Portuguese report

**In accordance with Article 12 of the
UNITED NATIONS FRAMEWORK CONVENTION
ON CLIMATE CHANGE**

Ministry of the Environment and Natural Resources
Lisbon, 1994

TEXT:

Ministry of the Environment and Natural Resources
Office for Community Affairs and Cooperation
with the Directorate General for the Environment

Institute of Meteorology
Institute of Environmental Promotion
Institute for the Preservation of Nature

Ministry of Agriculture
General Secretariat

Institute of Forestry
Institute of Agrarian Structures and Rural Development
National Institute for Agrarian Research
Institute for Agricultural Markets and Agro-Food Industry

Ministry of Education
General Secretariat

Ministry of Finance

Directorate General for the Treasury

Ministry of Industry and Energy

Directorate General for Energy
Directorate General for Industry

Ministry of Foreign Affairs

Institute for Portuguese Cooperation

Ministry of Public Works, Transport and Communications

Directorate General for Surface Transport

COORDINATION:

Institute of Meteorology

PREFACE

A fundamental step forward was taken for the protection of the Environment of our planet with the coming into effect of the United Nations Convention on Climate Change on 21st March 1994 which represents the institutionalisation of a legal instrument providing for the common concerns of Humanity, as a result of scientific evidence concerning the possibility of the ocurrence of global climate change caused by human activities.

Each International, Governmental, Inter-governmental and Non Governmental Organisation, each Country and each citizen must now assume their share of co-responsability, not only in compliance with and implementing the Convention but also in perfecting it, and negotiating the instruments which must be prepared over the short term.

Portugal, which played a relevant role in the negotiations, signed this Convention at UNCED in Rio de Janeiro and being 50th country to deposit the respective instrument of ratification on 21st December 1993. Portugal will honour its commitments resulting from these acts, and will continue to support all efforts to improve and develop the Convention, conscious of its importance in protecting the Environment of today and that of future generations.

The National Environmental Policy Plan, prepared by the Portuguese Government, pays special attention to UNCED recommendations and Agenda 21, within the scope of its major concern over international cooperation.

This report represents the desire of the Portuguese Government for the effective implementation of the Convention and describes some of the activities being carried out in Portugal, taking into consideration that policies and measures for protecting the climate should be appropriate to the specific conditions existing in each country.

Maria Teresa Gouveia

Minister of the Environment and Natural Resources

PORTUGUESE

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INTRODUCTION

Portugal signed the Framework Convention at the United Nations Conference on the Environment and Development in Rio de Janeiro and was the 50th country to deposit the respective instrument of ratification on 21st December 1993.

The Framework Convention on Climate Change recognises the following on the basis of the principles set out in Article 3:

> *"Policies and measures for the protection of the climate from al-terations caused by human activity should be appropriate to the specific conditions of each Party and should be included as part of national development programmes, on the basis of the fact that economic development is essential for the adoption of measures targeted at climate change".*

Article 4 paragraph 2 a) also recognises that the actions to be taken for redu-cing the effects of climate change should take the following into account: *"the differences between the Parties with regard to the starting point and ways of considering the problem, economic structures and basic resources, the need to maintain a strong, sustainable economic growth, available technologies and other individual constraints".*

As such, Portugal's strategy in respect of the problem of climate change is in line with compliance with its commitments as a European Union country, in accordance with the principle of joint but different responsibilities.

One of the International Community's most important obligations for achieving the convention final objective of "stabilising the concentrations of greenhouse effect gases in the atmosphere at a level which will avoid a dangerous anthropogenic interference with the climate system", consists on the communication of information on each Party's implementation.

This report therefore represents the Portuguese Government's first attempt to fulfill its obligations in accordance with the terms of Article 12 of the Convention. The report was prepared, as far as possible, in accordance with the "Guidelines for Communication of Information Under the Framework Convention on Climate Change" issued by the OECD/IEA.

1 - SUMMARY

NATIONAL CONTEXT

Portugal is located on the extreme Southwestern point of Europe with a coastline of approximately 800 kilometres and shares a 1200 kilometre border with Spain. It also has two archipelagoes, Madeira and the Azores, in the Atlantic Ocean.

It has a temperate climate with average annual temperatures of between 10°C and 20°C. The average annual rainfall varies between 3100mm in the mountainous inland Northern regions and 400mm on the Southern coast.

There were approximately 9.9 million inhabitants in Portugal in 1992 after the occurrence of growth during the eighties. National territory is mainly characterised by various medium sized centres, a significant dispersion of small communities and the two metropolises of Lisbon and Oporto which, as a whole, account for 38% of the citizens on the Mainland. On the other hand, 20% of the population live in communities of less than 200 inhabitants.

The major cities of Lisbon and Oporto are responsible for around 50% of Gross Domestic Product (GDP) with 80% of employment being concentrated along the Central/Northern coastal area of the Country.

Approximately 45% of the mainland territory is used for agricultural purposes. There has been an expansion occurring in areas used for permanent crops as opposed to arable soil. Forests and other arboreal plantations cover approximately 36% of the territory, mainly in the form of Scotch Pine, Hispania Oak, Holm Oak and Eucalyptus. Animal breeding is respectively split up among, fouls, pigs, cows and goats.

The national economy during the eighties was characterised by two different stages. The first stage, particularly during the 1982/1984 period in which there was an approximate drop of 2% in GDP per annum and a second, between 1985/1990 in which GDP grew at an average rate of 5% per annum which was one of the highest rates in the OECD although GDP per capita is still one of the lowest.

There was a considerable improvement in the unemployment and inflation indicators in 1992 which were respectively 4.1% and 8.9%. A significant contribution was made by Portugal's membership of the European Community in 1986 which helped to reinforce the means for compensating economic insufficiency and re-dimension economic activity and professional training.

Trade accounts for 28% of GDP with the share of imports of semi finished and capital goods being 74% with 11% for energy products. Exports are still concentrated on traditional products.

Employment for the active population is around 35% in the industrial and 20% in the agricultural sectors.

Housing, in 1992, had very high rates of coverage (_ 94%) for water and electricity and slightly lower rates for sanitary installations. There is still a certain degree of imbalance in interior regions.

Energy consumption in Portugal is heavily dependent on foreign sources (> 80%), mostly in the form of oil products (_ 70%). There was an average annual growth of 5.9% during the 1985/1990 period, particularly in the transport and residential/services sectors. Energy intensity is, however, far higher than the average for OECD countries in spite of the efforts being made to encourage the more efficient use of energy.

The rate of growth of vehicle usage, albeit having expanded very quickly, is still lower than the OECD average. The growth in the number of vehicles and traffic has been more marked in the private transport sector, both for private use and the carriage of goods although rail transport, as yet, is not as significant as it should be.

INVENTORIES

Anthropogenic Emissions

A national inventory was prepared for 1990 on the emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_X), non methane volatile organic compounds (*NMVOC*), methane (CH_4), carbon monoxide (*CO*), carbon dioxide (CO_2), ammonia (NH_3) and nitrous oxide (N_2O) using the methodology approved by the CORINAIR project, developed by the European Commission. These estimates for the different categories of sources, which were compiled for the CORINAIR inventory, were grouped together or, when necessary, split up, in order to obtain the data in the format proposed by the Intergovernmental Panel on Climate Change (IPCC).

The results have been summarised in Table I, from which it can be concluded that combustion processes, in Portugal, were the main sources of the emission of gases responsible for the greenhouse effect.

The only exception is CH_4 with a total emission of $227Kt$, whose principal sources of emission are essentially in the agricultural sector although the contribution of the processing and deposition of wastes has not played an inconsiderable role.

Reference should be made to the contribution (>90%) of NO_X, *CO* and CO_2 to combustion processes. Total emissions were $2145Kt$, $1Mt$ and $42Mt$ respectively in which transport accounts for a considerable proportion.

In the case of *NMVOC*, whose total emissions were around $200Kt$, reference should be made to industrial processes and the use of solvents as major factors, whereas in the case of N_2O, combustion and agricultural processes were major contributing factors for the emission of $10Kt$ in 1990.

These results do not include emissions from the use of fuel by aircraft and marine transport which, although having been calculated (see Table I) have not been included in the national totals.

Table I - Results of the inventories of gases responsible for the greenhouse effect

SOURCE CATEGORIES	EMISSION ESTIMATES (Gg of full mass of pollutant)					
	NOx	COVNM	CH4	C O	CO2	N2O
TOTAL (NET) NATIONAL EMISSIONS	214,5 / 210,1	199,5	13,0	1 082,6	38 686,3*	10,6
1A1-ENERGY & TRANSFORMATION ACTIVITIES	17,8	11,3	2,1	68,2	6 079,0*	3,0
1A3-TRANSPORT	1,6	81,4	3,7	614,1	1 045,0*	0,4
1A5-RESIDENTIAL	21,1	4,8	0,2	53,8	1338,1*	0,1
1A7-OTHER	11,1	NA	8,3	NA	6 773,5	NA
TRADITIONAL BIOMASS BURNED FOR ENERGY	NA	NA	2,0	NA	NA	NA
1B1-CRUDE OIL AND NATURAL GAS SYSTEMS	NA	7,6	2,0	NA	NA	NA
2-INDUSTRIAL PROCESSES	NA	15,4	NA	10,7	35,0	1,9
2B-NON-FERROUS METALS	1,7	NA	0,4	NA	277,5	NA
2D-ORGANIC CHEMICALS	NA	4,7	NA	NA	3 140,2	NA
2F-OTHER	NA	9,2	NA	0,0	NA	0,0
3-SOLVENTS USE	NA	26,3	0,0	NA	NA	NA
3A-PAINT APPLICATION	NA	6,3	0,0	NA	NA	NA
3C-CHEMICALPRODUCTS MANUFACTURE/PROCESSING	NA	NA	0,0	NA	NA	NA
4-AGRICULTURE	NA	NA	104,8	NA	NA	3,6
4B-ANIMAL WASTES	NA	NA	12,9	NA	NA	NA
4D-AGRICULTURAL SOILS	NA	NA	NE	NA	NE	3,6
4F-SAVANNAH BURNING	NE	NA	NE	NA	NE	NA
5-LAND USE CHANGE & FORESTRY	NE	NA	NE	NA	NE	NA
6-WASTES	NA	NA	33,4	NA	NA	NA
6B-WASTEWATER	NA	NA	NA	NA	NA	NA

* Does not include emissions from combustion of biomass

NE - Not Estimated

Sinks

Portuguese agriculture, owing to its level of development in comparison to the agriculture of the rest of the European Union (E.U.) has low emissions levels of pollutants and a reasonably satisfactory situation with regard to the removal of CO_2.

Accordingly, although of significant national importance with regard to emissions of CH_4 and N_2O, its contribution to the annual removal of CO_2 of $70.4 Mt$ represents a reasonably positive factor.

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POLICIES, MEASURES AND EFFECTS

Agricultural Sector

The European Union's current Common Agricultural Policy (CAP) is targeted at reducing incentives to agricultural production, and therefore, several support measures which have been introduced, i.e. those concerned with environmental protection, encourage the extending of vegetable production and animal breeding activities, therefore reducing emissions.

Forestry measures, on the other hand, by encouraging the maintenance, expansion and protection of forests, will help to reduce or stabilise the levels of CO_2 in the atmosphere owing to their important role as sinks.

Energy Sector

The major energy sector policies which have been put into practice are, generaly, in compliance with the policy objectives of environmental protection and encompass three major priorities:

- An increase in diversification and energy efficiency in all sectors of economic activity;

- The use of clean technologies in the burning of fossil fuels;

- Greater use of renewable resources.

The main areas of activity to be put into practice in the energy sector, include:

- The introduction of natural gas for the production of electricity and end use starting in 1997;

- The combined production of heat and electricity in various industrial subsectors;

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- An increase in the use of renewable energy sources for energy production;

- Improvements in the efficiency of thermal power stations and electricity transmission facilities;

- The more rational use of energy in all end user sectors.

Industrial Sector

Portuguese industry has, during the first five years of its membership of the European Union, accompanied the rate of growth of Gross Domestic Product (GDP), although there have been major regional asymmetries - a greater concentration of production and employment in the Northern, Central and Lisbon and Tagus Valley Regions - and a significant degree of vulnerability to outside forces, resulting from the fact that the manufacturing sector is dominated by the traditional, labour intensive, high energy consuming sectors.

Reference should be made to the fact that there are signs of a broadening of the industrial specialisation base, taking into account the major activity of the metal and electrical material sectors as well as several production sectors such as wood and cork, ornamental stones and automobiles.

Today's industrial development model includes living and environmental standards which attempt to emulate the current worldwide development model.

Surface Transport Sector

There was a considerable expansion in the number of vehicles during the eighties which was a period of major growth although the numbers are still below the average OECD levels.

The vehicles/kilometre ratio indicates a total increase in traffic of 67%.

eighties.

Demand for the various means of surface transport, has concentrated on road

the future, as policy measures in the sector are targeted at strengthening the competitiveness of rail transport.

and more are expected. This will be particularly the case with international connections and in respect of the network of inter and multi-modal terminals

PROJECTIONS OF CO_2

Activities for the production and use of energy are the major anthropogenic

Based on an energy demand situation which has been prepared on the basis of CO emission

which are set out in the following table.

Projections for CO_2 emissions in Gg produced by combustion (Category 1A)

Categories	1990	1995	2000
1A - FUEL COMBUSTION	38 686	46 024	54 274
1A1 - ENERGY-TRANSFORMATION ACTIVITIES	19 386	21 180	24 308
1A2 - INDUSTRY	6 079	7 143	8 911
1A3 - TRANSPORT	9 946	13 389	16 140
1A4 - COMMERCIAL-INSTITUTIONAL	1 045	1 273	1 404
1A5 - RESIDENTIAL	891	1 085	1 196
1A6 - AGRICULTURE-FORESTRY	1 338	1 953	2 315

Source: Institute of Meteorology.
Rates of Growth supplied by DGE - Directorate General for Energy.

These scenarios form part of the measures considered expedient for contai-ning the growth in $_2$ emissions, allowing Portugal to fulfill the objective (an

framework strategy for the control of *CO* emissions.

CLIMATIC VULNERABILITY AND ADAPTATION MEASURES

nature, albeit infrequent, is capable of causing significant socioeconomic incidents.

regions to a greater or lesser extent are subject to the occurrence of one type or another with the resulting loss of life, environmental alterations and major

It is in cooperation with international bodies such as the IPCC that a great deal of attention has been paid and care taken on the study of climate change, based

formulation of strategies for reducing vulnerability.

TECHNICAL AND FINANCIAL RESOURCES

Fund (GEF) with an escudo contribution of 4.5 million Special Drawing Rights (SDR).

of GEF and the Portuguese Government has formally undertaken to make an escudo payment equivalent to the sum of 4 million SDR. The contribution in

sharing" negotiated for the reconstitution of the GEF.

At the Rio Summit Conference, the European Community, under the Portuguese Presidency, undertook to make a contribution of 3 billion ECU for supporting projects to be included as part of the framework of Agenda 21. The Member States provided an indication of the amount in question, with the Portuguese contribution being 17 million ECU over a 5 year period.

It was later decided within the Group for Cooperation and Development that the Portuguese annual contribution would be around 2.6 MECU to be paid for out of the State Budget.

Reference should be made to the fact that Portugal is participating in a wide range of regional and international financial institutions and organisations whose objective is to provide assistance to developing countries. Reference should be made, *inter alia,* to participation in the institutions of the World Bank, of the African Development Bank and of the Interamerican Development Bank, in the European Bank for Reconstruction and Development, in the European Investment Bank and in the European Development Fund.

In budget terms, the Portuguese contributions to the above referred institutions and organisations in 1994 will be around 6 thousand million escudos.

In bilateral terms and from a regional viewpoint, the main beneficiaries of Portuguese aid will be Portuguese speaking African countries with Mozambique being the main beneficiary of this aid.

In budget terms, Portuguese support for the above mentioned objective in 1994 was approximately 8 thousand million escudos.

RESEARCH AND SYSTEMATIC OBSERVATION

The problem of climate change, resulting from complex phenomena, the dimension of which nowadays has the unprecedented originality of the added influence of global anthropogenic activities, affects all countries.

The activities which have, or are to be carried out in this area are concentrated on the following aspects:

- the improvement of observation networks and setting up of new networks with the objective, *inter alia,* of carrying out research in the field of climate change;

- increasing knowledge of the composition of the atmosphere and preventing Reductions to the Stratospheric Ozone Layer;

- encouraging the use of the best available, economically viable technologies with the objective of reducing atmospheric emissions and increasing the efficiency of processes for making the most use of resources and the economy of means available;

- publicising the existence of existing economic mechanisms for encouraging the rational use of energy and technological modernisation in the productive sector;

- evaluating the potential of renewable energy sources;

- preparing inventories of emissions and structuring climatological information and information on the quality of the air with the objective of supplying the development of correlational models for the evaluation of cause and effect with climate change as a reference.

EDUCATION, TRAINING AND INFORMATION

The subject of climate change is not a specific course in primary and se-condary education. The multi-disciplinary character, however, of Environmental Education has permitted the inclusion of these themes in various *curriculae* which, in the case of higher education, is dealt with by specialist studies in various degree level courses.

The translation of the text of the Convention has been widely publicised in brochures and expositions.

Awareness campaigns and training activities have been designed and developed and directed towards special targets and the public in general, particularly students.

INTERNATIONAL COOPERATION

Special reference should be made to the improvements in the relationship between Portugal and Portuguese Speaking African Countries through the dissemination of the Portuguese version of the Framework Convention, in addition to cooperation with Africa in which special reference should be made to the projects with Southern African Development Conference (SADCC):

- Crop and Phytogenetic databases, Geographical Databases for Environmental Purposes, support for the Administrative Technical Unit for the Energy Sector (with head offices in Luanda), support for the water survey for hydroelectric applications in the Zambese basin and the study of the Cunene basin.

This cooperation takes various forms, both instrumental (in strengthening the external position of the Portuguese State) and historical and with Public Aid for Development in which Portugal is a member of the group of E.U. donor countries (Lomé IV Convention), the Committee for the Support of OECD Development, UNO Agencies, Bretton Woods Institutions and the African Development Bank.

2 - NATIONAL CONTEXT

2.1 - GEOGRAPHY

There is a series of topographical transitions from Northern to Southern Portugal which is located on the Southwestern part of Europe with a coastline of approximately 800 kilometres.

The land north of the River Tagus is mountainous with altitudes of more than 400 metres rising to a maximum height of 1991 metres with the major exception of the plains of the basins of the Rivers Tagus and Vouga. The soil is mainly acid and ranges from extremely to moderately acid of which the latter are located in the Central Zone. South of the River Tagus in the Alentejo area, the height of the land is mainly between 50 - 400 metres, with acid, neutral soil albeit predominantly acid of with a pH content of between 5.6 - 6.5. The Algarve in the deep south is a continuous lowland coastal area (with an altitude of between 0-50 metres) with soils ranging from acid on the tableland to neutral and mainly alkaline soils on the lowland.

The Archipelago of Madeira is located approximately 1000 kilometres Southwest of Mainland Portugal whereas the Archipelago of the Azores is more than 1200 kilometres to the West.

Portugal shares a 1200 kilometre border with Spain. The longest rivers (Douro, Tagus, Guadiana and Minho) cross the border. National rivers (Vouga, Mondego and Sado) are smaller and more irregular.

2.2 - CLIMATE

Caracterisation

Mainland Portugal

The territory of Mainland Portugal, between latitudes 37° and 42°N is situated in the area of transition between the subtropical anticyclone zone and the subpolar depression zone. The factors which mostly condition the climate on Mainland Portugal are, in addition to latitude, orography, the continentalism and the influence of the Atlantic Ocean.

The latitudinal extent of the Mainland Portugal is only around 5° in terms of latitude; in terms of altitude the highest value range from 1000 metres to 1500 metres, with the exception of the *Serra da Estrela Mountain Range* which rises to a height of around 2000 metres; with regard to continentalism, the regions furthest from the Atlantic Ocean are located at a distance of around 220 kilometres.

Although the referred to variation in climate factors is small, they explain significant variations in the elements which provide a better characterisation of the climate, i.e. air temperature, the amount of precipitation and sunshine.

The climate on Mainland Portugal is temperate with patches of cold climate in the higher regions and the dry season coinciding with the Summer.

Air Temperature

The average annual air temperature values vary from 7°C in the inland highlands to 18°C on the Southern Coast. The average monthly air temperature values reach their peak in August and their lowest in January.
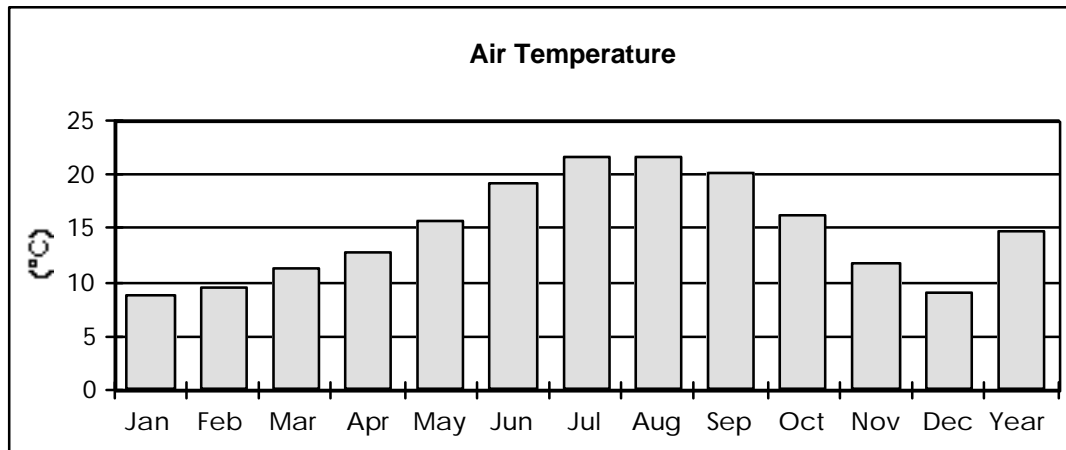
Figure 2.1 - Temperature normals for Portugal for the period 1961-1990

The number of days during the year with a minimum temperature of less than 0°C is at its greatest in the Northern and Central Highlands in the interior of the country and is nil on the Western and Southern coastal areas.

The average number of degree days (between 1st October and 31st May) for a base temperature of 18°C varies between 3000 in the highlands of the interior and less than 1000 on the Southern coast. The average number of degree days (between 1st June and 30th September) for a base temperature of 20°C varies between 50 in the highlands and 600 on the Southeastern Mainland.

Precipitation

The average annual precipitation on Mainland Portugal is around 900*mm*, with the highest amounts of around 3000*mm* in the highlands of the Northwest (Minho) and the lowest on the Southern coast and the Eastern Mainland of around 500*mm*. The rainiest months are in the Winter and the driest months are in July and August.
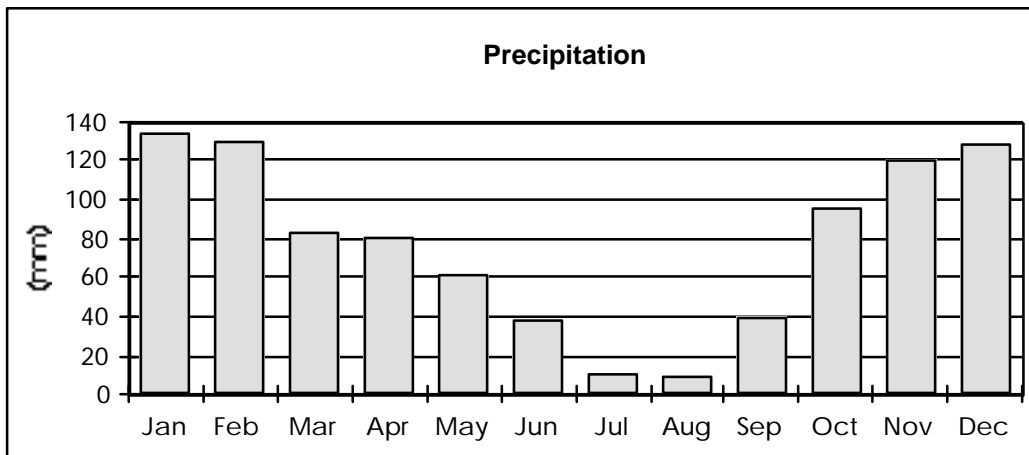

Figure 2.2 - Precipitation normals for Portugal for the period 1961-1990

The average number of days during the year with a precipitation equal to or more than 10 mm varies between 15 and 25 days in the Central and Southern coastal region of the country and the interior lowlands, between 25 and 50 in the Northwestern region and between 50 and 65 in the highlands.

Sunshine

There is, in general, a decrease with altitude in the average annual amount of sunshine from North to South, and from East to West. The lowest sunshine values occur in the Northwest of the territory (in the highlands of the Upper Minho) with amounts of between 1600 hours and 2200 hours whereas the highest values occur on the Southern coast, the Eastern part of the Alentejo and the Lisbon region with amounts of between 2600 and 3300 hours.
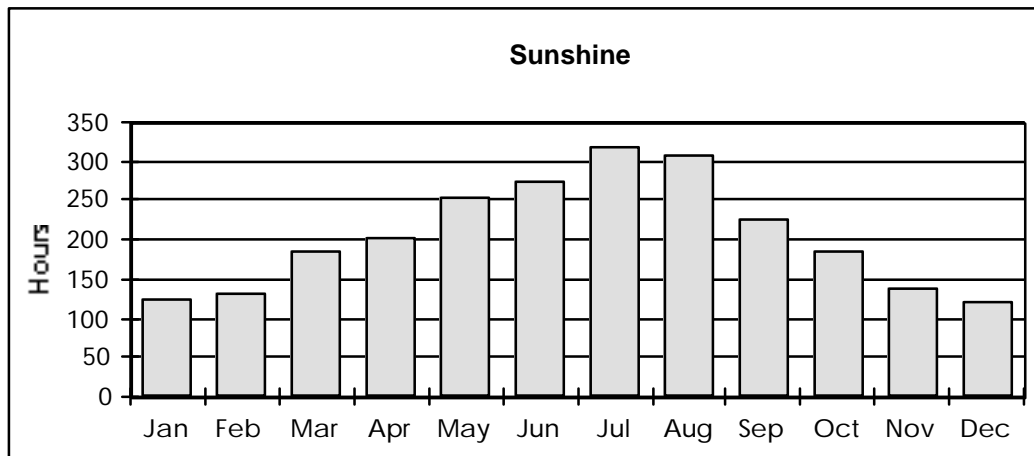
Sunshine

Figure 2.3 - Sunshine normals for Portugal for the period 1961-1990

Wind

The prevailing winds are usually from a North to Northwesterly direction on the Western coast, except for the Southern coast in which the winds are mainly Southwesterly.

The occurrence of strong winds (wind speeds of more than 36 kilometres per hour) and very strong winds (wind speeds of more than 55 kilometres per hour) varies from location to location although wind speeds are higher in the Western coastal and highland regions. The number of days during the year with a wind speed of more than 36 kilometres per hour varies between 30 and 50 days in the coastal region whereas it is around 70 days in the highlands.

North Atlantic Islands of the Azores and Madeira

Azores

The climate of the Azores is temperate with the occurrence of all year round precipitation. The average annual temperature values of the air in the Azores are higher than those to be found on Mainland Portugal. The annual variation amplitude values are even lower than those found on the Mainland coastal area.

The average monthly air temperature values reach their peak in August and their lowest in February. The number of days during the year with a minimum temperature of less than 0°C is nil in the lowest regions.

The average number of degree days for a base temperature of 18°C is around 155; the average number of degree days for a base temperature of 20°C varies between 130 and 200.

The average annual precipitation occurring during the year varies between 800mm and 2200mm. The average annual sunshine values vary between 1500 and 1900 hours.

In the Western and Central areas, the winds blow mainly from the West and in the Eastern Area mainly from the Northeast.

Madeira

The climate of Madeira is temperate, moderately rainy with precipitation during the Winter.

The average annual temperature values of the air in Madeira are higher than those to be found on Mainland Portugal (between 9°C and 19°C). The average monthly values reach their peak in August and their minimum in February.

The number of days during the year with a minimum temperature of less than 0°C is around 13 in the mountainous regions and nil in the lowest regions.

The average number of heating degree days for a base temperature of 18°C varies between 40 and 50; the average number of cooling degree days for a base temperature of 20°C varies between 7 and 14 in Madeira (excluding the mountainous region).

The average annual precipitation occurring during the year varies between 350*mm* and 2000*mm* in the highlands. The average annual sunshine values vary between 1600 and 2200 hours.

Evolution of Climate in Portugal over the last 60 Years

Average air temperature

The variation occurring in the average temperature of the air during the year for the period 1961/90 in comparison to the period 1931/60, does not indicate any significant difference.

There has been, in particular, an increase in the average temperature during the Autumn and Winter and a decrease in temperature during the Spring.
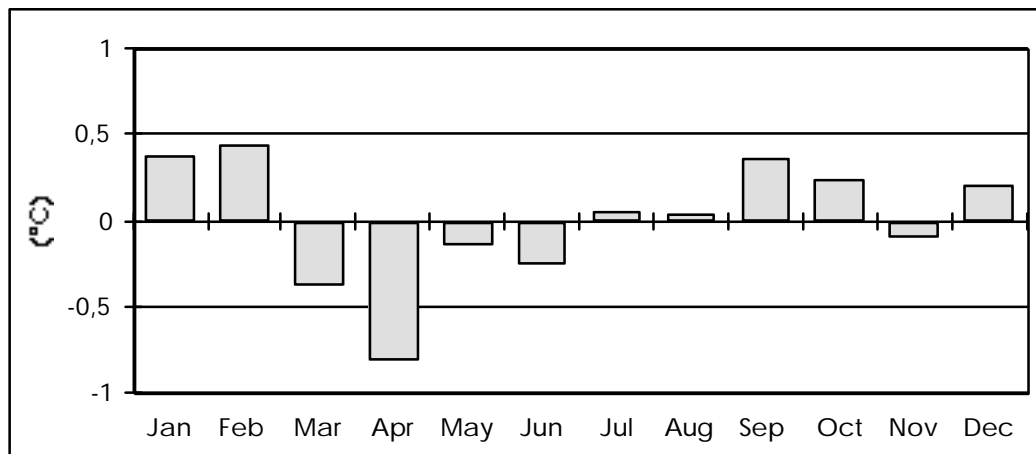
Figure 2.4 - Changes of the temperature normals from the period 1931-1960 to the period 1961-1990

A statistical analysis of the long climatological series of air temperatures in Portugal during the period between 1931 and 1993, shows that there has been an increase in the average annual surface air temperature values with 1989 having been the globally warmest year out of the last 60 years (see Figure 2.5).
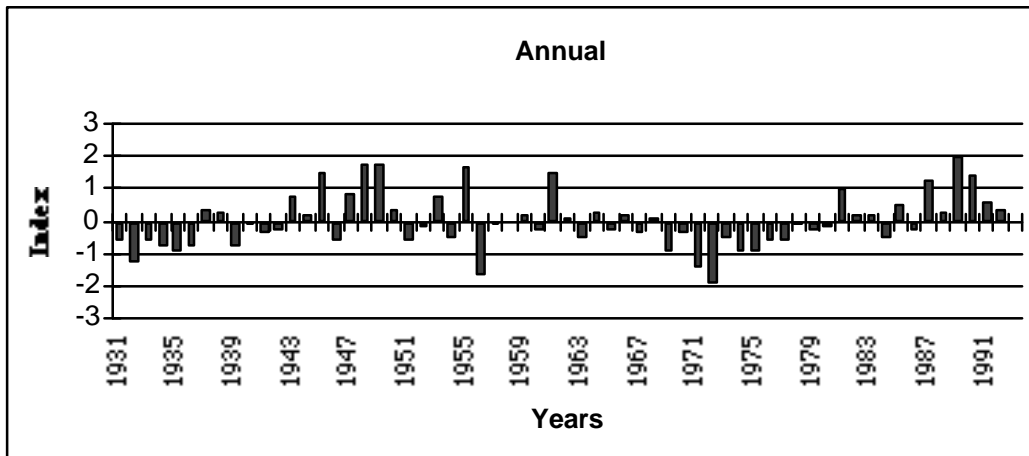
Figure 2.5 - Standardised Anomaly Index of mean air temperature - annual
(58 stations used)

Precipitation

An analysis of Figure 2.6 shows a significant decrease of precipitation amounts in Spring during the last 30 years, particularly during the month of March. This can also be seen in Figure 2.7.

There is an apparent trend for a shorter rainy season with an even stronger concentration of the precipitation in a shorter period of the year, that is, in Winter and Autumn.
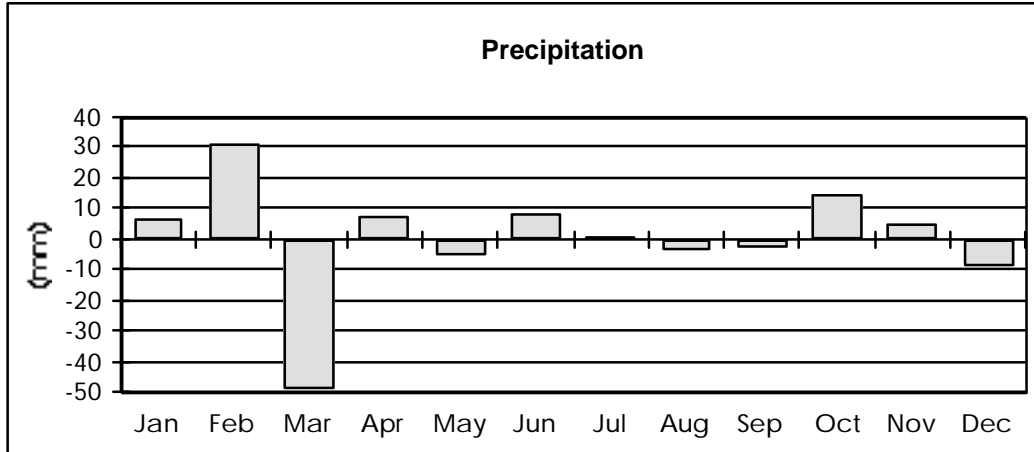
Figure 2.6 - Changes of the precipitation normals from the period 1931-1960
to the period 1961-1990
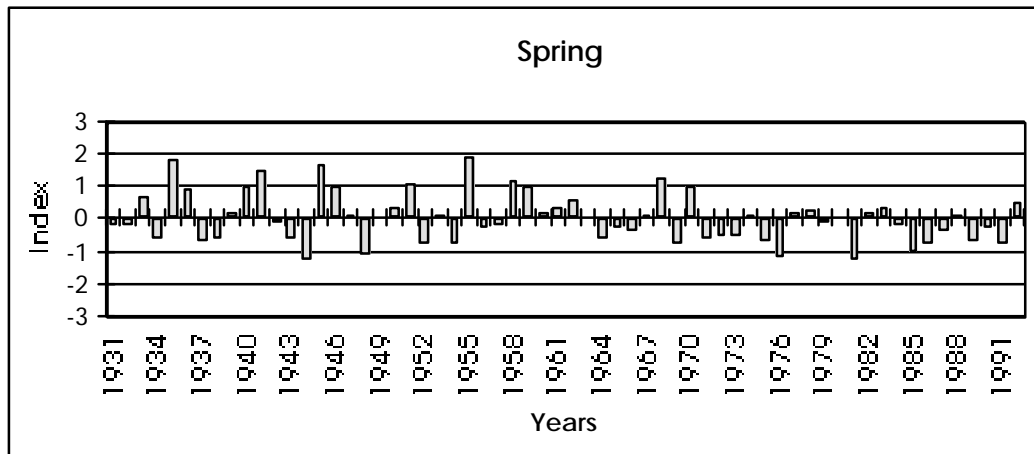
Figure 2.7 - Standardised Anomaly Index of rainfall amounts - Spring
(233 stations used)

2.3 - **POPULATION**

In 1992, the population of Portugal was 9.9 million, after the 5% increase in the eighties*.

The land occupation pattern is characterised by an urban network mainly comprised of medium sized communities and a large number of small communities signifying a major dispersion of the occupation of a large part of the territory**.

In respect of the distribution in question, reference should be made to the two metropolitan areas which, as a whole, account for 38% of the residents on Mainland Portugal and a collection of 59 urban areas containing more than 21% of the population**.

According to official statistical data, around 20% of the population lives in isolated areas or in locations with less than 200 inhabitants and, if locations with less than 1000 inhabitants are taken as a marker, the percentage rises to 43%. These figures are indicative of the major populational dispersement existing over a large part of national territory.

The metropolitan areas of Lisbon and Oporto are responsible for more than half of GDP. Several cities of average size, located in the interior of the country have experienced a dynamic economic growth over the last few years. The differences, however, are becoming more and more marked, particularly between the areas with a growing degree of industrialisation (Aveiro and Braga), those in which the services sector is beginning to have a certain de-gree of importance (Lisbon, Oporto and Setúbal) and the interior of the Country.

Around 80% of employment, in terms of industries and services, is located along the coastal area between Setúbal and Braga although this represents only a quarter of the area of national territory.

* INE, Office for Demographic Studies, Estimates of Resident Population, Lisbon, 1993.
** "Report on State of Territorial Planning", MPAT, Lisbon 1993.

There has been an increase in areas of demographic decline over the last ten years together with a discontinuous concentration of the population along a narrow strip of land to the West and in the Algarve which accounts for less than 25% of the territory on Mainland Portugal. In small communities of less than 100 inhabitants there has been a marked decline of more than 11% of the population.

Almost half of the population is concentrated in the areas of Lisbon and Oporto and in the districts of Braga, Aveiro and Coimbra. Almost three quarters of the population lives along a 50 kilometre strip of the coast in which the average population density is 241 inhabitants per square kilometre. The population density between Setúbal and Braga is 324 inhabitants per square kilometre which contrasts with the interior of the Country in which there are only 34 inhabitants per square kilometre.

2.4 - AGRICULTURE

In 1990, 45% of Mainland Portugal was in the form of agricultural land. There was a reduction of almost 2% in the area of arable soil between 1980 and 1990, whereas there was an increase of around 11% in the area used for permanent crops. Forests and other arboreal land cover approximately 36% of the total area.

Unlike the case of oak groves, a large number of pine and eucalyptus trees have been planted over the last thirty years for supplying raw material for the wood and paper industries.

Useable Agricultural Area and Composition thereof

The useable agricultural area is made up of arable land (cleared and covered by woods and forests), permanent crops, permanent pasture land and family type vegetable gardens. The respective areas for the different regions and to-tals are set out in Table 2.1. The composition of the useable agricultural area, which is similarly divided up, is set out in Table 2.2.

Table 2.1 - **Agricultural area in use 1989** - **(ha)**

REGION	AREA
PORTUGAL	4 005 872
MAINLAND	3 879 859
ENTRE DOURO E MINHO	289 710
TRÁS-OS-MONTES	489 154
BEIRA LITORAL	231 473
BEIRA INTERIOR	433 971
RIBATEJO E OESTE	456 599
ALENTEJO	1 842 187
ALGARVE	136 765
AZORES	118 997
MADEIRA	7 016

Source: Agriculture in Portugal - INE/IEADR (RGA 1989)
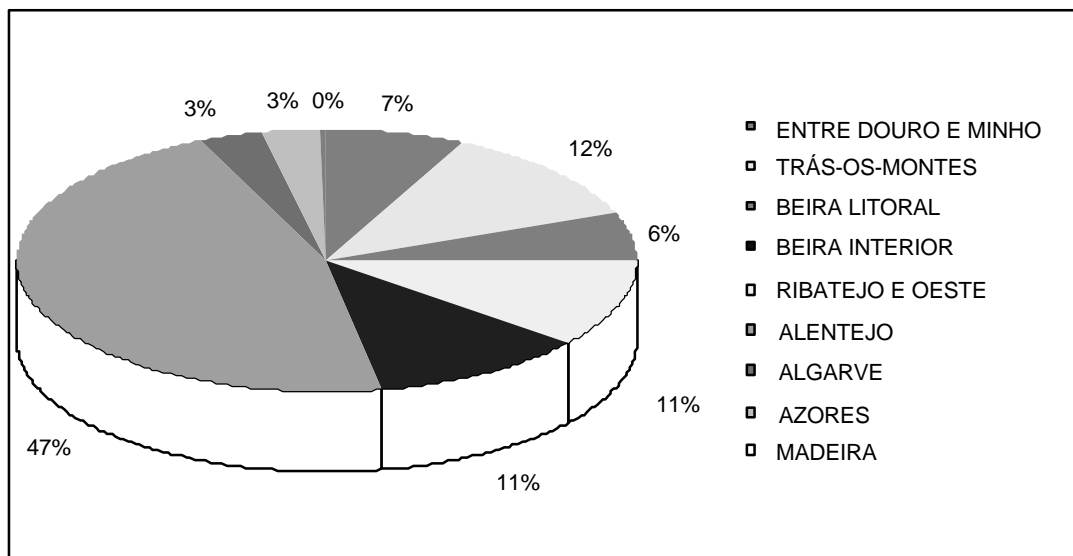
Figure 2.8 - Agricultural Area in Use 1989 - (%)

Table 2.2 - **Composition of Agricultural Area in Use 1989** - **(ha)**

REGION	ARABLE LAND	PERMANENT CROPS	PERMANENT PASTURE LAND	FAMILY TYPE VEGETABLE GARDENS
PORTUGAL	2 345 700	789 502	838 145	32 520
MAINLAND	2 330 365	781 050	736 651	31 799
ENTRE DOURO E MINHO	176 599	45 167	64 086	3 817
TRÁS-OS-MONTES	222 027	178 499	80 685	8 008
BEIRA LITORAL	153 151	56 475	15 354	6 515
BEIRA INTERIOR	215 617	100 180	112 249	5 949
RIBATEJO E OESTE	221 296	171 799	59 892	3 584
ALENTEJO	1 278 437	169 039	392 078	2 581
ALGARVE	63 238	59 891	12 307	1 345
AZORES	12 614	4 773	101 047	560
MADEIRA	2 721	3 679	447	161

Source: Agriculture in Portugal - INE/IEADR (RGA 1989)
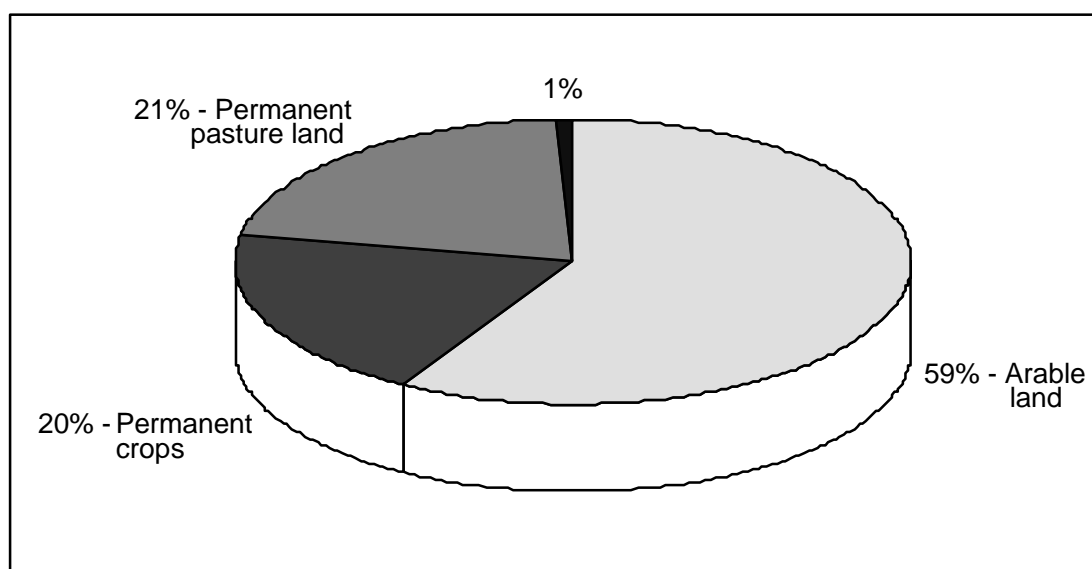
Figure 2.9 - Composition of Agricultural Area in Use 1989 - (%)

Heads of Cattle

The distribution of heads of cattle is set out in table 2.3. There are more milk producing cows in the regions of Entre Douro and Minho, Beira Litoral and the Azores. Meat production is more homogenous and covers the whole of the country. There is a higher concentration of pig distribution in the Ribatejo and

Western Regions, the Alentejo and Beira Litoral whereas the distribution of poultry is more uniform.

Table 2.3 - Number of Animals 1991 - (x 10^3)

ANIMALS	APROXIMATE NUMBER
CATTLE	1 415
< 2 years	640
> 2 years	775
Milk production	415
Others	360
SHEEP	2 925
GOATS	680
PIGS	2 490
for breeding	375
for fattening	2 115
POULTRY	29 325
for laying and for breeding	10 945
chicken meat	18 380

Source: Agricultural Statistics (INE), 1991.
* INE - RGA, 1989.

Forestry Area

The distribution of forests by species is set out in Table 2.4 which indicates a predominance of wild pine *(Pinus pinaster),* oak (*Quercus suber*), holm oak *(Quercus rotundifolia)* and eucalyptus *(Eucaliptus spp)* coming to a total of 3.2 million hectares.

Table 2.4 - Distribution of forests by species 1991 - (x 10^3ha)

SPECIES	AREA	
	10^3 ha	%
WILD PINE	1 249	39
OAK TREES	660	21
HOLM OAK	464	15
EUCALYPTUS	520	16
PINE TREES	50	2
OTHER OAK TREES	86	3
CHESTNUT TREES	32	1
OTHERS	139	4
TOTAL	3 200	100

Source: Institute of Forestry, 1991.

Several Aspects of the Agricultural Economy

Table 2.5 sets out the amounts, at constant prices (1980) of agricultural and animal production, intermediate consumption, gross added value (at market prices) and gross fixed capital formation for 1988 - 1992.

Table 2.5
Aspects of the agricultural economy
Figures at constant prices (Base year 1980) - (10^{6}Esc)

VARIABLES	1988	1989	1990	1991	1992
VEGETABLE PRODUCTION	60 590	74 605	89 064	91 238	87 495
ANIMAL PRODUCTION	85 813	92 883	97 596	95 800	98 197
TOTAL FINAL PRODUCTION	148 828	170 132	189 595	190 454	189 107
INTERMEDIATE CONSUMPTION	64 480	69 656	71 680	71 409	68 201
GAV	84 347	100 476	117 915	119 045	120 906
GFCF	15 309	11 621	12 830	11 827	-

Source: Portuguese Agriculture - INE/IEADR (RGA 1989).

2.5 - ECONOMY

There has been a considerable degree of fluctuation in the Portuguese economy over the last ten years. Between 1982 and 1984 there was a 2% fall in GDP and between 1985 and 1990 a growth of 4.6% per annum. The rate of economic growth in Portugal is one of the highest in the OECD although GDP per capita in 1985, taking the parity of purchasing power into account, is one of the lowest, having grown during the period between 1985 and 1990 at between 53% and 59% of the average for the European OECD. The rate of unemployment fell from 8.7% in 1985 to 4.1% in 1992. Inflation was approximately 25% per annum in 1984 but fell to 8.9% in 1992.

Portugal's membership of the European Community in 1986 was a contributing factor to its excellent production results. Member States of the U.E. are beneficiaries of various programmes in accordance with the Community Support Framework which led to the transfer of an amount of more than 3% of GDP at the beginning of 1990. This Community assistance has enabled Portugal to remedy areas of insufficiency in its infrastructures and increase its potential in terms of human resources. The Community has also modified the

perspectives of the contribution made by foreign investors in Portugal and has been responsible for bringing in more long term capital.

The increase, however, in Community demands and the reduction in customs barriers were the reason for the worsening of the balance of payments situation. Growth in GDP returned to a rate of 2.2% in 1991 and was 1.4% in 1992. The slowdown was the result of the reduction in exports in association with the depressed worldwide economic situation.

Trade (imports and exports) represents 28% of GDP. Semi-finished and capital goods represent 74% of imports with energy products accounting for 11%. This increase in economic activity has been accompanied by a growth in imports. In spite of the dynamism of the mechanical and transport equipment sectors, access to the markets of other E.U. countries has not, as yet, led to a major diversification of export products with the occurrence, on the contrary, of a greater degree of concentration on traditional products such as textiles, clothing, wood, paper and cork.

Portuguese economic structure can be characterised by a large industrial sec-tor share (namely textile and metals) which employs 35% of the working population, as opposed to the agricultural sector which, although employing 20%, only represents 6% of GDP. Tourism represents around 9% of GDP and is growing at a rate of 7% per annum.

2.6 - SOCIAL

As far as can be gauged from the available statistics on levels of consumption, access to collective facilities and the degree of comfort of households, there have, in general terms, been significant improvements to Portuguese living standards; nevertheless they are still below community averages.

There has been an improvement in the conditions of comfort of households, with an increase in the percentage of those which have piped water, electricity and bathrooms and for which the 1992 figures were 93.2%, 98.7% and 84% respectively*.

There are, however, still significant regional imbalances with regard to the percentage of households which do not have these basic structures with the Greater Oporto and Lisbon Regions contrasting with the North and Central Interior, Alentejo and the Algarve. In terms of major geographical units, the Alentejo is the region with the highest number of shortages whereas Lisbon and the Tagus Valley enjoy the most well developed housing infrastructures**.

* INE Comfort Indicators, 1992.
** "Portuguese Report on the follow up to CNUAD to be submitted to the Commission for Sustained Development", Lisbon 1994.

2.7 - **ENERGY**

There was an average, annual increase in the consumption of primary energy of 4.8% between 1980 and 1990, which is five times higher than the usual rate of the OECD* countries as a whole. This growth is essentially the result of the increased demand for fuel for road transport and electricity, particularly in the residential and tertiary sectors.

The energy intensity of primary energy continues to be high in comparison to GDP, having increased by around 22% between 1980 and 1990 in Portugal whereas it had fallen by 18% during the same period in OECD countries as a whole*.

The structure of the energy sector in Portugal in 1990 can be characterised in the following terms:

- a high degree of dependence on fossil fuel (crude oil and coal) which covered more than 85% of the consumption of primary energy;

- a sparse national production based on coal (around 1% of primary energy), hydroelectricity (5% of primary energy) and forestry biomass;

- an energy supply which is essentially based on crude oil products which represent more than 70% of primary energy requirements;

- a final consumption of energy concentrated in 75% of the industrial and transport sectors.

* Source: IEA /OECD: Energy Balance of OECD Countries 1990-1991, Paris, 1993.

2.8 - INDUSTRY

Portuguese industry accompanied the rate of growth of GDP during the first five years after its membership of the European Economic Community although its most characteristic imbalances continue to exist:

- firstly, the major regional asymmetries resulting from a marked concentration of production and employment in the Northern, Central and Lisbon and Tagus Valley Regions, particularly in the districts located along the adjacent coastline area such as Braga, Aveiro, Leiria, Lisbon and Setúbal - however, even in several mainly agricultural districts, there are certain industrial activities which are of considerable local importance.

- secondly, there is a considerable degree of vulnerability to outside forces, owing to a productive structure in which the traditional labour intensive and technologically commonplace sectors predominate together with a small scale presence of capital equipment and automobiles and a certain global relevance of intensive energy consuming activities.

Although it is not possible to talk of structural changes, there are signs of a broadening of the basis of industrial specialisation, seen in the dynamism shown by the metal and electrical machinery industries as well as several productive sectors such as wood and cork, ornamental stones and automobiles.

Table 2.6 - Sectoral structure of manufacturing industry 1991 - (%)

Sectors (CAE)	EMPLOYMENT	GAV*	EXPORTS
31 Food, Beverages and Tobacco	11,7	15,0	6,8
32 Textiles, Clothing, Footwear and Leather	36,6	20,6	40,5
33 Wood and Cork	10,3	5,9	6,9
34 Paper and Graphic Arts	5,0	7,1	5,6
35 Chemicals, Rubber and Plastic	5,6	19,9	9,4
36 Non Metallic Minerals	7,2	8,4	4,7
37 Basic Metallurgy	1,8	2,0	0,8
38 Transport Machinery, Equipment and Material	20,3	20,2	24,1
39 Other Manufacturing Industries	1,5	1,0	1,2
TOTAL MANUFACTURING INDUSTRY	100,0	100,0	100,0

* GAV: Gross Added Value.
  Source: INE.

EMPLOYMENT

39
1%

31
12%

38
20%

37
2%

36
7%

35
6%

34
5%

33
10%

32
37%
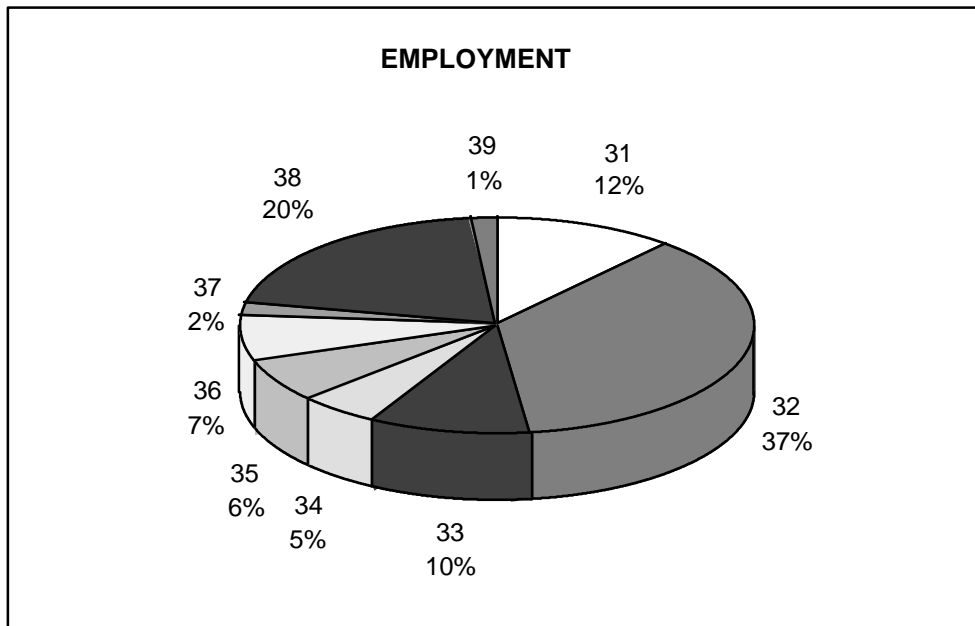
Figure 2.9 - Distribution of employment by sector of activity

GAV

39
1%

31
15%

38
20%

37
2%

36
8%

35
20%

34
7%

33
6%

32
21%
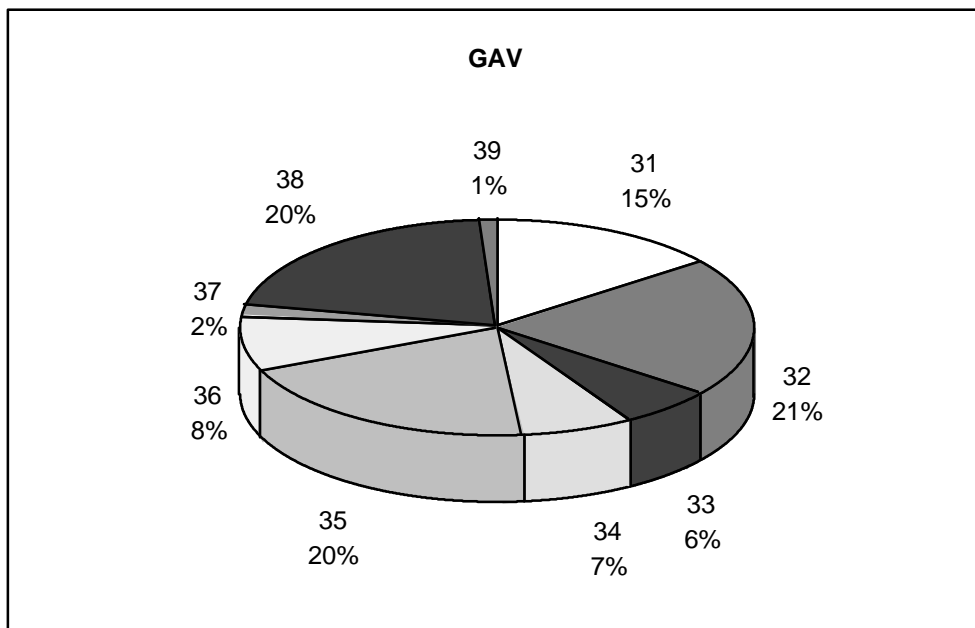
Figure 2.10 - Division of Gross Added Value by sector of activity

EXPORTS

39
1%

31
7%

38
24%

37
1%

36
5%

35
9%

34
6%

33
7%

32
40%
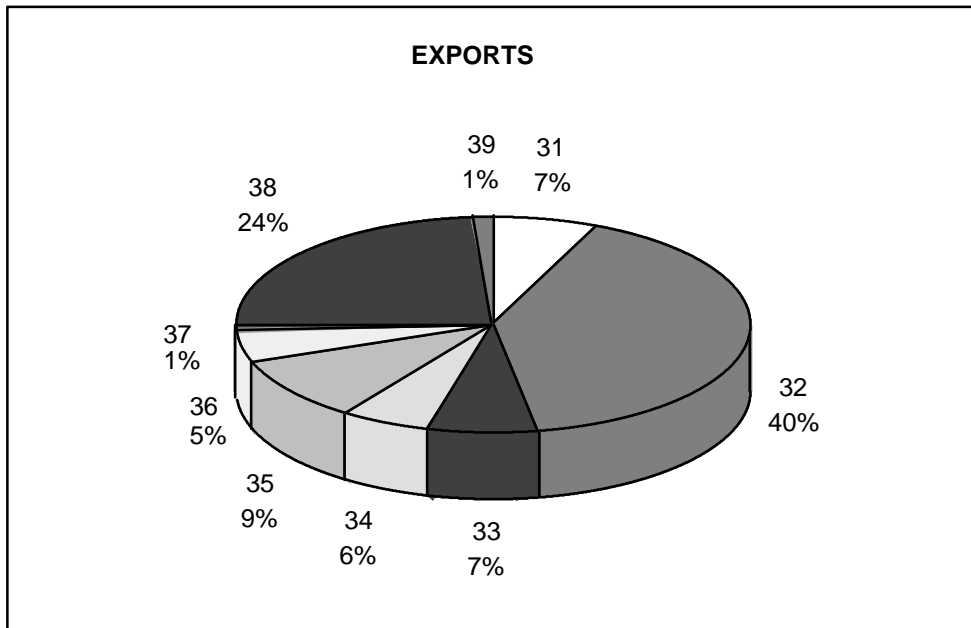
Figure 2.11 - Exports by sector of activity

The <u>textiles and clothing</u> industries are relatively concentrated in the Northern Region and their size is quite unlike any other sector. The major competition they have been facing, both in the domestic market, in which there have been high rates of growth in imports, as well as in foreign markets, has helped to speed up the necessary efforts for sectoral restructuring and cause a slight deterioration to their position within the national productive structure. The most important manufacturing sectors are cotton, wool, fabrics and clothing the latter two of which are major exporters. The <u>footwear</u> industry has, in turn, become increasingly important in the Portuguese industrial structure as well as within the context of national exports and is the reason for the relative growth in the tanning industry.

The <u>food, beverages and tobacco</u> industries are particularly targeted towards the domestic market, in which they have had to contend with a major upsurge in imported products, although several areas of production have traditionally been exporters (wine, tinned fish and tomato concentrates).

The <u>wood, furniture and cork</u> industries have a basis of natural resources in the country which, together with their industrial tradition, have provided them

with good development potential. The major exporting sector is cork although the dynamism of the furniture subsector has also been significant.

The <u>pulp, paper and graphics arts</u> sector in Portugal is also in a privileged position with regard to the supply of raw materials. As the pulp segment is the main exporter, there has tended to be an inversion of the situation on the basis of a greater degree of verticalisation of pulp paper production and the diversification of production to products of higher added value.

The <u>Chemicals</u> industries, in turn, are also significant within the industrial structure, particularly in terms of added value and export contribution. The existence of foreign investment capital, which dominates the markets, is also particularly significant.

The global relevance of the <u>transport machinery, equipment and materials</u> sector in the productive structure is mainly in the production of intermediate goods with major differences existing in the various component subsectors. The production of metal products is targeted at the domestic market with the exception of several segments such as moulds for plastics, taps and fittings. The production of non electrical machinery in the national marketplace is not particularly significant. The electrical and electronic materials subsector is, however, of considerable importance with a wide range of product diversification particularly so in the case of automobile and computer cables. The electronics sector is more targeted towards the export market. In the case of transport material, the automobile sector is the most recently developed sector in Portugal and has benefitted from a large degree of foreign investment while having provided important support for the expansion and modernisation of the components industry.

The <u>non metallic minerals</u> industries encompass ceramic products, glass, cement and cement products and ornamental stones. The ceramics subsector, which enjoys national raw material of excellent quality has made significant improvements and has been successful in penetrating foreign markets.   The production of glass for packaging applications has been associated with the development of the food and beverages industries which take up most of its production whereas flat glass concentrates more on foreign markets and also benefits from the growth of the domestic market for automobiles. The cement

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subsector has also developed reasonably well in association with the growth in the construction and public works industries.

Lastly, ornamental stones has been one of the manufacturing industry success stories with the consolidation of its position in foreign markets, with better quality products of higher added value, particularly in the marble segment.

Basic metallurgical industries account for a very small proportion of the manufacturing structure with the main segment being the steel industry whose production is mainly targeted at the national market, supplying 50% of requirements.

2.9 - MOBILITY

There was a major growth in the transport sector in Portugal in the eighties.

There was a rapid rate of expansion in the total number of automobiles and motoring indices (104% and 77% respectively) although the levels are still much lower than the average OECD rates.

There was a 67% increase in total traffic (measured in vehicles.kilometre) in which there was a higher rate of growth than GDP (31%).

There was also an increase of around 58% in the total consumption of fuel for surface transport.

In comparison to the 44% increase in transport, there was a 55% increase in travel by road. This indicates the existence of a preference for road as op-posed to rail transport.

Individual transport over the last ten years has increased its share for satisfy-ing demand and has taken the place of public transport.

The number of vehicles per 1000 inhabitants in Portugal is around 50% of the average in the E.U. The highest density of passenger vehicles is to be found in Greater Lisbon.

The Central and Alentejo regions have the oldest vehicles whereas the Algarve has the highest number of vehicles licensed after 1985*.

There was a 33% increase in the transportation of goods and ton-nage.kilometre carried between 1987 and 1991 with preference having been shown for road transport which is responsible for 90% of the traffic.   Rail transport is responsible for 3% of traffic and sea transport 7%.

* State of Territorial Planning Report - MPAT, Lisbon 1993.

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3 - INVENTORIES

3.1 - INVENTORY OF ANTHROPOGENIC EMISSIONS

Methodology

A national inventory was prepared for 1990 on the emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), non-methane volatile compounds (*NMVOC*), methane (CH_4), carbon monoxide (*CO*), carbon dioxide (CO_2), ammonia (NH_3) and nitrous oxide (N_2O) using the methodology approved in the CORINAIR project, developed by the European Commission (CORINAIR 90).

The estimates of the emissions for this report are based on the national inventory of emissions for 1990.

For the preparation of this inventory, use was made of emission factors mostly taken from international bibliographical references which do not always make reference to the conditions in which the factors are determined and which do not necessarily reflect the conditions existing in Portugal. In the choice of the emission factors preference was given to those compiled in the "CORINAIR Default Emission Factors Handbook" insofar as they were used as a basis for the performance of the national inventory for 1990.

Using the IPCC proposal, these emission estimates for the different categories of sources compiled for the national inventory, in accordance with the CORINAIR methodology, were grouped together or, when necessary, split up in order to obtain the data in the IPCC format.

Taking into account, however, the differences in scope between the two exercises several alterations were made:

- The categories of sources of emission between the two inventories differ. The main differences are a result of the systematic compilation of the pollution caused by combustion processes. The conversion between CORINAIR 90 and IPCC is based on the May 1994 CITEPA "CORINAIR/IPCC Interface".

- The national inventory includes all emissions resulting or not from anthropogenic activities. In accordance with IPCC estimates, the emissions taken into account are limited to anthropogenic emissions. The difference is particularly relevant in the case of *NMVOC*, which, in the national inventory represented a very important contribution. In the case of this inventory and with regard to the contribution of agriculture for the emissions of the pollutant N_2O, the total soil emissions have been included and not only, as in the case of the current report, prepared in accordance with the requirements of the Framework Convention on Climate Change, the increase in emissions caused by the use of fertilisers.

- In the case of the national inventory, the results of the CO_2 emis-sions refer to the emissions produced at the outlet of the sources of pollution. For this report, the amounts have been corrected in order to provide estimates of the ultimate emissions of CO_2. Accordingly the emissions of *CO*, CH_4 and *NMVOC* from combustion activities have been converted into carbon dioxide.

- In accordance with the CORINAIR 90 methodology, the emissions of CO_2 included the emissions from forest fires and the use of biomass as a fuel. These emissions have not been considered in the total national emissions.

- The emissions caused by the consumption of fuel sold in Portugal for air and sea transport, both domestic and international have been included in the preparation of the inventory of gases contributing to the greenhouse effect referred to by the Framework Convention on Climate Change. However, the emissions which were calculated in this manner have not been included in the total national emissions. Only the emissions from nautical coastal activities and emissions from the landing and the taking off of aircraft have been calculated for the national inventory.

There is no data available on the emissions associated with the alterations to the use of the soil owing to the current non availability of information on these alterations.

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Conversely, the alterations occurring in the meantime as a result of the abandoning of agricultural land, forest fires, wood cutting, increase in the number of forestry plantations and expansion of forestry species, are probably not as significant as those occurring in other regions of the planet.

The main categories of sources of pollution considered by the IPCC are as follows:

1A - Energy - Energy Related Activities including the following sub categories;

1A1 - Energy and Transformation Industries - Emissions arising from the combustion of fuel in activities for the generation of energy and conversion of forms of primary into secondary energy;

1A2 - Industry - Emissions of final combustion of energy in industry;

1A3 - Transport - Emissions from combustion and evaporation of fuel from transport activity as a whole;

1A4 - Commercial/Institutional - Combustion emissions from commercial and institutional buildings;

1A5 - Residential - Combustion emissions from housing;

1A6 - Agricultural/Forestry - Combustion emissions from agricultural and forestry activities including vehicles, pumps and other types of machinery.

1B - Fugitive fuel emissions - Fugitive emissions of CO_2 and CH_4 (non combustion) derived from the production, transmission, storage and distribution of fossil fuel:

1B1 - Oil and Natural Gas;

1B2 - Coal Mines.

2 - Industrial Processes - Emissions of greenhouse gases caused by production processes, not including emissions associated with combustion processes.

3 - Use of solvents - Emissions of *NMVOC* caused by the use of solvents and other products containing volatile organic compounds.

4 - Agriculture - Includes all anthropogenic emissions from the sector excluding emissions from the use of fuel.
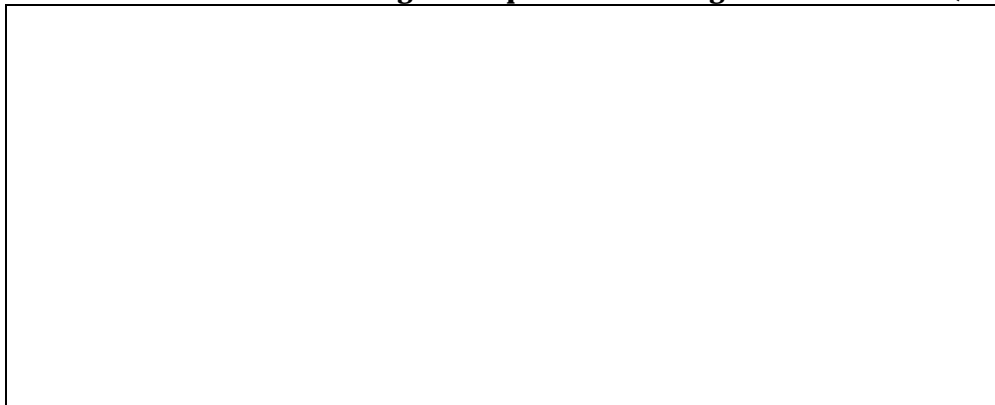
5 - Alterations in soil use - Emissions and removals of forests and alteration of soil use.

6 - Wastes - Emissions caused by the management of solid waste and waste waters.

Results

The results of the emission estimates are contained in the tables set out in Annex A.3 prepared in accordance with IPCC recommendations. Reference should be made to the fact that the tables for the alterations to the use of the soil have not been included owing to the fact that estimates were not made. The aggregate results can be summarised in the following table.

Table 3.1
Estimate of national emissions of gases responsible for the greenhouse effect - (10^9 g)

Source: Institute of Meteorology.
* Emissions resulting from the use of biomass as a fuel are not included.

Analysis of Results

A global analysis of the estimates shows that, in 1990, combustion processes were the main sources of the emission of most of the gases responsible for the greenhouse effect in Portugal.

The only exception is CH_4 whose principal sources of emissions are essen-tially from the agricultural sector.

Nitrogen Oxides (NO_x)

The estimates for the emission of this pollutant were calculated on the basis of fuel consumption to which the emission factors, most of which were taken from the "CORINAIR Handbook", were applied.

Total national emissions of this pollutant in 1990 were around $214Kt$, not including the results from aviation and ship fuels which came to a total amount of around $43Kt.$

An analysis of the results (see Figure 3.1) shows that it is easy to see that the emissions of this pollutant are practically associated with combustion pro-cesses coming to a total of 98% of the total emissions. There is also a minor contribution from industrial processes (2%).

NO $_X$

2%

98%

☐ 1A - FUEL COMBUSTION

■ 2 - INDUSTRIAL PROCESSES
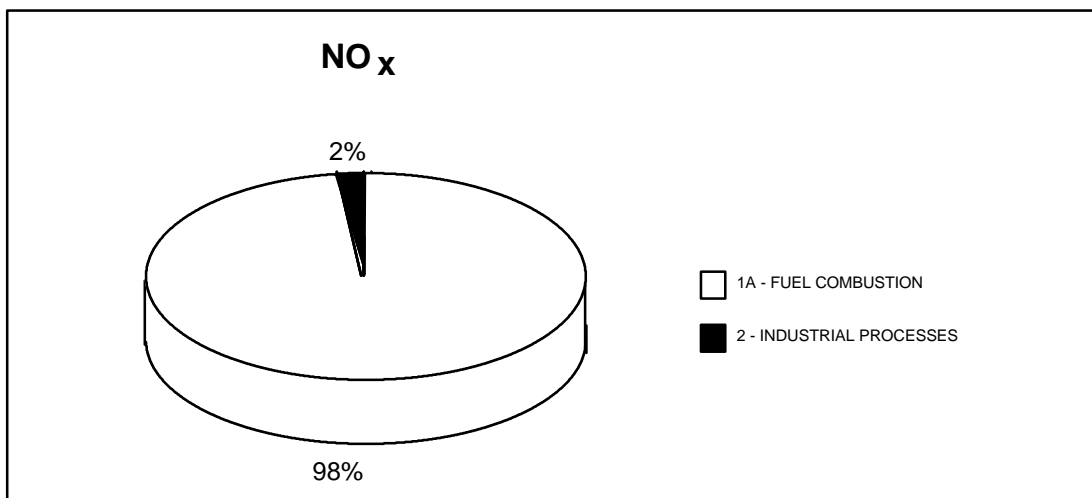
Figure 3.1 - Emissions of NO_X by category of sources of emission
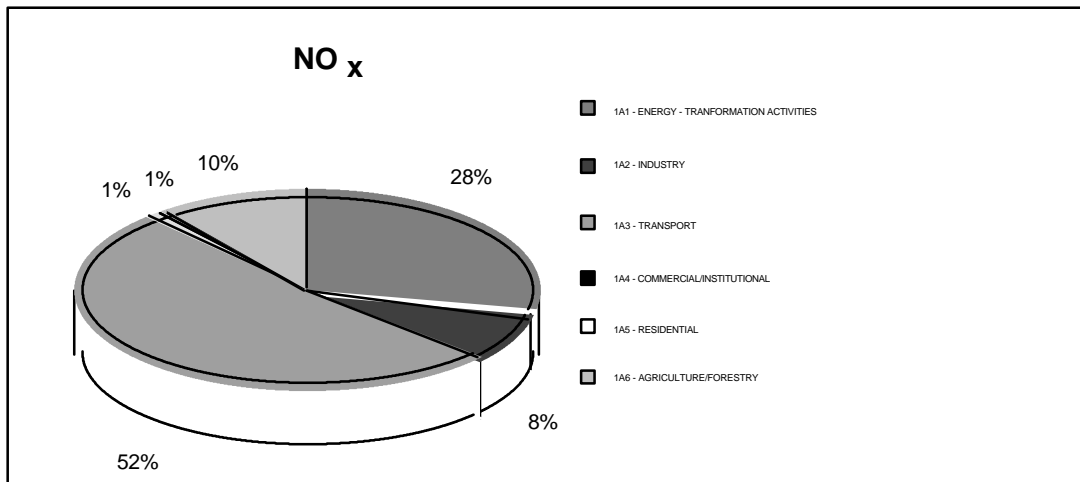
Figure 3.2 - Emissions of NO_X caused by combustion processes

Around 52% of the emissions caused by combustion processes (see Figure 3.2) can be attributed to the transport sector with emissions from energy transformation also being relatively important (28%).

In the case of industrial processes, the emissions of NO_X are essentially the result of the production of nitric acid.

Non-Methane Volatile Organic Compounds (*NMVOC*)

Unlike NO_X whose emissions depend on fuel consumption, *NMVOC* can also be caused by the evaporation of solvents, paints, and storage and waste treatment.

As in the case of emissions of NO_X, combustion processes are the main sources of emissions of non methane volatile organic compounds with around 54% out of a total of 200*Kt*, followed closely by the use of solvents with 34% (see Figure 3.3).

Around 32*Kt* of *NMVOC*, resulting from aviation and vessel combustion are not included in these emissions.

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The major contributor to the emissions of this pollutant caused by combustion processes is the transport sector with around 34% (see Figure 3.4)
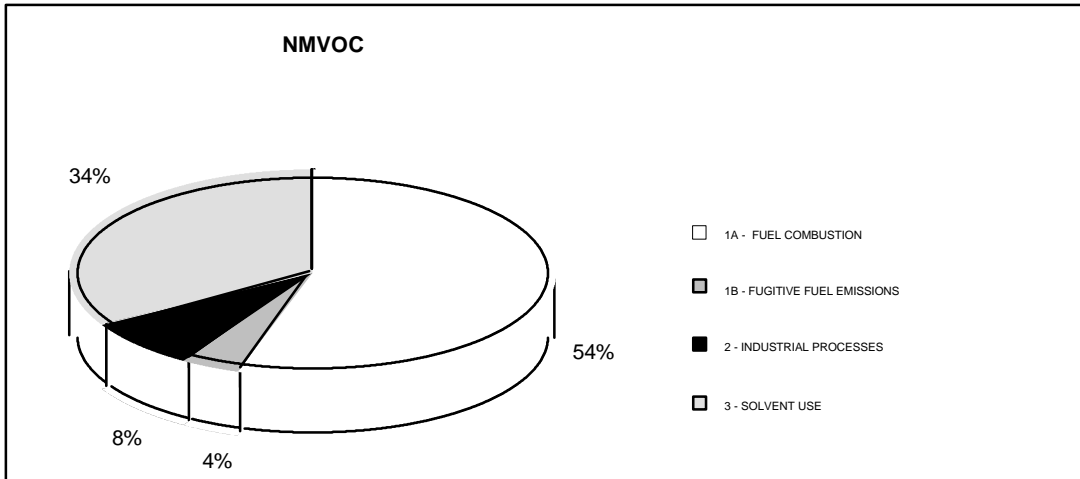
Figure 3.3 - Emissions of NMVOC by category of sources of emission
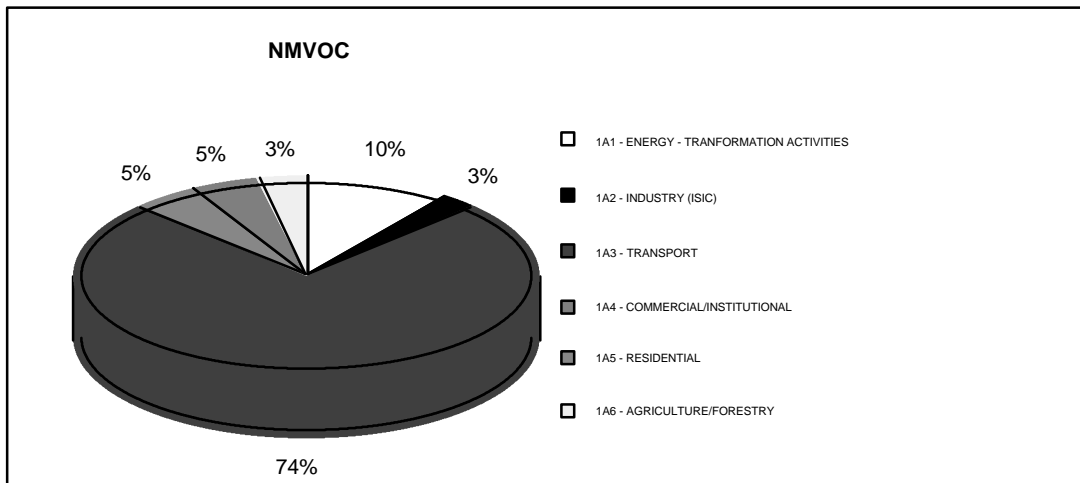
Figure 3.4 - Emissions of NMVOC caused by combustion processes

Methane (CH$_4$)

Of the total national emissions of this pollutant in 1990, around $227Kt$ of CH_4, 78% were mainly the result of agricultural activities.
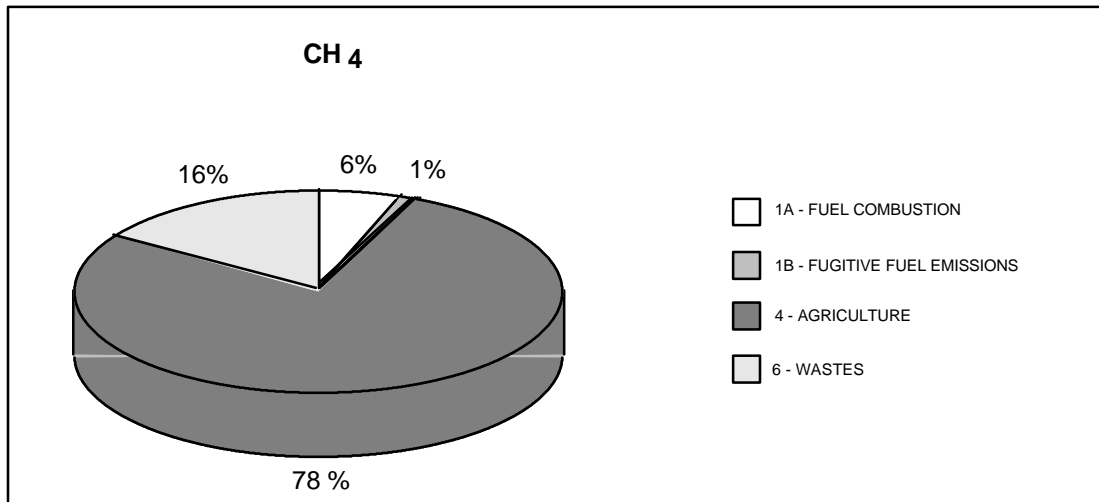
Figure 3.5 - Emissions of CH$_4$ by categories of source

Also of some significance are the emissions from the treatment and deposition of wastes which account for approximately 16% of the total (see Figure 3.5).
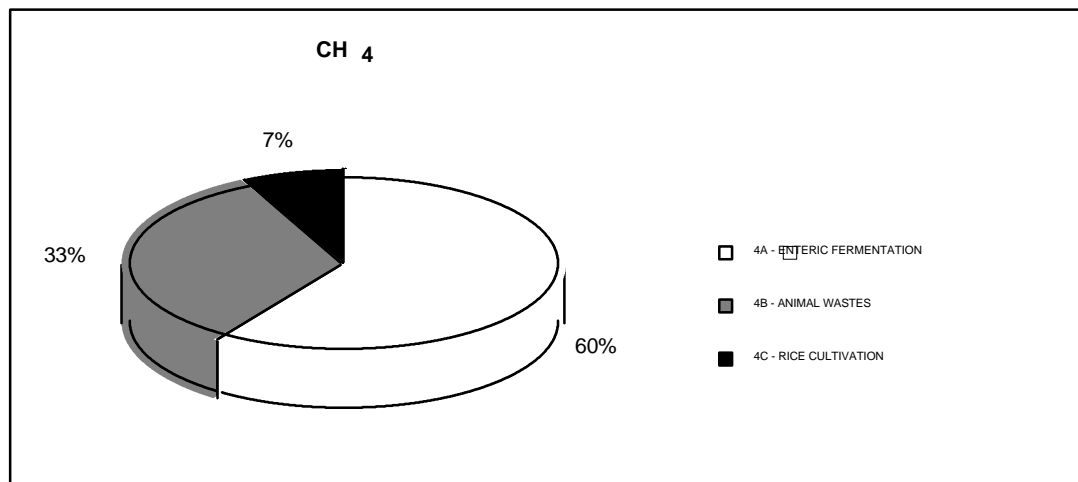
Figure 3.6 - Emissions of CH$_4$ from agricultural activities

An analysis of the results shows that the enteric fermentation of cattle is responsible for around 60% of the emissions from the agricultural sector (see Figure 3.6) followed by emissions from animal waste (droppings) with around 33% and the emissions from rice cultivation with around 7%.

Carbon Monoxide (CO)

This pollutant is essentially the result of combustion processes reflecting the existing burning conditions with the emissions factors from the CORINAIR Handbook having been used.

Combustion processes accounted for around 99% of the $1083Kt$ of CO discharged in 1990. Reference should also be made to the minor contribution made by industrial pollution processes.

The $243Kt$ attributed to the burning of fuels used by aviation and marine navigation have not been included in the total emissions of this pollutant.

Combustion (see Figure 3.7) from the transport sector is the major contributor to CO emissions with around 58% with a significant proportion also being provided by industry (25%), basically caused by the combustion of biomass.

CO

- 5%
- 5%
- 1%
- 6%
- 25%
- 58%

- 1A1 - ENERGY - TRANFORMATION ACTIVITIES
- 1A2 - INDUSTRY (ISIC)
- 1A3 - TRANSPORT
- 1A4 - COMMERCIAL/INSTITUTIONAL
- 1A5 - RESIDENTIAL
- 1A6 - AGRICULTURE/FORESTRY
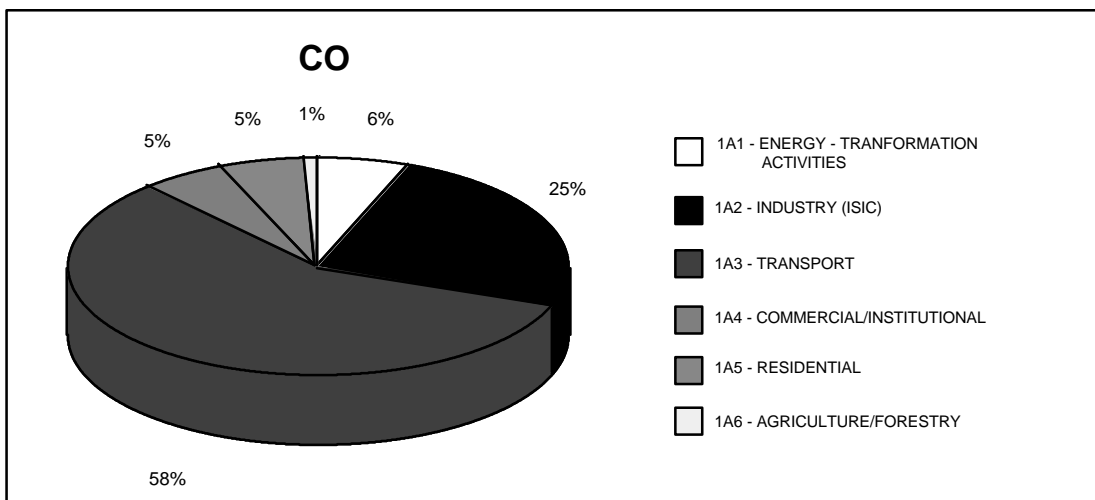
Figure 3.7 - Emissions of CO caused by combustion processes

Carbon Dioxide (CO_2)

CO$_2$

8%

92%

□ 1A - FUEL COMBUSTION

■ 2 - INDUSTRIAL PROCESSES
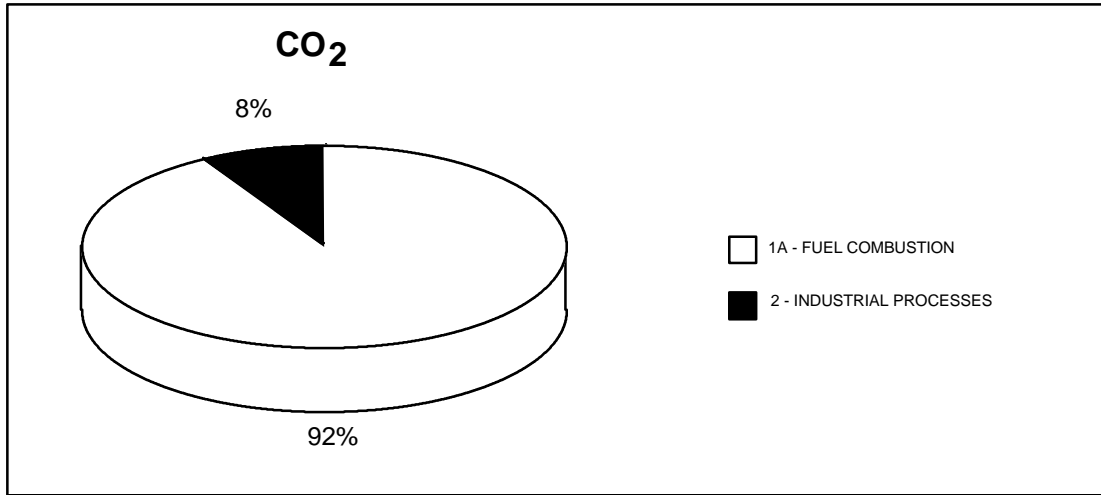
Figure 3.8 - Emissions of CO_2 by categories of source of emission

CO_2 emissions which, in 1990 were around 42Mt, excluding the emissions from the burning caused by aviation and ships (4Mt) and use of biomass as a fuel (7Mt) were basically caused by the most important fuel related groups responsible for around 92% (see Figure 3.8). The remaining 8% of emissions were essentially the result of industrial production processes.

The major sources of combustion processes were production and energy transformation activities which accounted for around 45% of the emissions followed by industrial combustion and transport with around 22% each, as set out in Figure 3.9.

CO $_2$

3%   3%   3%

3%

25%

50%

16%

- 1A1 - ENERGY - TRANFORMATION
  ACTIVITIES
- 1A2 - IINDUSTRY (ISIC)
- 1A3 - TRANSPORT
- 1A4 - COMMERCIAL/INSTITUTIONAL
- 1A5 - RESIDENTIAL
- 1A6 - AGRICULTURE/FORESTRY
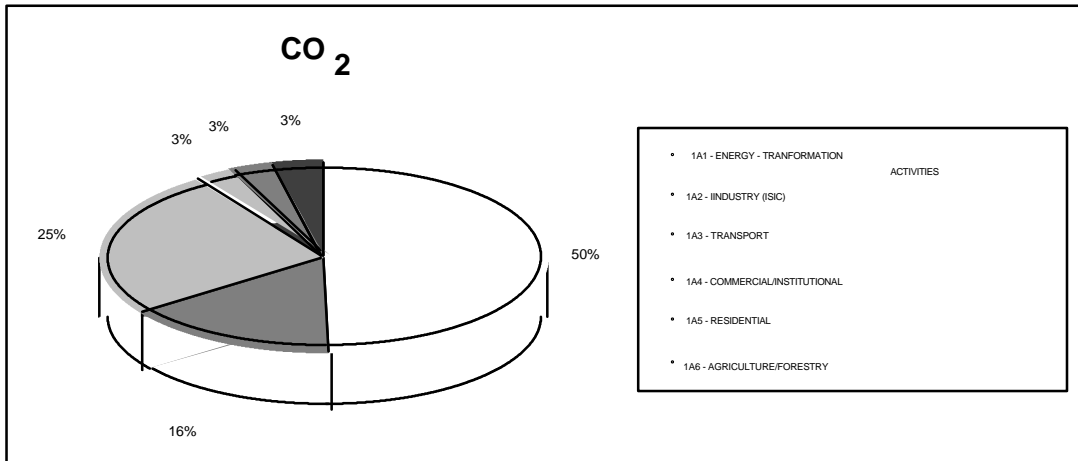
Figure 3.9 - Emissions of CO_2 caused by combustion processes

Nitrous Oxide (N_2O)

The emission factors contained in the CORINAIR Handbook, particularly those proposed by CITEPA, were used to estimate the emissions of this pollutant.

Total national emissions for 1990 came to around $10Kt$ of N_2O. Reference should be made to the fact that only anthropogenic emissions were included. Only the increase in emissions from agricultural soil as a result of the application of fertilisers was taken into account.

N_2O

34%

48%

18%

☐ 1A - FUEL COMBUSTION

■ 2 - INDUSTRIAL PROCESSES
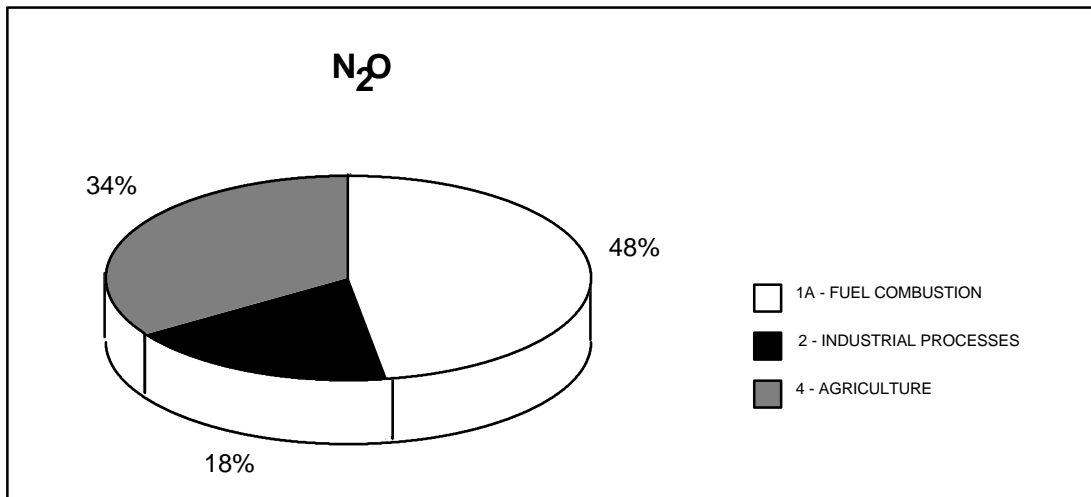
▨ 4 - AGRICULTURE

Figure 3.10 - Emissions of N_2O by categories of source of emission

Combustion processes and agriculture (the application of fertilisers) are the major culprits for the $10Kt$ of N_2O emmited in 1990, with emission percentages of 48% and 34% respectively. The contribution of industrial production processes (production of nitric acid) with around 18% of the total emissions is also considerable.

Reliability of Estimates

There is a certain degree of uncertainty involved in any estimate of emissions owing to a number of factors related both with the quality of the databases used and the methodology used for the calculation thereof.

Table XIV of Annex A.3, prepared in accordance with IPCC proposal, attributes categories of reliability to the estimates of emissions recorded in the Portuguese inventory as well as the level into which they are subdivided.

It can be seen that the degree of reliability of the estimates performed, in general terms, is medium.

It can also be seen that it was not possible to provide several of the estimates, the case of the burning of agricultural sector wastes and CO_2 emissions resulting from alterations to the use of the soil.

3.2 - INVENTORY OF SINKS

Carbon Stored in Soil

Portugal has a reasonably detailed soil chart and a database in respect of the fertility thereof. The amounts of carbon stored in the soil have been calculated on the basis of this data. There is a total amount of carbon storage of 390000*Kt* of *C* with an average value of 47*t/ha* of *C.* The amount has probably been underestimated. The lowest values are for lithosols with around 12.5*t/ha* of *C* and the highest are histosols with 200 *t/ha* of *C.*

Average Annual Removal of CO_2 in Portuguese Forests

According to the data available in the National Forestry Inventory, around 3.2 million hectares in Portugal are planted with trees with a distribution of species set out in Table 2.4

Therefore, considering an average annual removal of 22 tonnes of CO_2 per hectare, we can see that the annual removal of CO_2 for forests as a whole is 70.4*Mt.*

4 - POLICIES, MEASURES AND EFFECTS

4.1 - AGRICULTURAL SECTOR

Common Agricultural Policy

The Common Agricultural Policy (CAP) of the E.U. is based on Common Market Organisations. These organisations were designed to make agricultural production more efficient through the provision of price support mechanisms and, recently, owing to the reformation of the CAP, through compensatory payments. This recent reformation demonstrates a greater tendency to a lesser degree of incentive to agricultural production so that if we consider the operations of activities upstream and downstream from agriculture as an integral part of the agricultural sector, the new CAP principles and assumptions will have the effect of reducing emissions of gases which are responsible for causing the greenhouse effect.

If we consider the agricultural sector in isolation and, in accordance with a report issued by National Institute of Agrarian Research (INIA), "The emissions of CO_2 from agricultural activity are considered to have a nil or almost nil effect on temperate regions as they are cancelled out through the incorporation of atmospheric carbon in the vegetable material through photosynthesis. In the countries of those regions in which the agricultural soils have been cultivated for many years, the agricultural ecosystem is in a state of balance which is not the case for example in tropical regions in which virgin land is starting to be cultivated".

Furthermore, in accordance with the report in question, agricultural operations which contribute (on a small scale) to CO_2 emissions are the burning of stubble and liming of the soil which are normally associated with sown crops of i.e. cereals and oleaginous crops. There have been several recent alterations increasing the scope of the policies governing these activities.

The objective of the introduction of assistance subsidies (calculated per hectare) instead of price support mechanisms (calculated per kilo) was therefore to reduce the production, and consequently, the burning of stubble and liming, which, in association with the current value of the straw, previously referred to, helps to reduce CO_2 emissions.

The extending process will, on the other hand, also signify a reduction in the use of fertilisers and number of heads of cattle which will have a positive result on the emission of N_2O and CH_4.

The "set-aside" practice may have a beneficial influence on the storage of C in the soil. During the last 60 years the land newly cleared for sown crops has greatly accelerated soil erosion in many zones while causing, on the other hand, a greater degree of oxidisation of organic material.

Experimental work carried out in Portugal has shown that, during a period of rotation with 3 years fallowness and one year of cereals, it will be possible to increase the content of organic material in the soil over the medium term by 2 percentage points. For example, the non cultivation of 1/5 of the alluvial soil of around 200000 hectares, will correspond to a sink of at least $1000Kt$ of C resulting from the increase in the carbon content of the soil from 0.7% to 1%.

Support mechanisms have also appeared with the reformation of CAP, several of which have been designed to protect the environment. Of particular importance for the purpose in question are agro-environmental and forestry measures.

Agro-Environmental Measures

Agro-environmental measures are comprised of four major groups which can be broken down as follows:

 1 - <u>The extending and/or maintenance of traditional agricultural systems</u>

One of the fundamental objectives of agro-environmental measures is the extending of vegetable and animal productions, compatible with the protection of the environment, the preservation of natural space and the equilibrium of markets. In this case, assistance is provided to those systems which encourage extensive production such as the reconversion of arable into extensive pasture land, the maintenance of extensive forage systems and the extending of cattle production as well as the maintenance of traditional systems of orchards, vineyards, olive groves and oak groves.

2 - <u>Reduction of the pollutant effects of agriculture (principally on a level of the restrictions of the use of phytopharmaceutical products).</u>

With the objective of encouraging farmers to use these chemical products in a more rational manner and encouraging them to use alternative methods of combatting pests and disease, the following support has been provided to the following practices with the objective of reducing their use by around 30%:

- Advice on use of chemical means;

- Integrated protection;

- Integrated production;

- Biological agriculture.

3 - <u>Conservation of resources and rural countryside</u>

The recent abandoning of specific agricultural and forestry areas has caused serious problems, mainly environmental, which can be seen in the increase in the number of forest fires. These fires are, in turn, the cause of erosion, degradation of the environment and countryside as well as the emission of CO_2. With the objective of putting a halt to this process measures have been taken for maintaining abandoned forestry surfaces through the control and planning of woods as well as the maintenance of agricultural areas located inside forests. These are, in detail, as follows:

- The maintenance of abandoned forestry surfaces.

- The maintenance of forestry surfaces which are complementary to agricultural explorations;

- The preservation of pockets of arboreal species or autochthonous shrubs;

- The maintenance of agricultural land inside forestry areas.

4 - <u>Professional training and information</u>

The objective of this measure is to train and convince producers and other economic agents associated with the agricultural sector of the importance of these issues.

Forestry Measures

Owing to the type and scope of the implications created by the emissions of gas responsible for the greenhouse effect, forestry is of particular importance as a sink or reservoir for reducing or stabilising the rates of concentration of CO_2 in the atmosphere.

By way of reinforcing this understanding, the forestry subsector is concerned with the continuance of efforts in the following areas:

1 - <u>Maintenance and expansion of forestry areas</u>

Tasks for the expansion and maintenance of forestry areas which have been carried out will be based on the following support instruments over the next few years.

1.1 - The implementation of the 2^{II} Forestry Development Project as part of the Community Support Framework with the following principal objectives:

- Replanting of areas affected by forest fires with trees;

- Replanting of other areas with trees and improvements to existing forestry areas including the use of natural regeneration;

- Encouraging the planting of new areas with trees, with priority being given to those which are not eligible within the framework of national legislation to the application of EEC Regulation 2080/92 (forestry measures in agriculture).

72000 hectares of trees are expected to be planted under this programme and improvements are expected to be made to an area of 108000 hectares.

1.2 - The application of EEC Regulation 2080/92 within the scope of the re-formation of the CAP forestry measures, which establishes a number of incentive for the planting of trees and improvements to forestry plantations, with 124000 hectares expected to be planted with trees and 35000 hectares improved.

2 - Protection of forests

The protective measures which have already been put into practice are expected to continue and special emphasis placed on those resulting from the application of EEC Regulations 3528/86 and 2157/92 concerning atmospheric pollution, and EEC Regulation 2158/92 in respect of fire protection as well as phytosanitary protection measures.

The additional application of other forestry protection methods arising from the application of national legislation such as:

- The protection of cork oaks and holm oaks and spontaneous holly;

- The protection of isolated trees, thickets, rows of trees and groves of trees considered to be of public interest;

- The planting of areas affected by fires with trees;

- Regulatory legislation on the premature cutting down of trees;

- The encouragement of the planting of leafy fast growing varieties taking in account the environmental effects created by tree plantations, with these species, in areas subject to sustained management measures for the existing Forestry Patrimony.

4.2 - ENERGY SECTOR

Objectives

The major objectives of the general development of energy policy have been designed to fulfill the objectives of environmental preservation and involve three major priorities:

- An increase in diversification and energy efficiency in all sectors of economic activity;

- The use of clean technologies in processes for the burning of fossil fuels;

- Greater use of renewable energy sources.

Measures

The major areas of activity to be developed in the energy sector include:

- the introduction of natural gas for the production of electricity and end user consumption starting in 1997;

- the combined production of heat and electricity in various industrial subsectors;

- the increased use of renewable energy sources for the production of electricity;

- the improvement in the efficiency of thermal production and electricity transmission;

- the more rational use of energy in all sectors of consumption by end users.

The introduction of natural gas, with the objective of diversifying energy sources will cause a relative improvement to the levels of emission of pollutants, although the forecast growth in energy consumption will cause an increase in global emissions of CO_2 up to the year 2000.

The greater use of renewable energy sources, in the form of hydro, eolic and solar energy will also help to improve environmental conditions taking into account the fact that the existing potential is still significant.

The rational use of energy, through incentives for the use of more efficient technologies and the installation of energy management systems, will make an extremely important contribution to reducing the proportion of energy imports with its resulting positive effects on the environment in addition to an improvement to the competitiveness of companies.

In the case of instruments or effective means of intervention with the objective of encouraging the market to use more appropriate policies from a global viewpoint, including environmental protection, the procedural activities can be split up into actions of an economic, fiscal and/or financial type and legislative, regulatory, educational and voluntary type actions.

In the case of economic instruments, reference should be made to electricity tariffs in which electricity charges now have hourly and seasonal differences in order to permit a better adjustment of the load chart and progressively liberalise the prices of fuels.

Instruments

Reference should be made to the following instruments for defining an energy efficiency policy:

- Incentives System for the Rational Use of Energy;

- Legislation on the Self Production of Electricity;

- Energy Consumption Management Regulations;

- Regulations on the Characteristics of the Thermal Behaviour of Buildings;

- Regulations on the Quality of Energy Systems for the Acclimatisation of Buildings;

- Informative and training activities on the rational use of energy.

The promotion of the existence of energy services companies specialising in the "Third Party Financing" for energy related investments, the re-launch of the Centre for Energy Conservation and the creation of the Biomass Centre for Energy are other indirect forms of involvement for encouraging the initiatives of economic agents and private consumers.

Reference should be made to the following in respect of the Incentives for the Rational use of Energy:

SIURE - Incentives System for the Rational Use of Energy

SIURE - Regional Incentives System for the Rational Use of Energy is cur-rently the National System for supporting energy sector projects.

The essential object of the SIURE Incentives System is to promote the rational use of energy and support the development of new sources or forms of energy consumption in all sectors of economic activity with the exception of domestic consumers. A grant is given to companies carrying out projects with this objective.

Decree Law number 188/88 of 27th May established the Incentives System with the following characteristics:

- It covers all activities and forms of consumption with the exception of domestic consumers;

- it applies not only to actual investment projects but also to pre-   -
  investment and management activities, i.e. energy audits and viabili-
  ty studies provided that they are properly justified by the objectives of
  the operations;

- it also accepts that the promoters of the operations need not be the
  beneficiaries thereof but entities which accept responsibility for car-
  rying out the operations, on the basis of the technical/financial system
  referred to as "Third Party Financing";

- it allows the financial incentives attributed under SIURE to be ac-
  cumulated up to a specified limit with those provided under
  Community Programmes although accumulations with any other
  incentives of the same nature of a national scope are not permitted.

Operations eligible for SIURE can be included in three major groups:

- Pre-investment and energy management activity i.e. energy audits,
  viability studies and/or effect on the environment;

- Investment projects for energy conservation and the diversification of
  primary sources;

- Demonstration projects and the building and experimenting of pro-
  totypes.

Since 1992, SIURE has only been providing co-financing in energy terms since
the termination of the VALOREN Programme.

Table 4.1 SIURE - Finance obtained

	Nº	INVESTMENTS (PTE 10³)	SUBSIDIES AWARDED (PTE 10³)	SAVINGS (Toe)
ENERGY PRODUCTION	39	19 368 865	3 221 590	136 589.8
RENEWABLE ENRGIES(*)	42	2 751 265	689 347	22 224.3
STUDIES	27	560341	15 908	0.0
ENERGY SAVINGS	156	12 804 794	2 968 079	129 332.9
SUBSTITUTION OF OIL PRODUCTS	1	89 473	35 789	0.0
TOTAL	**265**	**35 070 738**	**6 930 713**	**288 167.0**

Source: DGE.
(*) Includes mini hydro projects, thermal solar biogas, solid waste projects and recycled oils.
August and September 88 applications, January, May and September 89.
January, May and September 90, January, May and September 91.
January, May and September 92 and January and May 93.
PLEASE NOTE: Approved projects: projects in progress terminated. The 78 cancelled projects were not taken into consideration after having been approved.

VALOREN Programme

The VALOREN Programme was established in 1986 by EEC Regulation number 3301/86 with the objective of promoting the development of the less developed regions of the Community by making use of endogenous energy potential.

The following operations were eligible for the VALOREN Programme:

- The exploitation of local energy resources, including renewable energy sources;

- The regional promotion of a better use of endogenous energy potential;

- Energy conservation. The rational use of energy in small and medium size companies.

The support granted to this kind of project in Portugal, undertaken by private operators, was included as part of SIURE, whose subsidy was increased by a regional component payable from the VALOREN Programme.

The global amount of the programme was 450 MECU with Portugal being given a sum of 65 MECU.

The maximum finance for the different types of operations performed in Portuguese regions was 70% of the total cost.

In the case of the promotion of SIURE projects by private entities, the financial subsidy was limited to 50% and conditioned to the modulation of the geographical region in which the project was set up.

The management of the Programme was the responsibility of the Directorate General for Regional Development. The management of the projects for energy conservation carried out in the private sector was shared by the Directorate General for Energy.

The period for the submission of applications ended in October 1991.

Table 4.2 - **VALOREN Programme** - (10^3 Esc)

	Nº OF APPLICATIONS	APPROVALS	EXECUTION	PAYMENTS
1987	26	304 316	58 736	-
1988	163	1 883 062	431 966	458 945
1989	118	1 729 582	1 016 797	626 277
1990	218	3 622 299	2 044 134	2 260 863
1991	149	6 850 391	4 245 662	3 631 126
1992	-	-	6 128 128	2 837 876
1993	-	-	-	742 876
TOTAL	**674**	**14 389 655**	**13 925 426**	**10 557 922**

RGCE - Energy Consumption Management Regulations

RGCE (Energy Consumption Management Regulations) which were established in accordance with the terms of Decree Law number 58/82 of 26th February and regulated in accordance with the terms of Ministerial Order *(Portaria)* number 359/82 of 7th April are applicable to most manufacturing sector activities.

The principal objective of these Regulations is to analyse energy as a "cost factor" by establishing a methodology of intervention for the management of energy consumption on the basis of the definition of reference markers (k) for the progressive reduction thereof.

The trend in the transport sector has, in the meantime been one of a strong growth of energy consumption which already represents a significant part of the consumption of primary energy.

This is why it was decided that the referred to Regulations should also be extended to Transport starting in 1988.

RCCTE - Regulations on the Characteristics of the Thermal Behaviour of Buildings

RCCTE - Regulations on the Characteristics of the Thermal Behaviour of Buildings, were published in Decree Law number 40/90 of 6th February and came into force on 1st January 1991.

These Regulations represent the first regulatory basis and an essential premise for the adopting of other measures concerning the use of energy in buildings and is in line with the need to draw closer to Community policies in this field taking into account specific aspects pertaining to Portugal.

ROSECE - Regulations on the Quality of Energy Systems for Acclimatisation of Buildings

ROSECE - Regulations on the Quality of Energy Systems for Acclimatisation of Buildings, were published in Decree Law number 156/92 of 29th July.

The application of these Regulations requires a greater degree of discipline in making buildings suitable for their respective objectives involving more requirements, starting from the project stage, with regard to the use to be made of spaces and the characteristics thereof *vis-à-vis* the exterior. It is assumed that rational energy consumption equipment will be used in accordance with justified and verifiable conditions.

4.3 - INDUSTRIAL SECTOR

Objectives

The objective of the new model of industrial development in Portugal is the emergence of a meta-industrialised society with high living and environmental standards in line with the advent of a new worldwide industrial development model. The model is based upon the concept of "lean production" and is targeted at reducing energy consumption, raw material, labour capital and time and will therefore represent a considerable advance in respect of the environmental dimension of production processes.

The environment is one of the horizontal priorities of Portuguese industrial policy for the nineties with emphasis being placed on the introduction of cleaner production technologies for reducing the external effects of industrial pollution.

As the priority objective is to prevent pollution by using cleaner production technologies, whenever this is not possible or expedient, encouragement is given to reducing the generation of pollution with the use of end-of-the-line corrective techniques.

Measures

The measures implemented in the industrial sector for furthering the objectives of environmental protection, without jeopardising the competitiveness of companies, include various types of activities, basically in the following areas:

- economic and financial;
- information and awareness;
- legislative.

Instruments

Special reference should be made to the following instruments used in Industrial Policy with the objective of furthering its environmental objectives:

1 - <u>Economic and financial</u>

PEDIP - Specific Programme for the Development of Portuguese Industry (1988-1992) is an industrial incentives system which has already implemented several strategies for adjusting industry to new environmental requirements.

The current PEDIP II - Strategic Programme for the Dynamisation and Modernisation of Portuguese Industry (1994-1999) is also an instrument for linking industrial and environmental policies with the objective of protecting national resources and the environment and takes into account the measures and actions required for implementing the environmental policy for the industrial sector.

PEDIP II, in furthering its objectives, contains incentives systems and actions of a voluntary nature for which public administration is responsible. Special reference should be made to the "environmental awareness missions" referred to in item 2.

In terms of the incentives systems and respective support regimes set out in PEDIP II, special reference should be made to SINDEPEDIP - Incentives System for Industrial Company Strategies.

Several SINDEPEDIP support schemes provide the following:

- support to "studies and audits for the support of the management strategy of industrial companies for the implementation of actions" particularly in the areas of environmental protection and energy management;

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• support to "integrated investment projects in the various functional company areas" which may include environmental investments, encouraging the use of cleaner production technologies as well as investments in the area of energy rationalisation;

• support for the promotion of dynamic competitiveness factors on the basis of investment projects including actions for the "protection of environmental conditions and improvements to working conditions, by providing assistance for the purchase of equipment and the implementation of suitable technologies";

• support for business demonstration activities through involvement in areas having an effect on the competitiveness of companies, such as the rational use of energy and protection of the environment;

Reference should also be made to the fact that, for the purposes of the access requirements for SINDEPIP support, and whenever applicable, "the applications must include an analysis of environmental aspects" on the basis of environmental audits, diagnostics or previous studies in accordance with the type of industry in question.

2 - Information and awareness

"Environmental awareness missions" of a voluntary type as a result of the DGI (Directorate General for Industry) initiative under PEDIP II.

The objectives of this measure are essentially to promote a number of awareness and information initiatives in areas, sectors and technologies in which the environmental aspect is particularly felt and which will, *inter alia* imply the need for support for the technological re-equipping of companies through the adopting of cleaner technologies in order to permit more savings to be made both in terms of raw material as in the case of energy and water.

3 - <u>Legislation</u>

The National Industrial Licensing System which is set out, in legal terms, in Decree Law number 282/93 of 17th August and Regulatory Decree number 25/93 of 17th August has established the protection of the environment as one of its objectives.

This System assumes the characteristics of an integrated system for the pre-vention and control of pollution and environmental risks of an industrial origin. Environmental protection is the crux of the project with the objectives of industrial licensing projects in mind.

This System caters for the necessary protection of the environment associated with industrial operations by means of requirements for location and technical and functional requirements on a level of the planned installation/alteration and manufacturing control. Reference should be made to the fact that the number of requirements varies in accordance with the classification of industrial activity in question and are all the more demanding the higher the degree of risk involved for man and the environment as a result of the performance of the activity being carried out.

In order to achieve the objectives of this System, compliance with the stan-dardisation, regulation and sectoral legislation existing in the areas of safety, industrial hygiene and environmental protection are a *sine qua non,* with compliance with the legal framework on gas emissions being particularly important.

4.4 - SURFACE TRANSPORT SECTORS

Policy Measures

In the transport sphere, the principal collection of measures and actions in progress or expected up until the year 2000, in line with a strategy of sustainable mobility are as follows:

1 - Integration of the transport sector in multi-sectoral plans for territorial planning in accordance with the different territorial levels.

  - The reserving of special lanes/channels for transport infrastructures, specifically catering for the conditions for the future development of networks for structuring public rail transport in special locations;

  - The reserving of areas for setting up interfaces for guaranteeing the suitable inter-coordination of heavy modes with road transport facilities in such a manner as to rationalise the operation of the transport sub system (see measure 5);

  - The establishing of regulatory dispositions governing the use of the soil, compatible with sustained development, particularly with regard to the suitability of the locations of major poles for the generation and attraction of traffic and the definition of urban parameters (e.g. density of occupation, reservation of areas for green belts, etc.) together with the provision of areas required for roads and parking.

2 - Reinforcing of the competitive position of rail transport in general.

  - The execution of a plan of activity with the objective of revitalising the rail network as a means of transport with sufficient technical potential to cater for a large proportion of the needs for the sustained mobility of persons and goods i.e. ensuring the continuity of logistical chains supported by multimodal systems from a commercial and competitive/complementary viewpoint of the various transport modes in the market segment to which it is targeted.

3 - The creation and development of infrastructures encouraging modal transfers with a significant effect on decongesting urban and metropolitan areas.

- Rail crossing over the River Tagus in Lisbon;

- An increase in the capacity and improvement in the levels of service of the existing suburban railways and their urban distribution;

- The execution of a new network expansion plan for the Lisbon Underground;

- The launch of a light surface "underground" in other urban and metropolitan areas;

- The introduction of high capacity articulated trams.

4 - The modernisation of road infrastructures with consequent improvements to safety and circulation and traffic flow in the zones of greater congestion and their repercussions on the reduction of energy consumption and respective pollutant emissions.

- The completion of almost all of the infrastructures set out in the National Road Plan, i.e. those concerning alternatives and roads for traffic distribution purposes in metropolitan areas.

- A new road bridge over the River Tagus in the Metropolitan area of Lisbon.

5 - Multi and inter-modal coordination with the consequent functional op-timisation of the transport sub-system, improvements to performance of the different modes involved and minimisation of the respective negative external impacts which will be seen in a reduction of social and environmental costs particularly with regard to energy consumption and corresponding levels of emission.

- The construction or reorganising of stations and passenger interfaces with the objective of making it easier to change transport modes at changeover points.

- The construction or organising of multi or inter-modal platforms with the ulterior objective of guaranteeing the operation of a combined transportation network.

6 - Other measures and actions for reducing the environmental impact of the transport sector.

- The improvement and control of the energy efficiency of vehicles respectively through the introduction of new technologies (as a result of the renewal and modernisation of the number of cars in circulation) and holding of periodic inspections.

- The modification of the behaviour of drivers with the view to encouraging more responsible driving standards and the imposing of certain speed restrictions as a result of the coming into force of the new Highway Code;

- The provision of incentives to the less polluting means of transport as an alternative to the public road carriage of goods;

- The regulating and control of goods and dangerous wastes;

- Traffic management and control measures for increasing traffic flows, particularly in the case of urban traffic, through the use of automation and the creation of lanes and corridors reserved for public transport, reversible direction zones, etc..

5 - PROJECTION OF CO_2 EMISSIONS

It is accepted that carbon dioxide accounts for around 55% of the greenhouse effect.

The activities of the production and use of energy are the main anthropogenic sources of pollutants responsible for the greenhouse effect. It has been estimated that around 57% of the worldwide effect is the result of human activities.

Projections for the portuguese emission of CO_2 caused by combustion have been made for the years 1995 and 2000. The results are set out in the follow-ing table:

Table 5.1
Projections for the emission of CO_2 caused by combustion (Category 1A) - (10^9g)

Categories	1990	1995	2000
1A - COMBUSTION	38 686	46 024	54 274
1A1 - ENERGY-TRANSFORMATION ACTIVITIES	19 386	21 180	24 308
1A2 - INDUSTRY	6 079	7 143	8 911
1A3 - TRANSPORT	9 946	13 389	16 140
1A4 - COMMERCIAL-INSTITUTIONAL	1 045	1 273	1 404
1A5 - RESIDENTIAL	891	1 085	1 196
1A6 - AGRICULTURE-FORESTRY	1 338	1 953	2 315

Source: Institute of Meteorology
Growth rates supplied by the Directorate General for Energy (DGE)

The methodology used for the calculation of the emissions derived from combustion are based on the forecast supply of and demand for energy for 1995 and 2000 which involves planning exercises which have been periodi-cally prepared by the competent organisation (see Annex A.5).

The scenario put forward is in line with the one prepared by the International Energy Agency/OECD and encompasses realistic projections of variations such as GDP, population, cars in circulation and average distance travelled up to the year 2000. They include energy policy measures in effect and those to be introduced up to the year 2000 in order to limit emissions and particularly those set out in chapter 4 on the energy and transport sectors.

The forecasts certify the national objective of an increase of 40% in CO_2 emissions for the year 2000 in comparison to 1990.

A chart is also provided setting out the percentage increase in CO_2 emissions from the Combustion category and each of its sub categories with 1990 as the base year.
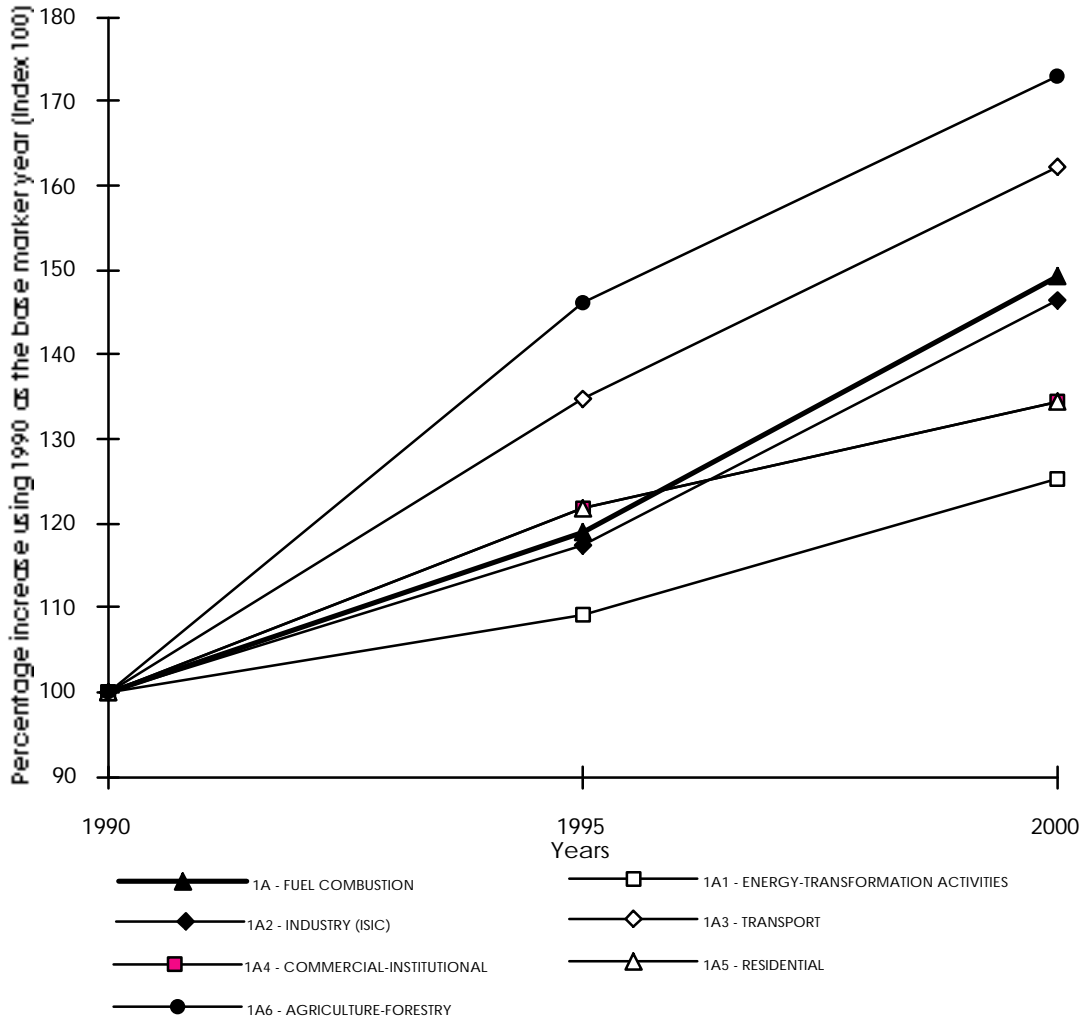
Figure 5.1 - Percentage evolution of in CO_2 emissions

6 - CLIMATE VULNERABILITY AND ADAPTATION MEASURES

6.1 - CLIMATE VULNERABILITY

The occurrence of meteorological type natural catastrophes (floods, droughts, heat waves) is a factor affecting Portugal with a greater or lesser degree of frequency and whose socioeconomic indices depend, to a large extent, on the degree of development and organisation of the infrastructures for minimising the effects thereof.

Albeit with a different degree of vulnerability to natural catastrophes, all regions, are subject to the occurrence of one type or another which may cause loss of life, environmental alterations and serious material damages.

Desertification

Desertification is a complex phenomenon which depends on natural factors (droughts, climate change) as well as human factors which are basically those which lead to the alteration of the microclimate such as poor soil use, deforestation, unsuitable irrigation processes, excessive pasturing, salinity. The main effect in Portugal is felt in its Southern regions which are badly affected by soil erosion as a result of unsuitable agricultural practices and the occurrence of heavy rainfall.

Recent studies have shown that this phenomenon needs to be looked at in these regions in order to avoid the complete degradation of the soil.

Droughts

The occurrence of droughts is almost always associated with blocking type situations in which the sub tropical anticyclone of the North Atlantic remains in a position which prevents the disruptions on the polar front from reaching the Iberian Peninsula.

An analysis of the inter-annual variability of the amount of precipitation shows that drought type situations frequently occur on Mainland Portugal and can last for as long as three years.

Heat Waves

Portugal is subject to heat waves, i.e. to sequences of days with high maxi-mum and minimum temperature records, which are far above normal levels.

Reference should be made to a relatively recent episode in July 1991 in which the maximum monthly were exceeded in several locations in the South of the Country and in which there were maximum temperatures of more than 40°C for seven consecutive days in Beja.

Heavy Rain

Violent downpours, occurring in specific locations and for short periods can cause sudden flooding which can, occasionally have catastrophic effects in small hydrographic basins and mainly in Southern regions and in urban re-gions (owing to the lack of suitable drainage).

The analysis of the precipitation series of the maximum annual values of the amount of precipitation during short periods has enabled the intensity of the precipitation to be calculated for various return periods. Therefore, for a return period of 100 years, the precipitation readings over a 15 minute period range between 20*mm* and 70*mm.*

Average Sea Level

In Portugal, an increase in the average sea level can cause storms along the coastal strip and may cause several problems such as:

. A speeding up of the rate of coastal regression. Erosion is causing a regression of the coastline which, in some locations is as much as 1 metre per year. With the acceleration of the increase in sea level, this regression will tend to get worse. Several urban zones are in danger.

. Sea coverage of low coastal zones and estuaries of several rivers, particularly the Tagus and Sado.

. An increased risk of flooding at the mouth of several rivers, particularly the River Douro;

. An increased risk of damage caused by storms to structures located close to beaches, particularly tourist facilities (Praia Grande, Alvor, etc.);

. An increased risk of damage and destruction to port and coastal works;

. Contamination of aquifers by salt water (Southern Coast - Algarve).

6.2 - ADAPTATION MEASURES

General

The priority activities in the area include:

- A characterisation of the Country in terms of its vulnerability to natural disasters;

- Studies of the variability and evolution of long-term series of precipitation amounts;

- Study of weather events extremes;

- Studies of series of maximum intensities of the amount of precipitation during short periods with the objective of contributing to a better understanding of the action of precipitation as a soil erosion factor;

- Studies of the characteristics of periods of drought in Portugal;

- The preparation of scenarios for the evolution of drought periods;

- Participation in the Ten Year International programme for the Prevention of Natural Catastrophes;

- Reinforcing of the National Civil Defence Service.

The established areas of activity will be furthered both in national and international programmes of which special reference should be made to Project MEDALUS - **Me**diterranean **D**esertification **A**nd **L**and **Us**e which is financed by the E.U.. Its principal objective is to obtain more knowledge on the mechanisms which contribute towards the desertification effect in the Mediterranean Region. The Beja - Mértola region is one of the Project's pilot zones.

Average Sea Level

. Survey of regions at risk owing to an increase in sea level.

. Adoption of regulations which impose the consideration of the problem of the increase in sea level on all construction projects close to the coast and particularly all coastal and port engineering works.

. A careful, independent evaluation of the problem of coastal erosion.

. Imposition of the consideration of downstream effects on coastal works projects.

. The avoidance of overpopulating jeopardised locations. The promotion of the natural conservation of beaches and sand dunes.

. The avoidance of actions susceptible to causing the subsidence of locations at risk such as the extraction of underground water.

7 - TECHNICAL AND FINANCIAL RESOURCES

Contribution to Financial Mechanisms

Portugal joined the pilot stage of the "Global Environmental Facility - GEF" in 1992 with an escudo contribution equivalent to 4.5 million worth of Special Drawing Rights (SDR). The referred to contribution was in the form of three drafts, redeemable up until August 1997.

The necessary legal formalities are being prepared for participation in GEF II and the Portuguese Government has accepted a formal commitment to make a payment of 4 million SDR. This contribution represents more than twice the amount allocated to Portugal under the "burden sharing" arrangements negotiated for reestablishing the GEF.

Granting of other Financial Resources through Bilateral, Multilateral and Regional Channels

During the meeting of the United Nations Conference on the Environment and Development which was held in Rio de Janeiro, the European Community, under the Portuguese Presidency, signed the INITIAL COMMITMENT to pay 3 billion ECU for the support of projects included as part of the framework of Agenda 21.

An indication was given to Member States on the distribution of the above referred to amount with Portugal being committed to pay 17 million ECU over a 5 year period.

In latter meetings of the Cooperation for Development Group held in Brussels, Spain submitted a proposal on 19.10.92 in accordance with which the Portuguese contribution of 4 MECU would be allocated via the Community Budget with the remaining 13 MECU being paid out of the State budgets. According with the Spanish proposal Portugal would be making an annual contribution of 2.6 MECU to be paid out of the State budgets.

Portugal is, in the meantime, awaiting the result of a Community decision on the definitive apportioning of costs, in proportion to existing and new and additional resources as well as the scheduling of Community financing.

Portugal is participating in a wide range of international and regional financial institutions and organisations whose objective is to provide assistance to developing countries. Reference should be made to the participation in World Bank Group Institutions, the African Development Bank,the Interamerican Development Bank, the European Bank for Reconstruction and Development, the European Investment Bank and the European Development Fund. All projects and activities financed by these institutions have environmental components which, to a greater or lesser extent, are concerned with climate change. In budget terms the Portuguese contributions to these institutions and organisations in 1992 should be around 6 thousand million escudos.

In bilateral terms and from a regional viewpoint, the main beneficiaries of Portuguese assistance are Portuguese speaking African countries with Mozambique being the main beneficiary. This is because of the size of the country, the magnitude of its assistance requirements, the volume of its financial commitments to Portugal and the guarantee of the effectiveness of the assistance arising from compliance with its Structural Assistance Programmes. In terms of financial cooperation instruments, debt reduction has played a significant role. In addition to the reduction of debt servicing through the rescheduling of payments, Portugal is giving more consideration to the possibility of converting part of the stock into cooperation shares to be developed in local currency i.e. "debt for aid" or in holdings in the share capital of companies in developing countries i.e."debt for equity". These conversions imply close cooperation with beneficiary countries for ensuring that the assistance is provided to priority areas and ensuring the reinforcing of the technical, technological and productive capacity thereof. In budget terms, Portuguese assistance in respect of the above mentioned objective will be 8 thousand million escudos.

8 - RESEARCH AND SYSTEMATIC OBSERVATION

RESEARCH AND OBSERVATION

The problem of climate change and concern over the preservation of a high quality environment are subject matters which, for many years, have been part of the agenda of the scientific community and international organisations, particularly the World Meteorology Organisation (WMO) and the United Nations Programme for the Environment.

The objective of the principal international activities in progress is to achieve global solutions. The problems of climate change and the environment and development are global and it is within a global context that solutions will have to be found.

The two major programmes which together represent the international milestone for research and understanding of the climate and global climate change are: The World Climate Programme (WCP) for which the World Meteorological Organisation is responsible, with the research component (WCRP) which has been jointly implemented by the International Council of Scientific Unions (ICSU), the **International Biosphere - Geosphere Programme** for which ICSU is responsible.

The Atmosphere

Of the various sectors of activity of the WMO and in respect of the cooperation with the United Nations Programme for the Environment referring to the composition of the atmosphere, Portugal is participating in the works and studies on the Global Atmospheric Watch/GAW of the WMO which include the two World Programmes on knowledge of the composition of the Atmospheric Environment i.e. Background Air Pollution Monitoring Network/BAPMON) and the Global Ozone Observing System/GO3OS.

Prevention of Reduction to Stratospheric Ozone Layer

Special reference should be made to the importance of the supervision/realisation and/or promotion of:

- Measures recommended and/or arising from the Vienna Convention and Montreal Protocol with the objective of reducing the production and stabilisation of ozone depleting substances.

- Systematic observation, since 1959, of total ozone and its vertical profile (Programme GO$_3$OS) and the performance of direct vertical probes (radio probes).

The setting up of a network of regional stations as part of the Background Air Pollution Monitoring Network/BAPMON goes back to 1979 as do two stations which are part of the EMEP (Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe) with the addition of a further station in 1987.

Reduction and Control of Transboundary Atmospheric Pollution

Portugal has been accompanying, promoting and executing programmes and projects in respect of the Convention on Long-range Transboundary Air Pollution.

Reference should be made to the following:

- The EMEP Programme;

- The work carried out during the nineties as part of the "Survey of heavy-metal in Europe using bryphytes as bioindicators" Project which was applied to Europe as a whole;

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- Participation in the "International Cooperative Programme on effects on materials, including historic and cultural monuments" still in progress. This project has been extremely important for the evaluation of critical loads and modelling of the global circulation of Atmospheric pollutants.

While still on the subject of cross border issues, reference should be made to the setting up of the border network of stations for the monitoring of air quality as part of the cross border cooperation activities of INTERREG (Operational Development Programme for the border regions of Portugal and Spain).

Meteorological Research on the Greenhouse Effect

This is a new programme designed to obtain scientific answers to the issue of guidelines and contribution to the management of the air for environmental protection activities via the observation of greenhouse effect gases and their respective environmental effect. The areas of activity include:

. The acquisition, verification, validation and filing of data on the concentration of trace gases;

. The analysis and interpretation of the results and the systematic supply thereof for WMO worldwide data centres and others;

. The continuous updating of databases on the composition of the atmosphere;

. The analysis and interpretation of the results of the observation of the composition of the air and its inter-reaction on the greenhouse effect and inclusion as part of climate change models.

. The study of the evolution of vertical distribution and total ozone layer;

. The acquisition, installation, maintenance and operation of atmospheric component sampling and measuring equipment.

Research on the Regime and Structure of Coastal Breezes

This is a new project which is concerned with improving the existing scientific knowledge of the regime and structure of coastal breezes in Portugal, using a spatial-temporal characterisation of the thermodynamic structure of the lower troposphere, influenced by coastal breezes. It is of fundamental importance for the planning of socioeconomic activities in the coastal regions of Portugal in which most of the population and industrial activities are concentrated. The actions to be performed include:

. The carrying out of observation activities on the lower troposphere;

. The application of physical/mathematical models for breeze simulation purposes;

. The acquisition of material, equipment and supporting accessories for the observation programmes.

Variability of the Climate and its Socioeconomic Effects

Monitoring and Characterisation of Climate in Portugal

Knowledge of the climate and its evolution is of fundamental importance in the planning of any socioeconomic activity.

The characterisation and climatic zoning of the Country, based on the requirements of its principal economic activities, is an indispensable tool for decision makers particularly when the preparation of the competitiveness of the Portuguese economy within the Single European Market is at stake.

Conversely, the interdisciplinary nature of Climatology requires cooperation between various scientific disciplines in order for the most suitable results to be obtained. Accordingly, the definition and implementation of a National Climate Programme taking into account the philosophy, guidelines and recommendations of the World Climate Programme of the WMO is of the greatest importance as an up-to-date issue.

Several of the most relevant actions to be carried out are already in progress and are:

. The definition and creation of the National Climate Programme;

. The organisation of a climate database for the Country with the inclusion of metadata;

. The study of the variability and evolution of the climate in Portugal (quality of series, trends) based on the reference marker climatological stations with the objective of promptly detecting climate variations;

. The study and analysis of regional climate scenarios particularly in respect of: air temperature, precipitation potential evapotranspiration, soil humidity and variations in average sea level.

Socioeconomic Effects of Climate Change

Reference should be made to the importance of the studies of the effects of the predictable climate change on the various sectors of socioeconomic activity, insofar as areas such as agriculture, water resources, coastal zones and many others may be seriously affected by the variations in question.

These actions will take into account the recommendations and guidelines issued by the IPCC as well as the structure of the World Meteorological Organisation/UNEP Programme on the Effects of Climate Change. The areas of activity to be performed include:

. The study of the predicted effects of climate scenarios in the following spheres: water resources, agriculture, coastal zones, including the effects of the possible increase in average sea level; human health; ecosystems.

Studies for the Support of Environmental Protection

<u>Studies for the Support of the Integrated Management of the Environment</u>

Evaluation methodologies and performance criteria which will make actions in the environmental sphere more effective are currently being developed.

Basic aspects of the management of air resources, meteorological and climatological information, a characterisation of sources of emission and information on air quality will be included.

After greater information has been obtained on the situation, the most environmentally and economically adjusted solutions will be taken for minimising the effects of economic and social development on the environment.

These actions are extremely important and, on the other hand, also constitute a fundamental basis for the preparation of national inventories on greenhouse effect gas emissions.

The priority areas of activity, include:

. Studies of the concentration of ozone in urban areas;

. The creating of information processing routines on the quality of the air;

. The listing of the emissions of specific pollutants (*GHG*) and particularly CO_2 and *VOC* produced by industry, in addition to traditional pollutants;

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. The listing of emissions from mobile sources;

. The integrating of the data collection with meteorological and climatological information. The application of mathematical modelling;

. The systematic organisation of environmental technologies applicable to resources savings and minimisation of environmental effects;

. The technical/economic evaluation of the cost-benefit ratio of each of the available technologies.

Evaluation of Available Renewable Energy Potential

Suitable knowledge of the available renewable energy potential for the purpose of evaluating its share as an alternative to fossil fuels, is an indispensable component part of the planning and management of the national energy system, from the viewpoint of sustainable development.

The actions which have been taken concentrate on the more efficient, cleaner use of fuel, both in the supply and demand sectors and in the promotion and demonstration of renewable energies.

The priority areas of activity in the Energy and Environmental fields are research into the mechanisms for the formation and removal of pollutants, the development of methodologies for the control of emissions at source, the development and demonstration of technologies for the separation and removal of pollutants and the development of processes for the conversion of fuels into other, cleaner fuels which are easier to handle.

In the demand sector, the priority areas of activity are targeted at the management of energy in industry, the optimising of combustion with the twofold objective of maximising efficiency and minimising the environmental effect and the development of new technological concepts for the combined production of heat and electricity by industries.

The diversification of sources of primary energy and the minimising of their environmental effects are the objectives to be furthered in the area of renewable energies. The priority areas of activity include:

> . The installation of temporary networks in key regions for the data collection on the potential for renewable energies;

> . The development and application of methodologies for the evaluation of potential eolic and solar power;

> . The evaluation of renewable energy potential and the development and demonstration both of autonomous systems and systems connected up to other electricity systems;

> . The development and demonstration of high and low temperature thermal applications of solar energy;

> . The development and demonstration of passive heating and cooling technologies;

> . The processing of domestic, agricultural and industrial effluent for the production of biogas;

> . The application of concepts of bioclimatic architecture.

The established areas of activity are being furthered both in national and in-ternational programmes.

Reference should be made to the activities carried out within the scope of the following areas: More Efficient and Cleaner Production of Energy and the Rational Use of Energy in Buildings contained in the European Union's JOULE II and THERMIE Programmes and the activities carried out in the programmes of the International Energy Agency, Fluidised Bed Combustion, Photovoltaic Energy Systems, Greenhouse Effect Gases and Process Integration Technology.

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Urban Environment

The growth of urban communities has raised a number of environmental problems which must be considered and resolved from a meteorological viewpoint.

Accordingly, the knowledge of meteorological conditions and the air quality in urban management and health is of fundamental importance.

Taking advantage of climate conditions for a greater degree of suitability of urban infrastructures to requirements for comfort i.e. heating and cooling and the protection of buildings from the effects of humidity is, on the other hand, of the greatest interest.

Special reference should be made to the following actions to be performed on the basis of prior studies which have already been carried out:

. An analysis of the climatological series of the stations located in Lisbon, Oporto and Coimbra for detecting the effect of urban growth and diagnosing the requirement for added information for defining the urban climatological network;

. A study of the series of air quality data from the measuring stations existing on the Lisbon and Oporto networks and the necessary complementary data collection using a mobile unit;

. Coordination of these activities with the interests of other Central and Local Administration departments and other entities interested in the following spheres: improvements to traffic management, more effective urban management and health protection.

Remote Sensing

Meteorological Satellites

Portugal, through the Institute of Meteorology, is a Member of the European Organisation for the Exploration of Meteorological Satellites (EUMETSAT). EUMETSAT's main objective is the establishing, maintenance and operation of European meteorological satellite systems on the basis of WMO reco-mmendations.

Another of EUMETSAT's objectives is to contribute towards the operational survey on the climate and the detection of climate change.

The areas of activity include:

. The preparation of methodology for the use of satellite data for ob-taining the cartography of areas covered by vegetation i.e. cereals and forests;

. The use of remote sensing for environmental protection purposes in the Ria Formosa area of the Algarve.

Meteorological Radars

The operation of several meteorological radars started to be exploited in Portugal and various territories which were, at the time, under Portuguese administration i.e. Angola, Guinea and Mozambique, in 1960.

The areas of activity carried out in this field are part of the "COST72", "COST73" and "EPOCH" projects; with several scientific and technical aspects of Radar-Meteorology and its applications to meteorology and hydrology having been developed, in addition to works involved with the actual instrumentation which has made it possible to improve scientific, technical and technological knowledge as well as software and concepts for the structuring of the design of radar systems.

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The major project currently in force is the establishing of a network of Doppler meteorological radars covering the whole of national territory. This network is expected to be connected up to the future integrated system for the diffusion of meteorological data and the European network of meteorological radars. The network will begin with the installation and start-up of a C Band meteorological radar station with a Doppler channel in a location to the Northeast of Lisbon.

Monitoring

Environmental Monitoring System

This environmental monitoring system which uses remote, real time detection facilities, has been designed to provide decision takers with a detailed and up--to-date scientific knowledge of the territory, in order to allow them to promptly take the necessary decisions. The main activity to be performed is:

. The acquisition of a multi-spectral digital radiometer sweeper and a surface calibrator system.

Automatic Air Quality Network

The revision and expanding of the automatic air quality network with the objective of adjusting it in line with the current concerns for the permanent monitoring of the quality of the atmospheric environment. Reference should be made to the following actions to be taken:

. The revision of the philosophy behind the establishing of the network, its maintenance and exploitation;

. The expanding of the network with the objective of controlling the pollution of "imported" air.

Urban Climatological Network

The urbanisation of an area introduces significant factors for the alteration of the region's natural climate with the population, accordingly, being subject to an alteration of the environmental conditions.

Knowledge of these alterations, on a limited scale, which is only possible with the support provided by huge density climatological networks of stations, will make it possible to improve urban and building planning conditions, manage energy resources and delineate areas which, to a greater or lesser extent, are the cause of specific types of allergic diseases.

9 - EDUCATION, TRAINING AND AWARENESS

The Ministry of Education is represented in a working group which was created for the preparation of the National Environmental Policy Plan. Its objective is to integrate the actions to be performed by the Ministry of Education as part of the National Environmental Policy Plan.

The issue of Climate Change has not been specifically dealt with in basic and secondary education. The subject is, however, involved with environmental issues in general and the Atmosphere in particular.

In accordance with the perspective behind the referred to approach, the issue of Climate Change may be dealt with on a level of the contents of various disciplines. For example Biology ("12th year") or, on a more systematic level, in disciplines such as Geography (10th and 11th years). This situation is a result of the fact that Environmental Education is common to various syllabi.

With regard to training/awareness activities a national Environmental Education competition in which 394 schools are competing was launched during the 4th National Environmental Education Meeting which was held in Gaia between 2nd and 5th October 1993 in conjunction with the Ministry for the Environment.

A survey was carried out on Environmental Education projects in Basic Educational Schools for the preparation of a computerised database.

In the area of higher education many universities have introduced new and postgraduate courses in Environmental Education.

Activity of the Ministry for the Environment and Natural Resources/Institute for Environmental Promotion

Following the Rio Conference, the text of the Framework Convention on Climate Change was translated into Portuguese and published.

The Task Force, appointed in August 1992 for analysing the application of UNCED's conclusions in Portugal prepared a document entitled "Thematic Analysis", which presented the "Actions and Steps" to be carried out in Portugal for implementing the Framework Convention, the relevant organisations for the implementation thereof, the current status of this issue and, in addition, its articulation with the 5th Community Policy and Action Programme for the Environment and Sustainable Development. The document was debated publicly in accordance with the "Rio spirit" with the representatives of major social trends in Portugal in 1993.

Panels and expositions on "Climate Change" targeted at specific segments of the public were also held as a follow up to the public debate ranging from ONG to school age.

Document Centres and Libraries in the Environmental Area supplied documentation on climate change, specifically greenhouse effect gases which documents have been much in demand by students.

Didactic posters containing pedagogical expressions on "Climate Change" have been prepared and will be widely publicised through the educational system and the ONG at the beginning of the 1994-95 school year.

A collection of slides has been prepared for the educational system and environmental clubs (associative and school organisations) on gases responsible for the greenhouse effect.

9.2 - **EDUCATION AND INTERDEPARTMENTAL COOPERATION**

Cooperation between the Ministry of Education and the Forestry Institute of the Ministry of Agriculture

- Every possible assistance has been given to the Forestry Institute in the form of the works carried out by the Commission for the Celebration of World Forestry Day and the holding of competitions in the district in which the official Commemorations are held and by the sending of suggestions for activities to all other districts.

- Active cooperation in campaigns for the prevention of forest fires.

- Participation, together with the Forestry Institute in the campaign on "Forest Fires" proposed for Basic Educational schools in the Northern and Central Regions of the Country.

- Showing of the "Forests, a resource to be Protected" video in schools in the 2nd and 3rd educational cycles.

- Representation of the Ministry of Education in the National Campaign for the Arborisation of Urban Areas and the Forestation of Areas of Special Ecological Interest.

Cooperation between the Ministry of Education and the Institute for Environmental Promotion of the Ministry of National Resources

- Participation in the Commission for the evaluation of the Environmental Education projects promoted by the Environmental Promotion Institute.

- The preparation of material for the promotion of Environmental Education - Environmental Agenda.

10 - INTERNATIONAL COOPERATION

10.1 - COOPERATION

One of the objectives of Portuguese foreign policy is to improve relations be-tween Portugal and Portuguese speaking African countries. One of the as-pects of the above referred to policy is therefore cooperation in Africa in general and Portuguese speaking Africa in particular.

Cooperation policy may be examined in various component parts: instrumental (strengthening the foreign position of the Portuguese State); historical; and as Public Development Aid.

Portugal, in this latter aspect of Public Development Aid, is one of the donor countries of the European Union (Lomé IV Agreement), the OECD Committee for Development Assistance, UNO Agencies and Bretton Woods Institutions.

Reference should be made to the objective proposed by the United Nations General Assembly and Rio Conference in 1992 for the industrialised countries to increase their Public Development Aid to amounts, as close as possible to 0.7% of GNP.

The assistance and development policy adhered to by Portugal has, *inter alia*, as its basic principles, the requirement for a sustained and shared de-velopment and it is with this in mind that environmental issues have become of increasing importance on a level of priority areas for Portuguese cooperation.

Sectoral cooperation on a technical and industrial level applies basically to agriculture, fisheries, industry, banking, tourism and the hotel sector, the environment, the provision of assistance for the exports of Portuguese speaking African Countries and vocational training.

Accordingly, the sectoral structure of bilateral Public Development Aid for 1993 (excluding financial flows) was distributed as follows:

Services and social infrastructures	64.6%
Productive sectors	12.7%
Food and emergency aid	8.7%
Services and economic structures	3.7%
Environment (not including Services and Environmental Infrastructures)	1.0%
Others	9.4%

Direct investment in Portuguese speaking African Countries has been mainly targeted at the business and hotel trade areas, banking and insurance companies, public works and construction.

The activity performed by the Economic Cooperation Fund in support of business cooperation and private initiative through incentives and short term interest rate reductions has been an important factor.

In light of the growing globalisation of foreign policies and political and economic interdependence in today's world, multilateral activities appear to be extremely effective and reinforce bilateral cooperation.

In short: this type of cooperation may help to expand Portugal's involvement in international aid development policy.

Portugal has also cooperated with the South African Development Community (SADC), the Regional African Organisation handling various projects: Cultural Databases, Phytogenetic Databases, Geographical Databases for Environmental Applications, support for the Administrative Technical Union of the Energy Sector, support for the Water Survey for hydrological applications in the basin of the Zambese and study of the Cunene Basin.

10.2 - **GUIDELINES FOR PORTUGUESE COOPERATION IN THE FUTURE**

To intensify international cooperation insofar as Portugal attributes the greatest importance to the North-South dialogue with priority on improving its relations with Portuguese speaking African Countries.

It should be remembered that a major proportion of our Public Development Aid is targeted at cooperation with Portuguese speaking African Countries.

To continue to contribute to the Trust Fund, UNDP and United Nations Programme for the Environment, for financing UNDP and United Nations Programme for the Environment projects in Portuguese speaking African Countries, mainly in the areas of education, training and research, and study.

To guarantee our contribution to the African Development Bank and the African Development Fund for participating in projects in Portuguese speaking and other African Countries.

To keep the promise made by industrial countries to comply with the objective of 0.7% of GNP for Public Development Aid, as soon as possible.

ANNEXES

A.3 - Inventories

MNIMIUM DATA TABLES

Table I
1A - Energy fuel combustion activities

SOURCE CATEGORIES	ACTIVITY DATA (PJ)	EMISSION ESTIMATES (Gg of full mass of pollutant)						AGGREGATE EMISSION FACTOR (kg/GJ)					
		NOx	NMVOC	CH4	C O	CO2	N2O	NOx	NMVOC	CH4	C O	CO2	N2O
1A-FUEL COMBUSTION ACTIVITIES	555 949	210,1	109,4	13,0	1 072,0	45 459,7	5,0	0,378	0,197	0,023	1,928	81,770	0,009
Oil	356 160	162,5	95,2	3,3	625,7	25 327,8	2,5	0,456	0,267	0,009	1,757	71,114	0,007
Gas	0	0,5	0,1	0,0	8,6	13,6	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	109 254	35,1	0,6	0,6	1,3	10 705,4	1,5	0,322	0,005	0,005	0,012	97,987	0,014
Biomass	65 722	11,1	12,7	8,3	436,0	6 773,5	0,7	0,169	0,193	0,127	6,634	103,062	0,011
Other	24 813	0,9	0,7	0,7	0,4	2 639,4	0,3	0,035	0,030	0,030	0,015	106,372	0,014
1A1-Energy and Transformation Activities	238 902	59,6	11,3	2,4	68,2	20 418,9	3,0	0,249	0,047	0,010	0,285	85,470	0,013
Oil	128 127	25,1	10,1	1,5	1,9	9 340,1	1,5	0,196	0,079	0,011	0,015	72,897	0,012
Gas	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	88 355	32,0	0,2	0,2	1,1	8 738,6	1,2	0,362	0,003	0,003	0,012	98,903	0,014
Biomass	10 113	2,0	0,5	0,3	65,0	1 032,6	0,1	0,200	0,050	0,030	6,427	102,104	0,012
Other	12 307	0,4	0,4	0,4	0,2	1 307,6	0,2	0,033	0,030	0,030	0,015	106,251	0,014
1A2-Industry	110 809	17,8	3,0	2,1	264,3	10 006,7	1,4	0,161	0,027	0,019	2,385	90,305	0,012
Oil	38 998	6,0	0,2	0,2	0,5	2 770,3	0,4	0,154	0,006	0,006	0,014	71,036	0,011
Gas	0	0,5	0,1	0,0	8,6	13,6	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	20 862	3,1	0,3	0,3	0,2	1 963,3	0,3	0,150	0,015	0,015	0,010	94,107	0,013
Biomass	38 442	7,7	1,9	1,2	254,7	3 927,7	0,5	0,200	0,050	0,030	6,627	102,171	0,013
Other	12 506	0,5	0,4	0,4	0,2	1 331,8	0,2	0,036	0,030	0,030	0,015	106,491	0,014
1A3-Transport	141 646	108,6	81,4	1,4	614,1	9 946,5	0,4	0,767	0,575	0,010	4,336	70,221	0,003
Oil	141 646	108,6	81,4	1,4	614,1	9 946,5	0,4	0,767	0,575	0,010	4,336	70,221	0,003
Gas	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Biomass	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Other	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
1A4-Commercial/Institutional	25 004	1,6	5,6	3,7	63,2	2 024,8	0,1	0,065	0,224	0,150	2,526	80,978	0,004
Oil	15 714	0,9	0,0	0,0	0,4	1 043,8	0,1	0,057	0,002	0,001	0,024	66,421	0,004
Gas	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	20	0,0	0,0	0,0	0,0	1,9	0,0	0,054	0,092	0,468	0,184	96,519	0,010
Biomass	9 270	0,7	5,6	3,7	62,8	979,1	0,0	0,080	0,600	0,400	6,773	105,622	0,004
Other	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
1A5-Residential	21 300	1,4	4,8	3,2	53,8	1 724,8	0,1	0,065	0,224	0,150	2,526	80,978	0,004
Oil	13 386	0,8	0,0	0,0	0,3	889,1	0,1	0,057	0,002	0,001	0,024	66,421	0,004
Gas	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	17	0,0	0,0	0,0	0,0	1,6	0,0	0,054	0,092	0,468	0,184	96,519	0,011
Biomass	7 897	0,6	4,7	3,2	53,5	834,1	0,0	0,080	0,600	0,400	6,773	105,622	0,004
Other	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
1A6-Agriculture/Forestry	18 288	21,1	3,4	0,2	8,4	1 338,1	0,0	1,155	0,185	0,009	0,462	73,167	0,002
Oil	18 288	21,1	3,4	0,2	8,4	1 338,1	0,0	1,155	0,185	0,009	0,462	73,167	0,002
Gas	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Coal	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Biomass	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Other	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
1A7-Other	0	0,0	0,0	0,0	0,0	0,0	0,0	0,000	0,000	0,000	0,000	0,000	0,000
Air and Marine Bunkers (Total)	47 310	43,0	32,2	0,6	243,2	3 938,2	0,2	0,909	0,681	0,012	5,140	0,000	0,003

Table II
1B1 - Fugitive fuel emissions (oil and gas)

SOURCE CATEGORIES	ACTIVITY DATA Fuel Quantity (Gg)	EMISSION ESTIMATES (Gg)		AGGREGATE EMISSION FACTOR (kg/Gg)	
		NMVOC	CH4	NMVOC	CH4
1B1-FUGITIVE FUEL EMISSIONS	16 394	7,6	0,010	0,466	0,001
1B1 a-Crude Oil (Total)	16 394	7,6	0,010	0,466	0,001
1B1 a1-Production	0	0,0	0,000	0,000	0,000
1B1 a2-Transported	12 893	3,9	0,000	0,300	0,000
1B1 a3-Refined	0	0,0	0,000	0,000	0,000
1B1 a4-Distribuition of Oil Products	3 501	3,8	0,010	1,078	0,003
1B1 b-Natural Gas (Total)	0	0,0	0,000	0,000	0,000
1B1 c-Oil/Gas Joint Production	0	0,0	0,000	0,000	0,000

Table III
1B2 - Fugitive fuel emissions (coal mining)

SOURCE CATEGORIES	ACTIVITY DATA Production (t)	EMISSION ESTIMATES (Gg) Total CH4	AGGREGATE EMISSION FACTOR (kg/t)
1B2-FUGITIVE FUEL EMISSIONS	281 117	2,0	7,000
1B2 a-Surface	232 119	1,6	7,000
1B2 b-Underground	48 998	0,3	7,000

Table IV

2 - Industrial processes

SOURCE CATEGORIES	Production Quantity (t)	EMISSION ESTIMATES (Gg)						AGGREGATE EMISSION FACTOR (Kg/t)					
		NOx	NMVOC	CH4	CO	CO2	N20	NOx	NMVOC	CH4	CO	CO2	N20
2-INDUSTRIAL PROCESSES	21754115	4.4	15.4	0.4	10.7	3462.1	1.9	0.201	0.707	0.017	0.490	159.147	0.089
2A-IRON AND STEEL	1132000	0.0	0.1		10.7	35.0	0.0	0.034	0.077	0.009	9.417	30.943	0.000
2B-NON-FERROUS METAL	1049	0.0	0.0	0.0	0.0	2.7	0.0	0.000	0.000	0.000	0.000	2573.880	0.000
2B1- ALUMINIUM PRODUCTION	0	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	0.000
2B2- OTHER	1049	0.0	0.0	0.0	0.0	2.7	0.0	0.000	0.000	0.000	0.000	2573.880	0.000
2C-INORGANIC CHEMICALS	1378564	1.7	1.4	0.4	0.0	277.5	1.9	1.234	1.018	0.255	0.000	201.296	1.411
2C1-NITRIC ACID	243084	1.7	0.0	0.0	0.0	0.0	1.9	7.000	0.000	0.000	0.000	0.000	8.000
2C2-FERTILIZER PRODUCTION	743893	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	0.000
2C3- OTHER	391587	0.0	1.4	0.4	0.0	277.5	0.0	0.000	3.585	0.896	0.000	708.655	0.000
2D-ORGANIC CHEMICALS	956816	0.0	4.7	0.0	0.0	0.0	0.0	0.000	4.918	0.000	0.000	0.000	0.000
2D1-ADIPIC ACID	0	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	0.000
2D2-OTHER	956816	0.0	4.7	0.0	0.0	0.0	0.0	0.000	4.918	0.000	0.000	0.000	0.000
2E-NON-METALLIC MINERAL PRODUCTS	7630828	0.0	0.0	0.0	0.0	3140.2	0.0	0.000	0.000	0.000	0.000	411.511	0.000
2E1-CEMENT	6500869	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	0.000
2E2-LIME	236457	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	0.000	0.000
2E3-OTHER	893502	0.0	0.0	0.0	0.0	36.6	0.0	0.000	0.000	0.000	0.000	40.962	0.000
2F-OTHER	10654858	2.6	9.2	0.0	0.0	6.7	0.0	0.248	0.862	0.000	0.000	0.629	0.000

Table V
3 - Solvents

SOURCE CATEGORIES	ACTIVITY DATA Quantity Consumed (t)	EMISSION ESTIMATES (Gg) NMVOC	AGGREGATE EMISSION FACTOR (t/t)
3-SOLVENT USE	202 254	67,1	0,332
3A-PAINT APPLICATION	30 142	26,3	0,874
3B-DEGREASING AND DRY CLEANING	2 391	2,4	0,998
3C-CHEMICAL PRODUCTS MANUFACTURE OR PROCESSING	132 270	6,3	0,047
3D-OTHER	37 451	32,2	0,859

Table VI
A & B - Enteric fermentation & animal wastes

SOURCE CATEGORIES	ACTIVITY DATA Number of Animals (1000)	EMISSION ESTIMATES CH4 (Gg) Enteric Fermentation	Animal Wastes	AGGREGATE EMISSION FACTOR (kg CH4/Animal) Enteric Fermentation	Animal Wastes
4A & B-ENTERIC FERMENTATION AND ANIMAL WASTES	7 170	104,8	58,6	14,615	8,168
4A & B 1a-Cattle/Beef	871	41,8	17,4	48,000	20,000
4A & B 1b-Cattle/Dairy	327	32,7	14,4	100,000	44,000
4A & B 2-Goats	696	3,5	0,1	5,000	0,200
4A & B 3-Sheep	2 909	23,3	0,6	8,000	0,200
4A & B 4-Pigs	2 368	3,6	26,0	1,500	11,000
4A & B 5-Horses/Mules/Asses	NE	NE	NE	NE	NE
4A & B 6-Buffalo	0	0,0	0,0	0,000	0,000
4A & B 7-Camels and Llamas	0	0,0	0,0	0,000	0,000
4A & B 8-Other		0,0	0,0	0,000	0,000

Table VII
4C - Rice cultivation

SOURCE CATEGORIES	ACTIVITY DATA Area Cultivated (Mha)	EMISSION ESTIMATES (Gg) CH4	AGGREGATE EMISSION FACTOR (kg/ha)
4C-RICE CULTIVATION	34	12,9	380,070
4C1-Flooded regime	34	12,9	380,070

Table VIII
4D - Agricultural soils

SOURCE CATEGORIES	ACTIVITY DATA Area Cultivated (Mha)	EMISSION ESTIMATES (Gg N2O) N2O	AGGREGATE EMISSION FACTOR (kg N2O/Ha)
4D-AGRICULTURAL SOILS	3 898	3,6	0,930
4D1-Permanent crops	785	0,7	0,930
4D2-Arable land crops	2 333	2,2	0,930
4D3-Market gardening	32	0,0	0,930
4D4-Grassland	748	0,7	0,930
4D5-Fallows	0	0,0	0,000

Table IX

6A - Wastes: Landfills

SOURCE CATEGORIES	ACTIVITY DATA Landfill discharges (t/year)	EMISSION ESTIMATES (Gg) CH4	AGGREGATE EMISSION FACTOR (kg CH4/kg)
6A-WASTES/LANDFILLS	2 177 794	33,4	0,015

Table X

6B - Wastes: Sewage treatmentWastewater

SOURCE CATEGORIES	ACTIVITY DATA Wastewater BOD5 (t/year)	EMISSION ESTIMATES (Gg) CH4	AGGREGATE EMISSION FACTOR (kg CH4/kg)
6B-WASTEWATER	54 942	1,8	0,033
6B-MUNICIPAL	54 942	1,8	0,033
6B-INDUSTRIAL	ND	NE	

Table XI

6C - Wastes/Other

SOURCE CATEGORIES	ACTIVITY DATA Weight (t/year)	EMISSION ESTIMATES (Gg) CH4	AGGREGATE EMISSION FACTOR (Kg CH4/Kg)
6C-OTHER	113031	NE	NO
SLUDGE SPREADING	22851	NE	NO
COMPOST PRODUCTION	90180	NE	NO

Table XII
Summary report for national greenhouse gas inventories

SOURCE CATEGORIES	EMISSION ESTIMATES (Gg of full mass of pollutant)					
	NOx	COVNM	CH4	C O	CO2	N2O
TOTAL (NET) NATIONAL EMISSIONS	214,5	199,5	226,7	1 082,6	42 148,4*	10,6
1A-FUEL COMBUSTION	210,1	109,4	13,0	1 072,0	38 686,3*	5,0
1A1-ENERGY & TRANSFORMATION ACTIVITIES	59,6	11,3	2,4	68,2	19 386,0*	3,0
1A2-INDUSTRY	17,8	3,0	2,1	264,3	6 079,0*	1,4
1A3-TRANSPORT	108,6	81,4	1,4	614,1	9 946,5*	0,4
1A4-COMMERCIAL/INSTITUTIONAL	1,6	5,6	3,7	63,2	1 045,0*	0,1
1A5-RESIDENTIAL	1,4	4,8	3,2	53,8	891,0*	0,1
1A6-AGRICULTURE/FORESTRY	21,1	3,4	0,2	8,4	1338,1*	0,0
1A7-OTHER	NA	NA	NA	NA	NA	NA
BIOMASS BURNED FOR ENERGY	11,1	12,7	8,3	436,0	6 773,5	0,7
TRADITIONAL BIOMASS BURNED FOR ENERGY	NA	NA	NA	NA	NA	NA
1B-FUGITIVE EMISSIONS	NA	7,6	2,0	NA	NA	NA
1B1-CRUDE OIL AND NATURAL GAS SYSTEMS	NA	7,6	0,0	NA	NA	NA
1B2-COAL MINING	NA	NA	2,0	NA	NA	NA
2-INDUSTRIAL PROCESSES	4,4	15,4	0,4	10,7	3 462,1	1,9
2A-IRON AND STEEL	NA	0,1	NA	10,7	35,0	NA
2B-NON-FERROUS METALS	NA	NA	NA	NA	2,7	NA
2C-INORGANIC CHEMICALS	1,7	1,4	0,4	0,0	277,5	1,9
2D-ORGANIC CHEMICALS	NA	4,7	0,0	NA	NA	NA
2E-NON-METALLIC MINERAL PRODUCTS	NA	NA	NA	NA	3 140,2	NA
2F-OTHER	2,6	9,2	0,0	0,0	6,7	0,0
3-SOLVENTS USE	NA	67,1	0,0	NA	NA	NA
3A-PAINT APPLICATION	NA	26,3	0,0	NA	NA	NA
3B-DEGREASING AND DRY CLEANING	NA	2,4	0,0	NA	NA	NA
3C-CHEMICALPRODUCTS MANUFACTURE/PROCESSING	NA	6,3	0,0	NA	NA	NA
3D-OTHER	NA	32,2	0,0	NA	NA	NA
4-AGRICULTURE	NA	NA	176,3	NA	NA	3,6
4A-ENTERIC FERMENTATION	NA	NA	104,8	NA	NA	NA
4B-ANIMAL WASTES	NA	NA	58,6	NA	NA	NA
4C-RICE CULTIVATION	NA	NA	12,9	NA	NA	NA
4D-AGRICULTURAL SOILS	NA	NA	NA	NA	NA	3,6
4E-AGRICULTURAL WASTE BURNING	NE	NE	NE	NE	NE	NE
4F-SAVANNAH BURNING	NA	NA	NA	NA	NA	NA
5-LAND USE CHANGE & FORESTRY	NE	NE	NE	NE	NE	NE
6-WASTES	NA	NA	35,2	NA	NA	NA
6A-LANDFILLS	NA	NA	33,4	NA	NA	NA
6B-WASTEWATER	NA	NA	1,8	NA	NA	NA
6C-OTHER	NA	NA	NA	NA	NA	NA

* Does not include emissions from combustion of biomass

Table XIII
Short summary report for national greenhouse gas inventories

SOURCE CATEGORIES	EMISSION ESTIMATES (Gg of full mass of pollutant)					
	NOx	NMVOC	CH4	CO	CO2	N2O
TOTAL NATIONAL EMISSIONS	214,5	199,5	226,7	1 082,6	42148,4*	10,6
1A-FUEL COMBUSTION	210,1	109,4	13,0	1 072,0	38686,3*	5,0
1B-FUGITIVE FUEL EMISSIONS	0,0	7,6	2,0	0,0	0,0	0,0
2-INDUSTRIAL PROCESSES	4,4	15,4	0,4	10,7	3 462,1	1,9
3-SOLVENTS USE	0,0	67,1	0,0	0,0	0,0	0,0
4-AGRICULTURE	0,0	0,0	176,3	0,0	0,0	3,6
4A-ENTERIC FERMENTATION	0,0	0,0	104,8	0,0	0,0	0,0
4B-ANIMAL WASTES	0,0	0,0	58,6	0,0	0,0	0,0
4C-RICE CULTIVATION	0,0	0,0	12,9	0,0	0,0	0,0
4D-AGRICULTURAL SOILS	0,0	0,0	0,0	0,0	0,0	3,6
4E-AGRICULTURAL WASTES BURNING	0,0	0,0	0,0	0,0	0,0	0,0
4F-SAVANNAH BURNING	0,0	0,0	0,0	0,0	0,0	0,0
5-LAND USE CHANGE & FORESTRY	0,0	0,0	0,0	0,0	0,0	0,0
6-WASTE	0,0	0,0	35,2	0,0	0,0	0,0

* Does not include emissions from combustion of biomass

Table XIV
Overview table for national greenhouse gas inventories

SOURCE CATEGORIES	CO2 Estimate	CO2 Quality	CH4 Estimate	CH4 Quality	N2O Estimate	N2O Quality	NOx Estimate	NOx Quality	C O Estimate	C O Quality	NMVOC Estimate	NMVOC Quality	Documentation	Disaggregation
1A-FUEL COMBUSTION	All	H	All	M	All	M	All	M	All	M	All	M	H	2
1B-FUGITIVE FUEL EMISSIONS	NA		Part	M	NA		NA		NA		Part	M	M	2
2-INDUSTRIAL PROCESSES	All	M	All	M	All	M	All	M	All	M	All	M	H	2
3-SOLVENTS USE	NA		NA		NA		NA		NA		Part	M	H	1
4-AGRICULTURE							NA							
4A-ENTERIC FERMENTATION	NA		All	M	NA		NA		NA		NA		M	1
4B-ANIMAL WASTES	NA		All	M	NA		NA		NA		NA		M	1
4C-RICE CULTIVATION	NA		All	M	IE		NA		NA		NA		M	1
4D-AGRICULTURAL SOILS	NA		NA		Part	M	NA		NA		NA		M	1
4E-AGRICULTURAL WASTES BURNING	NE		NE		NE		NE		NE		NE			
4F-SAVANNAH BURNING	NA		NA		NA		NA		NA		NA			
5-LAND USE CHANGE & FORESTRY	NE		NA		NA		NA		NA		NA			
6-WASTES	NA		All	L	NA		NA		NA		NA		M	1

Explanation of keys

ESTIMATES CODE	ESTIMATES MEANING	QUALITY OF ESTIMATES CODE	QUALITY OF ESTIMATES MEANING	DOCUMENTATION CODE	DOCUMENTATION MEANING	DISAGGREGATION CODE	DISAGGREGATION MEANING
Part	Partial estimate	H	High confidence	H	All background information included	1	Total emissions estimated
All	Full estimate	M	Medium confidence	M	Some background information included	2	Sectoral split
NE	Not estimated	L	Low confidence	L	Only emissions estmates included	3	Sub-sectoral split
IE	Included elsewhere						
NO	Not ocurring						
NA	Not applicable						

A.5 - Emission Projections

Projections for CO_2 emissions from energy sector

(Prepared by Directorate General for Energy)

Projection of emissions

Mt CO_2	1990	1995	2000
By type of fuel			
Coal	10,09	12,77	16,23
Liquified petroleum products	30,79	36,09	37,25
Derivative gases	0,23	0,41	0,12
Natural gas			4,51
Biomass	2,85	2,90	3,06
Others	2,40	0,62	0,69
Total	44,37	52,78	61,87
Total excluding biomass and others	41,11	49,27	58,12
By sector			
Electricity production	14,51	16,08	18,37
Refining	1,28	0,95	0,95
Industrial combustion	7,77	9,13	11,39
Road transport	9,45	12,74	15,40
Other mobile sources and machinery	0,17	0,21	0,21
Domestic/Services	2,71	3,30	3,64
Agriculture	1,37	2,00	2,37
Biomass for energy	3,25	3,51	3,75
Aviation bunkers	1,78	2,49	2,80
Marine bunkers	2,08	2,38	3,01
Total	44,36	52,79	61,87
Total excluding biomass	41,11	49,28	58,12
Total excluding bunkers	40,51	47,92	56,07
Total excluding bunkers and biomass	37,26	44,41	52,32

The following tables set out the consumption of fuel for 1990 and forecasts for 1995 and 2000 by form of energy and sector, subject to the calculations of CO_2 emissions and the main calculation premises.

Fuel Consumption

Mtoe	1990	1995	2000
Primary Energy			
Total	16,48	19,13	22,59
Coal	2,76	3,45	4,37
Liquified petroleum products	11,78	13,52	14,02
Derivative gases			
Natural gas			1,89
Biomass	0,95	0,95	1,00
Renewable	0,79	1,01	1,06
Other	0,20	0,20	0,25
Electricity production			
Total	4,31	4,79	5,63
Coal	2,03	2,50	3,12
Liquified petroleum products	2,11	2,05	1,46
Derivative gases	0,02	0,02	0,02
Natural gas			0,78
Biomass	0,02	0,02	0,02
Other	0,13	0,23	0,23
Refinery			
Total	0,51	0,38	0,38
Coal			
Liquified petroleum products	0,51	0,38	0,38
Derivative gases			
Natural gas			
Biomass			
Other			
Industrial Combustion			
Total	2,78	3,30	4,18
Coal	0,66	0,90	1,20
Liquified petroleum products	1,66	1,81	1,54
Derivative gases	0,04	0,04	0,04
Natural gas			0,80
Biomass	0,53	0,55	0,60
Other			

Fuel Consumption

Mtoe	1990	1995	2000
Road Transport			
Total	3,09	4,16	5,03
Coal			
Liquified petroleum products	3,09	4,16	5,03
Derivative gases			
Natural gas			
Biomass			
Other			
Other Mobile Sources and Machinery			
Total	0,06	0,07	0,07
Coal			
Liquified petroleum products	0,06	0,07	0,07
Derivative gases			
Natural gas			
Biomass			
Other			
Domestic/Services			
Total	1,37	1,59	1,71
Coal			
Liquified petroleum products	0,90	1,04	1,01
Derivative gases	0,06	0,15	0,00
Natural gas			0,30
Biomass	0,41	0,40	0,40
Other			
Agriculture			
Total	0,45	0,66	0,78
Coal			
Liquified petroleum products	0,45	0,66	0,78
Derivative gases			
Natural gas			
Biomass			
Other			
Aviation Bunkers	0,57	0,80	0,90
Marine Bunkers	0,66	0,75	0,95

Calculation premises

	Unit	1990	Index 1990=100	
			1995	2000
GDP	MPTE90	8,507	101,8	105,2
Population	M	9,866	100,1	100,3
Total number of vehicles in circulation	M	2,126	133,2	156,9
Average distance travelled	Km	9700	113,4	123,6

Emission factors (t CO_2/toe)

	Coal	Refinery Gas	Fuel oil	Gas oil	Petrol	LPG	Derivative Gases	Natural Gas	Biomass	Others
Electricity Production	3,757		3,246	3,049			2,057		3,000	3,000
Refining		2,057	3,246							
Industrial Combustion	3,757		3,246	3,049	3,073	2,770	2,057		3,000	
Road Transport				3,049	3,073					
Other mobile sources and machinery				3,049						
Domestic/Services			3,246	3,049		2,770	2,057		3,000	
Agriculture			3,246	3,049		2,770				
Aviation bunkers					3,107					
Marine bunkers			3,246	3,049						

DEFINITIONS AND SOURCES

Sectors

Electricity production including public utilities and self production

Industrial combustion including transforming industry and mining, excluding raw material

Other mobile sources and machinery - including rail transport

Domestic/Services - including construction and public works

Aviation bunkers - including national and foreign aircraft

Marine Bunkers - includes national, foreign and coastal fishing vessels

Fuels

Coal including mineral coal, anthracite and coke

Gas oil - including gas oil crude oil and diesel

Petrol - including gasoline and jet fuel

Derivative gases - including town gas, coke gas, kiln gas and propane

Biomass - including wood and vegetation wastes

Others - including sulphitic liqueurs and other wastes from industrial processes

Sources

DGE, National Energy Statistics, 1990

IEA, Energy Statistics, 1990

DGE, Modelling of Energy Consumption in Portugal, 1993-1996

Forecasts sent to IEA, 1995 and 2000