsic coherence of the transport sector, especially in terms of the relationship between the intervening agents i.e. the managing, financing and monitoring entities.

Name and Objective	Reduction Potential MT CO_2/year
Implementation of voluntary agreements with car manufacturers in order to reduce CO_2 emissions through the production of lighter vehicles	5 - 10
Improved technology in passenger vehicles, such as in engines and air conditioning units, as well as with regard to fuels	40
Improvements in the use of transport infrastructure, as well as tolls, including Intelligent Transport Systems	40 - 60
Fiscal measures	17
Intermodal / Multimodal transport, as well as enhanced logistical efficiency	Up to 50% in some sectors
Awareness-raising and behaviour modification. Includes awareness-raising on benefits of fuel efficiency.	> 50
Improved quality of information in order to evaluate and monitor all transport modes, in particular land and air transport.	N/A

Table 3.4.2: European Policies and Measures for the Transport Sector

3.5 – Sector: Waste

The Waste sector (including municipal, industrial, and hospital wastes, wastewater and sludge, and livestock wastes has been responsible for about 15% of national GHG emissions, with livestock wastes accounting for 80% of the total sectoral emissions.

Despite the relatively insignificant contribution of municipal solid wastes to the national GHG emissions (2 Mt CO_2 eq. of 60 Mt CO_2 eq. in 1990), this is still a strategic sector due to its cost-effective reduction potential. The pattern of emissions is directly proportional to the quantity of solid waste produced and their final destination. In 1990, Portugal had the lowest per capita waste production among the EU countries (roughly 350 Kg/capita/year). Methane emissions, the most important GHG of the waste sector, grew by 13% between 1990 and 1999.

The waste sector policy has been drawn up with a concern for GHG emissions reduction, and presents a significant direct and indirect reduction potential through avoided emissions from recycling and energy production. The future of this sector (municipal solid, industrial and hospital wastes) is set against a backdrop of plans defining targets for waste management until 2006, but in some cases until 2015. Waste management practices take into account many aspects such as production prevention (both in terms of quantities and hazard levels), reuse, recycling, energy recovery and disposal. Economic recovery of waste and dissemination of information are decisive factors for the achievement of the established targets. With regard to livestock waste, these have a high technical and economic potential for biogas recovery, thus reducing methane emissions. It is therefore particularly important to set up incentives for the development of enterprises providing this type of services.

Name	Objective	GHG affected	Type of Instrument	Stage of Implementation	Implementing Body	Reduction Potential ($MtCO_2$)
Plan of Action for Urban Solid Waste; Strategic Sectoral Plan for Management of Urban Solid Waste; National Plan for Prevention of Industrial Waste; Strategic Plan for Hospital Waste; Strategic Plan for Industrial Waste; Strategic Plan for Reduction of Industrial Waste; Application of Landfill Directive	Promote reduction, reutilisation and recycling of the various types of waste, thus promoting direct and indirect GHG emissions reduction	CO_2 CH_4		Under Implementation / Planning / Adopted	Ministries of Environment / Economy / Health	Reflected in other economic sectors
Effective application of Integrated Pollution Prevention and Control (IPPC) resulting from the transposing of the respective Directive, as relevant for intensive livestock and waste management sectors				Planning		
Use of Biogas from collectors of livestock waste subject to processing and treatment, to produce heat and electricity				Proposal		1.2

Table 3.5.1: National Policies and Measures for the Waste Sector

3.6 – Sector: Industry

The industry sector is responsible for GHG emissions from combustion and production processes. In Portugal, emissions from combustion account for over 60% of the sector's total, and have grown by 15% between 1990 and 1999. A further 18% increase until 2010 is forecasted. The share of emissions linked to electricity consumption in this sector is about 35% of the total.
Among the energy-intensive industrial sub-sectors are the following (in decreasing order of significance):

- "glass and ceramics",
- "cement and associated products",
- "basic metallurgy",
- "paste, paper and graphic arts" and
- "chemicals, plastics and rubber".

These represent around 65% of total industrial energy consumption. As for carbon-intensive sub-sectors, these are mainly "cement and products", "glass and ceramics" and "paste, paper and graphic arts".

Some of the instruments currently available were designed in the context of specific sectoral policies and can be of special significance in reducing GHG emissions. The most important are the policy on energy pricing, the Regulation on the Management of Energy Consumption (RGCE), the Operational Plan for the Economy and the legal arrangements in the context of the EU Directive on Integrated Prevention and Pollution Control.

An analysis of the policies and measures currently in force shows that some of the instruments need to be strengthened in order to increase their GHG reduction potential.

Name	Objective	GHG affected	Type of Instrument	Stage of implementation	Implementing Body	Reduction Potential ($MtCO_2$)
RGCE	Reduction of energy consumption by large power consumers; establish specific consumption reduction targets for businesses through Plans for Rational Use of Energy	CO_2	Voluntary Agreeements	In implementation		
Use of Energy Potential and Rationalisation of Consumption	Increase installed capacity, by 250 MW, of power production facilities based on renewable energy sources; 90MW of new installed capacity in co-generation; savings of 30,000 toe resulting from energy efficiency and rational use of energy.	CO_2	Financial Support	In implementation	DGE, DREs, Private Sector, other Public Institutions: INETI, AGEN,etc.	
Contract for the continuous improvement in environmental performance by the cement sector.	Development of a series of activities to improve environmental performance with a view to registration under EMAS of all the industrial units of the sector, including monitoring activities and gas emissions reductions.	CO_2	Voluntary Agreeements	In implementation	Ministries of Environment and Economy and Private Sector	
Contract for the continuous improvement in environmental performance by the packaging glass sector.	Reduction in pollution and in the use of natural resources and development of environmental management activities within the scope of EMAS. Reduction of CO_2 by 31.5% by 2003 (relative to1994).	CO_2	Voluntary Agreeements	In implementation	Ministries of Environment and Economy and Private Sector	
Emissions control at source	Application of legislation on Integrated Pollution Prevention and Control (IPPC) resulting from the transposing of the IPPC Directive			Planning		0.6
Use of Energy Potential and Rationalisation of Consumption	The reformulation of this measure, to take effect from 2003, will increase the reduction potential by about 0.11 Mt CO_2eq.	CO_2		Planning		0.1
Emissions reduction by carbon-intensive industrial sectors		CO_2	Voluntary Agreements and Fiscal Instruments	Planning		
Emissions reduction by SME	Rational Use of Energy by SME	CO_2	Financial Support	Planning		
Energy Services	Rational Use of Energy and introduction of clean technologies to SME	CO_2		Planning		0.3 - 0.7

Table 3.6.1: National Policies and Measures for the Industrial Sector

3.7 - Sector: Forestry

Forestry policy objectives include climate change concerns by considering the increase in the carbon sink capacity of forests as a means or reducing atmospheric CO_2. This is referred specifically in the following documents:

- **Framework Law on Forestry Policy (Law number 33/96 of August 17)** – Article 3 – Guiding Principles – refers to the contribution of forests to the stabilization of CO_2 sequestration.
- **Plan for the Sustainable Development of Portuguese Forests (Council of Ministers Resolution number 27/99 of April 8)**

Within the framework of the strategic orientation document "Conserving Nature and Raising the Value of the Environment in Forest Spaces", one of the identified objectives is the increase in carbon sequestration. The means to make this objective operational include:

- Carbon sequestration through increasing forest cover land (expansion of forest cover by 2% in the next 10 years);
- Promoting the use of timber (long life products);
- Expanding the life-cycle of timber derivate products (recycling and reusing);
- Promoting assessments of the contribution of forests to the carbon cycle.

The following measures aim at achieving the aforementioned objectives and have either been implemented or have been adopted and are presently in the early stages of implementation:

a) Specific Regulation:

- Regional Plans for Forestry Planning – aim at setting up, for each region, general guidelines for sustainable forestry management, options for improvement of existing forests and specific regional strategies;
- Protection of oak stands (helm and cork);
- Prevention of early felling of trees;
- Forest fire prevention;
- Soil protection.

b) Economic Incentives:

- AGRO Programme / Measure – Sustainable Development of Forests

- Action – Forestry support
- Action – Restoration of the forestry production potential – Support to tree planting of forest spaces, to enhancing and promotion of multi-use of forest spaces, and the productivity rehabilitation of forests damaged by fire and other natural causes.
- Action – Support to Seed and Plant Production – Support to the production of reproductive forest materials and adding value to base material in order to assure compliance with norms and standards for security and quality, thus supporting the forestry sector´s sustainable development and improving productivity generally.
- Action – Promotion of new markets and upgrading of forestry products - Support to marketing of forest products as renewable and environmentally sound, promotion of new uses of forest products, establishment of sustainable forest managment systems, awareness-raising of producers and the public on the need for management for sustainability.

- RURIS Programme / Afforestation of agricultural land

Promotion of quality forest extension to agricultural lands with species adapted to the environment. Rehabilitation of impoverished soils and mitigation of desertification effects, by recovering soil fertility and regulating water resources

- AGRIS Programme / Measure – Sustainable Management and Ecological Stability of Forests

Sub-action – prevention of risks caused by biotic and abiotic agents

- Reg. (CEE) nr. 2158/92 / Forest fire protection -

Support to projects in: preventive forestry, installation of defensive and support infrastructure, vigilance and first intervention, awareness-raising, studies on fire risk and cause

- Reg. (CEE) nr. 3528/86 – Protection of Forests against air pollution –

Support to studies and projects on forest ecosystems and monitoring initiatives

c) Other types of measures:

- Elimination of pests and disease;
- Public awareness-raising activities about forest protection;
- Studies, Investigation and Demonstration in the areas of: role of forests in the carbon cycle; Improvement in the methods for forest inventories, adding new parameters as required by UNFCCC and CBD; genetic improvement; improvements in productivity and soil protection; monitoring of forest areas damaged by fire and subsequent changes in soil, using GIS and satellite images;
- Forest fire prevention

It should also be noted that, from 1992/1993 onwards, all the national legislation on forests , namely with regard to issues of afforestation and improvement of forest areas, are based on EU legislation, which expressly refers to mitigating the greenhouse effect, sequestration of CO2 and the problems of climate change as issues to take into consideration (Reg. EEC 2080/92 of June, 30 and Reg. EEC 1257/99 of May, 17).

The following table provides a summary of these policies and measures.

Name	Objective	GHG affected	Type of Instrument	Stage of Implementation	Implementing Body	Reduction Potential ($MtCO_2$)
Regional Strategies for Forest Planning	Establishment of appropriate sustainable forest management strategies for each region. Protection of oak stands, prevention of premature felling of trees, forest fire prevention, soil protection.	CO_2	Regulatory	In implementation	DGF	
AGRO Programme / Measure. Sustainable Development of Forests: Project - Support to Forestry; Project - Re-establishment of Forest Productivity Potential	Support to tree planting of forest spaces, to enhancing and promotion of multi-use of forestspaces, and the productivity rehabilitation of forests damaged by fire and other natural causes.	CO_2	Financial Support	In implementation	DGF	
Project - Support to the production of seeds and plants	Support to the production of reproductive forest materials and adding value to base material in order to assure compliance with norms and standards for security and quality, thus supporting the forestry sector´s sustainable development and improving productivity generally.		Financial Support	In implementation	DGF	
Project - Promotion of new markets and value-adding processing of forest products.	Support to marketing of forest products as renewable and environmentally sound, promotion of new uses of forest products, establishment of sustainable forest managment systems, awareness-raising of producers and the public on the need for management for sustainability.		Financial Support	In implementation	MADRP	
RURIS Programme Afforestation of agricultural land	Promotion of quality forest extension to agricultural lands with species adapted to the environment. Rehabilitation of impoverished soils and mitigation of desertification effects, by recovering soil fertility and regulating water resources		Financial Support	In implementation	IFADAP	
AGRIS Programme / Measure- Sustainable Management and ecological stability of forests: Sub-project - minimising of risks from biotic and abiotice agents.			Financial Support	In implementation	Regional Directorates for Agriculture	
Reg. (CEE) N.º 2158/92 / Protection against forest fires	Support to projects in: preventive forestry, installation of defensive and support infrastructure, vigilance and first intervention, awareness-raising, studies on fire risk and cause		Financial Support	In implementation		
Reg. (CEE) No. 3528/86 - Forest protection from atmospheric pollution	Support to studies and projects on forest ecosystems and monitoring initiatives		Financial Support	In implementation	DGF	
Other measures: Elimination of pests and disease; Public awareness-raising activities about forest protection; Studies, Investigation and Demonstration in the areas of: role of forests in the carbon cycle; Improvement in the methods for forest inventories, adding new parameters as required by UNFCCC and CBD; genetic improvement; improvements in productivity and soil protection; monitoring of forest areas damaged by fire and subsequent changes in soil, using GIS and satellite images; Forest fire prevention						

Table 3.7.1: National Policies and Measures for the Forestry Sector

Chapter 4 – Projections and Assessment of Policies and Measures

4.1 – Introduction

The GHG emissions projections in this document are based on the background work for PNAC and refer to data from the inventory of 2000, excluding carbon sequestration from land use change and forestry. The scenario used for reference includes the policies, measures and instruments implemented in Portugal until mid-2001, and considers the socio-economic, demographic, technology, and energy price scenarios for the period under consideration.

As Portugal is currently working on consolidating the background information for the inventories (mainly from the forestry, land use changes and waste sectors) as well as fine-tuning its methodology, there may be changes to data reported in this publication.

4.2 – Reference Scenario

The reference economic scenarios are the product of a joint and coordinated effort by CISEP of the Higher Institute of Economics and Management (ISEG), which prepared the macroeconomic scenarios, and the Bureau of Economic Studies and Prospects (GEPE, 2002), responsible for the preparation of the sectoral scenarios.

Box 1: Macroeconomic scenarios (transcribed from CISEP (2002), Chap. 3, Nº 1))

The **central scenario** should not be seen as a quantitative projection of past trends, however recent. Rather, taking into consideration the recent context of the Portuguese economy, the central scenario results in a series of likely hypotheses described below. These hypotheses represent quantitative expressions of the principal trends identified for the medium term, such as the reinforcement and consolidation of the process of globalisation or demographic growth with the ageing of the population. This scenario considers that, for the next 25 years, the Portuguese economy and society will tend towards a model of growth with characteristics explained in Chapter 2, with a greater efficiency of productive and organisational systems. This implies the orientation of public policies principally towards areas where there are market externalities or failures, in particular the promotion of education and training policies and the upgrading of technological infrastructure.

The **low scenario** corresponds to some level of failure to overcome restraints to the productive system, by economic and social agents. Under this "pessimistic" perspective, the contribution to the growth of the qualitative aspects will be lower than that of the strictly quantitative factors.

The **high scenario** considers a more successful performance of the factors referred in the low scenario. The qualitative trend, resulting in "technical progress", will in this case be higher, elevating the Portuguese economy more quickly towards real convergence with the EU. Greater growth will be reinforced by a higher rate of investment and lower public consumption, as well as consolidation of external savings.

Considering the GEPE proposal two distinct scenarios (high-end and low-end estimates) are taken so that emissions projections can be presented in an interval format. The value added growth rates for each sector are given in the table 4.2.1.

The results from Census 2001 are the basis for the demographic forecasts presented in Table 4.2.2. This type of scenario is critical for energy demand simulations in the residential and service sectors.

A single scenario for energy prices was used for the two macroeconomic scenarios under consideration, on the assumption that oil prices will still be a reference for other types of primary energy within the next decade. The forecast of the trend in oil prices is presented in table 4.2.3.

	Annual average real rates of change of VA (%)			
	High-end Scenario		Low-end Scenario	
Sectors	**2000-15**	**2015-25**	**2000-15**	**2015-25**
Agriculture	3.0	2.5	2.0	2.0
Energy	4.0	4.0	2.0	2.0
Industry	3.2	2.8	2.0	1.3
Construction	3.7	3.3	2.1	1.6
Services	4.6	4.2	3.2	2.9
SIFIM	4.4	4.1	3.1	2.7
Total	4.2	3.8	2.8	2.5

	High-end Scenario		Low-end Scenario	
	2000-15	**2015-25**	**2000-15**	**2015-25**
Industry: Sub-Sectors				
Food	2.5	1.9	2.0	1.0
Beverages	3.0	2.4	1.5	0.5
Tobacco	2.0	1.5	1.5	1,0
Textiles, clothing, shoes and leather	2.2	1.7	0.3	-0.2
Wood, Cork and Furniture	2.2	1.7	1.7	0.7
Paste, Paper and Graphic Arts	4.0	3.5	3.0	2.0
Chemicals, Rubber and Plastic	3.5	3.0	2.0	1.5
Ceramics and other non-metallic minerals	3.7	2.7	2.5	2,0
Glass	3.5	3.0	2.0	1.5
Cement and other construction materials	3.5	3.0	2.0	1.0
Basic Metallurgy	1.5	1.0	0.0	-1.0
Metalomechanics and other processing industries	4.5	4.0	3.4	2.4

	High-end Scenario		Low-end Scenario	
	2000-15	**2015-25**	**2000-15**	**2015-25**
Services: Sub-Sectors				
Commerce	4.5	4.0	3.1	2.6
Tourism	5.6	5.2	4.1	3.5
Services mainly supplied to enterprises	6.3	5.8	4.2	3.9
Transport	5.2	4.0	3.5	3.4
Communications	6.6	5.8	4.2	4.9
Other activites	4.1	3.8	2.9	2.7
Non-Public Adm.	3.8	3.5	2.5	2.3

Source: GEPE (2002)

Table 4.2.1: Sectoral scenarios: Annual average rates of real variation in Value Added (%)

	1990	1995	2000	2005	2010	2015	2020
Population (1000 Inhab.)	9860	10036	10243	10430	10597	10729	10823
No. of Families (thousands)	3054	3268	3516	3729	3946	4161	4372

Source: INE (2001). Values for 1990-2020 taking into account data from Census 1991 and 2001.

Table 4.2.2 Population and number of families, 1990 – 2020

Year	Oil (USD/bbl)	Fueloil		Diesel (Euro/l)	Coal (Euro/t)	Natural Gas (Euro/m3 N)
		% S	(EUR/t)			
2000	26.6	3	155.43	0.384	38.59	0.156
2001	27.0	3	158.64	0.399	43.95	0.167
2002	24.0	3	131.85	0.389	41.80	0.150
2005	20.0	1	130.77	0.384	47.17	0.130
2010	21.0	1	137.20	0.404	48.66	0.141
2015	23.2	1	152.21	0.424	49.52	0.151
2020	26.0	1	170.43	0.449	50.92	0.165

Source: DGE, 2001

Table 4.2.3: Trend in fuel prices

4.3 – Reduction efforts in the reference scenario

It is estimated that GHG emissions will increase between 46.5% and 53.5% by 2010 (relative to 1990). This implies a reduction effort between 12.6 and 17.2 Mt CO_2eq for compliance with Kyoto's commitments. These estimates are based on the reference scenario parameters previously mentioned in sections 4.1 and 4.2.

The following table summarizes the results of the best possible estimation of the reference scenario.

	Inventories		High-end Scenario				Low-end Scenario			
	Mt CO_2eq.		Mt CO_2eq.		% increase relative to 1990		Mt CO_2eq.		% increase relative to 1990	
	1990	2000	2010	2020	2010	2020	2010	2020	2010	2020
1. Energy (combustion and leaks)	41.25	59.20	79.2	91.2	92.1	121.2	74.8	83.9	81.3	103.5
1.1. Energy supply	16.21	22.91	26.5	30.3	63.7	87.1	24.4	26.2	48.5	61.7
1.2. Industry and construction	8.90	10.18	15.1	17.7	69.9	99.4	14.2	15.6	60.1	75.3
1.3. Transport (w/o bunker fuels)	11.41	20.20	29.3	33.4	156.7	192.8	28.5	32.8	149.6	187.3
1.4. Other sectors	4.72	5.90	8.3	9.8	75.1	106.6	8.0	9.3	68.6	97.5
2. Industrial processes	4.74	5.84	5.9	6.9	25.2	45.9	5.8	6.6	22.4	38.5
3. Solvents and other products	0.27	0.28	0.3	0.3	2.7	2.7	0.3	0.3	2.7	2.7
4. Agriculture	12.30	11.76	12.2	12.7	-0.7	3.2	12.2	12.7	-0.7	3.2
5. Changes in land use and forestry (LUCF)	-3.75	-4.22	n.a	n.a			n.a	n.a		
6. Waste and others	6.39	7.63	2.1	2.1	-67.9	67.9	2.1	2.1	-67.9	-67.9
Total (without LUCF)	**64.95**	84.70	**99.7**	113.2	**53.5**	74.3	**95.1**	105.5	**46.5**	
Projections (without LUCF)			High-end Scenario				Low-end Scenario			
Kyoto target (+27% in 2010)	**64.95**		**82.5**	(+27%)			**82.5**	(+27%)		
Reduction effort (Mt CO_2eq.)			**17.2**				**12.6**			

n.a - not available

(Source: PNAC- Measures and Impacts, Nov. 2002, CEEETA/FCT-UNL)

Table 4.3.1: Greenhouse gas emissions by economic sector in 1990 and 2000, with projections for 2010 and 2020

4.4 – Intervention scenarios

The projections based on the reference scenario show the need for strong GHG reduction efforts in order to comply with international and EC agreements (Kyoto Protocol and EU burden-sharing, respectively). The adoption of the Climate Change National Programme (PNAC) is expected by mid-2003.

Currently, GHG emissions reducing PAMs are being evaluated according to criteria of environmental effectiveness, economic efficiency, equity, integration with other sectoral policies, temporal feasibility and social acceptability. These are being bundled in two major groups:
(i) "Immediate bloc" to be developed in the short-term (until 2005) and integrating PAMs in the implementation or planning stages (after May 2001), not considered in the baseline scenario.
(ii) "Additional bloc" integrating new and/or additional PAMs to maximize GHG reduction efforts.

These projections do not account for the reduction potential of land use change and forestry.

Portugal is also expected to consider other GHG emissions reduction initiatives, such as the new Community legislation under development in the context of the European Climate Change Programme (ECCP) and Kyoto market mechanisms, which are applicable at both Community and international levels.

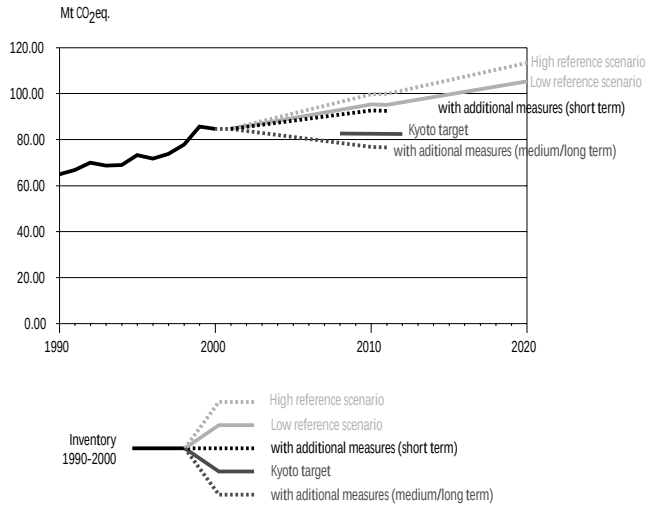

Figure 65 – Comparison of projections based on reference scenarios and some policies and measure foreseen in the PNAC

Chapter 5 – Impacts and vulnerability to climate change and adaptation measures

Between 1999 and 2002, the first stage of the project "Climate Change in Portugal – Scenarios, Impacts and Adaptation Measures (SIAM)" was developed with the crim of deepening the understanding of climate change and contributing to the preparation of a national strategic plan for adaptation. More specifically, the project aimed at defining adaptation measures and assessing their costs and benefits from an integrated perspective including physical, geophysical and biophysical, as well as economic and social phenomena.

This project gathered a multi-disciplinary team of 50 researchers from various national institutions, highly specialized in several different areas of knowledge, namely energy production, agriculture, forests, biodiversity, water resources, fisheries, coastal zones and human health.

The SIAM project resorted to the climate models HadCM2, HadRM2 and HadCM3 for estimation and analysis of the climate change impacts in the XXI century, with particular focus on the last two decades.

These models foresee a substantial rise in average air temperature throughout the whole country, especially in the summer period in the interior regions, particularly with regard to maximum temperature. Most models also predict reductions in average precipitation and on the length of the rainy seasons.

This study detected some impacts at the national level, such as:

- Climate
  - a substantial increase in mean air temperature all over the country, specially in summer and inland. The land-sea thermal gradient is also significantly increased.
  - almost all models project reductions in mean precipitation and in duration of rainy deason;
- Water resources:
  - Progressive reduction in the annual flow of rivers throughout the XXI century, more pronounced in the south of the country. This situation will aggravate the north-south assymmetry in water availability;
  - The concentration of precipitation in the winter months will result in increased river flows during the same periods. Thus, an increase in intensity and frequency of floods is expected, particularly in the north, and a decrease in water availability in the summer;
  - Degradation of water quality during the summer, particularly in the south, caused by lower flow rates and higher temperatures;

- Coastal zones
  - The most important consequence of climate change concerns the rise in sea level, changes in wave direction and power and the increase in intensity and frequency of storm surges;
  - Increase in flood zones and areas reclaimed by the ocean. Displacement of wetlands;
  - Acceleration of coastal erosion;
  - Flooding of coastal basins by tides;
  - Changes in tidal patterns;

- Agriculture
  - High CO_2 concentrations will directly stimulate productivity and increase the efficiency of soil use;
  - Decrease in springtime and summertime precipitation will increase water needs, causing water stress to cultures in arid zones;

- Human Health
  - Increase in heat related deaths;
  - Increase in water and food transmitted diseases;
  - Changes in vector-borne and rodent-borne diseases

- Energy

Climate change impacts in this sector were analysed in terms of their effects on supply and demand.

Supply:
- Likelyhood of an increase in production from hydroelectric power stations in the north, and a decrease throughout the rest of the country;
- Increase in energy losses in the transport and distribution of electricity due to higher temperatures;
- Improved performance of solar energy systems;

Demand:
- Decrease in buildings' heating needs;
- Strong increase in buildings' cooling needs;

- Forests
  - Decrease in productivity throughout most of the country;
  - Increase in soil degradation and the risk of forest fires due to a likely increase in droughts and more persistent and long lasting heat waves;

- Fisheries
  - Sardines: increase in productivity in the north-western coast and decrease in south-western coast;
  - Octopus: increase in productivity along the entire coast;
  - Tuna: increase in sea temperature may affect stock dynamics and induce a northern migration.

Chapter 6 – Financial support and technology transfer

The overall objectives of the cooperation and development policy laid out in the government's strategy are built on the principles of peace, solidarity, social justice, democracy and human rights. Unlike other sectors such as agriculture, fisheries, industry or tourism, environmental concerns, particularly climate change issues, have not been a core priority of cooperation policy. However, there has been an increased awareness and inclusion of "environment and development" issues in both the preparation of projects and the support to development initiatives.

Between 1997 and 2000, Portugal's contributions to the Global Environmental Facility amounted to a total of USD 5.07 million towards the resolution of global environmental problems including climate change. The table 6.1 presents annual break down of these contributions.

	Contributions (millions USD)			
	1997	1998	1999	2000
Global Environment Facility (GEF)	1.27	1.36	1.31	1.13

Table 6.1: Financial contributions to GEF

Cooperation is the cornerstone of a strategy on climate change mitigation and sustainable development, thus requiring strong commitment from all the parties involved. In this respect, Portugal considers the Bonn Declaration (COP6 – July 2001) an important step towards these twin goals and is committed to paying its share of the USD 410 million annual budget, from 2005 onwards.

With regard to multilateral cooperation on environmental issues, Portugal contributes, on an annual basis, to the budget of international financial and United Nations institutions towards developing country assistance, as can be seen in the table 6.2.

	Contributions (Millions USD)			
Multilateral Institutions	**1997**	**1998**	**1999**	**2000**
1. World Bank	7.74	6.34	0.28	13.33
2. International Finance Corporation	0.68	0	0	0
3. African Development Bank	8.67	6.1	0	10.64
4. Asian Development Bank	0	0	0	0
5. EBRD	0.07	1.33	1.26	1.09
6. Inter-American Development Bank	0.28	0.48	0.47	0
7. UNDP	1.79	1.69	1.27	2.28
8. UNEP	0.04	0.05	0.07	0.06
9. UNFCCC	0	0	0	0.148
10. Other	86.95	15.94	3.28	n.a
TOTAL MULTILATERAL	106.22	31.93	6.63	27.55*

n.a - not available
* - preliminary data

Table 6.2: Financial contributions to multilateral institutions

At the bilateral level, Portugal has developed several support initiatives with developing countries, namely in the areas of education and training, legal drafting on environmental issues, energy/environment projects, all with direct and indirect links to climate change mitigation and adaptation.

The Portuguese-speaking African countries are the main receivers of assistance from Portuguese institutions. More specifically, central authorities and the scientific/academic community can be valuable partners in the transfer of knowledge and technologies (some projects may be co-financed by public, private and European institutions).

Between 1996 and 2000, Portugal contributed a total € 292,694 as shown in the table below:

	Mitigation (Euros)						Adaptation (Euros)		
Recipient country	Energy	Transport	Forests	Agriculture	Waste Management	Industry	Capacity building	Coastal management	Other vulnerability evaluations
Argentina	7 831								
Brazil	47 545								
Cape Verde	192 376								
Latin America	17 009								
PALOP	27 933								
TOTAL	292 694								

Table 6.3: Bilateral contributions related to Convention implementation (1996 – 2000) (Euros)

Chapter 7 – Research and Systematic Observation

7.1 – General policy and financing of research

In Portugal, research is mainly carried out by universities, higher education institutes, and other institutions/foundations and financed by the government, Structural Fund co-financing (European Commission) and private entities. The Foundation for Science and Technology (FCT) coordinates most research activities. This institution aims at pushing the frontiers of scientific knowledge in Portugal according to the highest international standards, exploring new research opportunities, disseminating new information and enhancing the quality of life of the general public through improvements in education, health, and the environment.

FCT support comprises grants awarded on merit grounds (to institutions, research teams and individuals), cooperation agreements and other types of partnerships with universities and public or private institutions.

In 2000, Portugal dedicated 1.47% of the state budget to R&D, an increase of 10.85% relative to 1995. In 1999, about 20% of this budget was used on health and environment research.

7.2 – Research Programmes

There are several institutions focused on climate research, particularly climate change. This section describes to some examples of research projects taking place in Portugal or including Portuguese teams.

7.2.1 – Modelling and forecasting, including General Circulation Models (GCMs)

- CIELO PROJECT – A PHYSICALLY-BASED MODEL FOR LOCAL CLIMATE SIMULATION IN ISLAND ENVIRONMENTS (University of the Azores) – based on the CIELO (Island Climate at a Local Scale) model which was developed and calibrated for Terceira Island (Azores). This model is operated on a Geographic Information System (GIS) environment and can combine several different variables to produce a well-defined spatial climate distribution taking into consideration the specific orography, and forecast local climate and weather patterns.

- DEVELOPMENT OF STATISTICAL AND STOCHASTIC MODELS (INETI) – producing weather series and information on typical meteorological years for current and future climates; the aim is to produce quantitative estimates on impacts, adaptation and mitigation measures including the use of renewable energy and building characteristics.

7.2.2 – Research on the impacts of climate change

- CLIMATE CHANGE IN PORTUGAL: SCENARIOS, IMPACTS AND ADAPTATION MEASURES (SIAM) (led by the Faculty of Sciences of the University of Lisbon) – The first stage of this multidisciplinary project was developed in 2000-2001 and evaluated some climate change impacts on sectors such as agriculture, fisheries, forests, biodiversity and coastal zones. A second stage (SIAM II) is planned for development in the years 2002-03. Its key objectives are:
- Improve knowledge on climate change impacts in the various socio-economic sectors, and widen the scope of the project to include the Autonomous Regions of Madeira and the Azores;
- Propose adaptation measures to be implemented at a national level.

- MEFDIS: SIMULATION MODEL OF WATER EROSION CAUSED BY EXTREME EVENTS (Faculty of Science and Technology, New University of Lisbon, in collaboration with Civil Engineering Dept., Cornell University, USA) – The simulation of water erosion is essential for the management of hydrographic basins, particularly in terms of forecasting climate change impacts on soil use. In Mediterranean climates, extreme precipitation events are major factors in water erosion; this may be aggravated due to the increased probability of occurrence induced by climate change. The MEFDIS erosion model (Distributed, Physical Erosion Model) is a tool for analysing and forecasting patterns in water drainage and soil erosion caused by such events, with high spatial resolution (tested up to 10m). This model combines geographic information, namely satellite imagery, and has been implemented with a strong GIS component.

- DETERMINATION OF ZONES WITH MALARIA CONTAMINATION RISK AND THE INFLUENCE OF CLIMATE CHANGE ON THEIR EXPANSION – CASE STUDY ON THE ALGARVE REGION (Faculty of Science and Technology of the New University of Lisbon, in collaboration with the Laboratory for Terrestrial Physics, Goddard Space Flight Center (NASA, Maryland)) – Malaria is considered the disease with the highest likelihood of being influenced by climate change. It is therefore important to anticipate the impacts on its spatial distribution. Research carried out in the Algarve region, based on Landsat imagery concluded that the most densely populated regions are more favourable for malaria incidence. Temperature data from the HadRMGGa2 climate model (Climate Impacts LINK Project, University of East Anglia,

United Kingdom) generates further evidence for the influence of climate change in the increased probability of malaria transmission in the south of Portugal.

- GENETICLAND: DISCOVERING FUTURE LANDSCAPES UNDER CLIMATE CHANGE SCENARIOS USING GENETIC ALGORTHIMS (Faculty of Science and Technology of the New University of Lisbon, in collaboration with University of California at Santa Barbara and the Indian Institute of Technology at Kanpur) – This project aims at assessing the impacts of climate change on landscape, with reference to the following question: "In light of current data on climate change, is it possible to foresee what the landscape will look like in 50 years time?". Specifically, the project aims at evaluating the impacts on south Alentejo (Portugal) under several scenarios.

- SIGCHRUS PROJECT: "SIMULATION OF IMPACTS OF GLOBAL CHANGES ON THE HIDROLOGICAL CYCLE IN RELATION TO THE USE OF THE SOIL" – Joint project involving the Department of Agricultural Sciences of the University of the Azores, the Department of Rural Engineering of the Higher Institute of Agronomy (Technical University of Lisbon) and the Department of Rural Engineering of the University of Trás-os-Montes e Alto Douro.

7.2.3 – R&D in adaptation and mitigation

- R&D IN MITIGATION (INETI – Renewable Energy Department) – Research work on renewable energy (all types except hydro and geothermal), carbon sequestration via micro algae and energy efficiency in buildings.

- R&D IN COMBUSTION TECHNOLOGIES; TECHNOLOGIES APPLIED TO SOLID AND LIQUID FUELS, AND WASTE (INETI – Energy Engineering and Environmental Control Department) – Research on energy efficiency, alternative fuels and mitigation of environmental impacts (e.g. plastics recycling, cleaner and more efficient coal burning).

- "AGRICULTURAL SOIL AS A CARBON SINK THROUGH THE INCREASE IN ORGANIC MATTER" (Department of Phytotechnics of Évora University) – testing techniques of light mobilisation and non-removal of agricultural waste. Its permanence in the soil should increase organic matter and lead to an increase in carbon fixing.

7.2.4 – Others

- REMOTE SENSING AND ENVIRONMENTAL CHANGE RESPONSE TEMPORAL ANALYSIS OF TERRESTRIAL CARBON CYCLE: THE CASE OF THE IBERIAN PENINSULA (Faculty of Science and Technology of the New University of Lisbon, in collaboration with the Laboratory of Terrestrial Physics, Goddard Space Flight Center (NASA, Maryland)) – aims at developing a methodology for the (annual and inter-annual) estimation of the territorial component of the carbon cycle. It takes account of vegetation characteristics and environmental disturbances through remote sensing and analysis of time-series . A second goal is to forecast the trends in carbon sinks for the areas of study, within a given time period.

- "ROCA – "Network for Observation and Composition of the Air" developed by the National Meteorology Institute.

7.3 – Systematic observation

General Policy on Systematic Observation

Portugal´s efforts in this area are coherent with the policies of the following international organizations of which it is a member: World Meteorological Organization and its programmes, namely the World Climate Programme (WCP, and its research component WCRP), the International Geosphere-Biosphere Programme (IGBP) and other European Union programmes (COST and 5th Framework Programme). Portugal is also contributing research for the Intergovernmental Panel on Climate Change (IPCC).

In the international context, Portugal is an active member in maintaining and improving the global observation system through its participation in the European programmes of Terrestrial Observation (e.g. programmes of the European Meteorological Satellite Organization - EUMETSAT) and the Global Climate Observing Systems (GCOS).

Meteorological observations in Portugal date back to 1856. The Meteorology Institute (IM) is the institution responsible for data collection, research, and analysis relevant for the understanding of climate change.

a) Atmospheric climate and composition observation system

There are currently 115 meteorological stations and 700 udometric stations; the average of the climatological network density is about 9 stations per 1000Km2, a figure roughly in line with the European average. The IM is responsible for stations' maintenance and controlling the quality of the observations.

The Meteorological Institute operates 7 stations measuring UV-B radiation, 4 stations measuring total ozone concentrations and 3 aerologic stations, within the framework of the Global Atmosphere Watch (GAW) coordinated by the World Meteorological Organisation. Currently, the network on Global Atmospheric Composition of the IM includes 7 stations: Bragança, Viana do Castelo, Penhas Douradas, Castelo Branco, Lisboa, Funchal and Angra do Heroísmo.

The observation programmes under way include the monitoring of:

- Total ozone quantities using spectrophotometers;
- UV intensity using spectrophotometers and wide band detectors;
- Surface ozone concentration using photometric analysers:
- Concentrations of suspended particulate matter
- Concentrations of sulphur dioxide (aerosols and gas) using sequential samplers;
- Concentrations of carbon dioxide and methane
- PH
- Conductivity
- Concentration of ions and metals in rain water samples (wet deposition) and in dry depositions

The IM also collaborates with the Cooperative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP) in the areas of atmospheric deposition and atmospheric ozone observation.

	GSN	GUAN	GAW	CLIMATE
No. of stations under Portugal´s responsibility	4	1	8	15
No. of stations currently operational	4	1	7	15
No. of stations operating in accordance with GCOS standards	4	1	7	15
No. of stations expected to be operational by 2005	4	1	10	15
No. of stations supplying data to international data centres	4	1	7	15

Table7.3.1: Participation in the Global Atmospheric Observation System

b) Ocean climate observation system

	VOS	SOOP	TIDE GAUGES	SFC DRIFTERS	SUB-SFC FLOATS	MOORE DBUOYS	ASAP
No. of platforms under portuguese responsibility	15	0	12	0	0	0	0
No. of platforms supplying data to international centres	0	0	4	0	0	0	0
No. of platforms expected to be operational by 2005	-		15	-	-	-	-

Table 7.3.2 Participation in the Global Oceanographic Observation System

c) Territorial climate observation system

	GTN-P	GTN-G	FLUXNET	Other
No. of sites under Portugal´s responsibility	0	0	0	0
No. of sites currently in operation	0	0	0	0
No. of sites supplying data to international data centers	0	0	0	0
No. of sites expected to be operational by 2005	0	0	0	0

Table 7.3.3: Participation in the Global Terrestrial Observation System

d) Programmes based on space observations

Portugal is a member of EUMETSAT (European Meteorological Satellite Organisation) and participates in several of its programmes, one of the most important being the Satellite Application Facility for Land Surface Analysis (LAND-SAF) which in Portugal is based at the IM. This project is dedicated to processing satellite information with the aim of determining a set of biophysical parameters at the soil level. Such information is of great utility, not only to meteorology and climatology, but also to a range of other biophysical applications, especially in the fields of agriculture, forestry, hydrology and biodiversity. This project is broad in scope, combining 13 institutions of 8 different countries. It is also a large project in other aspects, namely in terms of total financing, technological innovation, the range of final "products" (15 parameters) and its overall nature (parameters available to a wide community of users).

e) Assistance to developing countries for implementing and maintaining observation, data collection and monitoring systems

CRIA Agency

CRIA is the Agency of the Portuguese-speaking countries and the Macau territory (China) for "Climate and Associated Environmental Implications". This is an international not-for-profit institution, financially and administratively independent, set up on June 5th 1998 through an accord between the Meteorology Institutes/services of the group of countries mentioned above.

Its objectives are to:

- Develop research on climate, its environmental implications and the links to other areas such as transport, health, agriculture, energy, etc;
- Define common strategies aimed at joint answers and active participation in global programmes on climate/environmental issues;
- Promote initiatives aimed at improving interdisciplinarity among the different institutions within member countries.
- Support the members in setting up regional development projects and programmes;
- Mobilize financial resources;
- Support programmes and projects to be implemented with the participation of civil society, entrepreneurs and governmental organizations.

CRIA´s main activities include:

- Development and implementation of an operational system to improve short, medium and long-term forecasting;
- Implementation of an operational system of regional climate simulation;
- Development of projects on climate information application in order to:

  • Improve safety of people and goods
  • Improve profitability of food production and balanced management of natural resources;
  • Improve energy production.

- Promotion of research on natural processes influencing the atmosphere and leading to climate change;
- Promotion of research on the links between development and climate change; Organization of seminars and technical conferences in the areas of climate-related environmental interactions;
- Promotion of specialized and/or post-graduate training on climate issues and related environmental impacts.

Chapter 8 – Education, Training and Public Awareness

8.1 – General policy guidelines on education, training and public awareness

There is general consensus on the need of educating citizens to become active members of society in the protection and improvement of natural and human environments. In this sense, environmental education ought to be a priority and, as such, it requires the definition of a strategy for integration of environmental concerns in the wider process of education.

In the Council of Ministers resolution on environmental education of May 24th, 1988, the European Community recommended the adoption of measures towards benchmarking environmental education initiatives across member-states.

Environmental education in Portugal received attention in the 1970s with the efforts of the National Commission on Environment. These efforts were later reinforced by the Framework law on the Environment and the legal competencies of the National Environment Institute (INamb) first, the Environmental Promotion Institute (IPAMB) later, and currently the for the Institute for the Environment (IA). This institution is in charge of developing initiatives on training, information dissemination and support to environmental protection organizations. More specifically, it develops projects on environmental education in partnership with local authorities, public administration services, and private institutions. It also oversees its integration in the education system.

In 1996, a cooperation partnership was signed between the Ministries of Education and the Environment for the implementation of the Government's environment and education policies, in accordance with priorities set by the second European Support Framework. This partnership set out the foundations for collaboration on technical, scientific, pedagogical, financial and logistic terms for the integration of environmental education in primary and secondary education curricula.

Special funding was made available for project assistance on environmental education at kindergartens and primary and secondary schools. Furthermore, the Ministry of Education has contributed with a quota of teachers seconded to requesting non-governmental organisations for technical and pedagogical support to schools at local level. The Ministry of Environment (MCOTA) contributes with technical, pedagogical and documental support through the Environment Institute, and financial support in the context of the Environment Programme.

8.2 – Primary, Secondary and Higher Education

The Framework Law on the Education System rests on the principles of fulfilment, personal development and citizenship, to promote the balanced and encompassing development of the individual.

Environmental education in primary and secondary education curricula is transversal and covers all subjects (including Social and Personal Development), as well as "school area" projects (interdisciplinary and compulsory in nature) and extra-curricular activities.

Climate change is not subject to a specific approach, but instead is covered under general environmental issues. It can therefore be taught at subject level within the context e.g. of Biology and Geology (12th grade), and Geography (10th and 11th grades), or in a more transversal manner.

Several educational packages have been prepared with the aim of supporting schools and raising awareness in the wider public. One of the most comprehensive packages was developed in 1997 for primary and secondary teachers and students on "atmospheric issues", and included a video, a slide show accompanied by a guide book, and a CD-ROM with information, games and written material.

In Portugal, seven primary and secondary schools (7th to 9th grade) participate in the GLOBE Programme, under which students measure and record atmospheric parameters using internationally agreed methodologies to enhance their knowledge and understanding of the different aspects of climate and the impacts of climate change.

At the higher education level, there are several "environmental" degrees such as Environmental Engineering, Biology, Geology, and Geography with specializations on environmental studies, spatial planning and development, biophysics and environmental law.

For example, the International Relations degree from the University of Coimbra (Faculty of Economics) has dedicated a significant amount of time to climate change issues from an economics and policy (national and international) perspective. Besides the public lectures on these issues, students also have classes and participate in simulations of international environmental negotiations (based on the Kyoto Protocol).

The Life and Environmental Science subject (11th grade – Technological Course on Chemistry and Environmental Control) is a privileged forum for developing environmental awareness and a capability for intervening in an environmentally-sound fashion, as it explores themes such as:

- Environmental ethics
- Limits to growth
- Sustainable Development
- Water, air and soil pollution
- Greenhouse effect, acid rain, ozone layer depletion, photochemical smog…

With this programme, students are expected to, inter alia:

- Identify some of the sources of anthropogenic air pollution: thermoelectric stations, incinerators, co-incinerators, cement factories, oil refineries and other processing industries, motor vehicles, forest fires, intensive and industrialized agriculture.
- Characterize the environmental problems for the following scales:
  - Local (photochemical smog, indoor pollution,…);
  - Regional (acid rain, particulate matter,...);
  - Global (climate change, greenhouse effect, stratospheric ozone depletion,…).

With regard to climate change, the programme suggests the following practical activities:

1. Discuss the Kyoto Protocol:
   a. What is the objective of this protocol?
   b. Why are some critical of short-term carbon dioxide reduction as a means of tackling climate change?
   c. Why is it said that farmers and bovines are responsible for increased methane levels in the atmosphere?

2. Have there been other conferences since Kyoto, and what were their objectives?

3. Research on gaseous emissions contributing to global warming, their impact on the climate, and how these emissions could be reduced in the future.

4. Group research on gases responsible for global warming: methane, carbon dioxide, nitrous oxide and hydrocarbons (including CFCs an HCFCs), and their relationship with ozone depletion.

5. What are the "main" steps to reducing global warming problems induced by GHGs?

6. Research on human activity interference on the carbon, nitrogen and oxygen cycles.

7. Set up a glossary of terms related to global warming, acid rain, and stratospheric ozone depletion, including important definitions and explanations for the understanding of these phenomena.

8.3 – Professional training initiatives

The areas of meteorology/air were included in the annual training plans set up between 1997 and 2000. IPAMB, in partnership with the Professional Training Institute (IFP), carried out the following training initiatives aimed at upgrading the skills of these professionals.

Following the 6th Conference of the Parties to the FCCC (COP 6), the Environment Institute organized a workshop targeting professionals from various public institutions, but open to the general public. This workshop included the participation of the national delegation, NGOs and journalists present at COP6, to debate the issues under discussion at the conference, namely those leading to the breakdown in negotiations. Journalists' and NGOs' participation provided for an alternative perspective on these issues. The workshop also aimed at raising awareness on climate change among the public administration institutions.

Year	Activity Denomination	Training Location	No. of Hours	No. of Trainees
1997	Adjunct Meteorological Observer	Lisbon	630	13
1998	Adjunct Meteorological Observer	Lisbon	630	15
	Meteorologist	Lisbon	480	11
1999	General Training - Meteorology and Seismology	Lisbon	60	15
	Air Quality	Lisbon	35	16
	Introduction to Weather Forecasting	Lisbon	405	17

Table 8.3.1 - Professional Training Initiatives (1997-2000) from IFP

8.4 – Information and Resource Centres

The Information and Documentation Centre (CDI) at the Environment Institute caters for a wide range of bibliographical references, namely books, brochures, leaflets, magazines and other publications on the environment. This is made available to the public, with staff providing direct user support and specific answers to written queries.

The causes and effects of climate change are among the most researched themes at CDI, particularly by students.

8.5 – Public and NGO involvement

In 2000, six Portuguese cities (including Lisbon and Porto, the largest), and a village participated in the "European Car-free day" campaign. In 2001 there were already 52 cities participating following the success of the first event. Significant parts of the city centre were closed to traffic, collective transport was upgraded and alternative means of transport were supplied. Though not specifically related to climate change, this initiative's objectives are consistent with GHG emissions reduction measures.

Portugal recognizes the vital role played by NGOs on education and public awareness. It has therefore been supporting environmental NGOs on climate change issues, namely through supporting their participation in COP sessions, as well as sponsoring related activities (for example, seminars on the use of flexibility mechanisms within a climate change policy).

For example, The Portuguese-American Foundation for Development (FLAD), in partnership and with the financial support of the Environment Institute has, throughout the years, provided much exposure of climate change issues, namely through the "Summer Institute on Global Environmental Issues". This week long short course counts on the participation of distinguished national and foreign specialists as speakers, and 25 selected participants.

The 2001version of PNAC was subject to public consultation for a period of 40 days, and made available for download on the Internet. Besides the possibility of sending in comments through various means (mail, electronic mail, fax), public participation was also made possible by three open sessions carried out in three different cities, two sectoral roundtables, and one roundtable with NGOs (from other areas besides the environment). In this process, 27 contributions were received from enterprise associations, NGOs, local authorities, companies and individuals. The PNAC team participated in several institutional and sectoral meetings, upon request and initiative of enterprise associations.

8.6 – Participation in International Activities

At the international level, Portugal participated with two secondary education students at the International Youth Meeting taking place in parallel with COP 6 to the UNFCCC, in The Hague. This participation led to the organization of a Meeting of Youth for the Environment (organized by the Portuguese Confederation of Environmental Protection Associations) with the objective of disseminating COP 6 results, as well as other issues related to climate change.

Anexe A

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

Portugal
1990
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2 emissions	CO_2 removals	CH_4	N_2O	$HFCs$ (1)		$PFCs$ (1)		SF_6		NO_x	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals		**44,108.66**	**-3,751.00**	**614.43**	**25.60**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00000**	**281.97**	**1,110.01**	**380.95**	**337.85**
1. Energy		**39,695.82**		**28.49**	**3.07**							**275.34**	**1,062.34**	**182.53**	**321.84**
A. Fuel Combustion	Reference Approach (2)	40,843.12													
	Sectoral Approach (2)	39,532.52		23.67	3.07							274.41	1,061.67	135.37	310.45
1. Energy Industries		15,884.17		0.21	0.20							68.01	2.60	0.46	202.18
2. Manufacturing Industries and Construction		8,797.46		1.63	0.21							29.99	28.70	9.70	81.00
3. Transport		11,221.34		2.50	0.44							138.86	709.03	97.59	20.12
4. Other Sectors		3,621.10		19.32	2.22							37.52	321.32	27.62	7.08
5. Other		8.45		0.01	0.00							0.02	0.02	0.01	0.06
B. Fugitive Emissions from Fuels		163.30		4.82	0.00							0.93	0.68	47.16	11.39
1. Solid Fuels		8.65		3.14	0.00							0.00	0.00	0.00	0.00
2. Oil and Natural Gas		154.65		1.68	0.00							0.93	0.68	47.16	11.39
2. Industrial Processes		**4,132.58**		**0.38**	**1.94**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.55**	**29.88**	**79.28**	**16.00**
A. Mineral Products		3,425.67		0.00	0.00							0.00	0.00	53.85	2.98
B. Chemical Industry		671.54		0.38	1.94	0.00	0.00	0.00	0.00	0.00	0.00	1.88	20.97	9.97	7.92
C. Metal Production		34.94		0.00	0.00				0.00		0.00	0.02	8.91	0.46	0.50
D. Other Production (3)		0.44										2.64	0.00	14.99	4.60
E. Production of Halocarbons and SF_6							0.00		0.00		0.00				
F. Consumption of Halocarbons and SF_6						0.00	0.00	0.00	0.00	0.00	0.00				
G. Other		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach. Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.

(3) Other Production includes Pulp and Paper and Food and Drink Production.

Note: The numbering of footnotes to all tables containing more than one sheet continue to the next sheet. Common footnotes are given only once at the first point of reference.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Portugal
1990
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	$HFCs$ (1)		$PFCs$ (1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
3. Solvent and Other Product Use	**271.42**			**0.00**							**0.00**	**0.00**	**89.38**	0.00
4. Agriculture	**0.00**	**0.00**	**302.06**	**19.21**							2.06	17.77	25.42	0.00
A. Enteric Fermentation			124.07											
B. Manure Management			164.96	3.64									0.00	
C. Rice Cultivation			12.18										0.13	
D. Agricultural Soils	(4) NE	(4) NE	0.00	15.46									25.28	
E. Prescribed Burning of Savannas			0.00	0.00							0.00	0.00	0.00	
F. Field Burning of Agricultural Residues			0.85	0.12							2.06	17.77	0.00	
G. Other			0.00	0.00							0.00	0.00	0.00	0.00
5. Land-Use Change and Forestry	(5) **0.00**	(5) **-3.751.00**	**0.00**	**0.00**							**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	(5) 0.00	(5) -1,839.00												
B. Forest and Grassland Conversion	0.00	-1,912.00	0.00	0.00							0.00	0.00	NE	
C. Abandonment of Managed Lands	(5) 0.00	(5) IE												
D. CO_2 Emissions and Removals from Soil	(5) 0.00	(5) NE												
E. Other	(5) 0.00	(5) 0.00	0.00	0.00							0.00	0.00	0.00	0.00
6. Waste	**8.84**		**283.50**	**1.37**							**0.02**	**0.02**	**4.35**	**0.01**
A. Solid Waste Disposal on Land	(6) 0.00		264.30									0.00	3.66	
B. Wastewater Handling			19.20	1.37							0.00	0.00	0.59	
C. Waste Incineration	(6) 8.84		0.00	0.00							0.02	0.02	0.10	0.01
D. Other	0.00		0.00	0.00							0.00	0.00	0.00	0.00
7. Other ***(please specify)***	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

(4) According to the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land-Use Change and Forestry (LUCF). At the same time, the Summary Report 7A (Volume 1. Reporting Instructions, Tables.27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under D. Agricultural Soils or in the Land-Use Change and Forestry sector under D. Emissions and Removals from Soil. Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. Double-counting of these emissions or removals should be avoided. Parties should include these emissions or removals consistently in Table8(a) (Recalculation - Recalculated data) and Table10 (Emission trends).

(5) Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

(6) Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biogenic or inorganic waste streams.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 3 of 3)

Portugal
1990
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	$HFCs$		$PFCs$		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Memo Items: (7)														
International Bunkers	**2,056.53**		**1.97**	**0.05**							**36.72**	**3.82**	**1.08**	**18.90**
Aviation	883.31		0.11	0.02							3.70	3.10	1.00	0.22
Marine	1,173.22		1.86	0.03							33.01	0.72	0.09	18.68
Multilateral Operations	**NE**		**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**12,023.15**													

(7) Memo Items are not included in the national totals.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Portugal
1990
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFC_S	PFC_S	SF_6	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**40,357.66**	**12,902.96**	**7,936.58**	**0.00**	**0.00**	**0.00**	**61,197.21**
1. Energy	**39,695.82**	**598.31**	**953.24**				**41,247.37**
A. Fuel Combustion (Sectoral Approach)	39,532.52	497.01	953.24				40,982.77
1. Energy Industries	15,884.17	4.38	61.28				15,949.83
2. Manufacturing Industries and Construction	8,797.46	34.15	66.64				8,898.25
3. Transport	11,221.34	52.59	136.91				11,410.85
4. Other Sectors	3,621.10	405.74	688.39				4,715.23
5. Other	8.45	0.15	0.02				8.62
B. Fugitive Emissions from Fuels	163.30	101.30	0.00				264.60
1. Solid Fuels	8.65	66.02	0.00				74.66
2. Oil and Natural Gas	154.65	35.28	0.00				189.94
2. Industrial Processes	**4,132.58**	**8.01**	**602.85**	**0.00**	**0.00**	**0.00**	**4,743.45**
A. Mineral Products	3,425.67	0.00	0.00				3,425.67
B. Chemical Industry	671.54	8.01	602.85	0.00	0.00	0.00	1,282.40
C. Metal Production	34.94	0.00	0.00		0.00	0.00	34.94
D. Other Production	0.44						0.44
E. Production of Halocarbons and SF_6				0.00	0.00	0.00	0.00
F. Consumption of Halocarbons and SF_6				0.00	0.00	0.00	0.00
G. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use	**271.42**		**0.00**				**271.42**
4. Agriculture	**0.00**	**6,343.17**	**5,955.70**				**12,298.88**
A. Enteric Fermentation		2,605.55					2,605.55
B. Manure Management		3,464.14	1,127.35				4,591.49
C. Rice Cultivation		255.71					255.71
D. Agricultural Soils [2]	NE	0.00	4,791.39				4,791.39
E. Prescribed Burning of Savannas		0.00	0.00				0.00
F. Field Burning of Agricultural Residues		17.77	36.96				54.73
G. Other		0.00	0.00				0.00
5. Land-Use Change and Forestry [1]	**-3,751.00**	**0.00**	**0.00**				**-3,751.00**
6. Waste	**8.84**	**5,953.46**	**424.79**				6,387.09
A. Solid Waste Disposal on Land	0.00	5,550.30					5,550.30
B. Wastewater Handling		403.15	424.37				827.52
C. Waste Incineration	8.84	0.01	0.42				9.27
D. Other	0.00	0.00	0.00				0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
							0.00
Memo Items:							
International Bunkers	**2,056.53**	**41.38**	**14.72**				**2,112.64**
Aviation	883.31	2.33	5.31				890.96
Marine	1,173.22	39.05	9.41				1,221.68
Multilateral Operations	**NE**	**0.00**	**0.00**				**0.00**
CO_2Emissions from Biomass	**12,023.15**						**12,023.15**

[1] For CO_2 emissions from Land-Use Change and Forestry the net emissions are to be reported. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[2] See footnote 4 to Summary 1.A of this common reporting format.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions / removals	CH_4	N_2O	Total emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-1,839.00	-1,839.00			-1,839.00
B. Forest and Grassland Conversion	0.00	-1,912.00	-1,912.00	0.00	0.00	-1,912.00
C. Abandonment of Managed Lands	0.00	0.00	0.00			0.00
D. CO_2 Emissions and Removals from Soil	0.00	0.00	0.00			0.00
E. Other	0.00	0.00	0.00	0.00	0.00	0.00
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	0.00	-3,751.00	-3,751.00	0.00	0.00	-3,751.00

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry [a]	64,948.21
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry [a]	61,197.21

[a] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land-Use Change and Forestry.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES
(IPCC TABLE 7A)
(Sheet 1 of 3)

Portugal
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs (1)		PFCs (1)		SF_6		NO_X	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**63,150.33**	**-4,216.42**	**625.41**	**26.64**	**0.00**	**0.00**	**0.00**	**156.77**	**0.00**	**0.00004**	**393.85**	**1,033.36**	**496.22**	**338.63**
1. Energy		**57,394.72**		**26.33**	**4.03**							**385.04**	**981.00**	**212.92**	**327.73**
A. Fuel Combustion	Reference Approach (2)	60,535.47													
	Sectoral Approach (2)	57,105.69		19.59	4.03							384.07	980.34	157.78	309.06
1. Energy Industries		22,376.76		0.31	0.32							82.82	3.76	0.74	221.21
2. Manufacturing Industries and Construction		10,056.15		1.91	0.26							39.06	33.36	8.75	69.63
3. Transport		19,632.59		2.85	1.64							215.75	701.46	126.34	9.69
4. Other Sectors		5,040.19		14.52	1.80							46.44	241.76	21.95	8.53
5. Other		0.00		0.00	0.00							0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels		289.03		6.74	0.00							0.96	0.66	55.14	18.68
1. Solid Fuels		0.00		0.00	0.00							0.00	0.00	0.00	0.00
2. Oil and Natural Gas		289.03		6.74	0.00							0.96	0.66	55.14	18.68
2. Industrial Processes		**5,070.36**		**0.34**	**1.96**	**0.00**	**0.00**	**0.00**	**156.77**	**0.00**	**0.00**	**5.19**	**35.81**	**162.68**	**10.88**
A. Mineral Products		4,510.72		0.00	0.00							0.00	0.00	136.83	3.85
B. Chemical Industry		498.71		0.34	1.96	0.00	0.00	0.00	0.00	0.00	0.00	1.89	20.93	9.65	2.22
C. Metal Production		60.49		0.00	0.00				156.77		0.00	0.05	14.88	0.20	1.27
D. Other Production (3)		0.44										3.25	0.00	15.99	3.53
E. Production of Halocarbons and SF_6							0.00		0.00		0.00				
F. Consumption of Halocarbons and SF_6						0.00	0.00	0.00	0.00	0.00	0.00				
G. Other		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach. Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.

(3) Other Production includes Pulp and Paper and Food and Drink Production.

Note: The numbering of footnotes to all tables containing more than one sheet continue to the next sheet. Common footnotes are given only once at the first point of reference.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Portugal
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs [1]		PFCs [1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)				(Gg)					
3. Solvent and Other Product Use	**278.88**			**0.00**							**0.00**	**0.00**	**92.00**	0.00
4. Agriculture	**0.00**	**0.00**	**279.82**	**18.97**							1.86	16.05	23.24	0.00
A. Enteric Fermentation			122.92											
B. Manure Management			147.51	3.91									0.00	
C. Rice Cultivation			8.62										0.09	
D. Agricultural Soils	(4) NE	(4) NE	0.00	14.95									23.15	
E. Prescribed Burning of Savannas			0.00	0.00							0.00	0.00	0.00	
F. Field Burning of Agricultural Residues			0.76	0.11							1.86	16.05	0.00	
G. Other			0.00	0.00							0.00	0.00	0.00	0.00
5. Land-Use Change and Forestry	(5) **0.00**	(5) **-4,216.42**	**0.00**	**0.00**							**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	(5) 0.00	(5) -2,277.42												
B. Forest and Grassland Conversion	0.00	-1939.00	0.00	0.00							0.00	0.00	NE	
C. Abandonment of Managed Lands	(5) 0.00	(5) IE												
D. CO_2 Emissions and Removals from Soil	(5) 0.00	(5) NE												
E. Other	(5) 0.00	(5) 0.00	0.00	0.00							0.00	0.00	0.00	0.00
6. Waste	**406.37**		**318.92**	**1.69**							**1.76**	**0.51**	**5.37**	**0.02**
A. Solid Waste Disposal on Land	(6) 0.00		296.39									0.00	4.50	
B. Wastewater Handling			22.48	1.59							0.00	0.00	0.71	
C. Waste Incineration	(6) 406.37		0.05	0.10							1.76	0.51	0.17	0.02
D. Other	0.00		0.00	0.00							0.00	0.00	0.00	0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

[4] According to the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land-Use Change and Forestry (LUCF). At the same time, the Summary Report 7A (Volume 1. Reporting Instructions, Tables.27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under D. Agricultural Soils or in the Land-Use Change and Forestry sector under D. Emissions and Removals from Soil.
Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. Double-counting of these emissions or removals should be avoided. Parties should include these emissions or removals consistently in Table8(a) (Recalculation - Recalculated data) and Table10 (Emission trends).

[5] Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[6] Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biogenic or inorganic waste streams.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 3 of 3)

Portugal
2000
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)				(Gg)					
Memo Items:														
International Bunkers	**2,526.03**		**2.64**	**0.06**							**48.83**	**3.95**	**1.12**	**25.73**
Aviation	929.64		0.11	0.02							3.89	2.97	1.00	0.24
Marine	1,596.40		2.53	0.04							44.94	0.98	0.12	25.50
Multilateral Operations	**NE**		**NE**	**NE**							**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass	**11,046.72**													

[7] Memo Items are not included in the national totals.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Portugal
2000
Submission 2002

GREENHOUSE GAS SOURCE AND SINK	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
CATEGORIES	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**58,933.91**	**13,133.70**	**8,258.21**	**0.00**	**156.77**	**1.01**	**80,483.60**
1. Energy	**57,394.72**	**553.01**	**1,250.01**				**59,197.74**
A. Fuel Combustion (Sectoral Approach)	57,105.69	411.37	1,250.01				58,767.07
1. Energy Industries	22,376.76	6.54	100.36				22,483.65
2. Manufacturing Industries and Construction	10,056.15	40.06	81.80				10,178.00
3. Transport	19,632.59	59.81	508.46				20,200.86
4. Other Sectors	5,040.19	304.97	559.40				5,904.56
5. Other	0.00	0.00	0.00				0.00
B. Fugitive Emissions from Fuels	289.03	141.64	0.00				430.67
1. Solid Fuels	0.00	0.00	0.00				0.00
2. Oil and Natural Gas	289.03	141.64	0.00				430.67
2. Industrial Processes	**5,070.36**	**7.18**	**606.24**	**0.00**	**156.77**	**1.01**	**5,841.56**
A. Mineral Products	4,510.72	0.00	0.00				4,510.72
B. Chemical Industry	498.71	7.18	606.24	0.00	0.00	0.00	1,112.13
C. Metal Production	60.49	0.00	0.00		156.77	0.00	217.25
D. Other Production	0.44						0.44
E. Production of Halocarbons and SF_6				0.00	0.00	0.00	0.00
F. Consumption of Halocarbons and SF_6				0.00	0.00	1.01	1.01
G. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use	**278.88**		**0.00**				**278.88**
4. Agriculture	**0.00**	**5,876.15**	**5,879.30**				**11,755.46**
A. Enteric Fermentation		2,581.26					2,581.26
B. Manure Management		3,097.75	1,212.13				4,309.88
C. Rice Cultivation		181.09					181.09
D. Agricultural Soils [2]	NE	0.00	4,633.76				4,633.76
E. Prescribed Burning of Savannas		0.00	0.00				0.00
F. Field Burning of Agricultural Residues		16.05	33.41				49.46
G. Other		0.00	0.00				0.00
5. Land-Use Change and Forestry [1]	**-4,216.42**	**0.00**	**0.00**				**-4,216.42**
6. Waste	**406.37**	**6,697.35**	**522.66**				7,626.39
A. Solid Waste Disposal on Land	0.00	6,224.23					6,224.23
B. Wastewater Handling		472.08	492.32				964.40
C. Waste Incineration	406.37	1.04	30.34				437.76
D. Other	0.00	0.00	0.00				0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
							0.00
Memo Items:							
International Bunkers	**2,526.03**	**55.51**	**18.31**				**2,599.85**
Aviation	929.64	2.35	5.50				937.48
Marine	1,596.40	53.16	12.81				1,662.36
Multilateral Operations	**NE**	**0.00**	**0.00**				**0.00**
CO_2 Emissions from Biomass	**11,046.72**						**11,046.72**

[1] For CO_2 emissions from Land-Use Change and Forestry the net emissions are to be reported. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[2] See footnote 4 to Summary 1.A of this common reporting format.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions / / removals	CH_4	N_2O	Total emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-2,277.42	-2,277.42			-2,277.42
B. Forest and Grassland Conversion	0.00	-1,939.00	-1,939.00	0.00	0.00	-1,939.00
C. Abandonment of Managed Lands	0.00	0.00	0.00			0.00
D. CO_2 Emissions and Removals from Soil	0.00	0.00	0.00			0.00
E. Other	0.00	0.00	0.00	0.00	0.00	0.00
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	0.00	-4,216.42	-4,216.42	0.00	0.00	- 4,216.42

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	(a)	84,700.02
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	(a)	80,483.60

[a] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land-Use Change and Forestry.

TABLE 10 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 5)

Portugal
2000
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
							(Gg)					
1. Energy	**0.00**	**39,695.82**	**41,450.10**	**45,343.28**	**44,264.25**	**44,391.23**	**48,172.67**	**46,131.30**	**47,850.04**	**51,778.04**	**58,707.94**	**57,394.72**
A. Fuel Combustion (Sectoral Approach)	0.00	39,532.52	41,296.34	45,165.92	44,092.74	44,158.81	47,949.16	45,915.94	47,622.96	51,530.74	58,435.98	57,105.69
1. Energy Industries		15,884.17	16,508.58	19,410.09	17,869.51	16,745.45	20,441.09	16,569.36	17,106.50	19,681.96	24,837.20	22,376.76
2. Manufacturing Industries and Construction		8,797.46	9,062.15	8,938.29	8,809.18	9,324.53	9,045.46	9,500.02	9,376.48	9,598.76	10,205.38	10,056.15
3. Transport		11,221.34	11,947.90	12,930.68	13,512.14	13,900.39	14,459.24	15,262.86	16,118.44	17,273.12	18,520.03	19,632.59
4. Other Sectors		3,621.10	3,771.62	3,881.09	3,898.80	4,188.04	4,003.38	4,583.70	5,021.54	4,976.89	4,873.37	5,040.19
5. Other		8.45	6.09	5.77	3.11	0.40	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	0.00	163.30	153.76	177.36	171.51	232.42	223.51	215.36	227.08	247.30	271.96	289.03
1. Solid Fuels		8.65	8.37	7.80	7.25	5.41	0.00	0.00	0.00	0.00	0.00	0.00
2. Oil and Natural Gas		154.65	145.39	169.56	164.26	227.01	223.51	215.36	227.08	247.30	271.96	289.03
2. Industrial Processes	**0.00**	**4,132.58**	**4,205.72**	**3,937.30**	**4,067.37**	**4,032.26**	**4,225.76**	**4,564.63**	**4,961.23**	**4,824.90**	**4,948.05**	**5,070.36**
A. Mineral Products		3,425.67	3,521.67	3,455.84	3,638.49	3,694.60	3,908.10	3,855.42	4,409.70	4,273.17	4,391.95	4,510.72
B. Chemical Industry		671.54	650.29	436.31	382.15	292.17	271.84	664.53	499.13	498.50	498.60	498.71
C. Metal Production		34.94	33.33	44.71	46.29	45.05	45.39	44.24	51.96	52.79	57.06	60.49
D. Other Production		0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
E. Production of Halocarbons and SF_6												
F. Consumption of Halocarbons and SF_6												
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use		**271.42**	**285.80**	**278.61**	**278.61**	**278.88**	**278.88**	**278.88**	**278.88**	**278.88**	**278.88**	**278.88**
4. Agriculture	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Enteric Fermentation		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure Management		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Rice Cultivation		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Agricultural Soils [2]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Prescribed Burning of Savannas		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Field Burning of Agricultural Residues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Land-Use Change and Forestry [3]	**0.00**	**-3,751.00**	**-3,834.67**	**-3,918.33**	**-4,002.00**	**-4,085.66**	**-4,169.33**	**-4,178.75**	**-4,188.16**	**-4,197.58**	**-4,207.00**	**-4,216.42**
A. Changes in Forest and Other Woody Biomass Stocks		-1,839.00	-1,921.87	-2,004.73	-2,087.60	-2,170.46	-2,253.33	-2,258.15	-2,262.96	-2,267.78	-2,272.60	-2,277.42
B. Forest and Grassland Conversion		-1,912.00	-1,912.80	-1,913.60	-1,914.40	-1,915.20	-1,916.00	-1,920.60	-1,925.20	-1,929.80	-1,934.40	-1,939.00
C. Abandonment of Managed Lands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. CO_2 Emissions and Removals from Soil		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Waste	**0.00**	**8.84**	**9.28**	**9.72**	**10.16**	**10.60**	**11.04**	**11.49**	**11.93**	**12.37**	**126.65**	**406.37**
A. Solid Waste Disposal on Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration		8.84	9.28	9.72	10.16	10.60	11.04	11.49	11.93	12.37	126.65	406.37
D. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Emissions/Removals with LUCF [4]	**0.00**	**40,357.66**	**42,116.23**	**45,650.57**	**44,618.40**	**44,627.32**	**48,519.03**	**46,807.55**	**48,913.92**	**52,696.61**	**59,854.52**	**58,933.91**
Total Emissions without LUCF [4]	**0.00**	**44,108.66**	**45,950.90**	**49,568.90**	**48,620.39**	**48,712.98**	**52,688.36**	**50,986.30**	**53,102.09**	**56,894.20**	**64,061.52**	**63,150.33**
Memo Items:												
International Bunkers	**0.00**	**2,056.53**	**2,062.56**	**2,127.26**	**1,842.97**	**1,844.36**	**1,874.10**	**1,863.28**	**1,930.82**	**2,047.08**	**2,334.23**	**2,526.03**
Aviation		883.31	871.82	917.08	856.28	900.10	852.89	770.21	792.25	842.90	867.89	929.64
Marine		1,173.22	1,190.74	1,210.18	986.68	944.26	1,021.21	1,093.06	1,138.57	1,204.18	1,466.35	1,596.40
Multilateral Operations		**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass		**12,023.15**	**12,227.06**	**12,157.42**	**11,887.84**	**11,493.33**	**11,423.06**	**11,285.42**	**10,558.55**	**11,248.73**	**11,156.98**	**11,046.72**

[1] Fill in the base year adopted by the Party under the Convention, if different from 1990.

[2] See footnote 4 to Summary 1.A of this common reporting format.

[3] Take the net emissions as reported in Summary 1.A of this common reporting format. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[4] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO_2 emissions and removals from Land-Use Change and Forestry.

TABLE 10 EMISSIONS TRENDS (CH_4)
(Sheet 2 of 5)

Portugal
2000
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		(Gg)										
Total Emissions	**0.00**	**614.43**	**614.88**	**607.81**	**594.02**	**605.83**	**604.45**	**605.35**	**609.29**	**607.83**	**624.80**	**625.41**
1. Energy	**0.00**	**28.49**	**27.97**	**27.69**	**26.88**	**26.09**	**23.55**	**22.89**	**22.75**	**24.73**	**29.60**	**26.33**
A. Fuel Combustion (Sectoral Approach)	0.00	23.67	23.39	23.04	22.51	21.96	21.49	21.00	20.48	20.02	19.89	19.59
1. Energy Industries		0.21	0.21	0.24	0.23	0.23	0.30	0.26	0.26	0.30	0.38	0.31
2. Manufacturing Industries and Construction		1.63	1.70	1.72	1.71	1.68	1.75	1.74	1.84	1.85	1.89	1.91
3. Transport		2.50	2.62	2.79	2.83	2.73	2.72	2.78	2.66	2.64	2.79	2.85
4. Other Sectors		19.32	18.85	18.29	17.74	17.33	16.73	16.22	15.72	15.23	14.83	14.52
5. Other		0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	0.00	4.82	4.58	4.64	4.37	4.13	2.06	1.88	2.27	4.71	9.71	6.74
1. Solid Fuels		3.14	3.04	2.84	2.64	1.97	0.00	0.00	0.00	0.00	0.00	0.00
2. Oil and Natural Gas		1.68	1.54	1.81	1.73	2.16	2.06	1.88	2.27	4.71	9.71	6.74
2. Industrial Processes	**0.00**	**0.38**	**0.33**	**0.35**	**0.34**	**0.34**	**0.33**	**0.31**	**0.36**	**0.34**	**0.34**	**0.34**
A. Mineral Products		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Chemical Industry		0.38	0.33	0.35	0.34	0.34	0.33	0.31	0.36	0.34	0.34	0.34
C. Metal Production		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6												
F. Consumption of Halocarbons and SF_6												
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4. Agriculture	**0.00**	**302.06**	**298.75**	**287.48**	**269.96**	**278.92**	**278.39**	**276.35**	**276.75**	**274.31**	**281.91**	**279.82**
A. Enteric Fermentation		124.07	126.14	121.05	118.72	118.39	119.04	117.73	116.79	116.41	123.58	122.92
B. Manure Management		164.96	159.70	157.99	145.68	151.05	150.72	147.62	148.86	147.35	148.45	147.51
C. Rice Cultivation		12.18	12.05	7.60	4.75	8.66	7.82	10.18	10.27	9.73	9.11	8.62
D. Agricultural Soils		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Prescribed Burning of Savannas		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Field Burning of Agricultural Residues		0.85	0.86	0.83	0.81	0.82	0.81	0.82	0.82	0.82	0.77	0.76
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Forest and Grassland Conversion		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Abandonment of Managed Lands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. CO_2 Emissions and Removals from Soil		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Waste	**0.00**	**283.50**	**287.84**	**292.29**	**296.83**	**300.49**	**302.18**	**305.80**	**309.44**	**308.44**	**312.95**	**318.92**
A. Solid Waste Disposal on Land		264.30	267.79	271.39	275.09	278.67	280.29	283.78	287.33	286.24	290.58	296.39
B. Waste-water Handling		19.20	20.04	20.89	21.74	21.82	21.89	22.03	22.11	22.20	22.36	22.48
C. Waste Incineration		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05
D. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items:												
International Bunkers	**0.00**	**1.97**	**2.00**	**2.03**	**1.67**	**1.61**	**1.73**	**1.83**	**1.91**	**2.01**	**2.43**	**2.64**
Aviation		0.11	0.11	0.12	0.11	0.12	0.11	0.10	0.11	0.11	0.11	0.11
Marine		1.86	1.89	1.92	1.56	1.50	1.61	1.73	1.80	1.90	2.32	2.53
Multilateral Operations		**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass												

TABLE 10 EMISSIONS TRENDS (N_2O)
(Sheet 3 of 5)

Portugal
2000
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
						(Gg)						
Total Emissions	**0.00**	**25.60**	**25.54**	**24.76**	**24.38**	**24.26**	**25.03**	**25.21**	**24.99**	**25.69**	**26.66**	**26.64**
1. Energy	**0.00**	**3.07**	**3.07**	**3.09**	**3.16**	**3.23**	**3.33**	**3.40**	**3.52**	**3.68**	**3.91**	**4.03**
A. Fuel Combustion (Sectoral Approach)	0.00	3.07	3.07	3.09	3.16	3.23	3.33	3.40	3.52	3.68	3.91	4.03
1. Energy Industries		0.20	0.20	0.23	0.22	0.22	0.26	0.23	0.23	0.26	0.35	0.32
2. Manufacturing Industries and Construction		0.21	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.25	0.26	0.26
3. Transport		0.44	0.47	0.51	0.64	0.76	0.86	1.01	1.15	1.31	1.48	1.64
4. Other Sectors		2.22	2.18	2.13	2.08	2.04	1.98	1.94	1.91	1.87	1.82	1.80
5. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Oil and Natural Gas		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes	**0.00**	**1.94**	**1.94**	**1.96**	**1.64**	**1.23**	**1.96**	**1.96**	**1.96**	**1.96**	**1.96**	**1.96**
A. Mineral Products		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Chemical Industry		1.94	1.94	1.96	1.64	1.23	1.96	1.96	1.96	1.96	1.96	1.96
C. Metal Production		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Production of Halocarbons and SF_6												
F. Consumption of Halocarbons and SF_6												
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4. Agriculture	**0.00**	**19.21**	**19.09**	**18.23**	**18.04**	**18.26**	**18.19**	**18.30**	**17.94**	**18.48**	**19.18**	**18.97**
A. Enteric Fermentation		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure Management		3.64	3.68	3.59	3.53	3.55	3.58	3.54	3.56	3.62	3.99	3.91
C. Rice Cultivation		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Agricultural Soils		15.46	15.30	14.52	14.39	14.58	14.50	14.64	14.27	14.75	15.09	14.95
E. Prescribed Burning of Savannas		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Field Burning of Agricultural Residues		0.12	0.12	0.12	0.11	0.12	0.11	0.12	0.12	0.12	0.11	0.11
G. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Forest and Grassland Conversion		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Abandonment of Managed Lands		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. CO_2 Emissions and Removals from Soil		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Waste	**0.00**	**1.37**	**1.43**	**1.48**	**1.54**	**1.55**	**1.55**	**1.56**	**1.57**	**1.57**	**1.61**	**1.69**
A. Solid Waste Disposal on Land		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling		1.37	1.43	1.48	1.54	1.54	1.55	1.56	1.56	1.57	1.58	1.59
C. Waste Incineration		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10
D. Other		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items:												
International Bunkers	**0.00**	**0.05**	**0.05**	**0.05**	**0.04**	**0.04**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**	**0.06**
Aviation		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Marine		0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.04	0.04
Multilateral Operations		**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
CO_2 Emissions from Biomass												

TABLE 10 EMISSION TRENDS (HFCs, PFCs and SF_6)
(Sheet 4 of 5)

Portugal
2000
Submission 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	(Gg)											
Emissions of HFCs (5) - CO_2 equivalent (Gg)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
HFC-23												
HFC-32												
HFC-41												
HFC-43-10mee												
HFC-125												
HFC-134												
HFC-134a												
HFC-152a												
HFC-143												
HFC-143a												
HFC-227ea												
HFC-236fa												
HFC-245ca												
Emissions of PFCs (5) - CO_2 equivalent (Gg)	**0.00**	**0.00**	**0.00**	**0.00**	**0,00**	**0.00**	**156.77**	**156.77**	**156.77**	**156.77**	**156.77**	**156.77**
CF_4							0.02006	0.02006	0.02006	0.02006	0.02006	0.02006
C_2F_6							0.00287	0.00287	0.00287	0.00287	0.00287	0.00287
C_3F_8												
C_4F_{10}												
$c\text{-}C_4F_8$												
C_5F_{12}												
C_6F_{14}												
Emissions of SF_6 (5) - CO_2 equivalent (Gg)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.91**	**0.93**	**0.95**	**0.97**	**0.99**	**1.01**
SF_6							0.00004	0.00004	0.00004	0.00004	0.00004	0.00004

(5) Enter information on the actual emissions. Where estimates are only available for the potential emissions, specify this in acomment to the corresponding cell. Only in this row the emissions are expressed as CO_2 equivalent emissions in order to facilitate data flow among spreadsheets.

HFCs: NE **PFCs (except CF4 and C2F6): NE**

TABLE 10 EMISSION TRENDS (SUMMARY)
(Sheet 5 of 5)

Portugal
2000
Submission 2002

GREENHOUSE GAS EMISSIONS	Base year (1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	CO_2 equivalent (Gg)											
Net CO emissions/removals	0.00	40,357.66	42,116.23	45,650.57	44,618.40	44,627.32	48,519.03	46,807.55	48,913.92	52,696.61	59,854.52	58,933.91
CO_2 emissions (without LUCF) (6)	0.00	44,108.66	45,950.90	49,568.90	48,620.39	48,712.98	52,688.36	50,986.30	53,102.09	56,894.20	64,061.52	63,150.33
CH_4	0.00	12,902.96	12,912.45	12,763.94	12,474.36	12,722.52	12,693.54	12,712.27	12,795.11	12,764.39	13,120.79	13,133.70
N_2O	0.00	7,936.58	7,917.36	7,676.97	7,558.46	7,521.59	7,759.25	7,815.31	7,745.40	7,963.62	8,264.91	8,258.21
HFCs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFCs	0.00	0.00	0.00	0.00	0.00	0.00	156.77	156.77	156.77	156.77	156.77	156.77
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.93	0.95	0.97	0.99	1.01
Total (with net CO_2 emissions/removals)	**0.00**	**61,197.21**	**62,946.04**	**66,091.48**	**64,651.21**	**64,871.43**	**69,129.50**	**67,492.83**	**69,612.15**	**73,582.36**	**81,397.99**	**80,483.60**
Total (without CO2 from LUCF)(6)	**0.00**	**64,948.21**	**66,780.71**	**70,009.81**	**68,653.21**	**68,957.09**	**73,298.83**	**71,671.57**	**73,800.32**	**77,779.94**	**85,604.99**	**84,700.02**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	CO_2 equivalent (Gg)											
1. Energy	0.00	41,247.37	42,990.36	46,883.22	45,809.11	45,941.42	49,700.22	47,664.98	49,418.66	53,438.55	60,541.78	59,197.74
2. Industrial Processes	0.00	4,743.45	4,815.40	4,552.24	4,581.73	4,420.12	4,996.65	5,335.03	5,732.73	5,596.05	5,719.22	5,841.56
3. Solvent and Other Product Use	0.00	271.42	285.80	278.61	278.61	278.88	278.88	278.88	278.88	278.88	278.88	278.88
4. Agriculture	0.00	12,298.88	12,192.83	11,687.84	11,262.20	11,516.28	11,485.31	11,475.56	11,374.61	11,489.56	11,867.34	11,755.46
5. Land-Use Change and Forestry (7)	0.00	-3,751.00	-3,834.67	-3,918.33	-4,002.00	-4,085.66	-4,169.33	-4,178.75	-4,188.16	-4,197.58	-4,207.00	-4,216.42
6. Waste	0.00	6,387.09	6,496.32	6,607.91	6,721.55	6,800.38	6,837.77	6,917.13	6,995.43	6,976.89	7,197.76	7,626.39
7. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(6) The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report C_2O emissions and removals from Land-Use Change and Forestry.

(7) Net emissions.

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Glossary of Terms

ACEA	European Automobile Manufacturers Association
CAC	Climate Change Committee
CEEETA	Centro de Estudos em Economia da Energia, Transportes e Ambiente
CHP	Combined Heat and Power Production
CRF	Common Reporting Format
CSF	Community Support Framework
DGA	General Directorate for Environment
DGE	General Directorate for Energy
DGF	General Directorate for Forestry
DGOTDU	General Directorate for Spatial Planning and Urban Affairs
EMAS	Eco-management and Audit Scheme
EUMETSAT	European Meteorological Satellite Organisation
FCT	Faculdade de Ciências e Tecnologia/ Universidade Nova de Lisboa
FOB	An international commercial term meaning "free on board", used in international sales contracts
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEPE	Bureau of Economic Studies and Prospects
GHG	Greenhouse Gases
HPI	Hydroelectric Productivity Index
IBW	Industrial Basic Waste
IHW	Industrial Hazardous Waste
INE	National Statistics Institute
IW	Industrial Waste
LUCF	Land use Change and Forestry
MCOTA	Ministry of Urban Affairs, Spatial Planning and the Environment
MSW	Municipal Solid Waste
PAMs	Policies, Measures and Instruments
PDSFP	Plan for Sustainable Development of Portuguese Forests
PNAC	Climate Change National Programme
RCCTE	Regulation on Thermal Behaviour of Buildings
RES	Renewable Energy Source
RGCE	Regulation on the Management of Energy Consumption
RSECE	Regulation of the Energy Systems for Acclimatization of Buildings

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