AGÊNCIA PORTUGUESA DO AMBIENTE

# SIXTH NATIONAL COMMUNICATION TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

## THIRD NATIONAL COMMUNICATION IN THE CONTEXT OF THE KYOTO PROTOCOL

**Portugal**

Amadora

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# Acronyms

| | |
|---|---|
| **APA** | Portuguese Environment Agency |
| **AR** | Portuguese Parliament |
| **ARA** | Autonomous Region of the Azores |
| **ARM** | Autonomous Region of Madeira |
| **CC** | Climate Change |
| **CDM** | Clean Development Mechanism |
| **CECAC** | Climate Change Commission, Executive Committee |
| **CLRTAP** | Convention on Long Range Transboundary Air Pollution |
| **CPLP** | Community of Portuguese Speaking Countries |
| **CRF** | Common Report Format |
| **CRP** | Constitution of the Portuguese Republic |
| **DGADR** | Directorate-General for Agriculture and Rural Development |
| **DGAV** | Directorate-General for Food and Veterinary |
| **DGEG** | Directorate-General for Economic Activities |
| **DGEG** | Directorate - General of Energy and Geology |
| **DGT** | Directorate - General of Territory |
| **ECV** | Essential Climate Variables |
| **EDF** | European Development Fund. |
| **EEA** | European Environmental Agency |
| **EFAP** | Economic and Financial Assistance Programme |
| **ENAAC** | National Climate Change Adaptation Strategy |
| **ENDS** | National Strategy for Sustainable Development |
| **ENGO** | Environmental Non-Governmental Organizations |
| **ENRRUBDA** | National Strategy for the reduction of the amount of biodegradable municipal waste |
| **EPB** | European Polar Board |
| **ES** | Education System |
| **ESA** | European Space Agency |
| **ESU** | Environmental Education for Sustainability |
| **EU** | European Union |
| **EU ETS** | European Union Emissions Trading Scheme |
| **FCT** | Foundation for Science and Technology |
| **FEC** | Final Energy Consumption |
| **FPC** | Portuguese Carbon Fund |
| **GAW** | Global Atmosphere Watch |
| **GCOS** | Global Climate Observing System |
| **GDI** | Gross Domestic Income |
| **GDP** | Gross Domestic Product |
| **GHG** | Greenhouse Gas |
| **GOP** | Major Planning Options |
| **GOS** | Global Observing System |
| **GPE** | Office of Strategy and Planning of the Ministry of Economy |
| **GPP** | Office of Planning and Policy of Ministry of Agriculture and Sea |
| **GTEAS** | Working Group on Environmental Education for Sustainability |
| **GVA** | Gross Value Added |

| | |
|---|---|
| **HFC** | Hydrofluorocarbons |
| **HI** | Hydrographic Institute |
| **HICP** | Harmonised Index of Consumer Prices |
| **IC** | Joint Implementation |
| **ICC** | Inter ministerial Commission for Cooperation |
| **ICNF** | Institute for Nature Conservation and Forestry |
| **ICT** | Information and Communication Technology |
| **IFAP** | Financing Institute of Agriculture and Fisheries |
| **IHP** | Index of Hydro Production |
| **IMOP** | Instruments and Methods of Observation Programme |
| **IMT** | Institute for Mobility and Transport. |
| **INAC** | National Civil Aviation Institute |
| **INE** | National Statistics Institute |
| **INERPA** | National Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of Air Pollutants |
| **INIAV** | National Institute for Agricultural and Veterinary Research |
| **IPAD** | Portuguese Institute for Development Support |
| **IPC** | Indicative Cooperation Programs |
| **IPMA** | Portuguese Institute of Sea and Atmosphere |
| **IUCN** | International Union for Conservation of Nature |
| **KP** | Kyoto Protocol |
| **LBSE** | Law on the Education System |
| **LULUCF** | Land Use, Land-Use Change and Forestry |
| **MDG** | Millennium Development Goals |
| **MoU** | Memoranda of Understanding |
| **MW** | Municipal (urban) Waste |
| **NGDO** | Non-Governmental Development Organizations |
| **NIR** | National Inventory Report |
| **NREE** | National Register of ENGO and Equivalents |
| **NUW** | Non- Municipal Waste |
| **NWMP** | National Waste Management Plan |
| **ODA** | Official Development Assistance |
| **OECD** | Organization for Economic Cooperation and Development |
| **PALOP** | Portuguese Speaking Countries |
| **PEC** | Primary Energy Consumption |
| **PEGRA** | Strategic Waste Management Plan for the Azores |
| **PERH** | Strategic Hospital Waste Plan 2011-2016 |
| **PERSU II** | Strategic Plan for Municipal Solid Waste 2007-2016 |
| **PESGRI** | Strategic Plan for Industrial Waste Management 2013-2020 |
| **PNDFCI** | National Plan for the Protection of Forest Fire |
| **PR** | President of the Republic |
| **PREMAC** | Central Administration Improvement and Production Plan |
| **PW** | Packaging Waste |
| **RCM** | Resolution of the Council of Ministers |
| **RCP** | Representative Concentration Pathways |
| **RES** | Renewable Energy Sources |

| | |
|---|---|
| **RIWS** | Regional Information Waste System |
| **SCAR** | Scientific Committee for Antartic Research |
| **SIRAPA** | Integrated System of Registration of the Portuguese Environmental Agency |
| **SNIERPA** | National Inventory System of Emissions by Sources of Removals by Sinks of Air Pollutants |
| **SRAM** | Regional Secretariat for the Environment and the Sea |
| **TOE** | Ton of Oil Equivalent |
| **UNFCCC** | United Nations Framework Convention on Climate Changes |
| **WCP** | World Climate Programme |
| **WEEE** | Waste of Electrical and Electronic Equipment |
| **WHYCOS** | World Hydrological Cycle Observing System |
| **WMO** | World Meteorological Organization |
| **WTO** | World Trade Organization |
| **WWW** | World Weather Watch |

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# Executive Summary

The Sixth National Communication to the United Nations Framework Convention on Climate Change (Third National Communication in the context of the Kyoto Protocol) hereby presented, is organised in eight chapters, in accordance with articles 4 and 12 of the Convention as well as the guidelines adopted in its 5th session (Decision 4/CP.5), as follows: national circumstances; information concerning the national system and greenhouse gas (GHG) inventory, information about policies and measures, projections of greenhouse gas emissions; impacts, vulnerability and adaptation, financial commitments; technology transfer, and international cooperation; systematic research and observation and, finally, education, training and awareness of the people.

The objective is to have a document containing information covering the 1990-2013 period, coherent with the National Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of air pollutants, previously submitted to the Convention (2013).

Portugal is bound by GHG limitation commitments, agreed in the context of the Kyoto Protocol and the European Union's Burden Sharing Agreement[1], to a 27% increase in GHG emissions by 2008-2012, relative to 1990. The main instruments geared towards compliance with the national GHG emissions target and, more broadly, the implementation of the Kyoto Protocol includes the National Climate Change Programme[2] (PNAC), the System to Monitor it – CumprirQuioto, the National System for the Estimation of Emissions by Sources and Removals by Sinks of Air Pollutants [3] (SNIERPA), the participation in the EU-ETS as defined by the National Allocation Plan[4] (PNALE) and the Portuguese Carbon Fund[5].

**National Circumstances**

The Portuguese Republic is a democratic State that is based upon the sovereignty of the people, the pluralism of democratic expression and democratic political organisation, and respect and effective guarantees for fundamental rights and freedoms and the separation and inter-dependence of powers, aiming to achieve economic, social and cultural democracy and a more participative democracy. It is a unitary State that is structured and acts under the rule of the self-governing system of the islands and under subsidiarity principles like the autonomy of local authorities and the democratic decentralisation of the public service. The archipelagos of the Azores and Madeira are autonomous regions with their own political and administrative statutes and their own institutions of self-government.

In relation to climate change, and impacts related to them, the organic structure of the XIX Constitutional Government of Portugal designates the Ministry for Environment, Spatial Planning and Energy (MAOTE) to carry out climate policy in order to achieve a competitive, resilient and low-carbon economy.

Portugal mainland covers an area of about 89,000 km2 and has a perimeter of 2,600 km, half of which corresponds to coastline with the Atlantic Ocean and the rest to the border, Northeast with Spain. Apart from the mainland, Portugal also includes the archipelagos of the Azores and Madeira.

The factors that most influence the weather conditions in mainland Portugal are latitude, orography and the influence of the Atlantic Ocean; some climate variables such as precipitation and air temperature have strong North-South and West-East gradients and high seasonal and inter-annual variability. Since the 70's

[1] Decision 2002/358/CE of the Council, of 25 April 2002, on the approval, on behalf of the European Community, the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and the joint compliance of their commitments. OJ L 130, May the 15th,pp. 1–20. Under this decision, the Member-States are jointly responsible for European Union's compliance with its quantified reduction objective. In this context, Portugal should not exceed, in the 5 year compliance period, its Assigned Amount (AA) of 385 970.45 kt $CO_2$e.

[2] Council of Ministers Resolution 104/2006, August the 23rd and Council of Ministers Resolution 1/2008, January the 4th.

[3] Council of Ministers Resolution 68/2005, March the 17th.

[4] Council of Ministers Resolution 1/2008, January the 4th and Decree- Law 154/2009, July the 6th.

[5] Decree-Law 71/2006, of March the 24th and Law 64-A/2008, December the 31st.

the mean air temperature has been rising in all regions of Portugal, at 0.3 ° C / decade. Note that from the 10 hottest years, seven occurred after 1990. 1997 was the hottest year. Regarding precipitation, the last 20 years have been particularly dry in Portugal mainland. Also note that five of the 10 driest years occurred after 2000.

According to data collected in the last Census of Population and Housing, 2011, the resident population in Portugal was estimated at 10,562,178. One of the major demographic phenomena that characterized the last decade in Portugal is the trend of the inversion of the age pyramid with an increase of age disparity between the younger (≤ 14 years) and the elder population (≥ 70 years).

Since 2000 the Portuguese economy has been showing significant difficulties in ensuring economic growth, which was aggravated, since 2008, by the international economic and financial crisis and forced a program of economic and financial adjustment. The recessive flow of international trade and investment, due to the financial crisis in 2008, reinforced the need for the adjustment of the Portuguese economy, which result in a higher unemployment (15.7% in 2012). During the past decade, the Portuguese economy showed an unbalanced trade balance. However, during the adjustment program, there has been a positive change in order to balance the international trade balance. The GVA structure has remained relatively constant. Nevertheless, the improvement of the Portuguese economy should undergo an increasing incorporation of added value in the external demand through exports.

The primary energy consumption in Portugal decreased 11.3% between 2007 and 2011. Portugal reduced the per capita consumption from 2.39 toe in 2007 to 2.14 toe in 2011. In relative terms, oil is still essential to meet energy demand, representing, in 2011, 45.9 % of total primary energy consumption. The introduction of natural gas, in 1997, contributed to decrease oil consumption, made possible the diversification of the structure of energy supply and reduced the dependence on foreign oil. The use of natural gas has a positive evolution, registering 15.1% in 2007 and 19.9 % in 2011.

Electricity production from renewable sources is highly dependent on the variations of the large hydropower plants and represented 48.8 % of total electricity production in 2011.

Considering the correction values of hydropower, according to the hydropower production Index (HPI) for each year, the result of the annual average contribution of renewable sources to the electricity production was 46.7 % between 2007 and 2011, in an mean hydrological scenario.

In what concerns to the evolution of final energy consumption by sector, the industrial sector, which represented 31.3 % of total final energy consumption in 2007, corresponded to 32.0 % in 2011. On the other hand the transport sector shows a percentage of 36.7 in 2007, slightly higher than the 36.4 % that were registered in 2011. Finally, the residential sector and the services sector represented 28.5 % of total consumption.

In 2011, the energy intensity on the primary energy consumption was 132 toe/$10^6$ Euros 2006. In terms of final energy consumption, it was of 97 toe/$10^6$ Euros 2006. The comparison between the results of 2011 with those of 1990 and 2007 show a constant positive evolution in the efficiency of the power sector systems and infrastructure. This growth corresponds to a reduction of the intensity of primary energy in GDP when related to the intensity of final energy. In 2010, the carbon intensity in Portugal was 0:41 $tCO_2$million Euros.

The transports in Portugal have been a major source of GHG emissions and major causes arrive from the changes in the last decades.

There is a clear decreasing trend in the total number of Passengers Travelling by Road Transport and Railway from 1991 to 2011 (33, 64% and 45, 82%, respectively). As for individual transport, a big increase has been verified, with more than doubled change rate since 1991 to 2011 in passenger vehicles. Fuel

consumption also shows a positive evolution, deriving from the diesel (141.05%) and the liquefied petroleum gas (51.314, 55 %) although with a negative change rate in the gasoline (-18.04%).

As for air transport, there has been a growth in Total Passenger Embarking on Scheduled Flights, an indicator that displays an absolute change rate of 6.630.361 passengers, which is equivalent, in relative terms, to 85.2%, from 2001 to 2011. In opposition to this trend, the indicator of the Total Passengers Embarking on Non-Scheduled Flights shows, for the same time period, a general decrease in the numbers of passengers.

In what concerns to Sea Transport, the indicator on the Passengers Movement in Ports in Portugal shows a general increase in the total number registered.

Despite the recorded differences between NUTS II, the Portuguese residential scenario reflects a growth in the housing stock in all regions examined. There was an increase of 657 313 buildings for family housing, territorially distributed by the Mainland (616,458), the Authonomous Region of Azores (ARA) (17,215) and the Authonomous Region of Madeira (ARM) (23,640). It's also noted an increasing trend of the number of buildings per $km^2$, especially in the ARM that shows a change rate of 23.55% in the 1991-2011 period. The analysis of this indicator should be coordinated with the number of residential dwellings per $km^2$, through which there is an increasing urban pressure upon the geographic area.

The Portuguese agriculture has shown in last years a positive performance regarding sustainability, which is evidenced by several agro-environmental indicators, in contrast to some retraction on the economic performance. This lead to the positive trend in terms of GHG emissions, which makes agriculture sector the only one that reduced emissions since 1990. In the period under review, the composition of the UAA according to major surface types has radically changed indicating the extensification of agricultural systems in Portugal. In 2009, the "arable land", comprising main arable crops, represents 32% of the UAA and almost half (49%) came to be occupied by permanent pastures. Between 1989 and 2009, the shift from arable crops (cereals) to permanent pastures was the major change in agriculture land occupation, resulting in a drop of use of fertilizers and soil carbon sequestration. Permanent crops also had some area reduction, but accompanied by productivity increases, namely in olive oil, which had new plantations, but older trees were abandoned or even pulled out.

The livestock evolution in Portuguese farms resulted in decreases in pigs and sheep and increases or stabilization in other species, from 1989 until 2009.

From energy consumption in agriculture indicator (direct on farm), we can verify that the sector is becoming more efficient through the period.

Organic farming showed a marked increase, from around 7.000 ha in 1994 to more than 220.000 ha in 2011, and the adoption of practices of soil improvement and erosion control has been growing, also.

Forest land has decreased slightly over the last years, despite the increases in afforestation areas. Forest composition has undergone some major shifts (eucalyptus became the major species, replacing pinus trees), but one of the main drivers for forest areas evolution have been fires that have reached huge proportions. Nevertheless, forestry resources play an important role in the national economy. Effectively, forest fires are one of the major threats to this sector in the country, especially in Mainland, and climatic conditions have been favourable to these occurrences with big damages both in economic, social and environmental terms.

When considered in its entirety, the LULUCF sector has turned from a net-source of emissions in 1990 to an overall net-sink in 2011. The main contributors for this change have been an increase in removals in forest land and in other land and reductions in emissions in cropland and grassland.

The main drivers for this change have been changes in land-use patterns over time, and the introduction of policies for increasing afforestation, improving the system for the prevention and combat of forest fires (introduced after the big fire seasons of 2003 and 2005) and the introduction of carbon sequestration incentives in agricultural and grassland soils.
Until 2010, there was an increasing trend in the production of municipal waste (MW) in Portugal mainland and, in 2011 and 2012; there has been a reversal of the trend, largely related with the economic crisis that Portugal is experiencing. In 2012 the total production of MW in Portugal mainland was about 4.528 million tons (+5 % compared to 2000 ). In the same year, the MW was 454 kg / per capita year, which was below the EU-27 average (502 kg / per capita/year in 2010). The region of Lisbon and Tagus Valley has the highest production of MW, followed by the Northern Region. The preferred destination of the MW is still the landfilling disposal (54 % in 2012).

In recent years society has been witnessing, both at national and Community level , the emergence of integrated waste management systems that , in our country, already exist in the following specific waste streams: packaging and packaging waste, used lubricating oils, used tires, waste electrical and electronic equipment, waste batteries and accumulators and end of life vehicles .

**Information concerning the National System and the Greenhouse Gases Inventory**
The National Inventory System of Emissions by Sources and Removals by Sinks of Air Pollutants (SNIERPA), which was established by Resolution of the Council of Ministers no. 68/2005, of 17th March, includes the institutional and legal definitions and procedures designed to ensure the estimation of emissions by sources and removals by sinks of air pollutants, their report and the archive of all relevant information.

Two SNIERPA instruments guarantee, in technical and methodological terms, the accuracy, completeness and reliability of the inventory: Methodological Development Program (MDP) and Quality Control and Assurance System (QCAS).

According to the National Inventory Report (NIR) 2013 (relative to 2011), GHG emissions, without counting the gas emissions from land use change and forestry (LULUCF), were estimated in 70.0 Mt $CO_2$e, representing an increase of 14.8 % over 1990. Under the EU burden - sharing agreement, Portugal is bind to limit its emissions in the first commitment period to 27 % compared to the 1990 level. After the rapid growth, occurred during the 90s, national emissions slowed down in the early 2000s. In recent years, especially after 2005, a decrease of national emissions was verified. As a matter of fact, in 2011, national emissions are about 20.5 % below the values related to 2005.

In 2011, the energy sector, including transport, remains as the main sector responsible for GHG emissions, representing 69.5 % of national emissions. $CO_2$ gas represented about 74 % of total national emissions in 2011, which is related with the importance of the energy sector and the predominant use of fossil fuels.

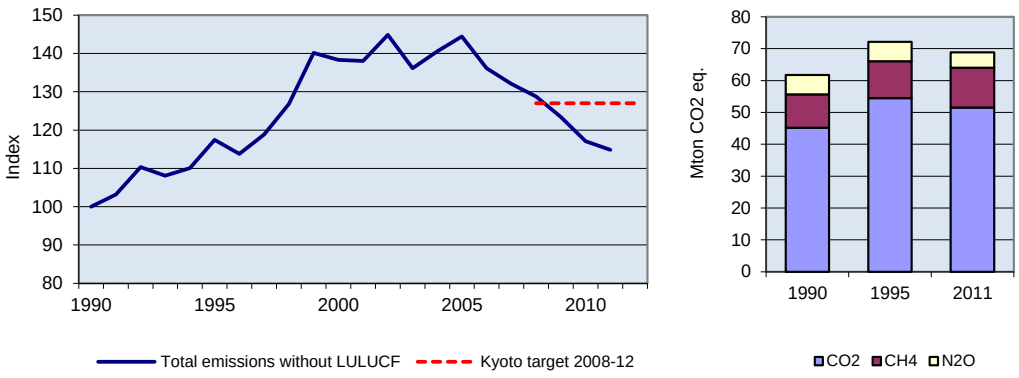



**Figure 0.1**
Development of national GHG emissions (without LULUCF)
**Source**: NIR, 2013

The main factors (key drivers) that explain the emissions reduction since 2005 include: (i) use in " cruising speed" of natural gas, (ii) the unprecedented penetration of renewable energy, (iii) the beginning of scale penetration of biofuels in transport, (iv) energy efficiency in sectors covered by the EU ETS (v) the " green" tax reform on vehicles and, finally, (vi) the present economic crisis (especially 2009-12). Meteorological parameters such as rainfall, which have high inter-annual variability, also have a significant effect in hydroelectric production, which influences very significantly the change rate of the emissions.

The analysis of greenhouse gases emissions per unit of GDP shows that the process of decoupling between GDP and emissions had started only in 2005, which is a result of the "decarbonisation" of the economy, i.e., an economy with less carbon emissions per unit of produced wealth, a trend that predates the current economic crisis.

**Information concerning Policies, Measures and Projections**

Public policies on climate change are now an integral part of a set of sectoral policies in Portugal. In fact, in areas such as energy and industry within the European Union Trade Emissions Licensing, "carbon dimension" is now part of the strategic and economic considerations of the companies concerned. In the agriculture and forestry sector there is a growing awareness of the important contribution to mitigate the emissions of greenhouse gases and to enhance its sink capacity. Even in areas with major challenges such as transport, some steps have already been given in terms of "decarbonization" of the fleet of vehicle , for instance in terms of natural gas in urban bus fleets or the electric vehicle program.

The Kyoto Protocol establishes that the European Union, as a whole, is obliged to reduce greenhouse gases (GHG) emissions by 8 % compared to the numbers registered in 1990. According to a commitment of shared responsibilities at Community level, it was established that Portugal could increase its emissions by 27 % compared to 1990.

The most recent estimated data concerning the Portuguese achievement trajectory under Kyoto shows, at this stage, that Portugal is well on track to comply with its 2008-2012 target. This is mainly due to a recent steady trend (since 2005) of the decarbonization of the economy, which precedes the current economic crisis. Emissions projections up to 2020 and 2030 show that Portugal is also on track to meeting its 2020 target under the EU climate and energy package and Kyoto second commitment period.

**Impacts, Vulnerability and Adaptation**

In 2010, Portugal adopted the National Adaptation Climate Change Strategy (ENAAC) which aims to raise awareness about climate change, keep updated and available scientific knowledge on climate change and its impacts and also strengthen the measures that Portugal has to adopt, as the international community, in order to monitor the effects of climate change.

The ENAAC first phase was marked by its strategic character, i.e., rather than obtaining immediate results such as a long list of possible adaptation measures, the purpose was to introduce this subject in the concerns and matrix analysis of the various sectors of the Portuguese society.

After the analyzing ENAAC`s first phase, the guidelines to the next one are established, which will begin in 2014. The second phase will be based on its strengths and will try to address the weaknesses identified in the first phase. Among others it has been taken into account the revaluation of the number and structures of the sectorial groups number, the strengthening of the interaction between sectors, the reinforcement of ENAAC´s governance structure, the introduction of legal obligations and their alignment with the core of climate policy for the 2013-2020 period.

**Financial, Technology Transfer and International Cooperation commitments**

The Indicative Cooperation Programs (PIC) remain in the current context as the main instrument of Portuguese cooperation with partner countries (PALOP and East Timor - most of which LDC and fragile

States), ensuring the alignment and the predictability of the aid. At this time, there are currently in force the Cape Verde`s PIC, 2011-2014 and Mozambique`s PIC, from 2012 to 2015.

A new strategic document for Portuguese Development Cooperation is being prepared. While the above mentioned process is on-going, new priorities in PICs have been introduced, such as "Entrepreneurship and Enterprise Development" and "Scientific and Technological Training ", "Private Sector Support" and "Climate Change".

Portuguese APD has presented an overall positive trend. In fact, in 2011, the Portuguese Cooperation have overcome the barrier of 500 M € (509 M € more specifically). In what concerns to APD related to climate change, in particular with mitigation, APD represented, between 2007 and 2012, about 51 % to 93 % of APD environment.

**Research and Systematic Observation**

In the period between 2006 and 2012, FCT has financed more than 100 projects of scientific research on climate change, with more than € 15 million budget. Since 2009, 29 research projects in the context of climate change have been developed by national research teams or are being financed by the European Union through the Seventh Framework Program for Research and Technological Development of the European Union. The total financing exceeds EUR 180 million.

As a member of the OMM, Portugal develops and operates several observation networks of weather and climate, in the context of its global programs, in particular the World Weather Watch (WWW) through the Global Observing System (GOS) but also the program of the Global Atmosphere Watch (GAW) and the World Hydrological Cycle Observing System (WHYCOS), also following the Instruments and Methods of Observation Program (IMOP) and the World Climate Program (WCP) of OMM`s recommendations.

In May 2013, there were 158 weather stations operating in Portugal, 144 of which are automatic and 14 are conventional. All stations measure, among other climatic elements, air temperature, intensity and wind direction as well as humidity and precipitation. Almost all of them also measure solar radiation and some of them measure atmospheric pressure.

**Education, Training and Public Awareness**

Environmental themes and contents, namely related to climate change, have been integrated in a cross-cutting way in school curricula of various levels of education in Portugal since the late 70s.

Between 2008 and 2012 more than 200 PhD and post-doctorate scholarships in the field of climate change were financed.

The ministries in charge of education and environment have being cooperating for a long time in the development and support of projects and initiatives related to Environmental Education for Sustainability, many involving Local Authorities, Universities and Government Institutions and Non-Governmental Organizations. In this context, adaptation and mitigation to climate change, greenhouse gas emissions and energy are themes developed in all projects.

Environmental Non-Governmental Organizations (ENGO) and equivalents play a key role in the promotion, protection, awareness and appreciation of the environment, developing activities of public interest with particular emphasis in the field of Environmental Education for Sustainability.

# 1. NATIONAL CIRCUMSTANCES

## 1.1. Government structures and decision-making process

As a territory, Portugal comprises tree geographic areas (Figure 1.1): the mainland (located in the European Plateau), the Azores (located on the convergence of the American, European and African Plateaus,) and the Archipelago of Madeira (located in the African Plateau).

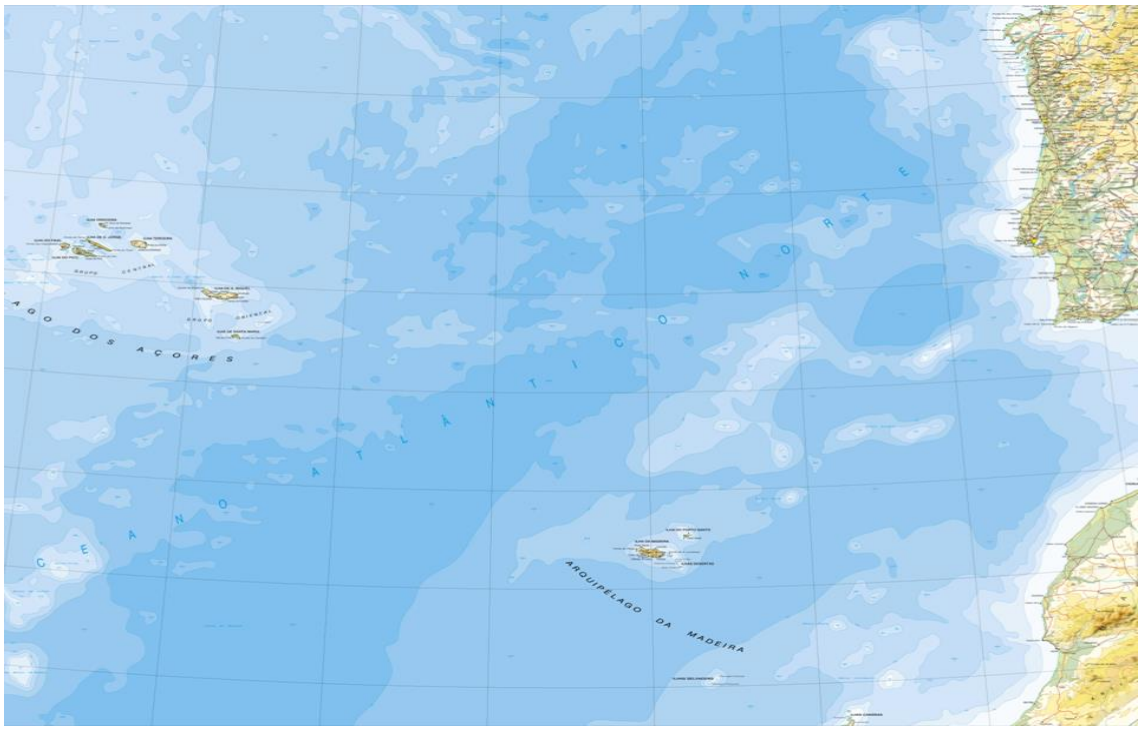



**Figure 1.1**
Map of Portugal (1:2.500.00)
**Source**: DGT, 2013

In accordance with Article 1 of the Constitution of the Portuguese Republic (CPR), Portugal is a Sovereign Republic, based on human dignity and popular will, committed in building a free, fair and solidary society.

The Portuguese Republic is a democratic State of Law, sustained on popular sovereignty, pluralism of expression and democratic political organization, on respect and effective guarantees for fundamental rights and freedoms and on the separation and inter-dependence of powers, aiming to achieve economic, social and cultural democracy and a more participative democracy (article 2 CPR).

Portugal is a unitary state that respects, regarding its organization and function, the rule of self-governing system of the islands and the principles of subsidiarity, autonomy of local authorities and the democratic decentralisation of public services. The archipelagos of the Azores and Madeira are autonomous regions with their own political and administrative statutes and their own institutions of self-government (article 6 CRP). Politically and administratively speaking, the Portuguese Republic structure is based on a tripartite division of its territory: Districts (total of 20), Municipalities (total of 308) and Parishes (total of 3092).

These administrative levels reflect the specificities of the Portuguese territory, namely of Portugal mainland and of the Autonomous Regions (ARs). Portugal mainland is organised into 18 districts, 278 municipalities and 2882 parishes, and the geographic characteristics of the AR territory are reflected as follows:

a) Autonomous Region of the Azores: 1 District, 19 municipalities and 156 parishes;
b) Autonomous Region of Madeira: 1 District 11 municipalities and 54 parishes.

Regarding Sovereign Organs, the CPR distinguishes the President of the Republic, the Portuguese Parliament, the Government and the Courts of Law (article 110 CPR). All should care for the separation and the interdependency established by the Constitution (article 111/1 CRP).

The President of the Republic (PR) who represents the Portuguese Republic ensures the national independence, the unity of the State and the normal functioning of the democratic institutions and, inherently, he is also the Supreme Commander of the Armed Forces (article 120 CPR).

The election is effected through universal, direct and secret suffrage (article 121 CPR) and all citizen voters of Portuguese origin, over 35 years, are eligible (article 122 CPR ). The President is elected to a five-year term (article 128 CPR). However, his re-election is not allowed for more than two consecutive terms, nor during the years immediately following the end of the second consecutive term (article 123/1 CPR).

The PR has competences concerning other Organs of the Republic (article 133 CRP), such as the Council of State, the Government and the representatives of the Republic for the Autonomous Regions. He has also competences to practice is own acts (article 134 CPR) and in international relations (article 135 CPR).

The second organ of sovereignty to describe is the Portuguese Parliament (AR), Composed by a minimum of 180 and a maximum of 230 Members (article 148 CPR) which is the representative assembly of all Portuguese citizens (article 147 CPR).

Members are elected by electoral districts geographical established by law, which may determine the existence of multi-member and single member electoral districts as well as their nature and complementary, to ensure the system of proportional representation and the Hondt highest average method in conversion of votes into the number of seats. The number of Members per plurinominal circle of the national territory, except for the domestic circle, when exiting, that is proportional to the number of registered electors (article 149 CPR).

It is important to emphasize that despite the connection between the Members and the geographic circles, by the time they assume their roles they also assume the responsibility of representing the whole country (Article 152/2 CPR).

The AR is responsible for exerting political and legislative power (article 161 CPR), supervise competences (article 162 CPR) and concerning other organs (article 163 CRP), witness the swearing-in ceremony of the PR or give the PR its consent to leave the national territory.

Each legislature last for four legislative sessions (article 171 CRP), starting each of one on the 15th of September and ending on the 15th of June.

The third organ of sovereignty is the Government which is responsible for setting general policy of the country. It is also the superior organ of the public administration (article 182 CPR) and it is formed by the Prime Minister, the Ministers and Secretaries and Secretaries of State.

The Prime Minister (PM) is nominated by the PR, after hearing the parties represented in the AR and in accordance with the election results (article 187 CRP). Therefore the PMs are accountable to the PR and to the AR, under the political responsibility of the Government (article 191 CRP).

The Government has political (article 197 CPR), legislative (article 198 CPR) and administrative (article 199 CRP) competences.

Finally, the Courts, the fourth Portuguese organ of sovereignty, have the competence to administrate the justice on behalf of the people (article 202/1 CPR). They are independent and are only subjected to Law 1 (article 203 CPR).

The courts are organized in categories (article 209 CRP) and apart from the Constitutional Court, Portugal has:

a) the Supreme Court and courts of first and second instance,
b) the Supreme Administrative Court and other administrative and tax court administrative employees,
c) the Court of Auditors.

There are also the Maritime and arbitration courts and Justices of the Peace.

With regard to the intervention of Portugal on matters related to climate change and its impacts, the organic structure of the XIX Constitutional Government of Portugal designated the Ministry of Environment, Spatial Planning and Energy (MAOTE) to carry out a climate policy, with the purpose of achieving a competitive, resilient and low-carbon economy.

Under the effort of rationalization and structural remodelling of Public Administration (Reduction Plan and Improving Central Administration - PREMAC), which aims to promote the increase of efficiency and reduce costs, it was noted between 2011 and 2012 a profound change in the Central Public Administration. In this context, the Climate Change Commission (CAC) and its Executive Committee (CECAC) were extinguished and their assignments and competences have been integrated into the new Portuguese Environment Agency, P.I. (APA , IP), established by Decree-Law 7/2012 of January 17th, which approved the Organic Law of the Ministry of Agriculture, Sea, Environment and Spatial Planning (MAMAOT), now restructured.

The Decree-Law 56/2012 of March 12nd, approving the Organic Law of APA, IP, assigns the entire competences under climate policy to the Agency, thereby assuming a decisive role in the proposal, development and implementation of related policies.

Therefore the APA, IP, was established as a new organizational structure that develops its activities based on rigor and control of revenue and expenditure, transparency and effectiveness of operation and an effective coordination and participated in the various sectors it integrates, promoting a form of performance based on positive collaboration with other governmental entities, businesses, nongovernmental organizations, and citizens in general.

The Portuguese Carbon Fund (FPC), created by Decree -Law 71/2006 of March 24th , wants to support the transition to a resilient, competitive and low-carbon economy by financing or co-financing of measures contributing to the fulfilment of the commitments of the Portuguese state under the Kyoto and other international and EU commitments on climate change protocol. According to the Decree-Law 56/2012 of March 12th the Portuguese Carbon Fund (FPC) works with APA, IP.

The financing of the Fund was in the past ensured by a combination of funds from the State Budget and its own revenues. Currently, the FPC only has its own income, including funds from the collection of tax harmonization between heating oil and diesel oil and from collecting taxes on low-efficiency bulbs, the product of compensation by not incorporating biofuels and revenues from auctioning allowances under the EU ETS (industrial intallations and aviation operators).

## 1.2 Geographic and climate Profile

In addition to the mainland, Portugal comprises two other territorial areas, the Azores and Madeira, both in the Atlantic Ocean. The archipelago of Madeira includes the islands of Madeira and Porto Santo and by the separate islands of Desertas and Savage Islands. The Azores archipelago is composed of nine major islands divided into three groups according to their geographical location: the western group (Flores and Corvo), the central group (Terceira, Graciosa, São Jorge, Pico and Faial) and the eastern group (Santa Maria and São Miguel).

Mainland Portugal is located in the southwest corner of Europe (Figure 1.2), between parallels 36$^0$ 57' and 42$^0$ 09' 15'' north latitude, and between meridians 06$^0$ 11' 20'' and 09$^0$ 31'01'' west of the Greenwich meridian. Mainland Portugal occupies an area of about 89,000 km2 and has a perimeter of 2600 km, half of which corresponds to the Atlantic Ocean coastline, sharing 1200 km, north and east, boarder with Spain.

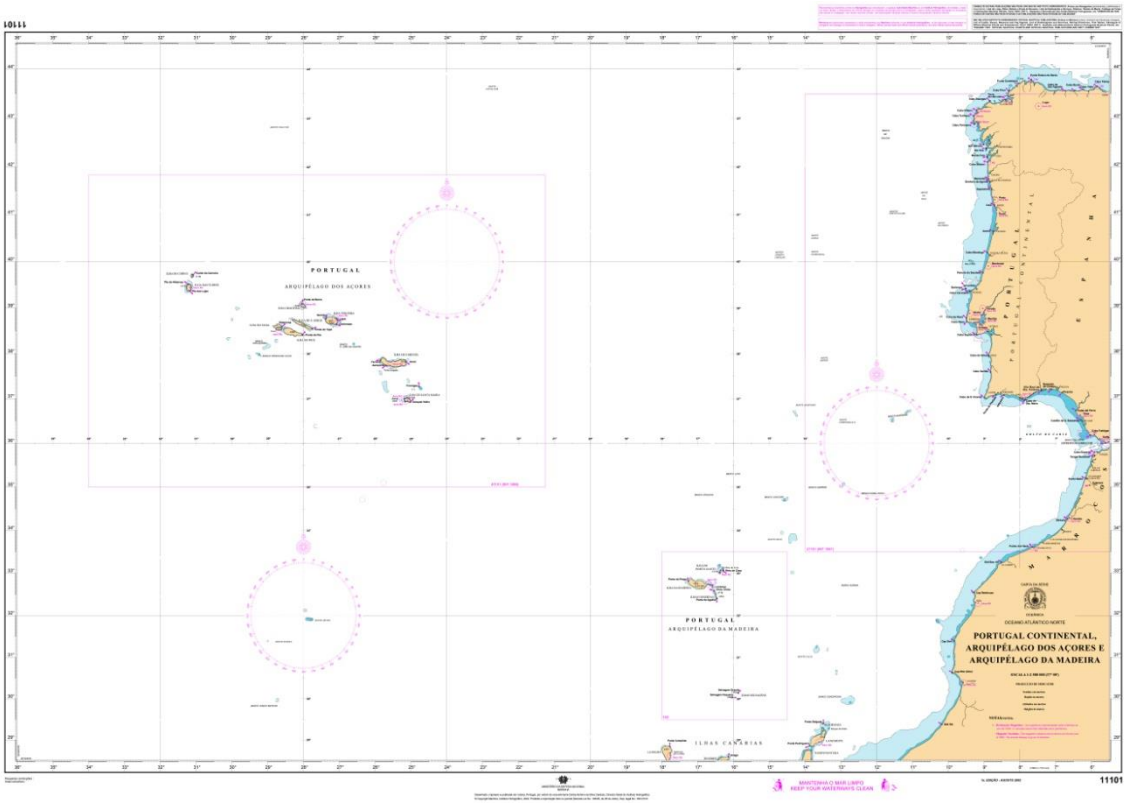



**Figure 1.2**
Portugal´s geographic location
**Source**: http://www.portugal.gov.pt

In mainland Portugal, there are two main types of relief split by the River Tagus. To the north the terrain is mountainous landscapes, with higher average altitudes while the south has vast plains and much less mountainous regions. The Portuguese mountain systems of higher altitude tend to concentrate in the Northern and Central regions of Portugal mainland, but also in the autonomous regions. In the autonomous region of the Azores, in Pico island, the national territory has a maximum altitude of 2,351 m.

The major watercourses run predominantly from east to west. This is the case of the two longest rivers in terms of length and basins that run through the Portuguese mainland - the Tagus and the Douro, which hydrological basins are shared with Spain. The Guadiana river, which runs from north to south, and the Sado and the Mira, which flow from north to south, are the main exceptions to the east-west direction. The Cávado, the Ave, the Vouga, the Mondego, the Sado and the Mira all spring in the Portuguese territory and have a length over 100 km.

## 1.2.1 Mainland Portugal

The most conditioning climate factors in Mainland Portugal are, in addition to latitude, its orography and the effect of the Atlantic Ocean. The variation in climate factors such as precipitation and air temperature show strong north-south and west-east gradients and high interannual and seasonal variability (Figure 1.3 and Figure 1.4).

In fact, the Northwest region of the country (Minho) is one of the areas of Europe`s rainiest regions, with an average of total annual precipitation exceeding the 3,000 mm in some places. Whilst, in several areas of

Alentejo, the annual average is of 500 mm. Precipitation shows high interannual variability, namely to extreme climate events like droughts or floods.

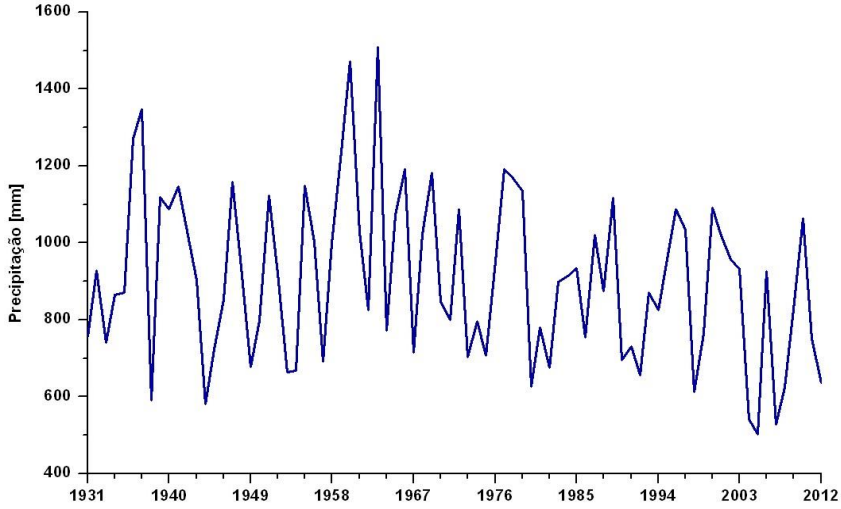



**Figure 1.3**
Annual variability of the precipitation in Portugal mainland
**Source**: IPMA, 2013

The mean annual air temperatures values vary from 6 and 9° C in the Central and Northern interior highlands (Serra da Estrela) to a maximum of 17° C along the southern coastline. The mean monthly air temperature values shows the combined effect of three main factors, whose relative importance varies in the annual cycle. It is an evident presence of an important air temperature gradient in the north-south direction, during winter, and a strong gradient along the coastline, during summer.

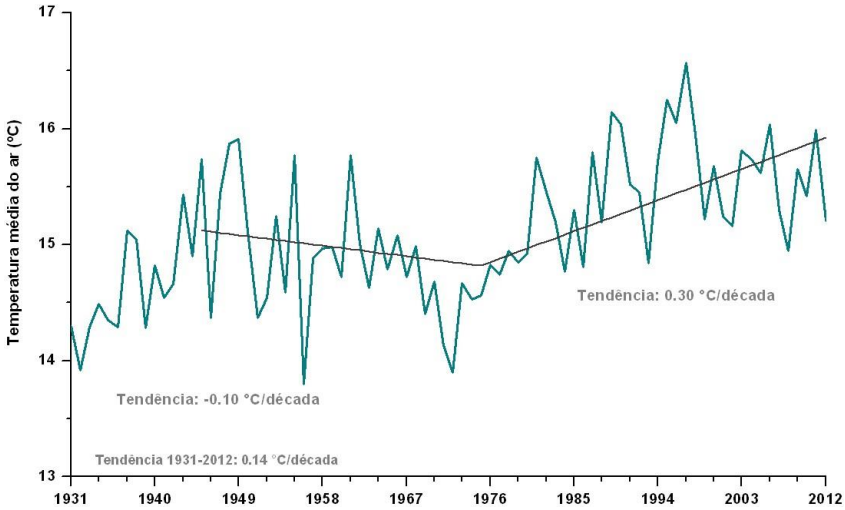



**Figure 1.4**
Annual variability of the mean air temperature in Portugal Mainland
**Source**: IPMA, 2013

In Portugal Mainland the decade of 1991/2000 was the warmest one (Figure 1.5). The first decade of the 21st century (2001/2010) was the second warmest and the driest since 1931 (Figure 1.6).

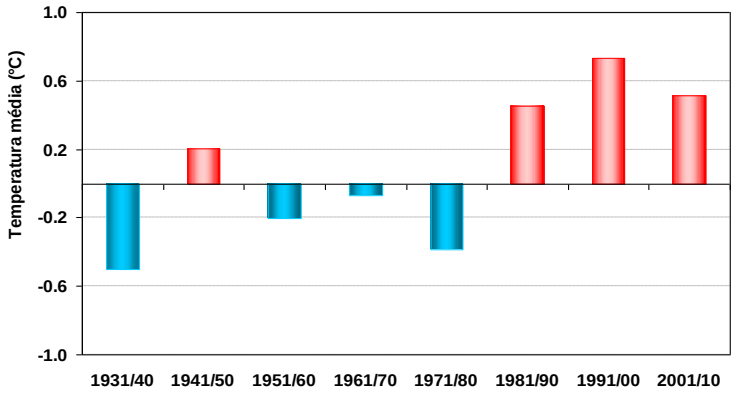



**Figure 1.5**
Mean air temperature anomalies, by decades, in Portugal Mainland
**Source**: IPMA, 2013

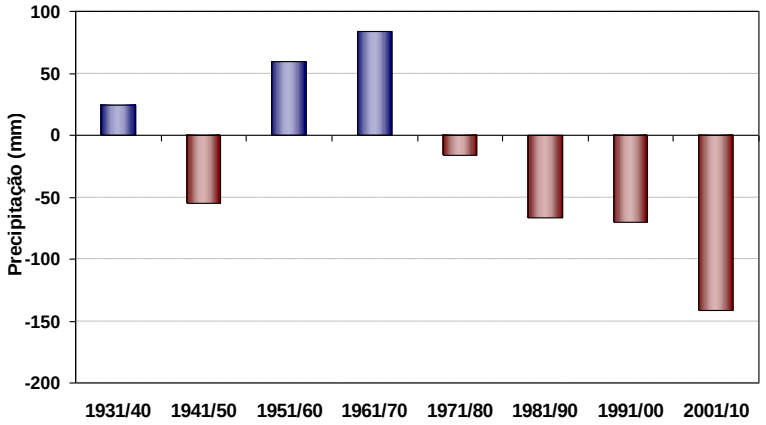
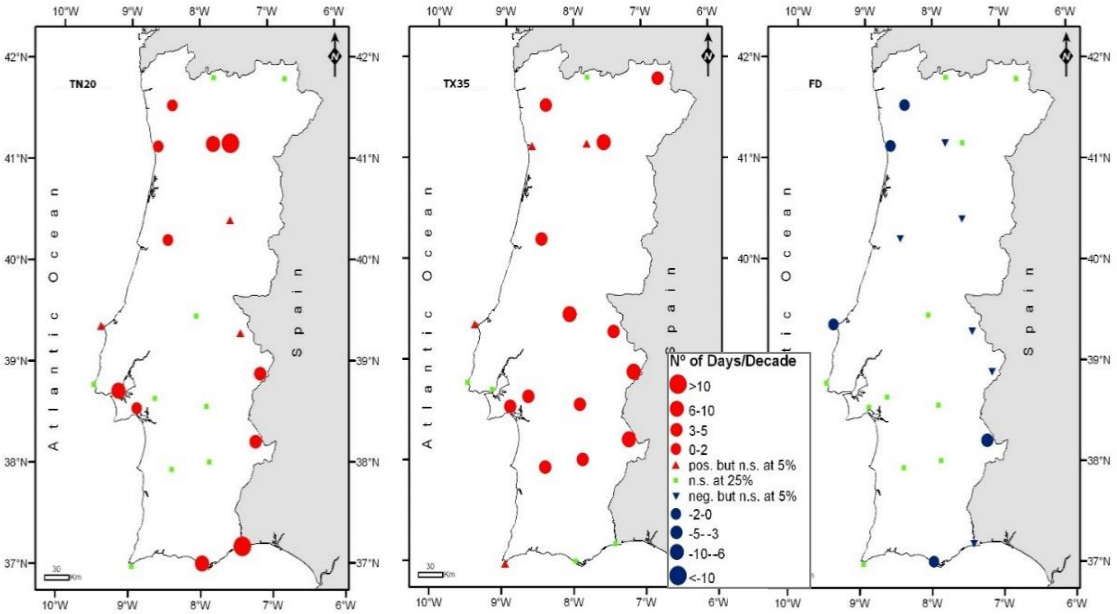



**Figure 1.6**
Precipitation anomalies, by decades, in Portugal Mainland
**Source**: IPMA, 2013

**CLIMATE TRENDS**

- Since the 70's the mean air temperature has been raising in all regions of Portugal, at 0.3° C/decade. Note that from the 10 hottest years, seven occurred after 1990 and 1997 has been the warmest.
- Increase in the number of days with high air temperatures and a reduction in number of days of low air temperatures, mainly after 1976. There is also an increase in the intensity and duration of heat waves index.
- Decrease of the annual precipitation: the last 20 years have been particularly dry in Portugal Mainland. Also note that five of the 10 driest years occurred after 2000.
- The seasonal variability of the precipitation has been decreasing in spring, in summer and in winter; whilst in autumn it has been increasing, thus reflecting a reduction in the winter period and anticipation in spring.
- Increased contribution of rainy in the annual precipitation, namely in the last 30 years and in regions more likely to desertification and drought.



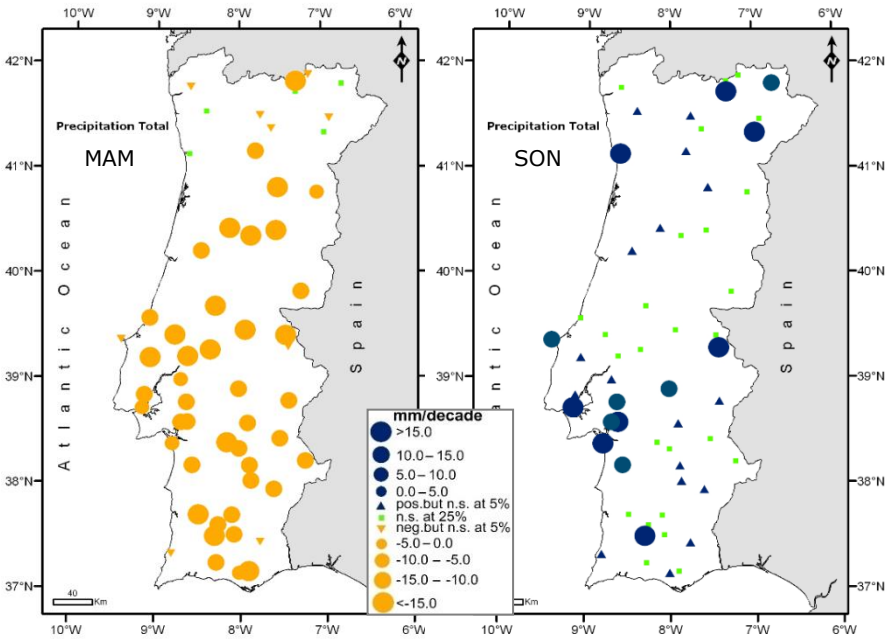

**Note 1**: Number of tropical nights (TN20) - number of days with more than 20° C minimum temperature, extremely hot days (XT35) - number of days with maximum temperature equal or above 35° C, number of days with frost (FD) - number of days with minimum temperature below 0° C.

**Note 2:** The symbols are scaled according to the magnitude of the trend: the red corresponds to an increasing trends and the blue to a decreasing trend.

**Figure 1.7**

Annual trends (° C decade$^{-1}$) since 1976 Number of tropical nights (TN20), extremely hot days (XT35) and frosty days (FD), in Portugal.

**Source**: Espírito Santo F, Ramos AM, de Lima MIP, Trigo RM (2013) *Seasonal changes in daily precipitation extremes in mainland Portugal from 1941 to 2007*. Reg Environ Change. doi:10.1007/s10113-013-0515-6




**Note**: The symbols are scaled according to the magnitude of the trend: Blue corresponds to an increasing trend and yellow to a decreasing trend).

**Figure 1.8**

Trends (mm decade$^{-1}$) the amount of precipitation in Portugal, in spring (MAM) and autumn (SON)

**Source**: Espírito Santo F, Ramos AM, de Lima MIP, Trigo RM (2013) Seasonal changes in daily precipitation extremes in mainland Portugal from 1941 to 2007. Reg Environ Change. doi:10.1007/s10113-013-0515-6

### 1.2.2 The Archipelago of the Azores

The Archipelago of the Azores is located in the subtropical area of the Northern hemisphere. The most determining factor that influences the weather conditions is the Azores anticyclone.

The climate in this archipelago is temperate and humid. However, given the altitudinal temperature variation, the climate is extremely rainy and cold in high altitudes regions.

The season between September and March is predominantly rainy, characterized by the frequent passage of depression disturbances related to the polar front. In the remaining months, the season is less rainy due to the anticyclone´s influence.

### 1.2.3 The Archipelago of Madeira

The climatic conditions in the archipelago of Madeira are moderate, both in winter and in summer, except in the highlands where there are lower temperatures. The depression systems that cross the Atlantic in winter and reach down the latitude of Madeira, or those that are created between the islands and Portugal mainland can cause heavy precipitation. The winds coming from the quadrant North (along with those from the northeast of the anticyclone) occur mainly in summer. However the island´s complex relief creates many micro-climates.

Mean annual air temperatures can vary from 8° C in higher peaks and 18-19° C in the coastal areas. The Funchal area, in the Southern bank of the downwind direction, is the hottest region of the island.

In Madeira the annual precipitation can vary from 3,400 mm (in the highlands) to 600 mm (in the Funchal area). There is a significant contrast between the Northern bank and the highest spots, where abundant precipitation occurs, and the Southern bank. The winter precipitation exceeds the 1,400 mm in the highlands, while in the Funchal area and in the valley of Machico valley is less than 300 mm. In the summer months the values of precipitation varies from 150 mm in the highlands and less than 50 mm in the Southern coast of the island. There is a heavier precipitation in the Northern area of Madeira during the summer is clearly due to the dominant direction of the wind (North) during this season and due to the orographic precipitation.

### 1.2.4 Climate Scenarios

Climate projections were made from global simulations under the context of the European consortium EC-earth2.

Figure 1.9 represents the evolution of air temperature and precipitation in two scenarios: the least worrying scenario, RCP4.5, corresponds to a socio-economic evolution that controls the increase of GHG emissions, with a peak around the 21st century; and the most worrying one, RCP8.5 that shows a continuous growth of the emissions over the 21st century. (RCP - Representative Concentration Pathways).

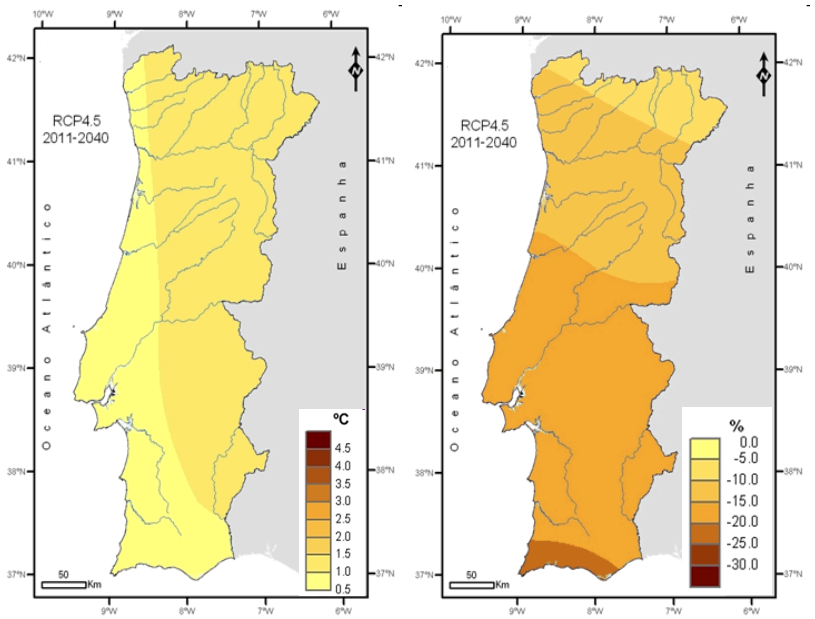



**Figure 1.9**

Evolution of the anomalies (regarding mean air temperature in 1961-90) in Portugal mainland. Land surface temperature, (on the left, in ° C) and Precipitation (on the right, %). Period of 1850-2005 (black curve) and for two future scenarios (2006-2100) in contrast with socio-economic evolution

**Source**: http://www.ipma.pt/pt/oclima/servicos.clima/index.jsp?page=cenarios21.clima.xml

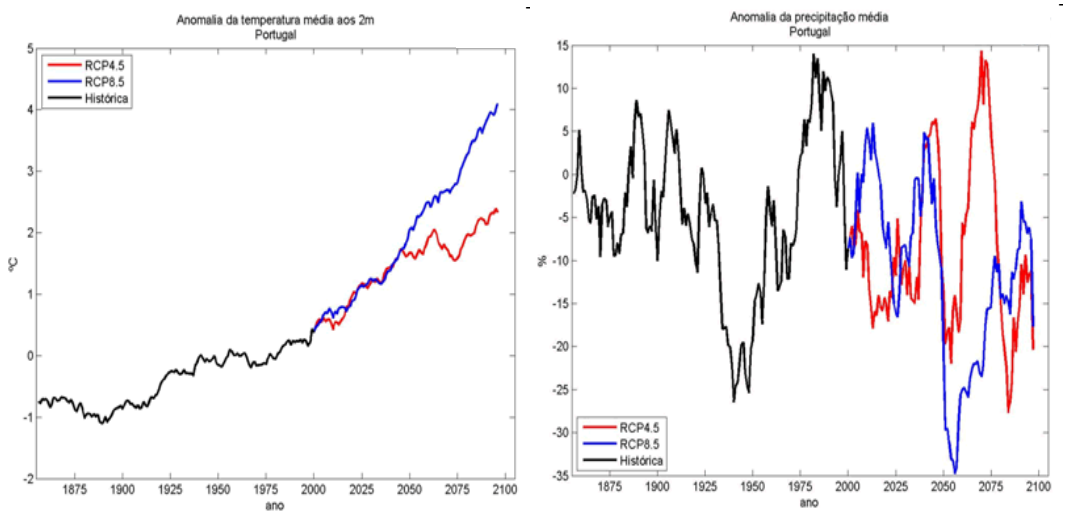



**Figure 1.10**

Mean air temperature and precipitation anomalies for the period of 2011-2040 in the least worrying scenario (RCP4.5)

**Source**: http://www.ipma.pt/pt/oclima/servicos.clima/index.jsp?page=cenarios21.clima.xml

**PORTUGAL WILL BE WARMER AND DRIER**

- By 2040 the annual mean air temperature in Portugal Mainland will rise from 0.5° C to 1.0° C, and by 2100, it can rise from 2 to 5° C, depending on the area and emissions scenario.
- The heating should be more significant in the South and the inland region.
- Annual precipitation will decrease by 15% in 2040 and 30% by 2100. The decrease of precipitation will be more significant in the Southern area of Portugal Mainland.

## 1.3 Population Profile

According to data collected in the last Census of Population and Housing (2011), the resident population in Portugal was 10,562,178 (Table 1.1), 5,046,600 male (47.78%) and 5,515,578 female individuals (52.22%).

For the period time series of 1991-2011[6], there has been a slow but gradual and continuous growth (Figure 1.11) in the number of residents in Portugal and in Portugal mainland, with 592,369 and 574,516 resident individuals, which represents an increase of 5.95% and 6.08%, respectively (Table 1.12).

The ARA and ARM feature a similar, but not identical, scenario (Figure 1.4). In both regions, the resident population grew in comparison with 1991. However, the numbers registered by the ARA (3.00%) are lower than the ones in the ARM (4.20%).

As for its annual development, this index presents, in all the areas under study, moments of negative growth (see Figures for the year 2011). The slight reverse in the growing population trend in all the areas under study between 2010 and 2011 is shown in figures 1.11 and 1.12 and Table 1.2.

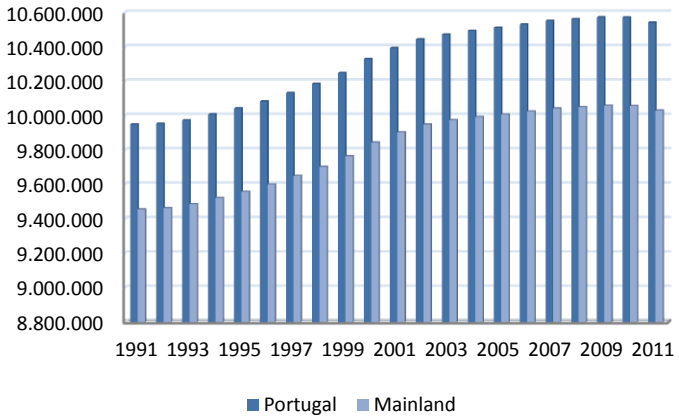



**Figure 1.11**
Total resident population estimates by geographic location (no.) – Portugal and Portugal Mainland – NUTS I

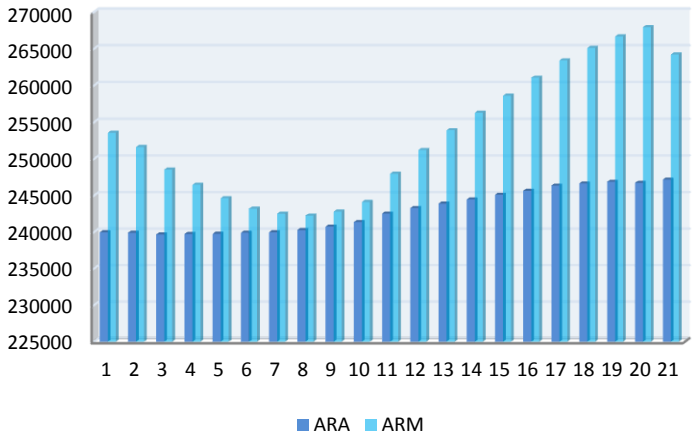



**Figure 1.12**
Total resident population estimates by geographic location (no.) – ARA and ARM – NUT I

[6] Resident Population Estimates (**Source**: Statistics of Portugal, 2013).

**Table 1.1**

Resident Population by Age and Geographic Location – Portugal and NUTS I (no.)

| Year | Total | | | | 0 - 14 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 9,950,029 | 9,456,452 | 239,984 | 253,593 | 1,926263 | 1,804,589 | 61,915 | 59,759 |
| **1992** | 9,954,958 | 9,463,390 | 239,918 | 251,650 | 1,873,574 | 1,755,474 | 60,463 | 57,637 |
| **1993** | 9,974,391 | 9,486,133 | 239,688 | 248,570 | 1,835,581 | 1,720,426 | 59,317 | 55,838 |
| **1994** | 10,008,659 | 9,522,397 | 239,757 | 246,505 | 1,799,243 | 1,686,731 | 58,238 | 54,274 |
| **1995** | 10,043,693 | 9,559,249 | 239,786 | 244,658 | 1,763,991 | 1,654,290 | 56,981 | 52,720 |
| **1996** | 10,084,196 | 9,601,049 | 239,935 | 243,212 | 1,737,474 | 1,630,233 | 55,919 | 51,322 |
| **1997** | 10,133,758 | 9,651,230 | 239,993 | 242,535 | 1,714,943 | 1,609,689 | 54,934 | 50,320 |
| **1998** | 10,186,634 | 9,704,074 | 240,289 | 242,271 | 1,699,675 | 1,596,328 | 53,938 | 49,409 |
| **1999** | 10,249,022 | 9,765,440 | 240,759 | 242,823 | 1,691,266 | 1,589,510 | 53,117 | 48,639 |
| **2000** | 10,330,774 | 9,845,237 | 241,387 | 244,150 | 1,678,890 | 1,578,779 | 52,601 | 47,510 |
| **2001** | 10,394,669 | 9,904,113 | 242,544 | 248,012 | 1,679,492 | 1,580,161 | 51,780 | 47,551 |
| **2002** | 10,444,592 | 9,950,051 | 243,303 | 251,238 | 1,682,761 | 1,584,049 | 51,013 | 47,699 |
| **2003** | 10,473,050 | 9,975,209 | 243,916 | 253,925 | 1,680,841 | 1,582,669 | 50,374 | 47,798 |
| **2004** | 10,494,672 | 9,993,865 | 244,491 | 256,316 | 1,675,752 | 1,578,236 | 49,673 | 47,843 |
| **2005** | 10,511,988 | 10,008,242 | 245,118 | 258,628 | 1,668,980 | 1,572,218 | 48,984 | 47,778 |
| **2006** | 10,532,588 | 10,025,838 | 245,671 | 261,079 | 1,656,988 | 1,561,106 | 48,097 | 47,785 |
| **2007** | 10,553,339 | 10,043,520 | 246,373 | 263,446 | 1,643,835 | 1,548,848 | 47,433 | 47,554 |
| **2008** | 10,563,014 | 10,051,206 | 246,670 | 265,138 | 1,630,985 | 1,537,286 | 46,658 | 47,041 |
| **2009** | 10,573,479 | 10,059,864 | 246,900 | 266,715 | 1,617,993 | 1,525,818 | 45,866 | 46,309 |
| **2010** | 10,572,721 | 10,057,999 | 246,757 | 267,965 | 1,595,173 | 1,504,808 | 44,874 | 45,491 |
| **2011** | 10,542,398 | 10,030,968 | 247,194 | 264,236 | 1,572,900 | 1,484,932 | 44,237 | 43,731 |

**Table 1.1 (cont.)**

Resident Population by Age and Geographic Location – Portugal and NUTS I (no.)

| Year | 15 -34 | | | | 35 - 54 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 3,072,293 | 2,910,077 | 76,449 | 85,767 | 2,457,478 | 2,354,080 | 49,726 | 53,672 |
| **1992** | 3,075,258 | 2,912,943 | 76,967 | 85,348 | 2,479,309 | 2,374,534 | 50,672 | 54,103 |
| **1993** | 3,078,565 | 2,917,064 | 77,277 | 84,224 | 2,503,015 | 2,397,074 | 51,607 | 54,334 |
| **1994** | 3,082,409 | 2,921,679 | 77,533 | 83,197 | 2,533,311 | 2,425,587 | 52,727 | 54,997 |
| **1995** | 3,082,012 | 2,922,547 | 77,579 | 81,886 | 2,574,521 | 2,464,358 | 54,073 | 56,090 |
| **1996** | 3,078,146 | 2,919,746 | 77,640 | 80,760 | 2,621,906 | 2,509,281 | 55,416 | 57,209 |
| **1997** | 3,072,546 | 2,915,274 | 77,591 | 79,681 | 2,669,288 | 2,553,951 | 56,868 | 58,469 |
| **1998** | 3,062,765 | 2,906,689 | 77,634 | 78,442 | 2,713,100 | 2,594,737 | 58,231 | 60,132 |
| **1999** | 3,049,822 | 2,894,903 | 77,398 | 77,521 | 2,759,528 | 2,638,083 | 59,447 | 61,998 |
| **2000** | 3,041,461 | 2,887,345 | 77,228 | 76,888 | 2,806,471 | 2,682,411 | 60,311 | 63,749 |
| **2001** | 3,024,738 | 2,868,707 | 77,919 | 78,112 | 2,848,247 | 2,720,926 | 61,532 | 65,789 |
| **2002** | 2,998,242 | 2,841,216 | 78,309 | 78,717 | 2,885,973 | 2,755,546 | 62,779 | 67,648 |
| **2003** | 2,964,386 | 2,806,874 | 78,387 | 79,125 | 2,906,451 | 2,773,152 | 63,959 | 69,340 |
| **2004** | 2,922,781 | 2,765,333 | 78,287 | 79,161 | 2,929,033 | 2,792,904 | 65,083 | 71,046 |
| **2005** | 2,879,705 | 2,722,472 | 78,151 | 79,082 | 2,952,887 | 2,814,316 | 65,946 | 72,625 |
| **2006** | 2,834,058 | 2,677,211 | 77,890 | 78,957 | 2,980,381 | 2,839,406 | 66,805 | 74,170 |
| **2007** | 2,786,742 | 2,630,634 | 77,370 | 78,738 | 3,010,884 | 2,867,249 | 67,886 | 75,749 |
| **2008** | 2,730,013 | 2,575,472 | 76,588 | 77,953 | 3,042,965 | 2,896,288 | 69,002 | 77,675 |
| **2009** | 2,667,679 | 2,515,074 | 75,571 | 77,034 | 3,078,033 | 2,928,265 | 70,147 | 79,621 |
| **2010** | 2,595,759 | 2,447,427 | 74,351 | 73,981 | 3,109,859 | 2,955,620 | 71,372 | 82,867 |
| **2011** | 2,526,037 | 2,381,539 | 73,589 | 70,909 | 3,125,820 | 2,970,500 | 72,332 | 82,988 |

**Table 1.1 (cont.)**

Resident Population by Age and Geographic Location – Portugal and NUTS I (no.)

| Year | 55 - 69 | | | | ≥ 70 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 1,590,508 | 1,523,972 | 31,867 | 34,669 | 903,487 | 863,734 | 20,027 | 19,726 |
| **1992** | 1,598,263 | 1,532,163 | 31,514 | 34,586 | 928,554 | 888,276 | 20,302 | 19,976 |
| **1993** | 1,604,744 | 1,539,381 | 31,120 | 34,243 | 952,486 | 912,188 | 20,367 | 19,931 |
| **1994** | 1,610,331 | 1,545,845 | 30,685 | 33,801 | 983,365 | 942,555 | 20,574 | 20,236 |
| **1995** | 1,610,602 | 1,546,833 | 30,278 | 33,491 | 1,012,567 | 971,221 | 20,875 | 20,471 |
| **1996** | 1,606,004 | 1,542,740 | 29,911 | 33,353 | 1,040,666 | 999,049 | 21,049 | 20,568 |
| **1997** | 1,610,969 | 1,548,226 | 29,433 | 33,310 | 1,066,012 | 1,024,090 | 21,167 | 20,755 |
| **1998** | 1,617,673 | 1,554,888 | 29,388 | 33,397 | 1,093,421 | 1,051,432 | 21,098 | 20,891 |
| **1999** | 1,631,368 | 1,568,225 | 29,634 | 33,509 | 1,117,038 | 1,074,719 | 21,163 | 21,156 |
| **2000** | 1,650,481 | 1,587,127 | 29,706 | 33,648 | 1,153,471 | 1,109,575 | 21,541 | 22,355 |
| **2001** | 1,659,062 | 1,595,721 | 29,656 | 33,685 | 1,183,130 | 1,138,598 | 21,657 | 22,875 |
| **2002** | 1,664,830 | 1,601,690 | 29,453 | 33,687 | 1,212,786 | 1,167,550 | 21,749 | 23,487 |
| **2003** | 1,683,156 | 1620,084 | 29,334 | 33,738 | 1,238,216 | 1,192,430 | 21,862 | 23,924 |
| **2004** | 1,699,755 | 1,636510 | 29,431 | 33,814 | 1,267,351 | 1,220,882 | 22,017 | 24,452 |
| **2005** | 1,714,627 | 1,650,423 | 29,935 | 34,269 | 1,295,789 | 1,248,813 | 22,102 | 24,874 |
| **2006** | 1,731,849 | 1,666,631 | 30,580 | 34,638 | 1,329,312 | 1,281,484 | 22,299 | 25,529 |
| **2007** | 1,756,326 | 1,689,625 | 31,223 | 35,478 | 1,355,552 | 1,307,164 | 22,461 | 25,927 |
| **2008** | 1,776,708 | 1,708,533 | 31,919 | 36,256 | 1,382,,343 | 1,333,627 | 22,503 | 26,213 |
| **2009** | 1,801,110 | 1,730,944 | 32,851 | 37,315 | 1,408,664 | 1,359,763 | 22,465 | 26,436 |
| **2010** | 1,832,187 | 1,759,817 | 33,573 | 38,797 | 1,439,743 | 1,390,327 | 22,587 | 26,829 |
| **2011** | 1,858,747 | 1,784,891 | 34,418 | 39,438 | 1,458,894 | 1,409,106 | 22,618 | 27,170 |

**Source:** INE, 2013

**Table 1.2**

Change Rate of the Total Resident Population by Age and Geographic Location – Portugal and NUTS I (no.)

| Ano | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **1991-1992** | 0.05 | 0.07 | -0.03 | -077 |
| **1992-1993** | 0.20 | 0.24 | -0.10 | -1.22 |
| **1993-1994** | 0.34 | 0.38 | 0.03 | -0.83 |
| **1994-1995** | 0.35 | 0.39 | 0.01 | -0.75 |
| **1995-1996** | 0.40 | 0.44 | 0.06 | -0.59 |
| **1996-1997** | 0.49 | 0.52 | 0.02 | -0.28 |
| **1997-1998** | 0.52 | 0.55 | 0.12 | -0.11 |
| **1998-1999** | 0.61 | 0.63 | 0.20 | 0.23 |
| **1999-2000** | 0.80 | 0.82 | 0.26 | 0.55 |
| **2000-2001** | 0.62 | 0.60 | 0.48 | 1.58 |
| **2001-2002** | 0.48 | 0.46 | 0.31 | 1.30 |
| **2002-2003** | 0.27 | 0.25 | 0.25 | 1.07 |
| **2003-2004** | 0.21 | 0.19 | 0.24 | 0.94 |
| **2004-2005** | 0.16 | 0.14 | 0.26 | 0.90 |
| **2005-2006** | 0.20 | 0.18 | 0.23 | 0.95 |
| **2006-2007** | 0.20 | 0.18 | 0.29 | 0.91 |
| **2007-2008** | 0.09 | 0.08 | 0.12 | 0.64 |
| **2008-2009** | 0.10 | 0.09 | 0.09 | 0.59 |
| **2009-2010** | -0.01 | -0.02 | -0.06 | 0.47 |
| **2010-2011** | -0.29 | -0.27 | 0.18 | -1.39 |
| **1991-2001** | 4.47 | 4.73 | 1.07 | -2.20 |
| **2001-2011** | 1.42 | 1.28 | 1.92 | 6.54 |
| **1991-2011** | 5.95 | 6.08 | 3.00 | 4.20 |

In Portugal there is a gender inbalance as well as an age disparity in the structure of the population. In 2011, there is an increase of age disparity between the younger (≤14 years) and the elder population (≥70 years). This gradual trend of the inversion of the pyramid (Figure 1.13) is one of the major demographic phenomena that describe Portugal in the last decade, as listed in Tables 1.3 and 1.4.

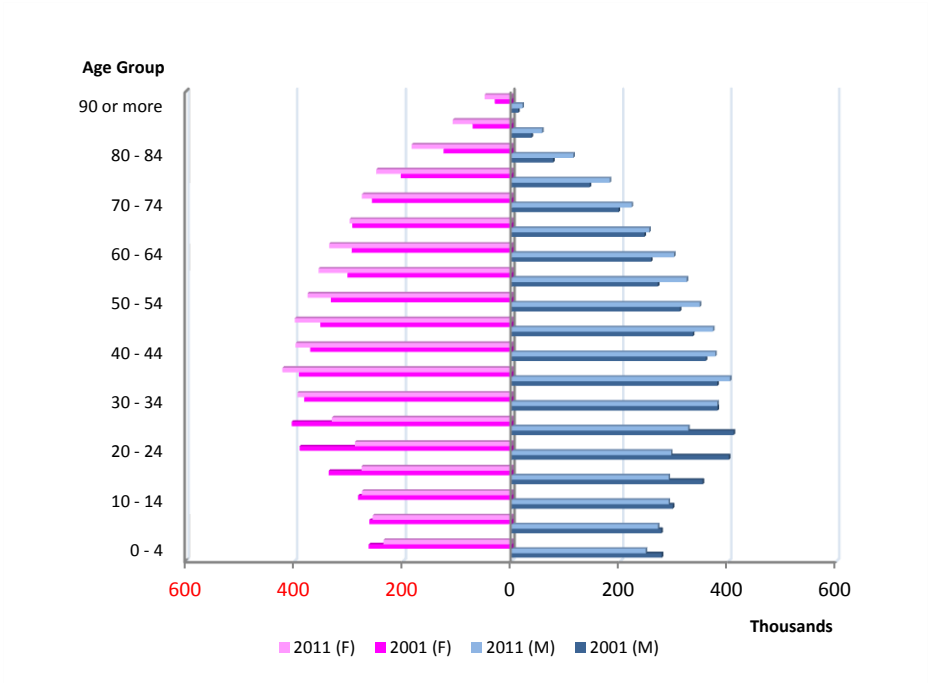



**Figure 1.13**
Resident population by age and gender group (2001-2011) - no. thousands

According to data listed by the NUTS I, two circumstances support the scenario described above: an increase from 1991 to 2001 in the number of individuals over 70 years old (4.76 p.p); and a decrease also from 1991 to 2001 in the individuals with 14 years or less (4.40 p.p).

Simultaneously, in the national scenario in 1991, the age groups of 15-34, 35-54 and 55-69 represented an increasing growth of 71.56 %, corresponding to a retraction of 0,32 pp in the year of 2011 (71.24%).

In 2011, to a NUTS I level, Portugal Mainland shows an increase of 4.91 p.p. in the number of individuals aged over 70 and a decrease of 4.28 pp, individuals aged 14 or less. As for the age groups of 15-34 , 35-54 and 55-69 years, corresponding in 1991 to an total value of 71.78 %, they show a decrease of 0.63 p.p. in 2011 (71.15%).

In 2011, in the case of the ARA, the number of individuals aged over 70 grew 0.81 p.p. whilst the number of individuals aged 14 or less decreased in 7.90 p.p.. As for the age groups of 15-34, 35-54 and 55-69 years, which showed a growth of 65.86% in 1991, they indicate a decrease of 7.10 p.p. (72.95%) in 2011.

In 2011, the ARM shows an increase of 2.50 p.p. in the number of individuals aged over 70 and a decrease of 7.01 p.p. of individuals aged 14 years or less. As for the age groups of 15-34, 35-54 and 55-69 years, which showed a growth of 68.66% in 1991, they indicate a decrease of 4.51 p.p (73.17%) in 2011.

**Table 1.3**

Proportion of no. of Individuals by Age Group regarding the total Resident Population – Portugal and NUTS I (%)

| Year | 0 - 14 | | | | 15 -34 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 1936 | 19.08 | 25.80 | 23.56 | 30.88 | 30.77 | 31.86 | 33.82 |
| **1992** | 18.82 | 18.55 | 25.20 | 22.90 | 30.89 | 30.78 | 32.08 | 33.92 |
| **1993** | 18.40 | 18.14 | 24.75 | 22.46 | 30.86 | 30.75 | 32.24 | 33.88 |
| **1994** | 17.98 | 17.71 | 24.29 | 22.02 | 30.80 | 30.68 | 32.34 | 33.75 |
| **1995** | 17.56 | 17.31 | 23.76 | 21.55 | 30.69 | 30.57 | 32.35 | 33.47 |
| **1996** | 17.23 | 16.98 | 23.31 | 21.10 | 30.52 | 30.41 | 32.36 | 33.21 |
| **1997** | 16.92 | 16.68 | 22.89 | 20.75 | 30.32 | 30.21 | 32.33 | 32.85 |
| **1998** | 16.69 | 16.45 | 22.45 | 20.39 | 30.07 | 29.95 | 32.31 | 32.38 |
| **1999** | 16.50 | 16.28 | 22.06 | 20.03 | 29.76 | 29.64 | 32.15 | 31.92 |
| **2000** | 16.25 | 16.04 | 21.79 | 19.46 | 29.44 | 29.33 | 31.99 | 31.49 |
| **2001** | 16.16 | 15.95 | 21.35 | 19.17 | 29.10 | 28.96 | 32.13 | 31.50 |
| **2002** | 16.11 | 15.92 | 20.97 | 18.99 | 28.71 | 28.55 | 32.19 | 31.33 |
| **2003** | 16.05 | 15.87 | 20.65 | 18.82 | 28.30 | 28.14 | 32.14 | 31.16 |
| **2004** | 15.97 | 15.79 | 20.32 | 18.67 | 27.85 | 27.67 | 32.02 | 30.88 |
| **2005** | 15.,88 | 15.71 | 19.98 | 18.47 | 27.39 | 27.20 | 31.88 | 30.58 |
| **2006** | 15.73 | 15.57 | 19.58 | 18.30 | 26.91 | 26.70 | 31.71 | 30.24 |
| **2007** | 15.58 | 15.42 | 19.25 | 18.05 | 26.41 | 26.19 | 31.40 | 29.89 |
| **2008** | 15.44 | 15.29 | 18.92 | 17.74 | 25.85 | 25.62 | 31.05 | 29.40 |
| **2009** | 15.30 | 15.17 | 18.58 | 17.36 | 25.23 | 25.00 | 30.61 | 28.88 |
| **2010** | 15.09 | 14.96 | 18.19 | 16.98 | 24.55 | 24.33 | 30.13 | 27.61 |
| **2011** | 14.92 | 14.80 | 17.90 | 16.55 | 23.96 | 23.74 | 29.77 | 26.84 |

**Table 1.3 (cont.)**

Proportion of no. of Individuals by Age Group regarding the total Resident Population – Portugal and NUTS I (%)

| Year | 35 - 54 | | | | 55 - 69 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 24.70 | 24.89 | 20.72 | 21.16 | 15.98 | 1612 | 13.28 | 13.67 |
| **1992** | 24.91 | 25.09 | 21.12 | 21.50 | 16.05 | 16.19 | 13.14 | 13.74 |
| **1993** | 25.09 | 25.27 | 21.53 | 21.86 | 16.09 | 16.23 | 12.98 | 13.78 |
| **1994** | 25.31 | 25.47 | 21.99 | 22.31 | 16.09 | 16.23 | 12.80 | 13.71 |
| **1995** | 25.63 | 25.78 | 22.55 | 22.93 | 16.04 | 16.18 | 12.63 | 13.69 |
| **1996** | 26.00 | 26.14 | 23.10 | 23.52 | 15.93 | 16.07 | 12.47 | 13.71 |
| **1997** | 26.34 | 26.46 | 23.70 | 24.11 | 15.90 | 16.04 | 12.26 | 13.73 |
| **1998** | 26.63 | 26.74 | 24.23 | 24.82 | 15.88 | 16.02 | 12.23 | 13.78 |
| **1999** | 26.92 | 27.01 | 24,69 | 25.53 | 15.92 | 16.06 | 12.31 | 13.80 |
| **2000** | 27.17 | 27.25 | 24.99 | 26.11 | 15.98 | 16.12 | 12.31 | 13.78 |
| **2001** | 27.40 | 27.47 | 25.37 | 26.53 | 15.96 | 16.11 | 12.23 | 13.58 |
| **2002** | 27.63 | 27.69 | 25.80 | 26.93 | 15.94 | 16.10 | 12.11 | 13.41 |
| **2003** | 27.75 | 27.80 | 26.22 | 27.31 | 16.07 | 16.24 | 12.03 | 13.29 |
| **2004** | 27.91 | 27.95 | 26.62 | 27.72 | 16.20 | 16.38 | 12.04 | 13.19 |
| **2005** | 28.09 | 28.12 | 26.90 | 28.08 | 16.31 | 16.49 | 12.21 | 13.25 |
| **2006** | 28.30 | 28.32 | 27.19 | 28.41 | 16.44 | 16.62 | 12.45 | 13.27 |
| **2007** | 28.53 | 28.55 | 27.55 | 28.75 | 16.64 | 16.82 | 12.67 | 13.47 |
| **2008** | 28.81 | 28.82 | 27.97 | 29.30 | 16.82 | 17.00 | 12.94 | 13.67 |
| **2009** | 29.11 | 29.11 | 28.41 | 29.85 | 17.03 | 17.21 | 13.31 | 13.99 |
| **2010** | 29.41 | 29.39 | 28.92 | 30.92 | 17.33 | 17.50 | 13.61 | 14.48 |
| **2011** | 29.65 | 29.61 | 29.26 | 31.41 | 17.63 | 17.79 | 13.92 | 14.93 |

**Table 1.3 (cont.)**

Proportion of no. of Individuals by Age Group regarding the total Resident Population – Portugal and NUTS I (%)

| Year | ≥ 70 | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **1991** | 9.08 | 9.13 | 8.35 | 7.78 |
| **1992** | 9.33 | 9.39 | 8.46 | 7.94 |
| **1993** | 9.55 | 9.62 | 8.50 | 8.02 |
| **1994** | 9.83 | 9.90 | 8.58 | 8.21 |
| **1995** | 10.08 | 10.16 | 8.71 | 8.37 |
| **1996** | 10.32 | 10.41 | 8.77 | 8.46 |
| **1997** | 10.52 | 10.61 | 8.82 | 8.56 |
| **1998** | 10.73 | 10.83 | 8.78 | 8.62 |
| **1999** | 10.90 | 11.01 | 8.79 | 8.71 |
| **2000** | 11.17 | 11.27 | 8.92 | 9.16 |
| **2001** | 11.38 | 11.50 | 8.93 | 9.22 |
| **2002** | 11.61 | 11.73 | 8.94 | 9.35 |
| **2003** | 11.82 | 11.95 | 8.96 | 9.42 |
| **2004** | 12.08 | 12.22 | 9.01 | 9.54 |
| **2005** | 12.33 | 12.48 | 9.02 | 9.62 |
| **2006** | 12.62 | 12.78 | 9.08 | 9.78 |
| **2007** | 12.84 | 13.01 | 9.12 | 9.84 |
| **2008** | 13.09 | 13.27 | 9.12 | 9.89 |
| **2009** | 13.32 | 13.52 | 9.10 | 9.91 |
| **2010** | 13.62 | 13.82 | 9.15 | 10.01 |
| **2011** | 13.84 | 14.05 | 9.15 | 10.28 |

**Table 1.4**

Crude Rate of increase by Gender Group and Geographic Location – Portugal and NUTS I (%)

| Year | Total | | | | 0-14 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991-2001** | 3.83 | 4.11 | 0.58 | -3.72 | -12.84 | -12.51 | -15.04 | -20.50 |
| **2001-2011** | 2.05 | 1.89 | 2.41 | 8.23 | -6.31 | -5.94 | -15.90 | -15.90 |
| **1991-2011** | 5.95 | 6.08 | 3.00 | 4.20 | -18.34 | -17.71 | -28.55 | -26.82 |

| Year | 15 -34 | | | | 35 - 54 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991-2001** | -1.00 | -0.78 | 1.02 | -10.35 | 14.20 | 13.95 | 21.29 | 18.78 |
| **2001-2011** | -16.95 | -17.52 | -4.71 | -7.78 | 11.38 | 10.74 | 19.93 | 30.18 |
| **1991-2011** | -17.78 | -18.16 | -3.74 | 54.62 | 27.20 | 26.19 | 45.46 | 54.62 |

| Year | 55 - 69 | | | | ≥ 70 | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991-2001** | 3.77 | 4.14 | -6.78 | -2.94 | 27.67 | 28.46 | 7.56 | 13.33 |
| **2001-2011** | 12.62 | 12.46 | 15.86 | 17.21 | 26.48 | 27.00 | 5.00 | 21.54 |
| **1991-2011** | 16.86 | 17.12 | 8.01 | 13.76 | 61.47 | 63.14 | 12.94 | 37.74 |

The Natural Balance (Figure 1.14), indicator that shows the difference between the number of live births and the number of deaths, show a significant decrease from 2001 (+7,682) to 2011 (-5,992).

With regard to migration growth (Figure 1.15), and taking only into account the years of 2001 and 2011 (Table 1.5) migration did not contribute for the population net growth in Portugal in 2011.

This indicator shows a similar tendency to the Natural Balance one, a comparison established with the Natural Growth Rate (Table 1.5). However there are two aspects in each they differ:

a) the soft downward trend;

b) The starting time register of the negative values in the series (in the Natural Balance it is in 2007 - see Table 1.5).

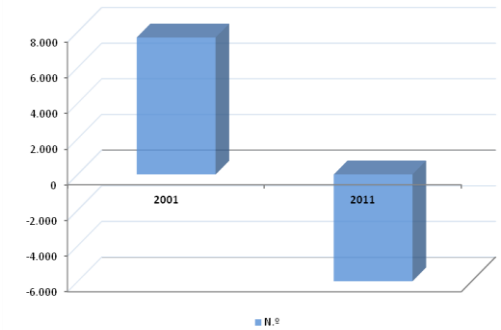



**Figure 1.14**
Natural balance (2001 and 2011)

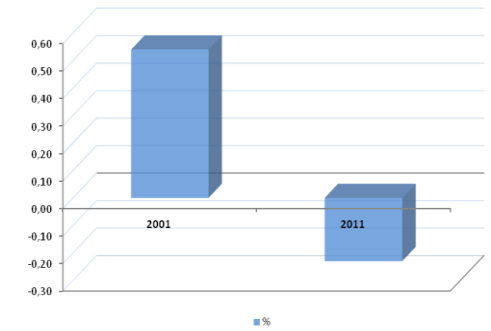



**Figure 1.15**
Migration growth rate – Portugal (2001 and 2011)

**Table 1.5**
Natural Balance, Natural Growth Rate and Migration Growth Rate - Portugal

| Year | Natural Balance | Natural Growth Rate | Migration Growth Rate |
|---|---|---|---|
| | (n.º) | (%) | |
| **1991** | 12,417 | 0.12 | -0.33 |
| **1992** | 14,286 | 0.14 | -0.09 |
| **1993** | 8,010 | 0.08 | 0.11 |
| **1994** | 9,995 | 0.10 | 0.24 |
| **1995** | 3,622 | 0.04 | 0.31 |
| **1996** | 3,380 | 0.03 | 0.37 |
| **1997** | 8,155 | 0.08 | 0.41 |
| **1998** | 7,186 | 0.07 | 0.45 |
| **1999** | 8,131 | 0.08 | 0.53 |
| **2000** | 14,644 | 0.14 | 0.65 |
| **2001** | 7,682 | 0.07 | 0.54 |
| **2002** | 8,125 | 0.08 | 0.40 |
| **2003** | 3,720 | 0.04 | 0.24 |
| **2004** | 7,286 | 0.07 | 0.14 |
| **2005** | 1,935 | 0.02 | 0.15 |
| **2006** | 3,459 | 0.03 | 0.16 |
| **2007** | -1,020 | -0.01 | 0.21 |
| **2008** | 314 | o | 0.09 |
| **2009** | -4,943 | -0.05 | 0.15 |
| **2010** | -4,573 | -0.04 | 0.04 |
| **2011** | -5,992 | -0.06 | -0.23 |

**Source:** INE, 2013

**Table 1.6**
Crude Rate of increase of Resident Population in Portugal

| Year | Resident Population |
|---|---|
| | (%) |
| **1991-92** | 1.09 |
| **1992-93** | 0.16 |
| **1993-94** | 0.27 |
| **1994-95** | 0.26 |
| **1995-96** | 0.29 |
| **1996-97** | 0.37 |
| **1997-98** | 0.39 |
| **1998-99** | 0.45 |
| **99-2000** | 0.60 |
| **2000-01** | 0.97 |
| **2001-02** | 0.50 |
| **2002-03** | 0.65 |
| **2003-04** | 0.52 |
| **2004-05** | 0.38 |
| **2005-06** | 0.28 |
| **2006-07** | 0.17 |
| **2007-08** | 0.09 |
| **2008-09** | 0.10 |
| **2009-10** | -0.01 |
| **2010-11** | -0.70 |

o: Data inferior to half of the mode unit used

The Old Age Dependency Ratios (Figure 1.16; Table 1.7) confirms the already mentioned widening difference between young and elder people. The first indicator examined in this subsection, Resident Population by Age Group, the percentage of young population (0-14 years) decreases and the opposite scenario is registered in the elder population (70 years or above). Thus, according to Table 1.7, in 2001 and 2011 there is an increasing trend of the index values in Portugal, Portugal mainland and in the ARM. On the other hand, the ARA shows a decreasing tendency regarding those same values.

**Table 1.7**
Old-Age Dependency Ratios– Portugal and NUTS I (No.)

| NUTS | 1991 | 2001 | 2011 |
|---|---|---|---|
| **Portugal** | 20,9 | 24,6 | 28,8 |
| **Mainland** | 21,0 | 24,8 | 29,3 |
| **ARA** | 20,4 | 19,7 | 18,7 |
| **ARM** | 18,3 | 20,6 | 20,9 |

**Source:** INE, 2013

The aging of the population is therefore one of the phenomena which currently exerts greater pressure on the modern societies. Its worsening has occurred widely throughout the territory, triggering the need for an expansion of the scale of observation and the full recognition of its spatial transversality (inland/coast, North/South).

In 2011, the aging index (Figure 1.17, Table 1.8) got worse in Portugal (127.60) regarding the values recorded in 2001 (102.60). This means that for every 100 young people there are 127.60 elderly people. A similar scenario happens in the ARA (72.3) and in the ARM (87), which stand as the lowest ratios.

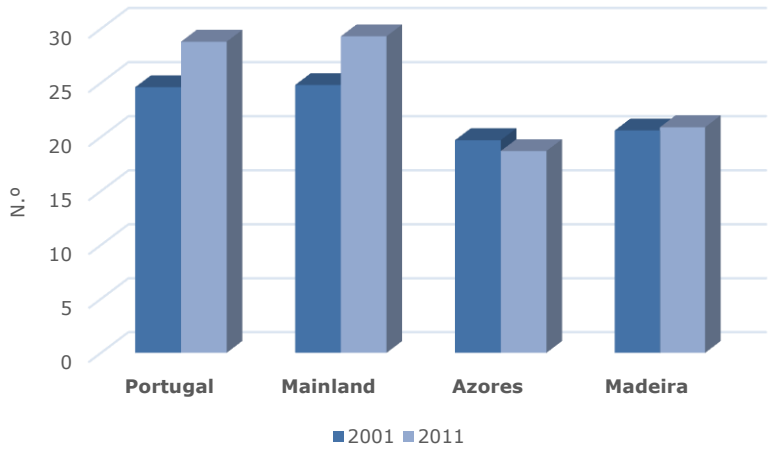



**Figure 1.16**
Old-age dependancy index by place of residence – Portugal and NUTS I (no.)

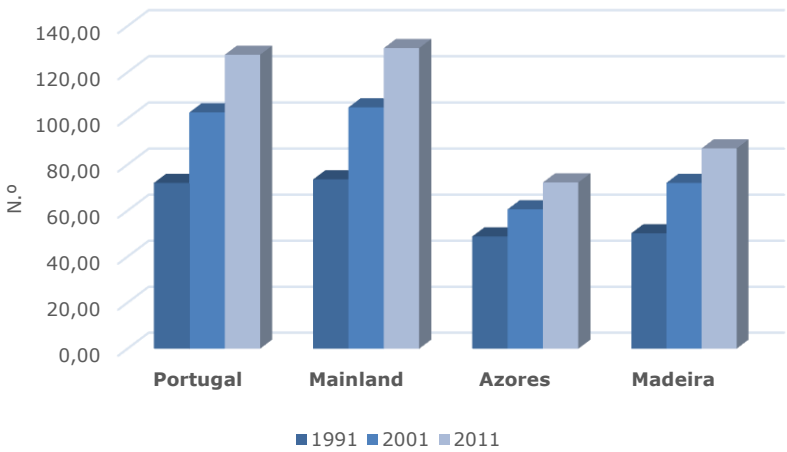



**Figure 1.17**
Aging index – Portugal and NUTS I (no.)

**Table 1.8**
Aging Index by Geographic Location (no.)

| Year | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **1991** | 72.10 | 73.60 | 48.80 | 50.20 |
| **2000** | 100.60 | 102.80 | 59.60 | 70.80 |
| **2001** | 102.60 | 104.80 | 60.60 | 72.10 |
| **2002** | 104.00 | 106.30 | 61.20 | 72.70 |
| **2003** | 105.50 | 107.90 | 61.50 | 72.90 |
| **2004** | 107.60 | 110.10 | 62.10 | 73.40 |
| **2005** | 109.30 | 111.80 | 63.00 | 74.20 |
| **2006** | 111.50 | 114.10 | 64.40 | 75.20 |
| **2007** | 113.80 | 116.40 | 65.30 | 76.40 |
| **2008** | 116.40 | 119.10 | 66.70 | 78.00 |
| **2009** | 119.30 | 122.00 | 68.60 | 80.10 |
| **2010** | 123.90 | 126.70 | 70.90 | 82.80 |
| **2011** | 127.60 | 130.50 | 72.30 | 87.00 |

**Source:** INE, 2013

It is a fact that the combination of the spatial distribution of the population and demographic dynamics observed in the last decade illustrate an asymmetric territorial and potentially unbalanced country. The mass population migration process in the inland – coast direction remains, in 2011, a trend which has effects on the territories of the receiving country.

This picture is confirmed through the Population Density (Table 1.9), an indicator that describes the different dimensions of the individuals‘ concentration in the territory. In 2001, Portugal had a population density of 112.30 inhabitants per km$^2$, a number that in 2011 is of 114.30 inhab/km$^2$.

**Table 1.9**
Population Density (inhab/km$^2$)

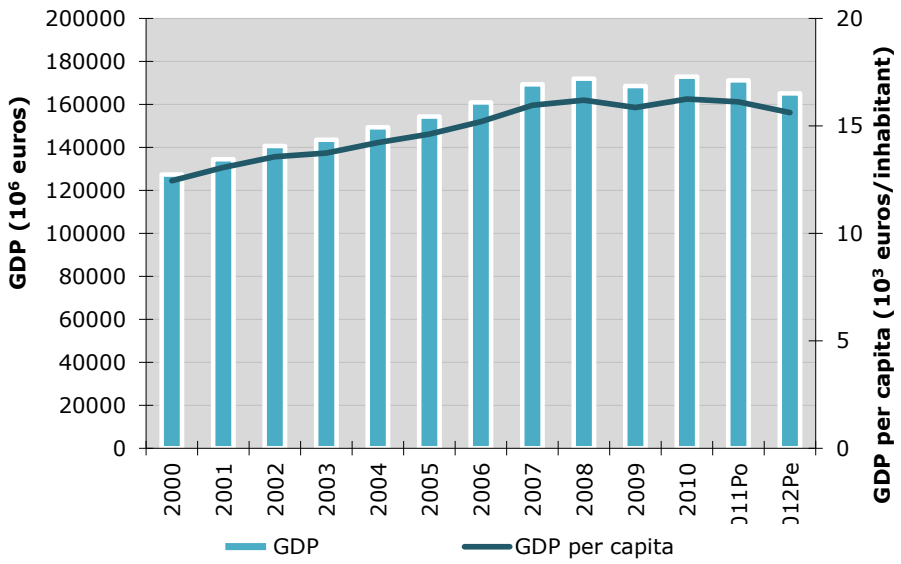
| NUTS | 2001 | 2011 |
|---|---|---|
| Portugal | 112.30 | 114.30 |
| Mainland | 110.90 | 112.60 |
| ARA | 102.30 | 106.40 |
| ARM | 290.30 | 332.70 |

**Source:** INE, 2013

## 1.4 Economic characterization

Since 2000 the Portuguese economy has been showing significant difficulties in ensuring economic growth, which was aggravated with the international economic and financial crisis since 2008 and forced a program of economic and financial adjustment.

In Portugal, GDP per capita increased by about 34% between 2000 and 2007, while in 2007-2011 ranged 1.1% (Figure 1.18). When compared with other EU countries, in 2012 the national GDP per capita (Purchasing Power Parity - PPP) represented 75% of the EU-27 average.




Po – provisional data
Pe – preliminary data

**Figure 1.18**
Gross domestic product at market prices
**Source**: Statistics Portugal (National Accounts), December 2013

Due to the financial crisis of 2008, the recessive flows of international trade and investment was reflected in a greater need for adjustment of the Portuguese economy, resulting in an increase of unemployment (Table 1.10 and 1.11). In 2012 the unemployment rate reached 15.7%, exceeding the maximum of the previous year, which was 12.7%.

**Table 1.10**
Performance of the Portuguese economy 2006-2012
Values of growth rates in volume

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011Po | 2012Pe |
|---|---|---|---|---|---|---|---|
| GDP | 1.4 | 2.4 | 0.0 | -2.9 | 1.9 | -1.3 | -3.2 |
| Private consumption | 1.8 | 2.4 | 1.3 | -2.3 | 2.6 | -3.4 | -5.4 |
| Public consumption | -0.6 | 0.5 | 0.5 | 4.7 | 0.1 | -5.0 | -4.7 |
| Gross fixed capital formation | -1.3 | 2.6 | -0.3 | -8.6 | -3.1 | -10.5 | -14.4 |
| Exports of goods (FOB) and services | 11.6 | 7.5 | -0.1 | -10.9 | 10.2 | 6.9 | 3.2 |
| Imports of goods (FOB) and services | 7.2 | 5.5 | 2.3 | -10.0 | 8.0 | -5.3 | -6.6 |
| Current-account balance (% of GDP) | -10.7 | -10.2 | -12.6 | -10.8 | -10.4 | -7.2 | -1.9 |
| Public budget balance (% of GDP) | -4.6 | -3.2 | -3.6 | -10.2 | -9.8 | -4.3 | -6.5 |
| Gross public debt (% of GDP) | 69.4 | 68.4 | 71.7 | 83.7 | 94.0 | 108.3 | 124.1 |
| Unemployment rate (%) | 7.7 | 8.0 | 7.6 | 9.5 | 10.8 | 12.7 | 15.7 |
| Inflation rate (IHPC) | 3.0 | 2.4 | 2.7 | -0.9 | 1.4 | 3.6 | 2.8 |

Po – provisional data
Pe – preliminary data
**Source**: INE and Portuguese Central Bank, 2013

**Table 1.11**

Active Population, employment and unemployment

| Year | Active Population | Employed population | Employment Rate | Unemployment Rate |
|---|---|---|---|---|
| | ($10^3$ individuals) | | (%) | |
| **2000** | 5,226.4 | 5,020.9 | 49.1 | 3.9 |
| **2001** | 5,325.2 | 5,111.7 | 49.7 | 4,0 |
| **2002** | 5,407.8 | 5,137.3 | 49.6 | 5,0 |
| **2003** | 5,460.3 | 5,118,0 | 49,0 | 6.3 |
| **2004** | 5,487.8 | 5,122.8 | 48.7 | 6.7 |
| **2005** | 5,544.8 | 5,122.6 | 48.5 | 7.6 |
| **2006** | 5,587.3 | 5,159.5 | 48.7 | 7.7 |
| **2007** | 5,618.3 | 5,169.7 | 48.8 | 8,0 |
| **2008** | 5,624.9 | 5,197.8 | 48.9 | 7.6 |
| **2009** | 5,582.7 | 5,054.1 | 47.5 | 9.5 |
| **2010** | 5,580.7 | 4,978.2 | 46.8 | 10.8 |
| **2011** | 5,543.2 | 4,837,0 | 45.4 | 12.7 |
| **2012** | 5,494.8 | 4,634.7 | 43.7 | 15.7 |

**Note**: Amendment of the basis of the series in 2011

**Source**: Statistics Portugal, 2013

The GDP fall was determined largely by the behavior of domestic demand, especially the reduction of final consumption expenditure of households and investment.

**Table 1.12**

GDP, GDP *per capita* and GDP deflator in Portugal

| Year | GDP | | GDP deflator | | GDP per capita |
|---|---|---|---|---|---|
| | Current prices | In volume | | | |
| | ($10^6$ euros) | | (2006=100) | Variation (%) | ($10^3$ euros) |
| **2000** | 127,316.9 | 152,155.9 | 83.7 | 3.2 | 12.5 |
| **2001** | 134,471.1 | 155,160.6 | 86.7 | 3.6 | 13.1 |
| **2002** | 140,566.8 | 156,346.7 | 89.9 | 3.7 | 13.6 |
| **2003** | 143,471.7 | 154,922.2 | 92.6 | 3.0 | 13.7 |
| **2004** | 149,312.5 | 157,339.5 | 94.9 | 2.5 | 14.2 |
| **2005** | 154,268.7 | 158,559.0 | 97.3 | 2.5 | 14.6 |
| **2006** | 160,855.4 | 160,855.4 | 100.0 | 2.8 | 15.2 |
| **2007** | 169,319.2 | 164,660.2 | 102.8 | 2.8 | 16.0 |
| **2008** | 171,983.1 | 164,646.2 | 104.5 | 1.6 | 16.2 |
| **2009** | 168,529.2 | 159,857.7 | 105.4 | 0.9 | 15.9 |
| **2010** | 172,859.5 | 162,953.2 | 106.1 | 0.6 | 16.3 |
| **2011Po** | 171,126.2 | 160,915.5 | 106.4 | 0.3 | 16.1 |
| **2012Pe** | 165,107.5 | 155,717.1 | 106.0 | -0.3 | 15.6 |

**Note**: Base 2006; Po – provisional data; Pe – Preliminary data

**Source**: Statistics Portugal (National Accounts), December 2013

The economic deterioration was aggravated after 2010 and throughout 2011 and 2012, with a recession in the generation of wealth, even partially accommodated by the good performance of the export sector, which contributes to an external adjustment faster than initially expected.

With regard to the structure of exports, the trend is toward an increase in the technological intensity degree of the exported products, from low technology products to others of a higher technology intensity. The medium technology products have represented, since 2005, more than half of total exports of the manufactured industrial products. In 2012, these products accounted for 56.4 % of total exports of such

products. In services, tourism still stands out but there has seen a surge in the growth of exports regarding other business services and, to a lesser extent, software, research and development.

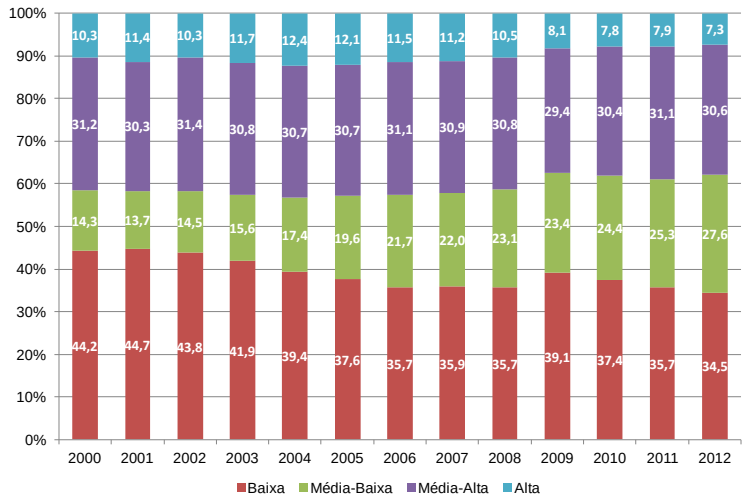



Figure 1.19
Exports by degree of Technology Intensity
**Source**: Statistics Portugal, 2013

Over the past decade, the Portuguese economy shows a deficit in the trade balance. However, during the adjustment program, there has been a favorable trend towards a balance in the international trade balance.

**Table 1.13**
Trade Balance

| Year | Exports | | | Imports | | | Imports | Exports | Current-account balance |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Goods | Services | Total | Goods | Services | | | |
| | $10^6$ euros | | | | | | (% PIB) | | |
| **2000** | 36,838.8 | 28,909.0 | 7,929.8 | 50,832.2 | 44,429.2 | 6,403.0 | 39.9 | 28.9 | -11.0 |
| **2001** | 37,753.0 | 29,554.1 | 8,198.9 | 51,532.1 | 45,184.2 | 6,347.9 | 38.3 | 28.1 | -10.3 |
| **2002** | 38,797.6 | 30,202.0 | 8,595.6 | 50,469.7 | 44,104.9 | 6,364.8 | 35.9 | 27.6 | -8.3 |
| **2003** | 39,630.8 | 31,020.5 | 8,610.3 | 49,388.0 | 43,233.2 | 6,154.8 | 34.4 | 27.6 | -6.8 |
| **2004** | 41,874.7 | 32,413.8 | 9,460.9 | 54,294.2 | 47,601.8 | 6,692.4 | 36.4 | 28.1 | -8.3 |
| **2005** | 42,668.8 | 32,750.4 | 9,918.4 | 57,190.5 | 49,878.1 | 7,312.4 | 37.1 | 27.7 | -9.4 |
| **2006** | 49,712.7 | 37,670.3 | 12,042.4 | 63,685.2 | 55,154.6 | 8,530.6 | 39.6 | 30.9 | -8.7 |
| **2007** | 54,498.2 | 40,342.8 | 14,155.4 | 68,044.8 | 58,746.7 | 9,298.1 | 40.2 | 32.2 | -8.0 |
| **2008** | 55,801.8 | 40,999.7 | 14,802.1 | 73,124.7 | 63,270.5 | 9,854.2 | 42.5 | 32.5 | -10.1 |
| **2009** | 47,235.7 | 33,716.9 | 13,518.8 | 59,717.2 | 50,573.7 | 9,143.5 | 35.4 | 28.0 | -7.4 |
| **2010** | 54,109.4 | 39,421.3 | 14,688.1 | 67,439.1 | 57,666.0 | 9,773.1 | 39.0 | 31.3 | -7.7 |
| **2011Po** | 61,060.4 | 45,098.6 | 15,961.8 | 68,537.9 | 58,345.9 | 10,192.0 | 40.1 | 35.7 | -4.4 |
| **2012Pe** | 63,882.1 | 47,674.1 | 16,208.0 | 64,880.4 | 55,352.1 | 9,528.3 | 39.3 | 38.7 | -0.6 |

**Source**: Statistics Portugal (National Accounts), December 2013

The GVA sub-sectors have remained relatively constant. However, the improvement of the Portuguese economy will have to go through an increase of the value added content towards external demand through exports.

**Table 1.14**
GVA sub-sectors

| Year | 2007 | 2008 | 2009 | 2010 | 2011Po | 2012Pe |
|---|---|---|---|---|---|---|
| GVA at base prices | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Agriculture, forestry and fisheries | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.3 |
| Industry | 14.6 | 14.1 | 13.0 | 13.8 | 14.22 | 14.4 |
| Energy, waster and sanitation | 3.4 | 3.2 | 3.6 | 3.9 | 3.99 | 4.2 |
| Constuction | 7.3 | 7.3 | 6.7 | 6.3 | 5.84 | 5.1 |
| Trade and repair of vehicles; accommodation and restaurants | 18.3 | 18.2 | 18.9 | 18.7 | 19.15 | 19.7 |
| Transports and storage; communication and information activities | 8.7 | 8.6 | 8.8 | 8.5 | 8.75 | 9.0 |
| Financial and real estate activities | 15.6 | 16.0 | 15.1 | 15.4 | 15.55 | 16.2 |
| Other activity services | 29.7 | 30.3 | 31.6 | 31.2 | 30.3 | 29.3 |

Note: Po – Provisional data; Pe – preliminary data
**Source**: Statistics Portugal (National Accounts), September 2013

## 1.5 Energy

### 1.5.1 National Energy Resources

Portugal is a country with scarce indigenous fossil fuel resources, such as oil, coal and natural gas, being dependent of external sources to supply its demand (78.1% in 2011) (Figure 1.20). The energy dependence rate has been declining since 2005, despite the slight increase in 2008 compared to 2007 and in 2011 compared to 2010, resulting in a less favorable hydrology.

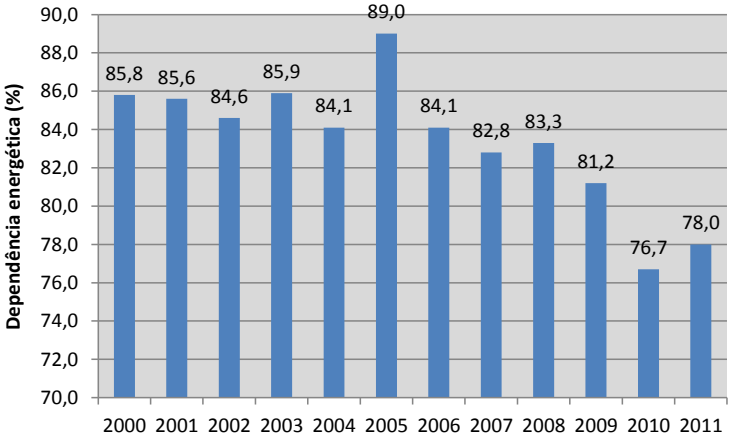



**Figure 1.20**
Energy dependence rate
**Source**: DGEG, 2013

However, the potential to use renewable energy sources (RES) in Portugal is notable. The most relevant RES are hydro, wind, solar, geothermal and biomass.

In Portugal the contribution of renewable energy for the total primary energy demand comes from hydropower energy and from forest biomass energy. Despite the fact that biomass and solar energies have good potential to generate heat, the electricity production is the form of energy that has been showing a larger development of technologies and the form that allow you to use renewable sources. Therefore, between 2007 and 2011, Portugal had a boosted growth in the installation of infrastructures to produce energy from renewable energy when comparing to past years being the wind power the major responsible for this development.

Hydropower has contributed significantly to electricity generation, being responsible for 28.7 % of its total in 2011 (Table 1.15). Wind power has reached, in the same year, 4,378 MW of installed capacity, which

represents 41.2 % of its total in power plants from renewable energy sources (Table 1.16). The total installed capacity in renewables grew 35.3 % between 2007 and 2011.

**Table 1.15**

Energy production from renewable sources

| Year | Hydro> 10MW | Hydro < 10MW | Biomas | wind | Geothermal | Photovoltaic | Total Renewables | Total Electricity | Renewables |
|---|---|---|---|---|---|---|---|---|---|
| | GWh | | | | | | | | % |
| **1995** | 7,962 | 492 | 988 | 16 | 42 | 1 | 9,501 | 33,264 | 28.6% |
| **1996** | 14,207 | 658 | 959 | 21 | 49 | 1 | 15,895 | 34,520 | 46.0% |
| **1997** | 12,537 | 638 | 1,036 | 38 | 51 | 1 | 14,301 | 34,207 | 41.8% |
| **1998** | 12,488 | 566 | 1,022 | 89 | 58 | 1 | 14,224 | 38,984 | 36.5% |
| **1999** | 7,042 | 589 | 1,237 | 122 | 80 | 1 | 9,071 | 43,287 | 21.0% |
| **2000** | 11,040 | 675 | 1,554 | 168 | 80 | 1 | 13,518 | 43,764 | 30.9% |
| **2001** | 13,605 | 770 | 1,600 | 256 | 105 | 2 | 16,338 | 46,509 | 35.1% |
| **2002** | 7,551 | 706 | 1,732 | 362 | 96 | 2 | 10,449 | 46,107 | 22.7% |
| **2003** | 15,163 | 891 | 1,663 | 496 | 90 | 3 | 18,306 | 46,852 | 39.1% |
| **2004** | 9,570 | 577 | 1,797 | 816 | 84 | 3 | 12,847 | 45,105 | 28.5% |
| **2005** | 4,737 | 381 | 1,976 | 1,773 | 71 | 3 | 8,941 | 46,575 | 19.2% |
| **2006** | 10,633 | 834 | 2,001 | 2,925 | 85 | 5 | 16,483 | 49,041 | 33.6% |
| **2007** | 9,927 | 522 | 2,140 | 4,037 | 201 | 24 | 16,851 | 47,253 | 35.7% |
| **2008** | 6,780 | 516 | 2,133 | 5,757 | 192 | 41 | 15,419 | 45,969 | 33.5% |
| **2009** | 8,108 | 901 | 2,376 | 7,577 | 184 | 160 | 19,306 | 50,207 | 38.5% |
| **2010** | 15,458 | 1,088 | 3,427 | 9,182 | 197 | 214 | 29,566 | 54,093 | 54.7% |
| **2011*** | 11,253 | 862 | 3,849 | 9,161 | 210 | 277 | 25,612 | 52,459 | 48.8% |

**Source**: DGEG, 2013 * Provisional data

**Table 1.16**

Installed capacity in power plants from renewable energies (MW)

| Ano | Hydro > 10MW | Hydro < 10MW | Biomass | wind | Geothermal | Photovoltaic | Total Renewables | Total Electricity |
|---|---|---|---|---|---|---|---|---|
| **1995** | 4,032 | 246 | 359 | 8 | 9 | 0 | 4,655 | 9,689 |
| **1996** | 4,036 | 248 | 345 | 18 | 9 | 0 | 4,657 | 9,810 |
| **1997** | 4,130 | 245 | 351 | 29 | 9 | 1 | 4,764 | 9,865 |
| **1998** | 4,051 | 247 | 351 | 53 | 18 | 1 | 4,721 | 10,989 |
| **1999** | 4,035 | 257 | 441 | 57 | 18 | 1 | 4,809 | 11,167 |
| **2000** | 4,037 | 266 | 441 | 83 | 18 | 1 | 4,846 | 11,280 |
| **2001** | 4,050 | 281 | 441 | 125 | 18 | 1 | 4,916 | 11,405 |
| **2002** | 4,061 | 294 | 479 | 190 | 18 | 2 | 5,044 | 11,620 |
| **2003** | 4,061 | 298 | 459 | 268 | 18 | 2 | 5,106 | 12,018 |
| **2004** | 4,321 | 307 | 475 | 553 | 18 | 3 | 5,677 | 13,114 |
| **2005** | 4,493 | 323 | 476 | 1,063 | 18 | 3 | 6,376 | 13,899 |
| **2006** | 4,524 | 324 | 488 | 1,699 | 29 | 3 | 7,067 | 14,961 |
| **2007** | 4,524 | 329 | 492 | 2,464 | 29 | 15 | 7,852 | 15,792 |
| **2008** | 4,533 | 324 | 437 | 3,058 | 29 | 62 | 8,443 | 16,477 |
| **2009** | 4,544 | 341 | 502 | 3,564 | 29 | 111 | 9,090 | 18,125 |
| **2010** | 4,544 | 354 | 713 | 3,914 | 29 | 134 | 9,688 | 19,633 |
| **2011(*)** | 4,975 | 357 | 712 | 4,378 | 29 | 174 | 10,625 | 20,630 |

**Source:** DGEG, 2013 * Provisional data

In Portugal, geothermal energy is only used in the Azores.

According to solar radiation data, Portugal receives annually the equivalent to 140 million of GWh, representing a great potential for its utilization through thermal and solar photovoltaic technologies.

Similarly, the potential of wave energy in Portugal is considerable. Due to the available potential along the Portuguese coastline to exploring ocean energy, a pilot area was created as an example of this concept and to the development of offshore wind energy projects.

### 1.5.2 Primary Energy Production

Portugal has scarce endogenous energy resources so the primary energy production depends entirely on renewable energies.

The production of electricity from renewable sources is highly dependent on change rates in the production from large hydro and represented, in 2011, 48.8 % of its total production. To accomplish at least 39 % of gross electricity consumption from renewable sources in 2010, Portugal depended strongly on large hydro production (Table 1.15).

However, wind energy represented 9,161 GWh in 2011 (4,037 GWh in 2007). In the Azores, geothermal has contributed with 210 GWh in 2011 (201 GWh in 2007) (Table 1.17). With the instability of hydropower, which has a strong impact in the national energy structure, the contribution of renewable energy to primary energy demand is irregular.

Considering the correction of values for hydro production, according to the Index of Hydro Production (HPI) for each year, the result of annual average contribution of renewable sources in electricity production was 46.7 % , between 2007 and 2011 , with a medium hydrologic scenario (Table 1.17) .

**Table 1.17**

Share of renewables in the supply of energy consumption, corrected by IPH

| Year | Total Hydro | IPH | Total Hydro Corrected | Total corrected | Gross Production+ Import Balance | Renewable (Directive) |
|---|---|---|---|---|---|---|
| | | Directive Reference year (1997) | | | (GWh) | % |
| **1997** | 13,175 | 1.000 | 13,175 | 14,301 | 37,106 | 38.5% |
| **1998** | 13,054 | 0.852 | 15,322 | 16,492 | 39,258 | 42.0% |
| **1999** | 7,631 | 0.557 | 13,700 | 15,140 | 42,427 | 35.7% |
| **2000** | 11,715 | 0.885 | 13,237 | 15,040 | 44,695 | 33.7% |
| **2001** | 14,375 | 0.975 | 14,744 | 16,707 | 46,748 | 35.7% |
| **2002** | 8,257 | 0.623 | 13,254 | 15,446 | 48,006 | 32.2% |
| **2003** | 16,054 | 1.090 | 14,728 | 16,980 | 49,646 | 34.2% |
| **2004** | 10,147 | 0.664 | 15,282 | 17,982 | 51,586 | 34.9% |
| **2005** | 5,118 | 0.336 | 15,232 | 19,055 | 53,399 | 35.7% |
| **2006** | 11,467 | 0.800 | 14,334 | 19,350 | 54,482 | 35.5% |
| **2007** | 10,449 | 0.627 | 16,665 | 23,067 | 54,741 | 42.1% |
| **2008** | 7,296 | 0.461 | 15,826 | 23,949 | 55,400 | 43.2% |
| **2009** | 9,009 | 0.634 | 14,210 | 24,507 | 54,983 | 44.6% |
| **2010** | 16,547 | 1.070 | 15,464 | 28,483 | 56,716 | 50.2% |
| **2011*** | 12,115 | 0.750 | 16,153 | 29,650 | 55 ,273 | 53.6% |

**Source**: DGEG, 2013 * Provisional Data

### 1.5.3 Primary Energy Consumption

The primary energy consumption decreased 11.3% between 2007 and 2011. Between 2007 and 2011, Portugal registered a decline from 2.39 toe /in the per capita consumption in 2007, to 2.14 toe / per capita in 2011.

In relative terms, the oil is still essential to satisfy the Portuguese demand, representing in 2011, 45.9% of the total primary energy consumption.

The introduction of natural gas in 1997 contributed for this decrease, which enabled the diversification of the structure of energy supply and reduced external dependence on oil. The use of natural gas has registered a positive evolution, representing 15.1% of the total primary energy demand in 2007 and 19.9 % in 2011.

In 2011 coal consumption represented 9.9% of total primary energy consumption. In 2011, about 78.1 % of the primary energy consumed in Portugal was imported.

Energy´s GHG emissions depend on the type of fuel used and its carbon intensity. In 2011, 75.5 % of the primary energy consumed was produced from fossil fuels (oil, natural gas and coal), the renewable sources represented 22 %, referring to the domestic sources, the remaining 2.5 % are provided from imported electricity and waste industrial.

### 1.5.4 Final Energy Consumption

Final energy consumption is an important parameter in order to understand the evolution of the demand, aiming the definition and application of an energy policy focused on the rationalization of its use and sustainability.

Oil production consumption represented 51.7% of the total in 2007, decreasing to 48.1% in 2011.

As for the evolution of sectoral energy consumption, the industrial sector which represented 31.3% of the overall final energy consumption in 2007, represented 32.0% in 2011. On the other hand, the transport sector represented 36.7% of the final energy consumption in 2007, slightly higher than the 36.4% that were registered in 2011. In 2011, the residential and the services sectors represented 28.5% of total final energy consumption (Table 1.18).

**Table 1.18**

Primary energy consumption by fuel type (ktoe)

| Year | PEC[7] | Coal | | Oil | | Electricity | | Natural Gas | | Others[8] | | Population ** | PEC *per capita* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ktoe | (%) | Ktoe | (%) | Ktoe | (%) | Ktoe | (%) | Ktoe | (%) | (million) | |
| **1990** | 17,625 | 2,760 | 15.7% | 11,731 | 66.6% | 804 | 4.6% | 0 | 0.0% | 2,331 | 13.2% | 9,877 | 1.78 |
| **1991** | 17,881 | 2,906 | 16.3% | 11,767 | 65.8% | 798 | 4.5% | 0 | 0.0% | 2,410 | 13.5% | 9,961 | 1.80 |
| **1992** | 19,033 | 2,950 | 15.5% | 13,148 | 69.1% | 552 | 2.9% | 0 | 0.0% | 2,383 | 12.5% | 9,965 | 1.91 |
| **1993** | 18,743 | 3,142 | 16.8% | 12,479 | 66.6% | 768 | 4.1% | 0 | 0.0% | 2,354 | 12.6% | 9,983 | 1.88 |
| **1994** | 19,308 | 3,328 | 17.2% | 12,637 | 65.4% | 1,001 | 5.2% | 0 | 0.0% | 2,342 | 12.1% | 10,013 | 1.93 |
| **1995** | 20,474 | 3,604 | 17.6% | 13,649 | 66.7% | 811 | 4.0% | 0 | 0.0% | 2,410 | 11.8% | 10043 | 2.04 |
| **1996** | 20,363 | 3,430 | 16.8% | 13,147 | 64.6% | 1,379 | 6.8% | 0 | 0.0% | 2,406 | 11.8% | 10,072 | 2.02 |
| **1997** | 21,935 | 3,513 | 16.0% | 14,444 | 65.9% | 1,390 | 6.3% | 87 | 0.4% | 2,502 | 11.4% | 10,110 | 2.17 |
| **1998** | 23,209 | 3,232 | 13.9% | 15,634 | 67.4% | 1,159 | 5.0% | 700 | 3.0% | 2,484 | 10.7% | 10,149 | 2.29 |
| **1999** | 24,880 | 3,747 | 15.1% | 15,993 | 64.3% | 600 | 2.4% | 1,956 | 7.9% | 2,584 | 10.4% | 10,195 | 2.44 |
| **2000** | 25,325 | 3,813 | 15.1% | 15,568 | 61.5% | 1,109 | 4.4% | 2,135 | 8.4% | 2,699 | 10.7% | 10,257 | 2.47 |
| **2001** | 25,244 | 3,201 | 12.7% | 15,799 | 62.6% | 1,288 | 5.1% | 2,267 | 9.0% | 2,689 | 10.7% | 10,329 | 2.44 |
| **2002** | 26,334 | 3,500 | 13.3% | 16,417 | 62.3% | 913 | 3.5% | 2,743 | 10.4% | 2,761 | 10.5% | 10,407 | 2.53 |
| **2003** | 25,737 | 3,355 | 13.0% | 15,257 | 59.3% | 1,672 | 6.5% | 2,649 | 10.3% | 2,805 | 10.9% | 10,475 | 2.46 |
| **2004** | 26,445 | 3,375 | 12.8% | 15,411 | 58.3% | 1,508 | 5.7% | 3,316 | 12.5% | 2,835 | 10.7% | 10,529 | 2.51 |
| **2005** | 27,087 | 3,349 | 12.4% | 15,877 | 58.6% | 1,186 | 4.4% | 3,761 | 13.9% | 2,914 | 10.8% | 10,570 | 2.56 |
| **2006** | 25,971 | 3,310 | 12.7% | 14,305 | 55.0% | 1,713 | 6.6% | 3,595 | 13.8% | 3,048 | 11.7% | 10,599 | 2.45 |
| **2007** | 25,350 | 2,883 | 11.4% | 13,567 | 53.5% | 1,909 | 7.5% | 3,821 | 15.1% | 3,170 | 12.5% | 10,618 | 2.39 |
| **2008** | 24,215 | 2,526 | 10.4% | 12,365 | 51.0% | 1,953 | 8.1% | 4,157 | 17.1% | 3,214 | 13.2% | 10,627 | 2.28 |
| **2009** | 23,911 | 2,858 | 11.9% | 11,533 | 48.2% | 1,867 | 7.8% | 4,233 | 17.7% | 3,419 | 14.3% | 10,638 | 2.25 |
| **2010** | 23,102 | 1,657 | 7.2% | 11,241 | 48.5% | 2,475 | 10.7% | 4,507 | 19.5% | 3,223 | 13.9% | 10,637 | 2.18 |
| **2011*** | 22,496 | 2,222 | 9.9% | 10,331 | 45.9% | 2,114 | 9.4% | 4,483 | 19.9% | 3,345 | 14.9% | 10,561 | 2.14 |

**Source**: DGEG and ** INE, 2013 * Provisional Data

[7] Primary Energy Consumption

[8] Considers wood and biomass wastes, urban solid wastes, sulphite liquors, biogas and biodiesel

**Table 1.19**

Final energy consumption by fuel type

| Year | FEC[9] | Coal | Oil | Electricity | Natural Gas | Others[10] | Renewables |
|---|---|---|---|---|---|---|---|
| | ktoe | | | | | | |
| **1990** | 11,664 | 658 | 6,497 | 2,011 | 0 | 2,498 | 1,759 |
| **1991** | 12,237 | 656 | 6,903 | 2,145 | 0 | 2,534 | 1,699 |
| **1992** | 12,649 | 663 | 7,237 | 2,245 | 0 | 2,504 | 1,647 |
| **1993** | 12,776 | 647 | 7,366 | 2,267 | 0 | 2,497 | 1,611 |
| **1994** | 13,171 | 657 | 7,641 | 2,344 | 0 | 2,529 | 1,593 |
| **1995** | 13,554 | 600 | 7,894 | 2,469 | 0 | 2,591 | 1,597 |
| **1996** | 14,278 | 632 | 8,392 | 2,607 | 0 | 2,646 | 1,629 |
| **1997** | 14,919 | 526 | 8,909 | 2,747 | 44 | 2,693 | 1,635 |
| **1998** | 15,789 | 448 | 9,513 | 2,911 | 246 | 2,671 | 1,630 |
| **1999** | 16,542 | 401 | 9,750 | 3,109 | 503 | 2,779 | 1,635 |
| **2000** | 17,386 | 506 | 10,112 | 3,300 | 719 | 2,749 | 1,633 |
| **2001** | 17,812 | 227 | 10,421 | 3,436 | 1,054 | 2,675 | 1,668 |
| **2002** | 18,197 | 177 | 10,624 | 3,567 | 1,180 | 2,651 | 1,638 |
| **2003** | 18,352 | 140 | 10,494 | 3,712 | 1,267 | 2,739 | 1,688 |
| **2004** | 18,739 | 88 | 10,650 | 3,842 | 1,369 | 2,791 | 1,703 |
| **2005** | 18,743 | 16 | 10,558 | 3,932 | 1,300 | 2,936 | 1,742 |
| **2006** | 18,643 | 26 | 10,172 | 4,083 | 1,337 | 3,025 | 1,766 |
| **2007** | 18,372 | 168 | 9,505 | 4,216 | 1,431 | 3,051 | 1,793 |
| **2008** | 17,832 | 71 | 9,049 | 4,159 | 1,505 | 3,048 | 1,807 |
| **2009** | 17,313 | 22 | 8,804 | 4,126 | 1,378 | 2,982 | 1,820 |
| **2010** | 17,267 | 50 | 8,675 | 4,289 | 1,514 | 2,739 | 1,349 |
| **2011*** | 16,525 | 20 | 7,946 | 4,160 | 1,544 | 2,855 | 1408 |

**Source**: DGEG, 2013 * Provisional data

[9] *Final Energy Consumption (without Non Energy Uses).*

[10] *Considers wood and biomass waste, urban solid waste, sulphite liquors, biogas, coque gas, oven gas, condensable gases.*

**Table 1.20**

Final energy consumption by sector [11]

| | Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** |
| **Total Industry**[12] | 4,130 | 4,291 | 4,343 | 4,224 | 4,326 | 4,415 | 4,646 | 4,958 | 5,058 | 5,217 | 5,299 |
| *Coal* | 658 | 656 | 663 | 647 | 657 | 600 | 632 | 526 | 448 | 401 | 506 |
| *Oil* | 1,382 | 1,468 | 1,452 | 1,363 | 1,371 | 1,410 | 1,530 | 1,803 | 1,776 | 1,609 | 1,366 |
| *Electricity* | 935 | 920 | 969 | 942 | 979 | 1,029 | 1,056 | 1,115 | 1,160 | 1,201 | 1,266 |
| *Natural Gas* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 223 | 435 | 592 |
| *Others*[13] | 1,155 | 1,247 | 1,258 | 1,272 | 1,319 | 1,376 | 1,428 | 1,471 | 1,451 | 1,572 | 1,569 |
| *% in F.E.C* | 35.4 | 35.1 | 34.3 | 33.1 | 32,8 | 32.6 | 32.5 | 33.2 | 32 | 31.5 | 30.5 |
| **Total Transports** | 3,579 | 3,794 | 4,091 | 4,228 | 4,402 | 4,644 | 4,879 | 5,122 | 5,717 | 6,054 | 6,617 |
| *Gasoline* | 1,448 | 1,592 | 1,778 | 1,873 | 1,923 | 1,984 | 2,035 | 2,023 | 2,093 | 2,118 | 2,159 |
| *%* | 40 | 42 | 43 | 44 | 44 | 43 | 42 | 40 | 37 | 35 | 33 |
| *% in F.E.C* | 30.7 | 31 | 32.3 | 33.1 | 33.4 | 34.3 | 34.2 | 34.3 | 36.2 | 36.6 | 38.1 |
| **Total Residential** | 2,428 | 2,453 | 2,486 | 2,515 | 2,525 | 2,547 | 2,655 | 2,666 | 2,737 | 2,854 | 2,924 |
| *Coal* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Oil* | 585 | 615 | 653 | 687 | 697 | 700 | 755 | 738 | 777 | 820 | 831 |
| *Electricity* | 512 | 564 | 600 | 619 | 634 | 653 | 702 | 724 | 755 | 819 | 865 |
| *Natural Gas* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 36 | 74 |
| *Others14* | 1,331 | 1,274 | 1,233 | 1,209 | 1,195 | 1,194 | 1,199 | 1,203 | 1,195 | 1,179 | 1,154 |
| % in F.E.C | 20.8 | 20 | 19.7 | 19.7 | 19.2 | 18.8 | 18.6 | 17.9 | 17.3 | 17.3 | 16.8 |
| **Total Services** | 779 | 898 | 938 | 976 | 1,041 | 1,076 | 1,175 | 1,340 | 1,566 | 1,721 | 1,790 |
| *Coal* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Oil* | 268 | 300 | 326 | 338 | 391 | 376 | 418 | 533 | 668 | 716 | 700 |
| *Electricity* | 499 | 585 | 599 | 622 | 634 | 682 | 738 | 789 | 863 | 948 | 1,020 |
| *Natural Gas* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 32 | 52 |
| *Others*[15] | 12 | 13 | 13 | 15 | 15 | 18 | 19 | 19 | 22 | 25 | 18 |
| *% in F.E.C* | 6,7 | 7.3 | 7.4 | 7.6 | 7.9 | 7.9 | 8.2 | 9 | 9.9 | 10.4 | 10.3 |
| **Total FEC** | 11,664 | 12,237 | 12,649 | 12,776 | 13,171 | 13,554 | 14,278 | 14,919 | 15,789 | 16,542 | 17,386 |

[11] Final Energy Consumption (without Non Energy Uses);

[12] Includes Extractive and Manufacturing Industries;

[13] Includes wood and wastes, coque gas, oven gas, incondensable gases and heat;

[14] Includes city gas and heat.

**Table 1.20 (cont.)**

Final energy consumption by sector

| | Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011*** |
| **Total Industry** | 5,339 | 5,388 | 5,353 | 5,484 | 5,809 | 5,778 | 5,756 | 5,467 | 5,510 | 5,099 | 5,285 |
| *Coal* | 227 | 177 | 140 | 88 | 140 | 88 | 16 | 26 | 168 | 71 | 22 |
| *Oil* | 1,465 | 1,509 | 1,363 | 1,417 | 1,567 | 1,610 | 1,573 | 1,155 | 1,152 | 917 | 888 |
| *Electricity* | 1,275 | 1,293 | 1,321 | 1,340 | 1,340 | 1,312 | 1,362 | 1,427 | 1,390 | 1,267 | 1,378 |
| *Gas Natural* | 842 | 909 | 963 | 1,026 | 1,026 | 941 | 958 | 1,019 | 1,036 | 887 | 980 |
| *Others* | 1,530 | 1,500 | 1,566 | 1,613 | 1,735 | 1,828 | 1,847 | 1,839 | 1,765 | 1,957 | 2,017 |
| *% in F.E.C* | 30 | 29.6 | 29.2 | 29.3 | 31 | 31 | 31.3 | 30.7 | 31.8 | 29.5 | 32 |
| **Total Transports** | 6,690 | 6,841 | 6,878 | 6,869 | 6,819 | 6,912 | 6,735 | 6,440 | 6,497 | 6,447 | 6,010 |
| *Gasoline* | 2,034 | 2,135 | 2,070 | 1,988 | 1,885 | 1,756 | 1,644 | 1,561 | 1,531 | 1,453 | 1,309 |
| *%* | 30 | 31 | 30 | 29 | 28 | 25 | 24 | 24 | 24 | 23 | 22 |
| *% in F.E.C* | 37.6 | 37.6 | 37.5 | 36.7 | 36.4 | 37.1 | 36.7 | 36.1 | 37.5 | 37.3 | 36.4 |
| **Total Residential** | 2,926 | 3,017 | 3,068 | 3,146 | 3,231 | 3,215 | 3,213 | 3,191 | 3,203 | 2,954 | 2,801 |
| *Coal* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Oil* | 761 | 761 | 742 | 736 | 716 | 682 | 621 | 553 | 531 | 680 | 587 |
| *Electricity* | 914 | 979 | 1,018 | 1,069 | 1,139 | 1,153 | 1,192 | 1,158 | 1,220 | 1.249 | 1,183 |
| *Natural Gas* | 118 | 147 | 159 | 182 | 200 | 203 | 221 | 300 | 265 | 300 | 259 |
| *Others* | 1,134 | 1,130 | 1,150 | 1,159 | 1,176 | 1,177 | 1,178 | 1,181 | 1,187 | 725 | 772 |
| % in F.E.C | 16.4 | 16.6 | 16.7 | 16.8 | 17.2 | 17.2 | 17.5 | 17.9 | 18.5 | 17.1 | 17 |
| **Total Services** | 1,998 | 2,095 | 2,301 | 2,451 | 2,421 | 2,173 | 2,216 | 2,133 | 2,174 | 2,015 | 1,943 |
| *Coal* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Oil* | 826 | 862 | 977 | 1,065 | 934 | 584 | 587 | 498 | 473 | 250 | 181 |
| *Electricity* | 1,086 | 1,124 | 1,196 | 1,246 | 1,297 | 1,379 | 1,408 | 1,427 | 1,446 | 1,480 | 1,463 |
| *Natural Gas* | 86 | 110 | 128 | 141 | 138 | 157 | 169 | 154 | 199 | 209 | 214 |
| *Others* | 2 | 0 | 0 | 0 | 52 | 52 | 53 | 53 | 56 | 77 | 85 |
| *% in F.E.C* | 11.2 | 11.5 | 12.5 | 13.1 | 12.7 | 11.4 | 11.8 | 11.7 | 12.3 | 11.4 | 11.5 |
| **Total FEC** | 17,812 | 18,197 | 18,352 | 18,739 | 18,743 | 18,643 | 18,372 | 17,832 | 17,313 | 17,267 | 16,525 |

**Source:** DGEG, 2013

*Provisional Data

### 1.5.5 Energy Intensity and Carbonic Intensity

Energy intensity is an indicator of efficiency and sustainability of the economic sector. This indicator is usually expressed by energy consumption (primary energy or final energy) per unit GDP.
In 2011, energy intensity relative to the primary energy consumption was 132 toe/$10^6$ Euros 2006.

The final energy consumption was 97 toe/$10^6$ Euros 2006 (Table 1.21). Comparing 2011 with the latest years of 1990 and 2007 it is possible to conclude that the constant positive development of efficiency systems and infrastructure of the energy sector is represented in the largest reduction in GDP primary energy intensity relative to the final energy intensity:

a) Evolution of primary energy intensity:
- 1990-2011: -34.0%;
- 2007-2011: -16.0%.

b) Evolution of final energy intensity:
- 1990-2011: -27.1%;
- 2007-2011: -14.2%.

**Table 1.21**

Energy Intensity of GDP

| Year | Primary Energy Intensity | Final Energy Intensity |
|---|---|---|
| | (toe/$10^6$ Euros 2000)[16] | |
| **1990** | 200 | 133 |
| **1991** | 199 | 136 |
| **1992** | 207 | 138 |
| **1993** | 207 | 141 |
| **1994** | 208 | 142 |
| **1995** | 240 | 159 |
| **1996** | 225 | 158 |
| **1997** | 224 | 152 |
| **1998** | 218 | 148 |
| **1999** | 218 | 145 |
| **2000** | 207 | 142 |
| **2001** | 195 | 138 |
| **2002** | 194 | 134 |
| **2003** | 186 | 132 |
| **2004** | 183 | 130 |
| **2005** | 182 | 126 |
| **2006** | 167 | 120 |
| **2007** | 155 | 113 |
| **2008** | 145 | 107 |
| **2009** | 146 | 106 |
| **2010**[17] | 134 | 100 |
| **2011**[18]* | 132 | 97 |

**Source**: DGEG, 2013 *Provisional Data

The carbon intensity evaluates GHG emissions per unit of production and can be expressed in GHG emissions per unit of GDP.

[16] *Final energy consumption per GDP money unit, adjusted to 2000 price level (oil equivalent tonne per thousand million Euros) ((FEC without Non Energy Uses)*
[17] *Energy consumption per GDP money unit, adjusted to 2006 price level (oil equivalent ton per thousand million Euros)*
[18] *Energy consumption per GDP money unit, adjusted to 2006 price level (oil equivalent ton per thousand million Euros)*

In 2010, the carbon intensity in Portugal was 0.41t$CO_2$/million euros (Table 1.22). Despite the significant reduction in the carbon intensity of GDP, Portugal still is above the European average. The country has to face the challenge of making its economy more efficient compared to the European context, continuing its reduction trend of $CO_2$ emissions.

**Table 1.22**

Carbon Intensity of the GDP (CO2/PIB)

| Year | Carbon intensity of the economy |
|---|---|
| | 1 000 t equiv. $CO_2$/million euros |
| **1995** | 0.79 |
| **1996** | 0.71 |
| **1997** | 0.70 |
| **1998** | 0.69 |
| **1999** | 0.71 |
| **2000** | 0.65 |
| **2001** | 0.62 |
| **2002** | 0.62 |
| **2003** | 0.58 |
| **2004** | 0.57 |
| **2005** | 0.56 |
| **2006** | 0.51 |
| **2007** | 0.47 |
| **2008** | 0.45 |
| **2009** | 0.44 |
| **2010** | 0.41 |

**Source**: Eurostat, 2013

## 1.6 Transport

This subchapter begins with a brief analysis of the data related to vehicles, distances travelled and fuel consumption by public and individual transport. This step will enable a suitable understanding of the conclusions reached and to achieve that purpose a core set of indicators was selected, which are described at the Tables 1.23, 1.24 1.25, 1.26, 1.27 and 1.28.

As for Table 1.23, in 2011, Portugal had a total passenger cars of 4,107,557; 697,109 light duty vehicles, 123 153 heavy vehicles, 278 805 mopeds and 215 538 motorcycles.

The readings from Table 1.24 allow an accurate observation of the annual and decadal change rate. A comparison between the years of 2011 and 1991 records a positive change rate in the number of passenger cars (125.95 %, equivalent to 2.289.612 vehicles), light duty vehicles (48.08 %, equivalent to 226 349 vehicles), heavy vehicles (73.05 %, equivalent to 51,986 vehicles) and motorcycles (213.46 %, equivalent to 146 777 vehicles). Mopeds, on the contrary, show a negative change rate of 65.33 %, number that represents a decrease of 525,341 vehicles.

**Table 1.23**

Vehicle Stock (no.)

| Year | Passenger Cars | Light Duty Vehicles | Heavy Vehicles (total)[19] | Mopeds | Motorcycles |
|---|---|---|---|---|---|
| **1991** | 1,817,945 | 470,760 | 71,167 | 804,146 | 68,761 |
| **1992** | 2,074,933 | 493,586 | 71,167 | 773,618 | 72,856 |
| **1993** | 2,299,637 | 514,533 | 71,656 | 743,089 | 79,539 |
| **1994** | 2,530,489 | 536,351 | 73,157 | 712,560 | 86,679 |
| **1995** | 2,702,220 | 545,091 | 74,244 | 682,031 | 92,239 |
| **1996** | 2,891,635 | 560,783 | 73,547 | 651,502 | 101,864 |
| **1997** | 3,073,919 | 585,923 | 74,980 | 620,973 | 111,769 |
| **1998** | 3,287,238 | 617,314 | 76,412 | 590,444 | 123,961 |
| **1999** | 3,519,558 | 648,600 | 77,845 | 559,915 | 135,565 |
| **2000** | 3,743,313 | 684,953 | 79,277 | 529,387 | 144,595 |
| **2001** | 3,903,178 | 713,640 | 101,984 | 442,246 | 129,827 |
| **2002** | 4,014,335 | 728,521 | 100,336 | 479,290 | 143,298 |
| **2003** | 4,075,829 | 735,865 | 100,595 | 362,292 | 144,879 |
| **2004** | 4,135,212 | 743,159 | 137,142 | 344,295 | 150,991 |
| **2005** | 4,185,544 | 751,144 | 139,797 | 330,528 | 157,055 |
| **2006** | 4,214,766 | 753,012 | 139,525 | 321,835 | 166,956 |
| **2007** | 4,238,265 | 755,877 | 137,489 | 328,129 | 185,017 |
| **2008** | 4,253,808 | 750,360 | 133,734 | 301,285 | 192,631 |
| **2009** | 4,195,928 | 735,549 | 128,840 | 285,895 | 200,044 |
| **2010** | 4,191,284 | 718,869 | 125,123 | 283,369 | 215,987 |
| **2011** | 4,107,557 | 697,109 | 123,153 | 278,805 | 215,538 |

**Source**: INE, 2013

**Table 1.24**

Vehicle Stock Change Rate (%)

| Year | Passenger Cars | Light Duty Vehicles | Heavy Vehicles (total) | Mopeds | Motorcycles |
|---|---|---|---|---|---|
| **1991-92** | 14.14 | 4.85 | 0.00 | -3.80 | 5.96 |
| **1992-93** | 10.83 | 4.24 | 0.69 | -3.95 | 9.17 |
| **1993-94** | 10.04 | 4.24 | 2.09 | -4.11 | 8.98 |
| **1994-95** | 6.79 | 1.63 | 1.49 | -4.28 | 6.41 |
| **1995-96** | 7.01 | 2.88 | -0.94 | -4.48 | 10.43 |
| **1996-97** | 6.30 | 4.48 | 1.95 | -4.69 | 9.72 |
| **1997-98** | 6.94 | 5.36 | 1.91 | -4.92 | 10.91 |
| **1998-99** | 7.07 | 5.07 | 1.87 | -5.17 | 9.36 |
| **1999-00** | 6.36 | 5.60 | 1.84 | -5.45 | 6.66 |
| **2000-01** | 4.27 | 4.19 | 28.64 | -16.46 | -10.21 |
| **2001-02** | 2.85 | 2.09 | -1.62 | 8.38 | 10.38 |
| **2002-03** | 1.53 | 1.01 | 0.26 | -24.41 | 1.10 |
| **2003-04** | 1.46 | 0.99 | 36.33 | -4.97 | 4.22 |
| **2004-05** | 1.22 | 1.07 | 1.94 | -4.00 | 4.02 |
| **2005-06** | 0.70 | 0.25 | -0.19 | -2.63 | 6.30 |
| **2006-07** | 0.56 | 0.38 | -1.46 | 1.96 | 10.82 |
| **2007-08** | 0.37 | -0.73 | -2.73 | -8.18 | 4.12 |
| **2008-09** | -1.36 | -1.97 | -3.66 | -5.11 | 3.85 |
| **2009-10** | -0.11 | -2.27 | -2.89 | -0.88 | 7.97 |
| **2010-11** | -2.00 | -3.03 | -1.57 | -1.61 | -0.21 |
| **1991-01** | 141.51 | 58.62 | 43.30 | -47.02 | 96.32 |
| **2001-11** | 5.24 | -2.32 | 20.76 | -36.96 | 66.02 |
| **1991-11** | 125.95 | 48.08 | 73.05 | -65.33 | 213.46 |

[19] Includes passengers and duty.

By reading Table 1.25, it is expected that in 2011, in Portugal, passengers cars travelled a total of 59546.42 kmx$10^6$, light duty vehicles travelled a total of 12562.85 kmx$10^6$, heavy vehicles reached travelled a total of 3562.83 kmx$10^6$, mopeds travelled a total of 1429.97 kmx$10^6$ and the number of motorcycles reached travelled a total of 2653.16 kmx$10^6$.

The annual and decadal change rate of these indicators can be understood from Table 1.26. From 1991 to 2011 the numbers show a positive change rate in total distances covered by passenger cars (136.13%, equivalent to 34328.64 kmx$10^6$), by light duty vehicles (32.01%, equivalent to 3046.65 kmx$10^6$), by heavy vehicles (27.08%, equivalent to 759.16 vehicles) and by motorcycles (153.96%, equivalent to 1608.43 kmx$10^6$). On the other hand, the distances travelled by mopeds show a negative change rate of 71.91%, the equivalent to 3660.81 kmx$10^6$.

**Table 1.25**

Kilometers travelled per vehicle type ($10^6$vkm)

| Year | Passenger Cars | Light Duty Vehicles | Heavy Vehicles (total) | Mopeds | Motorcycles |
|---|---|---|---|---|---|
| **1991** | 25,217.78 | 9,519.20 | 2,803.66 | 5,090.79 | 1,044.73 |
| **1992** | 29,214.25 | 10,114.39 | 2,767.73 | 4,915.65 | 1,111.04 |
| **1993** | 31,818.09 | 10,014.40 | 2,836.08 | 4,616.26 | 1,185.88 |
| **1994** | 34,525.80 | 10,490.27 | 2,888.76 | 4,278.37 | 1,249.06 |
| **1995** | 36,791.10 | 10,705.64 | 3,194.76 | 4,047.89 | 1,313.87 |
| **1996** | 39,081.96 | 10,874.23 | 3,520.55 | 3,803.78 | 1,427.35 |
| **1997** | 41,606.53 | 11,947.55 | 3,627.36 | 3,489.52 | 1,507.39 |
| **1998** | 46,184.98 | 13,707.39 | 4,034.09 | 3,309.12 | 1,667.36 |
| **1999** | 49,272.58 | 14,304.27 | 3,761.32 | 3,060.40 | 1,778.34 |
| **2000** | 55,019.29 | 16,461.64 | 3,851.00 | 2,883.79 | 1,890.40 |
| **2001** | 55,440.38 | 16,705.84 | 4,235.25 | 2,273.69 | 1,601.93 |
| **2002** | 59,037.49 | 16,922.73 | 3,923.39 | 2,593.40 | 1,860.90 |
| **2003** | 60,097.90 | 16,729.91 | 3,759.32 | 1,963.66 | 1,884.62 |
| **2004** | 59,870.22 | 15,856.13 | 4,161.57 | 1,856.87 | 1,954.40 |
| **2005** | 59,461.13 | 15,138.27 | 4,313.15 | 1,759.31 | 2,006.30 |
| **2006** | 60,231.84 | 15,217.67 | 4,418.68 | 1,669.51 | 2,078.59 |
| **2007** | 59,483.83 | 14,530.71 | 4,475.42 | 1,670.94 | 2,261.20 |
| **2008** | 61,290.82 | 14,565.80 | 3,936.31 | 1,537.12 | 2,358.67 |
| **2009** | 63,531.02 | 14,694.12 | 3,570.36 | 1,520.38 | 2,553.19 |
| **2010** | 64,767.04 | 14,381.46 | 3,495.86 | 1,505.05 | 2,753.20 |
| **2011** | 59,546.42 | 12,565.85 | 3,562.83 | 1,429.97 | 2,653.16 |

**Source**: INE, 2013

**Table 1.26**

Change rate of Kilometers travelled (Vkm) per vehicle type (%)

| Year | Passenger Cars | Light Duty Vehicles | Heavy Vehicles (total) | Mopeds | Motorcycles |
|---|---|---|---|---|---|
| **1991-92** | 15.85 | 6.25 | -1.28 | -3.44 | 6,35 |
| **1992-93** | 8.91 | -0.99 | 2.47 | -6.09 | 6,74 |
| **1993-94** | 8.51 | 4.75 | 1.86 | -7.32 | 5,33 |
| **1994-95** | 6.56 | 2.05 | 10.59 | -5.39 | 5,19 |
| **1995-96** | 6.23 | 1.57 | 10.20 | -6.03 | 8,64 |
| **1996-97** | 6.46 | 9.87 | 3.03 | -8.26 | 5,61 |
| **1997-98** | 11.00 | 14.73 | 11.21 | -5.17 | 10,61 |
| **1998-99** | 6.69 | 4.35 | -6.76 | -7.52 | 6,66 |
| **1999-00** | 11.66 | 15.08 | 2.38 | -5.77 | 6,30 |
| **2000-01** | 0.77 | 1.48 | 9.98 | -21.16 | -15,26 |
| **2001-02** | 6.49 | 1.30 | -7.36 | 14.06 | 16,17 |
| **2002-03** | 1.80 | -1.14 | -4.18 | -24.28 | 1,27 |
| **2003-04** | -0.38 | -5.22 | 10.70 | -5.44 | 3,70 |
| **2004-05** | -0.68 | -4.53 | 3.64 | -5.25 | 2,66 |
| **2005-06** | 1.30 | 0.52 | 2.45 | -5.10 | 3,60 |
| **2006-07** | -1.24 | -4.51 | 1.28 | 0.09 | 8,79 |
| **2007-08** | 3.04 | 0.24 | -12.05 | -8.01 | 4,31 |
| **2008-09** | 3.66 | 0.88 | -9.30 | -1.09 | 8,25 |
| **2009-10** | 1.95 | -2.13 | -2.09 | -1.01 | 7,83 |
| **2010-11** | -8.06 | -12.62 | 1.92 | -4.99 | -3,63 |
| **1991-01** | 149.66 | 80.88 | 49.15 | -56.82 | 60,00 |
| **2001-11** | 7.41 | -24.78 | -15.88 | -37.11 | 65,62 |
| **1991-11** | 136.13 | 32.01 | 27.08 | -71.91 | 153,96 |

As for the fuel consumption in the road sector, Table 1.27, in 2011, Portugal consumed a total of 1.240.759,35 tons of gasoline, 4.014.823,55 tons of diesel, 28.944,21 tons of liquefied petroleum gas (LPG), 11.459,12 tons of compressed natural gas (CNG) and 341.585,75 tons of biodiesel.

Analyzing its annual and decadal change rate across Table 1.28, the numbers show a negative change rate in the gasoline (18.04%, equivalent to 273.067,66 tons) from 1991 to 2011. On the other hand, the values for diesel (141.05 %, equivalent to 2.349.244,60 tons) and for liquefied petroleum gas (51314.55 %, equivalent to 28,559.98 tons) show a positive change rate.

As for the compressed natural gas and biodiesel, statistical data available indicate in both cases an increase in the quantities consumed. However, this trend has suffered occasional interruptions, as illustrated by the years of 2004 (CNG: -10.90 %), 2006 (CNG: -0.67 %) , 2008 (CNG: -42.39 %; biodiesel: - 0.94 %) and 2011 (biodiesel: -5.87 %).

**Table 1.27**

Fuel consumption from road transport sector (tons)

| Year | Gasoline (total) | Diesel | LPG | CNG | Biodiesel |
|---|---|---|---|---|---|
| **1991** | 1,513,827.01 | 1,665,578.94 | 55.66 | n/a | n/a |
| **1992** | 1,690,627.08 | 1,769,092.39 | 98.00 | n/a | n/a |
| **1993** | 1,781,289.18 | 1,822,672.12 | 109.35 | n/a | n/a |
| **1994** | 1,828,766.73 | 1,965,846.59 | 117.34 | n/a | n/a |
| **1995** | 1,885,861.50 | 2,110,210.04 | 288.66 | n/a | n/a |
| **1996** | 1,935,188.32 | 2,269,116.36 | 1,799.34 | n/a | n/a |
| **1997** | 1,923,620.76 | 2,513,347.33 | 17,320.56 | n/a | n/a |
| **1998** | 1,990,007.86 | 2,998,556.49 | 19,794.49 | n/a | n/a |
| **1999** | 2,013,486.18 | 3,240,565.84 | 23,861.66 | n/a | n/a |
| **2000** | 2,052,007.18 | 3,759,008.78 | 22,329.01 | 647.87 | n/a |
| **2001** | 1,932,893.28 | 3,976,418.01 | 21,652.65 | 4,286.62 | n/a |
| **2002** | 2,029,090.25 | 4,029,319.73 | 21,213.19 | 6,616.17 | n/a |
| **2003** | 1,967,402.13 | 4,065,128.72 | 20,483.78 | 9,559.79 | n/a |
| **2004** | 1,889,720.06 | 4,121,935.34 | 18,868.63 | 8,517.42 | n/a |
| **2005** | 1,791,425.26 | 4,147,186.78 | 20,935.13 | 9,572.19 | n/a |
| **2006** | 1,669,149.91 | 4,290,079.56 | 22,356.42 | 9,508.13 | 66,651.95 |
| **2007** | 1,562,258.06 | 4,272,991.16 | 23,218.35 | 10,527.34 | 128,777.47 |
| **2008** | 1,483,025.03 | 4,270,962.61 | 25,865.11 | 6,065.20 | 127,562.22 |
| **2009** | 1,454,631.27 | 4,273,000.35 | 30,308.55 | 10,933.57 | 227,495.04 |
| **2010** | 1,379,897.23 | 4,281,331.19 | 28,944.21 | 11,459.12 | 341,585.75 |
| **2011** | 1,240,759.35 | 4,014,823.55 | 28,615.64 | 11,492.82 | 321,520.26 |

**Source**: APA, 2013

**Table 1.28**

Change rate of fuel consumption from road transport sector (%)

| Year | Gasoline (total) | Diesel | LPG | CNG | Biodiesel |
|---|---|---|---|---|---|
| **1991-92** | 11.68 | 6.21 | 76.08 | ne | ne |
| **1992-93** | 5.36 | 3.03 | 11.58 | ne | ne |
| **1993-94** | 2.67 | 7.86 | 7.31 | ne | ne |
| **1994-95** | 3.12 | 7.34 | 146.01 | ne | ne |
| **1995-96** | 2.62 | 7.53 | 523.34 | ne | ne |
| **1996-97** | -0.60 | 10.76 | 862.61 | ne | ne |
| **1997-98** | 3.45 | 19.31 | 14.28 | ne | ne |
| **1998-99** | 1.18 | 8.07 | 20.55 | ne | ne |
| **1999-00** | 1.91 | 16.00 | -6.42 | ne | ne |
| **2000-01** | -5.80 | 5.78 | -3.03 | 561.65 | ne |
| **2001-02** | 4.98 | 1.33 | -2.03 | 54.34 | ne |
| **2002-03** | -3.04 | 0.89 | -3.44 | 44.49 | ne |
| **2003-04** | -3.95 | 1.40 | -7.89 | -10.90 | ne |
| **2004-05** | -5.20 | 0.61 | 10.95 | 12.38 | ne |
| **2005-06** | -6.83 | 3.45 | 6.79 | -0.67 | ne |
| **2006-07** | -6.40 | -0.40 | 3.86 | 10.72 | 93.21 |
| **2007-08** | -5.07 | -0.05 | 11.40 | -42.39 | -0.94 |
| **2008-09** | -1.91 | 0.05 | 17.18 | 80.27 | 78.34 |
| **2009-10** | -5.14 | 0.19 | -4.50 | 4.81 | 50.15 |
| **2010-11** | -10.08 | -6.22 | -1.14 | 0.29 | -5.87 |
| **1991-01** | 27.68 | 138.74 | 38,803.96 | ne | ne |
| **2001-11** | -35.81 | 0.97 | 32.16 | 168.11 | ne |
| **1991-11** | -18.04 | 141.05 | 51,314.55 | ne | ne |

On the subject of public transport of passengers and freight, should be emphasized that the data presented for passengers transport concern only public transport, national and international. For a better understanding of this sector, the following tables refer to the number of transported passengers and to the amount of freight (tons), as well as to the numbers of passenger*km (pkm) and ton*km (tkm).

Thus, according to Tables 1.29 and 1.30, there is a clear decrease in the total number of Passengers Travelling by Road and Railway in Portugal, statement supported by the totals in 1992 (1.561,39 $10^6$Pkm) and in 2011 (873,37 $10^6$Pkm).

**Table 1.29**

Total of Passengers by Railway, Road Transport and Total ($10^6$)

| Year | Railway | Road Transport | Total |
|---|---|---|---|
| **1991** | 223.63 | na | ne |
| **1992** | 224.62 | 1,336.76 | 1,561.39 |
| **1993** | 208.59 | 1,215.46 | 1,424.05 |
| **1994** | 201.36 | 1,119.91 | 1,321.26 |
| **1995** | 187.53 | 1,112.58 | 1,300.11 |
| **1996** | 177.09 | 1,121.42 | 1,298.51 |
| **1997** | 178.13 | 1,096.51 | 1,274.64 |
| **1998** | 177.97 | 1,169.89 | 1,347.85 |
| **1999** | 167.54 | 1,175.89 | 1,343.42 |
| **2000** | 160.08 | 1,184.08 | 1,344.17 |
| **2001** | 160.86 | 1,109.72 | 1,270.58 |
| **2002** | 160.06 | 1,029.56 | 1,189.62 |
| **2003** | 150.69 | 999.49 | 1,150.18 |
| **2004** | 152.57 | na | Ne |
| **2005** | 151.18 | na | Ne |
| **2006** | 154.64 | na | Ne |
| **2007** | 156.71 | na | Ne |
| **2008** | 158.46 | na | Ne |
| **2009** | 153.79 | na | Ne |
| **2010** | 153.01 | na | Ne |
| **2011** | 149.06 | 724.31 | 873.37 |

**Source**: INE, 2013

**Table 1.30**

Change rate of passengers by Railway and Road transport (%)

| Year | Railway | Road Transport |
|---|---|---|
| **1991-92** | 0.44 | na |
| **1992-93** | -7.14 | -9.07 |
| **1993-94** | -3.47 | -7.86 |
| **1994-95** | -6.86 | -0.65 |
| **1995-96** | -5.57 | 0.79 |
| **1996-97** | 0.59 | -2.22 |
| **1997-98** | -0.09 | 6.69 |
| **1998-99** | -5.86 | 0.51 |
| **1999-00** | -4.45 | 0.70 |
| **2000-01** | 0.48 | -6.28 |
| **2001-02** | -0.50 | -7.22 |
| **2002-03** | -5.85 | -2.92 |
| **2003-04** | 1.25 | ne |
| **2004-05** | -0.91 | ne |
| **2005-06** | 2.29 | ne |
| **2006-07** | 1.34 | ne |
| **2007-08** | 1.11 | ne |
| **2008-09** | -2.94 | ne |
| **2009-10** | -0.51 | ne |
| **2010-11** | -2.58 | ne |
| **1992-2011** | -33.64 | -45.82 |
| **2001-2011** | -7.33 | -34.73 |
| **2003-2011** | -1.08 | -27.53 |

The above facts are confirmed by all the data contained in Tables 1.29 and 1.30. A negative change rate of 31.10% is estimated since 2011 (10,374 $10^6$ Pkm) compared to 2001 (15,058 $10^6$ Pkm), Passenger – km of Railway and Road Transport.

When you analyse these data by type of transport, the last decade (2001 to 2011) of the road trend it seems to be in accordance with the one mentioned in the previous paragraph, statement that supports at the 44,16% negative change rate. For the same time period analysis, the railway trend presents a positive change rate of 6.28 %.

The interurban component of road transport shows a negative change rate of -80.32 % (Table 1.31) for the same time period (2001: 2,220.00 $10^6$Pkm; 2011: 437.00 $10^6$ Pkm). At this point it is important to say that by 2003 the statistical data included urban, suburban and interurban elements. In 2011, the data refers only to the interurban component (INE, 2013), which may explain - in part - the registered dynamics.

Concerning railway transport of passengers (tables 1.31 and 1.32), the evolution along the series can be seen in two standpoints: intermittency between growing and decreasing values of the pkm indicator and coherence of this indicator with its interurban component.

**Table 1.31**

Volume of passengers transport (PKm) on Road and Railway Transport ($10^6$)

| Year | Passengers | | | |
|---|---|---|---|---|
| | Railway [20] | Road Transport [21] | ***Interurban*** | |
| | | | *Railway* | *Road Transport* [22] |
| **1991** | 5,692 | na | 2,094 | na |
| **1992** | 5,694 | 14,173 | 2,076 | 5,394 |
| **1993** | 5,397 | 12,150 | 1,958 | 4,059 |
| **1994** | 5,149 | 11,711 | 1,892 | 3,949 |
| **1995** | 4,840 | 11,246 | 1,812 | 3,489 |
| **1996** | 4,503 | 11,142 | 1,745 | 3,538 |
| **1997** | 4,563 | 10,442 | 1,757 | 2,631 |
| **1998** | 4,602 | 11,409 | 1,815 | 2,473 |
| **1999** | 4,380 | 11,474 | 1,671 | 2,904 |
| **2000** | 3,834 | 11,821 | 1,614 | 2,862 |
| **2001** | 3,899 | 11,159 | 1,609 | 2,220 |
| **2002** | 3,926 | 9,936 | 1,650 | 2,189 |
| **2003** | 3,585 | 10,537 | 1,585 | 2,303 |
| **2004** | 3,693 | na | 1,615 | na |
| **2005** | 3,753 | na | 1,606 | na. |
| **2006** | 3,876 | na | 1,618 | na |
| **2007** | 3,987 | na | 1,671 | na |
| **2008** | 4,213 | na | 1,787 | na |
| **2009** | 4,152 | na | 1,792 | na |
| **2010** | 4,111 | na | 1,751 | na |
| **2011** | 4,143 | 6,231[23] | 1,624 | 437[24] |

**Source:** INE, 2013

[20] These railway transport data do not include underground railway.

[21] The Road data in this column are nationwide until and including 2003. From 2011, the same data refer only to the Mainland. Only the transport for hired or reward and heavy vehicles are taken into account.

[22] Interurban road Transport data in this column are nationwide until and including 2003. From 2011, they only refer to the Mainland. Only the transport for hired or reward or heavy vehicles are taken into account.

[23] Data reviewed in November 2013.

[24] Data reviewed in November 2013.

**Table 1.32**

Change rate of passengers (Pkm) by Road and Railway Transport (%)

| Year | Railway | Road | Interurban | |
|---|---|---|---|---|
| | | | Railway | Road |
| **1990-91** | 0.49 | ne | 1.27 | ne |
| **1991-92** | 0.04 | ne | -0.84 | ne |
| **1992-93** | -5.22 | -14.27 | -5.69 | -24.75 |
| **1993-94** | -4.59 | -3.61 | -3.35 | -2.71 |
| **1994-95** | -6.01 | -3.97 | -4.23 | -11.65 |
| **1995-96** | -6.95 | -0.92 | -3.70 | 1.40 |
| **1996-97** | 1.33 | -6.28 | 0.70 | -25.64 |
| **1997-98** | 0.86 | 9.26 | 3.30 | -6.01 |
| **1998-99** | -4.82 | 0.57 | -7.94 | 17.43 |
| **1999-00** | -12.47 | 3.02 | -3.40 | -1.45 |
| **2000-01** | 1.67 | -5.60 | -0.37 | -22.43 |
| **2001-02** | 0.71 | -10.96 | 2.57 | -1.40 |
| **2002-03** | -8.69 | 6.05 | -3.95 | 5.21 |
| **2003-04** | 3.00 | ne | 1.89 | ne |
| **2004-05** | 1.62 | ne | -0.54 | ne |
| **2005-06** | 3.29 | ne | 0.71 | ne |
| **2006-07** | 2.87 | ne | 3.31 | ne |
| **2007-08** | 5.65 | ne | 6.95 | ne |
| **2008-09** | -1.45 | ne | 0.27 | ne |
| **2009-10** | -0.98 | ne | -2.28 | ne |
| **2010-11** | 0.79 | ne | -7.26 | ne |
| **1992-11** | -27.23 | -56.04 | -21.78 | -91.90 |
| **2001-11** | 6.28 | -44.16 | 0.96 | -80.32 |
| **2003-11** | 15.57 | -40.87 | 2.48 | -81.02 |

As for air transport (Table 1.33), from 2001 to 2011, there has been a growth in Total Passenger Embarking on Scheduled Flights, an indicator that displays an absolute change rate of 6.630.361 passengers, which is equivalent, in relative terms, to 85.2%.

In opposition to this trend, the indicator of the Total Passengers Embarking on Non-Scheduled Flights shows, for the same time period, a general decrease in the numbers of passengers, which corresponds to a negative change rate of 60.8%.

With regard to Total number of Passengers Disembarking on Scheduled and Non-Scheduled Flights (Table 1.33) trends seem to be the same when talking about embarking passengers. Only the absolute and relative numbers involved change.

**Table 1.33**

Passengers embarking and disembarking and respective change rate

| Type | Embarking | | Disembarking | | Embark. | Desimb. |
|---|---|---|---|---|---|---|
| | 2001 | 2011 | 2001 | 2011 | 2001-11 | 2001-11 |
| | No. | | | | % | |
| **Scheduled Flight (SF)** | 7,779,958 | 14,410,319 | 7,811,044 | 14,344,967 | *85.2* | *83.6* |
| SF- International | 5,020,110 | 11,496,259 | 5,099,689 | 11,440,908 | *129.0* | *124.3* |
| SF - National | 1,514,884 | 2,914,060 | 1,509,379 | 2,904,059 | *92.4* | *92.4* |
| **Non-Scheduled Flight** | 2,145,499 | 841,529 | 2,174,531 | 837,687 | *-60.8* | *-61.5* |
| NSF- International | 2,106,262 | 818,856 | 2,142,848 | 813,140 | *-61.1* | *-62.1* |
| NSF - National | 31,258 | 22,673 | 26,504 | 24,547 | *-27.5* | *-7.4* |

**Source**: INE, 2013

In what concerns Sea Transport, the indicator on the Passengers Movement at Seaports for Portugal and for NUTS I (Figure 1.21 and Table 1.34) shows a general increase in the total number registered.

When we analyse the increase of movements from 2001 to 2011, the numbers display a higher increase of the total passengers movement for ARM (22.56%) and ARA (23.93%) than for the total of Portugal (21,58%). The sum of this two autonomous regions in the Total National Movements are equivalent to 96.57% at 2001 and 96.91% at 2011.

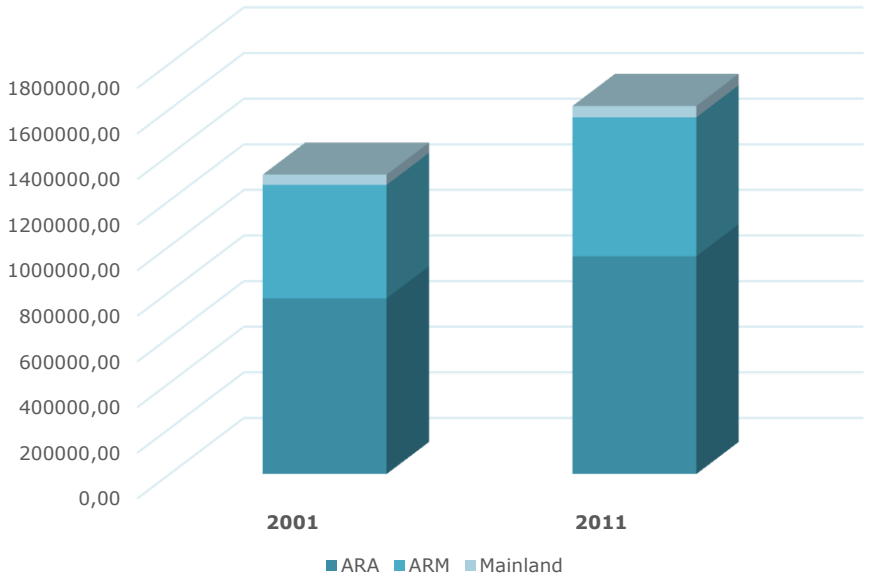



**Figure 1.21**
Total Passenger Movement at Seaports - NUTS II (n.º)

**Table 1.34**
Passengers Movement at Seaports – Portugal and NUTS II

| Geographic Location | Total | | | Embarking | | | Disembarking | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2011 | 2001-11 | 2001 | 2011 | 2001-11 | 2001 | 2011 | 2001-11 |
| | N.º | | % | N.º | | % | N.º | | % |
| Portugal[25] | 1,312,499 | 1,613,805 | 22.96 | 654,307 | 807,287 | 23.38 | 658,192 | 806,518 | 22.54 |
| Mainland | 45,004 | 49,841 | 10.75 | 21,666 | 25,555 | 17.95 | 23,338 | 24,286 | 4.06 |
| ARA | 770,114 | 954,374 | 23.93 | 385,057 | 477,187 | 23.93 | 385,057 | 477,187 | 23.93 |
| ARM | 497,381 | 609,590 | 22.56 | 247,584 | 304,545 | 23.01 | 249,797 | 305,045 | 22.12 |

**Source**: INE (2013) and Regional Statistical Office of Azores (2013).

Concerning freight carriage by road and railway , it is interesting to show data for tons transported and also for the indicator ton.km, the data show a trend that could be analyzed according to two different time periods:

1. The first started in 1993 and extended throughout 2007. This increasing trend is occasionally interrupted through the series under analysis;
2. The second moment, which starts from 2008 and ends at 2010, a decrease may be is observed but that it is difficult to analyze due to the short time period.

[25] **Note**: the *Portugal Total Number of Passengers Movements at Seaports* indicator reflects the sum of the values registed at each Portuguese NUTS I (Mainland, ARA and ARM).

Thus, it is noted the registration of a sequence of three consecutive years (2007-08, 2008-09, 2009-10) of negative change rate of ton - kilometer (Table 1.36) transported. In this case this , this should be interpreted as an exception to the positive change rate (6.40 %) shown in 2009-10, by the rail transport and which anticipates a slight growth in 2010-11 for both modes (road transport : 8.18 %; railway transport: 0.36 %).

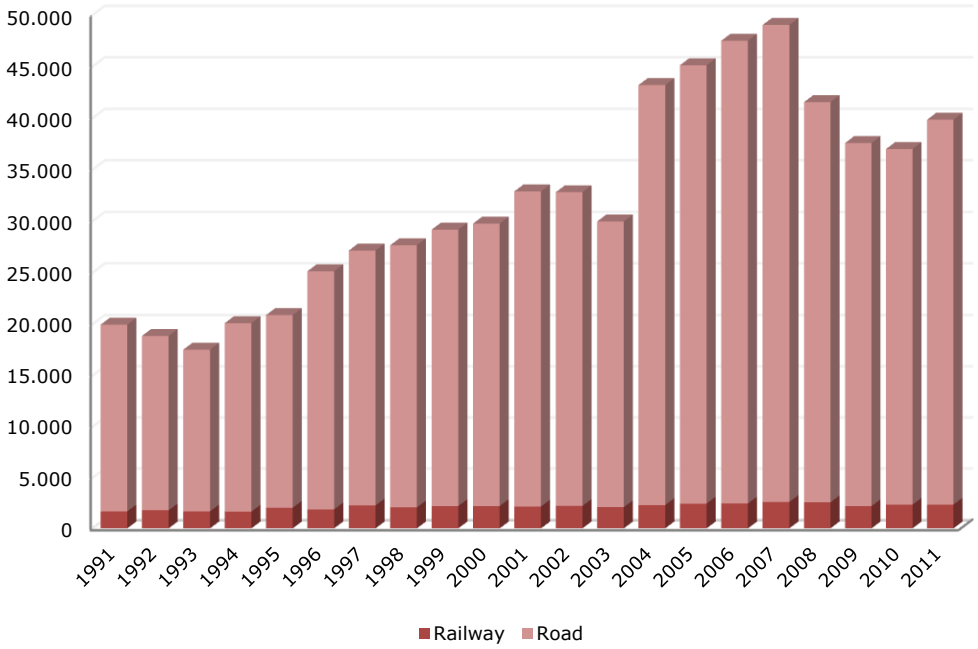



**Figure 1.22**

Freight transport by Road and Rail in Portugal ($10^6$Tkm

An important fact is the road and rail inland transport of freight rate. The road transport is often responsible for more than 90% of the total freight transported, reaching, in 2006, a maximum of 94.88 %. Its minimum rate value occurred in 1995, with an equivalent of 90.32 %.

When you analyze the registered change rate between the time limits of the series, 1991 and 2011, there is a clear and significant increase in the ton-kilometer indicators in both transport modes (Table 1.35). The road transport sector shows a relative change rate of 105 % and the railway one of 39.80%. Considering only the last decade (2001 to 2011), the differences between the year of departure and the last year are leveled out. Road transport shows a relative increase of 22.01% while railway transport has a growth of 8.60 %.

**Table 1.35**

Volume of Freight transported by Portuguese operators, via road and railway (Tkm)

| Year | Railway [26] | Road [27] | Total | Weight (total) | |
|---|---|---|---|---|---|
| | | | | Railway | Road |
| | ($10^6$ Tkm) | | | % | |
| **1991** | 1,661 | 18,242 | 19,903 | 8.34 | 91.66 |
| **1992** | 1,767 | 17,051 | 18,818 | 9.39 | 90.61 |
| **1993** | 1,665 | 15,821 | 17,486 | 9.52 | 90.48 |
| **1994** | 1,635 | 18,421 | 20,056 | 8.15 | 91.85 |
| **1995** | 2,019 | 18,826 | 20,845 | 9.68 | 90.32 |
| **1996** | 1,857 | 23,238 | 25,095 | 7.40 | 92.60 |
| **1997** | 2,247 | 24,860 | 27,107 | 8.29 | 91.71 |
| **1998** | 2,048 | 25,567 | 27,615 | 7.42 | 92.58 |
| **1999** | 2,179 | 26,949 | 29,128 | 7.48 | 92.52 |
| **2000** | 2,183 | 27,531 | 29,714 | 7.35 | 92.65 |
| **2001** | 2,138 | 30,711 | 32,849 | 6.51 | 93.49 |
| **2002** | 2,196 | 30,567 | 32,763 | 6.70 | 93.30 |
| **2003** | 2,073 | 27,853 | 29,926 | 6.93 | 93.07 |
| **2004** | 2,282 | 40,880 | 43,162 | 5.29 | 94.71 |
| **2005** | 2,422 | 42,656 | 45,078 | 5.37 | 94.63 |
| **2006** | 2,430 | 45,032 | 47,462 | 5.12 | 94.88 |
| **2007** | 2,586 | 46,406 | 48,992 | 5.28 | 94.72 |
| **2008** | 2,549 | 38,950 | 41,499 | 6.14 | 93.86 |
| **2009** | 2,174 | 35,356 | 37,530 | 5.79 | 94.21 |
| **2010** | 2,313 | 34,640 | 36,953 | 6.26 | 93.74 |
| **2011** | 2,322 | 37,472 | 39,794 | 5.83 | 94.17 |

**Table 1.36**

Change rate of relative weight of railway and road in the Volume of freight transported, by Portuguese operators in Portugal

| Year | Railway | Road |
|---|---|---|
| | % | |
| **1991-1992** | 6.41 | -6.53 |
| **1992-1993** | -5.76 | -7.21 |
| **1993-1994** | -1.80 | 16.43 |
| **1994-1995** | 23.43 | 2.20 |
| **1995-1996** | -7.98 | 23.44 |
| **1996-1997** | 20.97 | 6.98 |
| **1997-1998** | -8.86 | 2.84 |
| **1998-1999** | 6.40 | 5.41 |
| **1999-2000** | 0.17 | 2.16 |
| **2000-2001** | -2.06 | 11.55 |
| **2001-2002** | 2.72 | -0.47 |
| **2002-2003** | -5.62 | -8.88 |
| **2003-2004** | 10.10 | 46.77 |
| **2004-2005** | 6.14 | 4.34 |
| **2005-2006** | 0.31 | 5.57 |
| **2006-2007** | 6.45 | 3.05 |
| **2007-2008** | -1.45 | -16.07 |
| **2008-2009** | -14.70 | -9.23 |
| **2009-2010** | 6.40 | -2.03 |
| **2010-2011** | 0.36 | 8.18 |
| **1991-2001** | 28.74 | 68.35 |
| **1991-2011** | 39.80 | 105.42 |
| **2001-2011** | 8.60 | 22.01 |

As for sea transport, this component will be analyzed in the double perspective of loaded and unloaded freight.

The Mainland is primarily responsible for the absolute values here displayed. This statement is reinforced by the analysis of Table 1.33, which calls our attention to this fact whith rates like 95.09% at 1999 or 99.41% at 2000. Regarding the Autonomous Regions, in the ARA this indicator does not exceed the 4.36 % (1999) as a maximum rate or 2.56% (2010) as minimum rate, while the ARM has a residual wheight (less than 1%) on balance (0.81 % in 2002 and 0.56% in 1999).

If analyzing the behavior of the Total Change Rate of Loaded and Unloaded Freight by Geographic Location (Table 1.37), it is possible to identify in the ARA an increasing trend until 2008, which suffered a fall in the immediately following year (2009) and a gradual and slow recovery (even unstable in the RAs) from 2010. In this cycle, the growth in the loaded amounts rises to 116.40 % in Portugal, 119.25% in the Mainland, 145.86 % in the ARA and 181.45% in the ARM. On the other hand, the unloaded amounts show less significant numbers. It´s worth underlining their corresponding numbers: 11.99% for Portugal, 13.83% for the Mainland and 6.86% for the ARA. The numbers announced for the ARM show a decrease of 25.06%, which is an exception to this trend.

[26] Source: INE, 2013

[27] Source: INE, 2013

For the time period of 2001-2011, the trend appears to be similar to that of 1991-2011, diverging only in two circumstances. The first has to do with the positive change rate registered over the comparative process between these two moments of the series. A change rate of 86.07% in the ARM; 18.74% in Portugal and 27.41% in the Mainland. The same type of calculation was not possible to do regarding the ARA´s unavailable data.

The second circumstance has to do with the dynamics presented by the unloaded amounts in 2001-2011. This one is different from that in 1999-2011 due to a negative relative change rate of the displayed numbers, with particular emphasis on the ARM (-27.97%), but also on the Mainland (-5.08%) and on Portugal (-1.72%). As in the previous paragraph, these calculations are not extended to the ARA due to unavailable important data.

In short, there was a significant and widespread growth in the quantity of loaded and unloaded freight between 1999-2011, a trend that strongly emerged during the time period of 2001-2011.

Apart from the already mentioned aspects, the negative change rate presented by the ARM both in 1999-2001 and in 2001-2011 regarding the total unloaded freight is worth underlining. This trend extends to other analyzed regions for the same time period of 2001-2011.This analysis was confirmed by a reading of the interannual change rate values, showing that the periods of 2008-09 (Portugal and the Mainland) and 2010-11 (the ARA) were the most important ones.

**Table 1.37**

Volume of loaded and unloaded freight by geographic location – Portugal and NUTS I (tonnes)

| Year | Loaded | | | | Unloaded | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA* | ARM | Portugal | Mainland | ARA | ARM |
| 1999[28] | 11,388,765 | 10,757,722 | 568,085 | 62,958 | 38,451,834 | 35 194,599 | 1,746,643 | 1,510,592 |
| 2000 | 13,147,343 | 12,510,876 | 563,439 | 73,028 | 45,580,340 | 42,288,763 | 1,760,024 | 1,531,553 |
| 2001 | 12,997,883 | 12,294,986 | 612,203 | 90,694 | 45,701,922 | 42,207,079 | 1,923,340 | 1,571,503 |
| 2002 | 13,496,985 | 12,737,289 | 656,052 | 103,644 | 44,782,160 | 41,213,951 | 2,024,056 | 1,544,153 |
| 2003 | 15,372,947 | 14,559,969 | 697,173 | 115,805 | 44,836,309 | 41,094,153 | 2,029,677 | 1,712,479 |
| 2004 | 16,719,992 | 15,872,071 | 720,171 | 127,750 | 45,700,915 | 41,549,342 | 2,076,881 | 2,074,692 |
| 2005 | 17,950,333 | 17,091,780 | 737,610 | 120,943 | 47,919,084 | 44,064,263 | 2,087,949 | 1,766,872 |
| 2006 | 20,060,096 | 19,195,244 | 723,803 | 141,049 | 47,075,150 | 43,408,406 | 2,133,742 | 1,533,002 |
| 2007 | 21,170,772 | 20,348,748 | 677,869 | 144,155 | 47,420,495 | 43,588,146 | 2,372,243 | 1,460,106 |
| 2008 | 21,819,326 | 21,020,725 | 649,348 | 149,253 | 45,211,172 | 41,417,893 | 2,256,095 | 1,537,184 |
| 2009 | 19,877,162 | 19,071,168 | 664,002 | 141,992 | 42,039,080 | 38,597,637 | 2,116,857 | 1,324,586 |
| 2010 | 23,181,132 | 22,356,359 | 670,364 | 154,409 | 43,013,010 | 39,644,091 | 2,143,944 | 1,224,975 |
| 2011 | 24,579,475 | 23,586,159 | 816,119 | 177,197 | 43,225,361 | 40,063,389 | 2,029,944 | 1,132,028 |

**Source**: INE, 2013 **Source**: Regional Service of Statistc in the Azores, 2013

[28] These numbers do not include the port of Lisbon.

**Table 1.38**

Change rate of the volume loaded and unloaded freight by geographic location – Portugal and NUTS I (%)

| Year | Loaded | | | | Unloaded | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| 99-2000 | 15.44 | 16.30 | -0.82 | 15.99 | 18.54 | 20.16 | 0.77 | 1.39 |
| 2000-01 | -1.14 | -1.73 | 8.65 | 24.19 | 0.27 | -0.19 | 9.28 | 2.61 |
| 2001-02 | 3.84 | 3.60 | 7.16 | 14.28 | -2.01 | -2.35 | 5.24 | -1.74 |
| 2002-03 | 13.90 | 14.31 | 6.27 | 11.73 | 0.12 | -029 | 0.28 | 10.90 |
| 2003-04 | 8.76 | 9.01 | 3.30 | 10.31 | 1.93 | 1.11 | 2.33 | 21.15 |
| 2004-05 | 7.36 | 7.68 | 2.42 | -5.33 | 4.85 | 6.05 | 0.53 | -14.84 |
| 2005-06 | 11.75 | 12.31 | -1.87 | 16.62 | -1.76 | -1.49 | 2.19 | -13.24 |
| 2006-07 | 5.54 | 6.01 | -6.35 | 2.20 | 0.73 | 0.41 | 11.18 | -4.76 |
| 2007-08 | 3.06 | 3.30 | -4.21 | 3.54 | -4.66 | -4.98 | -4.90 | 5.28 |
| 2008-09 | -8.90 | -9.27 | 2.26 | -4.86 | -7.02 | -6.81 | -6.17 | -13.83 |
| 2009-10 | 16.62 | 17.23 | 0.96 | 8.74 | 2,32 | 2.71 | 1.28 | -7.52 |
| 2010-11 | 6.03 | 5.50 | 21.74 | 14.76 | 0.49 | 1.06 | -5.32 | -7.59 |
| 1999-2001 | 14.13 | 14.29 | 7.77 | 44.05 | 18.85 | 19.92 | 10.12 | 4.03 |
| 2001-2011 | 89.10 | 91.84 | 33.31 | 95.38 | -5.42 | -5.08 | 5.54 | -27.97 |
| 1999-2011 | 115.82 | 119.25 | 43.66 | 181.45 | 12.41 | 13.83 | 16.22 | -25.06 |

**Table 1.39**

Loaded and unloaded freight by geographic location – NUTS I (%)

| Year | Loaded | | | Unloaded | | |
|---|---|---|---|---|---|---|
| | Mainland | ARA | ARM | Mainland | ARA | ARM |
| 1999 | 94.46 | 4.99 | 0.55 | 91.53 | 4.54 | 3.93 |
| 2000 | 95.16 | 4.29 | 0.56 | 92.78 | 4.02 | 3.50 |
| 2001 | 94.59 | 4.71 | 0.70 | 92.35 | 4.39 | 3.59 |
| 2002 | 94.37 | 4.86 | 0.77 | 92.03 | 4.73 | 3.61 |
| 2003 | 94.71 | 4.54 | 0.75 | 91.65 | 4.74 | 4.00 |
| 2004 | 94.93 | 4.31 | 0.76 | 90.92 | 4.76 | 4.76 |
| 2005 | 95.22 | 4.11 | 0.67 | 91.96 | 4.40 | 3.72 |
| 2006 | 95.69 | 3.61 | 0.70 | 92.21 | 4.55 | 3.27 |
| 2007 | 96.12 | 3.20 | 0.68 | 91.92 | 5.04 | 3.10 |
| 2008 | 96.34 | 2.98 | 0.68 | 91.61 | 5.03 | 3.43 |
| 2009 | 95.95 | 3.34 | 0.71 | 91.81 | 5.05 | 3.16 |
| 2010 | 96.44 | 2.89 | 0.67 | 92.17 | 5.00 | 2.86 |
| 2011 | 95.96 | 3.32 | 0.72 | 92.68 | 4.72 | 2.63 |

Finally as for Air Transport, this type of analysis uses the indicators such as loaded and unloaded tons in Scheduled and Non- Scheduled Flights and their growth trend in 2001 and 2011 (see Table 1.40).

Before beginning the analysis, it should be noted that for several years Portugal has been changing from Non-Scheduled Flights (Charters) to Scheduled Flights, which follows the global trend. Thus, the analysis of the two aspects should be cross matched.

Furthermore, the advent of low cost airlines has led to an increase in the number of trips. With more flights in sequence there is a growth in the number of loaded and unloaded freight. Although the records show that this growth is in fact real, it is also due to an increase in freight transits (not direct, that is, with different flight numbers).

Thus, the dominant trend is a decrease in the absolute loaded and unloaded quantities (ton) in national airports. This trend is also true when comparing it to the increase of flights in 2001-2011, specially the total number of loaded (-18.63%) and unloaded (-10.64%) freight in Non-Scheduled Flights.

The Scheduled Flights show a positive change rate of loaded freight (8.87%) and a negative in the unloaded (-6.65%). The international context shows a similar scenario. There is a significant growth of the loaded (24.63%) and a tiny decrease of the unloaded (-1.84%) freight. The results referring to these two elements are quite the opposite in terms of national trend. The first one shows a negative change rate (-6.11%) and second a positive change rate (9.07%).

The Non-Scheduled Flights (Charters) stand out from the others by showing a negative loaded (-29.16%) and unloaded (-33.56%) change rate, internationally. On the other hand, nationally there is a significant positive loaded (278.02%) and unloaded (715.84%) change rate.

**Table 1.40**

| Type of freight | | Loaded | | Unloaded | | Loaded | Unloaded |
|---|---|---|---|---|---|---|---|
| | | Tons | | | | Change Rate (%) | |
| | | 2001 | 2011 | 2001 | 2011 | 2001-2011 | |
| **Total** | Scheduled Flights (SF) | 62,565 | 68,116 | 60,409 | 56,390 | 8.87 | - 6.65 |
| | Non-Scheduled Flights (NSF) | 7,398 | 6,020 | 5,874 | 5,249 | - 18.63 | - 10.64 |
| **SF** | International | 44,742 | 55,762 | 45,265 | 44,433 | 24.63 | - 1.84 |
| | National | 13,158 | 12,354 | 10,963 | 11,957 | - 6.11 | 9.07 |
| **NSF** | International | 6,070 | 4,300 | 5,420 | 3,601 | - 29.16 | - 33.56 |
| | National | 455 | 1,720 | 202 | 1,648 | 278.02 | 715.84 |

**Source**: INE, 2013

**NATIONAL TRANSPORT POLICY**

Given the economic and financial weaknesses that have been affecting Portugal in recent years, there was a need for signing a Memorandum of Understanding on Specific Economic Policy Conditionality (MoU) between the XVIII Government of Portugal and its international partners (European Commission, European Central Bank and International Monetary Fund) in March 2011. The political attention to the transport area focused mainly on the economic and financial restructuring of multiple operators and public bodies of the sector.

In this sense, the present national transport policy is depicted by its emphasis on economic and financial sustainability within the context of management system. This requires a continuous reflection on the various subsystems (environmental, social, financial and economic) that it comprises.

Firstly, this effort was made possible through the publication in October 2011 of a Strategic Transport Plan, Sustainable Mobility , Horizont 2011-2015 (STP), which was supported by Law 64 -A/2011 of December 30 and Law 66-A/2012 of 31 December, so called Major Planning Options (MPO) from 2012 to 2015 and 2013, respectively.

This reinforcement of efforts led to the need for a new balance in the current political discourse, much more focused on the financial and economic efficiency of the investment made or to be made. Accordingly, the XIX Government of Portugal determined the implementation of a structural reform program for the infrastructure and transport sector to be achieved within the timeframe of 2011-2015, which is based on three priority action vectors (PAV 2011):

a) to meet external commitments made by Portugal and to make the sector financially balanced and affordable for the Portuguese taxpayers;
b ) to promote competitiveness and the development of national economy;
c ) to ensure mobility and accessibility to people and goods in an efficient and appropriate way to the needs, promoting social cohesion.

Regarding the environmental objectives that characterize the obligations under the Kyoto Protocol, the MPO 2012-2015 indicate as principles the following measures:

a) To ensure an improvement in the mobility of people and goods in order to improve the functioning of the economy;
b) to increase energy efficiency;
c) to reduce environmental impacts.

For this purpose, the following structural actions have been selected:

a) to elaborate a strategic transport plan to revise and simplify the regulatory framework of the sector, ensuring, this way, the development of a comprehensive and coherent modernization of the modes of transport;
b) to determine an investment priorities order for the sector, bringing it into line with the financial constraint framework of the country. According to this order all those who contribute to an improvement of the competitiveness of domestic exports, reduce the effective costs and promote an effective integration of Portugal in the Transeuropean Transport Network will be rewarded.

Thus, there is a need to develop a strategic plan for the railway sector, taking into account not only some investment priorities for a timeframe of 20 years, but also the financial constraint of the country. This plan will be developed in a partnership with several agents, trying to contribute efficiently to the improvement of national competitiveness (MPO 2013 2012).

Regarding the road sector, it should be noted that the building of a vast network of highways, initially through a " without cost to the user " (SCUT) model and secondly through a sub-concession model of the Estradas de Portugal, SA., (Portuguese Roads Public Agency) placed Portugal as one of the countries with the world's largest relative extension highway network. The difficult financial situation of the sector, largely due to the very high level of debts that will have to occur to face future charges, determines the enhancement of two measures seen as crucial to achieve the proposed objectives for this sector:

a) the user pays principle: measure achieved with the introduction of tolls on toll roads;
b) security: developing a casualty reduction strategy for transport.

Regarding the maritime and the ports sector, it is a fact that it has gradually been developing. There are several measures that aim to reflect the importance of the sea in the national economy but, on general terms, they are focused on an increasing modernization of port infrastructures and in the investment in accessibility to domestic ports.

In order to ensure the development and improvement of the efficiency of the sector, it was decided that the improvement of the governance model of port system, within which labor regulations were incorporated, has to follow up the modernization effort (Unique Port Window, Unique Logistics Window, among others) sector, which will contribute to a greater competitiveness and to the increase of national exports. In parallel, some measures leading to the provision of supply chains and distribution of freight are going to be adopted, as well as a reduction in the effective costs. All these measures aim to promote the attraction and setting of businesses as well as the development of the industrial structure.

Regarding the airline sector, it is a fact that it is small, given the European and world scale. However, and due to the recognition of its growing potential largely supported by the unique competitive advantages provided (natural and human surroundings), this issue will be subject to a long-term growth strategy which should recognize its importance as well as the importance of the airport system in the economic development of the country.

In 2013, by resolution of Council of Ministers no. 20/2013 of 10 April, the XIX Government of Portugal publishes National Action Plan for Energy Efficiency (PNAEE 2016) and the National Action Plan for Renewable Energy (PNAER 2020). In addition to the intrinsic objectives of this Law, with its publication the transport area recovers - at least partially - the dynamics existing at the signing date of the MoU.

Following what was mentioned before, the Eco-Car, Urban Mobility and Efficiency in Transport System (see Subchapter on Policies and Measures for the Energy Sector) programs should be taken into account. They were all implemented under the PNAEE 2016 context and seek to identify a set of priority measures to improve the energy efficiency of transports and the associated quantitative targets for reducing consumption (see Table 1.41).

**Table 1.41**

Impacts of the Programs laid down by the PNAEE 2016

| Program | | Unit | Energy | |
|---|---|---|---|---|
| | | | *Final* | *Primary* |
| **Eco Car** | | | | |
| Results | Energy saved | (toe) | 43,643 | 43,643 |
| Targets | Target for 2016 | (toe) | 60,889 | 60,534 |
| | Implementation in 2016 | % | 72 | |
| | Target for 2020 | (toe) | 83,372 | 81,773 |
| | Implementation in 2020 | % | | 53 |
| **Urban Mobility** | | | | |
| Results | Energy saved | (toe) | 104,931 | 104,931 |
| Targets | Target for 2016 | (toe) | 128,003 | 128,003 |
| | Implementation in 2016 | % | 82 | |
| | Target for 2020 | (toe) | 157,421 | 157,421 |
| | Implementation in 2020 | % | | 67 |
| **System of Energy Efficiency in Transports** | | | | |
| Results | Energy saved | (toe) | 48,544 | 48,544 |
| Targets | Target for 2016 | (toe) | 99,305 | 99,305 |
| | Implementation in 2016 | % | 49 | |
| | Target for 2020 | (toe) | 111,780 | 111,780 |
| | Implementation in 2020 | % | | 43 |

**Source**: RCM 20/2013, 10th of April.

## 1.7 Residential

In the last decade, Portugal has shown a steady decline of values recorded by various indicators related to residential buildings, as tables 1.42 and 1.43 indicate.

In this context the year 2002 stands out since it has the highest values of all series under study, a framework applied to Portugal, to Portugal mainland and the ARM. The ARA registers its highest value of Buildings Completed Total Work and location in 2003, whether it refers to the Total Work or Total New Constructions. A similar pattern can be observed in the Family Dwellings of both indicators (see Tables 1.44 and 1.45).

According to this same indicator and still bearing in mind tables 1.42, 1.43, 1.44 and 1.45, the year of 2011 has the lowest numbers of completed buildings in Portugal and Portugal mainland. According to this pattern, the ARM follows the normal trend, except for Buildings Completed at Type and Work and Geographic Location - Type of Work: Total New Constructions, that occurred in 2010.

Furthermore the ARA follow a different trend of the rest of the regions. The lowest number of works completed in the several studied items happened in 2010.

**Table 1.42**

Buildings Completed - Total work (no.)

| Year | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001** | 62,131 | 58,700 | 1,714 | 1,717 |
| **2002** | 64,939 | 61,370 | 1,846 | 1,723 |
| **2003** | 58,472 | 54,855 | 1,952 | 1,665 |
| **2004** | 48,260 | 45,259 | 1,633 | 1,368 |
| **2005** | 49,845 | 46,459 | 1,857 | 1,529 |
| **2006** | 45,356 | 42,171 | 1,807 | 1,378 |
| **2007** | 44,130 | 41,308 | 1,605 | 1,217 |
| **2008** | 40,559 | 37,993 | 1,549 | 1,017 |
| **2009** | 33,718 | 31,812 | 1,079 | 827 |
| **2010** | 28,292 | 26,824 | 795 | 673 |
| ***2011** | 26,471 | 24,975 | 866 | 630 |

**Table 1.43**

Buildings Completed New Constructions - Total (no.)

| **Year** | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001** | 50,728 | 48,211 | 1,186 | 1,331 |
| **2002** | 54,563 | 51,751 | 1,441 | 1,371 |
| **2003** | 48,344 | 45,559 | 1,501 | 1,284 |
| **2004** | 39,164 | 36,882 | 1,217 | 1,065 |
| **2005** | 40,566 | 37,948 | 1,415 | 1,203 |
| **2006** | 36,267 | 33,821 | 1,393 | 1,053 |
| **2007** | 35,155 | 32,951 | 1,220 | 984 |
| **2008** | 32,284 | 30,226 | 1,230 | 828 |
| **2009** | 26,182 | 24,737 | 780 | 665 |
| **2010** | 21,540 | 20,439 | 575 | 526 |
| ***2011** | 19,604 | 18,502 | 636 | 466 |

**Table 1.44**

Buildings Completed - Total Work (no.)

| **Year** | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **2001** | 51,398 | 48,684 | 1,228 | 1,486 |
| **2002** | 54,568 | 51,670 | 1,372 | 1,526 |
| **2003** | 48,587 | 45,645 | 1,476 | 1,466 |
| **2004** | 39,643 | 37,176 | 1,233 | 1,234 |
| **2005** | 41,152 | 38,376 | 1,424 | 1,352 |
| **2006** | 37,008 | 34,418 | 1,362 | 1,228 |
| **2007** | 35,541 | 33,293 | 1,169 | 1,079 |
| **2008** | 32,318 | 30,244 | 1,174 | 900 |
| **2009** | 26,368 | 24,848 | 769 | 751 |
| **2010** | 21,682 | 20,493 | 575 | 614 |
| ***2011** | 19,955 | 18,832 | 588 | 535 |

**Table 1.45**

Buildings Completed - New Constructions (no.)

| **Year** | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **2001** | 43,314 | 41,260 | 847 | 1,207 |
| **2002** | 46,627 | 44,306 | 1,073 | 1,248 |
| **2003** | 40,855 | 38,557 | 1,128 | 1,170 |
| **2004** | 32,782 | 30,880 | 910 | 992 |
| **2005** | 34,145 | 31,946 | 1,098 | 1,101 |
| **2006** | 30,268 | 28,236 | 1,050 | 982 |
| **2007** | 28,971 | 27,197 | 882 | 892 |
| **2008** | 26,465 | 24,764 | 957 | 744 |
| **2009** | 21,114 | 19,943 | 558 | 613 |
| **2010** | 17,077 | 16,170 | 421 | 486 |
| ***2011** | 15,329 | 14,484 | 449 | 396 |

**Source:** INE, Buildings Statistics: Buildings Completed, 2001- 2010; Complete works estimates 2011
*Estimated data

According to tables 1.46, 1.47, 1.48 and 1.49, all regions show between a significant negative change rate between 2010 and 2011. This behavioral pattern is also true for the key indicators of Type (Total Work and New Constructions Work) and Aim (Family Dwelling).

All regions show a positive change rate during the period of 2001-02. Only in 2003-04 was the trend similar in all the time series. The importance of these results will change according to the different regions.

**Table 1.46**

Change rate of Buildings Completed - Total Work - Total (no.)

| Years | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-02** | 2,808 | 2,670 | 132 | 6 |
| **2002-03** | -6,467 | -6,515 | 106 | -58 |
| **2003-04** | -10,212 | -9,596 | -319 | -297 |
| **2004-05** | 1,585 | 1,200 | 224 | 161 |
| **2005-06** | -4,489 | -4,288 | -50 | -151 |
| **2006-07** | -1,226 | -863 | -202 | -161 |
| **2007-08** | -3,571 | -3,315 | -56 | -200 |
| **2008-09** | -6,841 | -6,181 | -470 | -190 |
| **2009-10** | -5,426 | -4,988 | -284 | -154 |
| **2010-11** | -1,821 | -1,849 | 71 | -43 |
| **2001-11** | -35,660 | -33,725 | -848 | -1,087 |

**Table 1.47**

Change rate of Buildings completed - New Constructions. Total (no.)

| Years | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-02** | 3,835 | 3,540 | 255 | 40 |
| **2002-03** | -6,219 | -6,192 | 60 | -87 |
| **2003-04** | -9,180 | -8,677 | -284 | -219 |
| **2004-05** | 1,402 | 1,066 | 198 | 138 |
| **2005-06** | -4,299 | -4,127 | -22 | -150 |
| **2006-07** | -1,112 | -870 | -173 | -69 |
| **2007-08** | -2,871 | -2,725 | 10 | -156 |
| **2008-09** | -6,102 | -5,489 | -450 | -163 |
| **2009-10** | -4,642 | -4,298 | -205 | -139 |
| **2010-11** | -1,936 | -1,937 | 61 | -60 |
| **2001-11** | -31,124 | -29,709 | -550 | -865 |

**Table 1.48**

change rate of Buildings Completed - Total Work - Family Dwelling (no.)

| Years | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | RAM |
| **2001-02** | 3,170 | 2,986 | 144 | 40 |
| **2002-03** | -5,981 | -6,025 | 104 | -60 |
| **2003-04** | -8,944 | -8,469 | -243 | -232 |
| **2004-05** | 1,509 | 1,200 | 191 | 118 |
| **2005-06** | -4,144 | -3,958 | -62 | -124 |
| **2006-07** | -1,467 | -1,125 | -193 | -149 |
| **2007-08** | -3,223 | -3,049 | 5 | -179 |
| **2008-09** | -5,950 | -5,396 | -405 | -149 |
| **2009-10** | -4,686 | -4,355 | -194 | -137 |
| **2010-11** | -1,727 | -1,661 | 13 | -79 |
| **2001-11** | -31,443 | -29,852 | -640 | -951 |

**Table 1.49**

Change rate of Buildings Completed - New Constructions - Family Dwelling (no.)

| Years | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **2001-02** | 3,313 | 3,046 | 226 | 41 |
| **2002-03** | -5,772 | -5,749 | 55 | -78 |
| **2003-04** | -8,073 | -7,677 | -218 | -178 |
| **2004-05** | 1,363 | 1,066 | 188 | 109 |
| **2005-06** | -3,877 | -3,710 | -48 | -119 |
| **2006-07** | -1,297 | -1,039 | -168 | -90 |
| **2007-08** | -2,506 | -2,433 | 75 | -148 |
| **2008-09** | -5,351 | -4,821 | -399 | -131 |
| **2009-10** | -4,037 | -3,773 | -137 | -127 |
| **2010-11** | -1,748 | -1,686 | 28 | -90 |
| **2001-11** | -27,985 | -26,776 | -398 | -811 |

Tables 1.46, 1.47, 1.48 and 1.49 clearly illustrate the above phenomena, whose interpretations show several trends, such as:

- Apart from 2003-04, Portugal and Portugal mainland show a negative variation in all the key indicators used. On the other hand, the autonomous regions are characterized by divergent trends which can be interpreted according to two different aspects: range of percentage decrease and time period.
- Regarding the range of percentage decrease, the ARA presents, in all indicators, values above 30%, whilst the ARM shows similar numbers to Portugal and Portugal mainland.
- The time period also presents significant changes. In the ARA, the main change rate of all indicators is in 2008-09; whilst in the ARM it happens during the period of 2009-10, with an exception to the Variation of Buildings completed Work and Family Dwelling , where the moment of greatest contraction is recorded in 2008-09.

Still according to tables 1.46, 1.47, 1.48 and 1.49, the negative change rate pattern occurred between 2001-11 in all regions is reinforced by tables 1.50, 1.51, 1.52 and 1.53. However, in the ARA this trend is less negative, just going above the 50% of the contraction as for the indicator Chane Rate of Buildings Completed Total Work in Family Dwelling.

Once more the ARM stands out from the other regions. All the present indicators show a negative change rate above the 63.31%. This scenario can be explained by an eventual decrease in the growth of urban pressure.

**Table 1.50**

Change rate of Buildings Completed - Total Work *(no.)*

| Years | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-02** | 4.52 | 4.55 | 7.70 | 0.35 |
| **2002-03** | -9.96 | -10.62 | 5.74 | -3.37 |
| **2003-04** | -17.46 | -17.49 | -16.34 | -17.84 |
| **2004-05** | 3.28 | 2.65 | 13.72 | 11.77 |
| **2005-06** | -9.01 | -9.23 | -2.69 | -9.88 |
| **2006-07** | -2.70 | -2.05 | -11.18 | -11.68 |
| **2007-08** | -8.09 | -8.03 | -3.49 | -16.43 |
| **2008-09** | -16.87 | -16.27 | -30.34 | -18.68 |
| **2009-10** | -16.09 | -15.68 | -26.32 | -18.62 |
| **2010-11** | -6.44 | -6.89 | 8.93 | -6.39 |
| **2001-11** | -57.39 | -57.45 | -49.47 | -63.31 |

**Table 1.51**

Change rate of Buildings Completed - New Constructions *(no.)*

| Years | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-02** | 7.56 | 7.34 | 21.50 | 3.01 |
| **2002-03** | -11.40 | -11.96 | 4.16 | -6.35 |
| **2003-04** | -18.99 | -19.05 | -18.92 | -17.06 |
| **2004-05** | 3.58 | 2.89 | 16.27 | 12.96 |
| **2005-06** | -10.60 | -10.88 | -1.55 | -12.47 |
| **2006-07** | -3.07 | -2.57 | -12.42 | -6.55 |
| **2007-08** | -8.17 | -8.27 | 0.82 | -15.85 |
| **2008-09** | -18.90 | -18.16 | -36.59 | -19.69 |
| **2009-10** | -17.73 | -17.37 | -26.28 | -20.90 |
| **2010-11** | -8.99 | -9.48 | 10.61 | -11.41 |
| **2001-11** | -61.35 | -61.62 | -46.37 | -64.99 |

**Table 1.52**

Change rate of Buildings Completed Total Work *(%)*

| Anos | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **2001-02** | 6.17 | 6.13 | 11.73 | 269 |
| **2002-03** | -10.96 | -11.66 | 7.58 | -3.93 |
| **2003-04** | -18.41 | -18.55 | -16.46 | -15.83 |
| **2004-05** | 3.81 | 3.23 | 15.49 | 9.56 |
| **2005-06** | -10.07 | -10.31 | -4.35 | -9.17 |
| **2006-07** | -3.96 | -3.27 | -14.17 | -12.13 |
| **2007-08** | -9.07 | -9.16 | 0.43 | -16.59 |
| **2008-09** | -18.41 | -17.84 | -34.50 | -16.56 |
| **2009-10** | -17.77 | -17.53 | -25.23 | -18.24 |
| **2010-11** | -7.97 | -8.11 | 2.26 | -12.87 |
| **2001-11** | -61.18 | -61.32 | -52.12 | -64.00 |

**Table 1.53**

Change rate of Buildings Completed New Constructions *(%)*

| Anos | Family Dwelling | | | |
|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM |
| **2001-02** | 7.65 | 7.38 | 26.68 | 3.40 |
| **2002-03** | -12.38 | -12.98 | 5.13 | -6.25 |
| **2003-04** | -19.76 | -19.91 | -19.33 | -15.21 |
| **2004-05** | 4.16 | 3.45 | 20.66 | 10.99 |
| **2005-06** | -11.35 | -11.61 | -4.37 | -10.81 |
| **2006-07** | -4.29 | -3.68 | -16.00 | -9.16 |
| **2007-08** | -8.65 | -8.95 | 8.50 | -16.59 |
| **2008-09** | -20.22 | -19.47 | -41.69 | -17.61 |
| **2009-10** | -19.12 | -18.92 | -24.55 | -20.72 |
| **2010-11** | -10.24 | -10.43 | 6.65 | -18.52 |
| **2001-11** | -64.61 | -64.90 | -46.99 | -67.19 |

The Housing scenario described above acquires deeper strength when cross-matched with the analysis of Table 1.55 and Figure 1.23. It reflects the housing stock estimates for the period of 1991 to 2011 (included). The first conclusion taken from all data is that the housing stock grew in all regions, despite differences in pace recorded among the NUTS II.

This happens due to different territorial speeds (see Figure 1.23) as is the case of the ARM, that has the highest growth, according to the data listed in Table 1.55 (variation of new buildings for residential dwellings).

Thus, an increasing number of buildings for residential dwellings is expected in the period 1991-2011 (Table 1.54). This trend decreased during the period 2001-2011 in the case of Portugal and Portugal mainland, which showed an - almost - stabilization compared to that recorded in 1991-2001 (differential: 0.43 pp. in Portugal; 0 10 pp. on Portugal Mainland).

**Table 1.54**

Housing stock estimates 1991-2011 – Buildings - Classic Family Dwelling, per NUTS II (no.)

| Year | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **1991** | 2,880,388 | 2,730,926 | 81,316 | 68,146 |
| **2001** | 3,185,972 | 3,022,087 | 87,267 | 76,618 |
| **2003** | 3,238,500 | 3,071,304 | 88,331 | 78,865 |
| **2004** | 3,290,111 | 3,119,432 | 89,732 | 80,947 |
| **2005** | 3,329,037 | 3,155,555 | 90,769 | 82,713 |
| **2006** | 3,372,219 | 3,195,252 | 92,297 | 84,670 |
| **2007** | 3,411,657 | 3,231,414 | 93,694 | 86,549 |
| **2008** | 3,449,103 | 3,265,495 | 95,339 | 88,269 |
| **2009** | 3,484,238 | 3,297,729 | 96,866 | 89,643 |
| **2010** | 3,514,014 | 3,325,278 | 97,881 | 90,855 |
| **2011** | 3,537,701 | 3,347,384 | 98,531 | 91,786 |

**Source**: INE, Housing Stock Estimates

**Table 1.55**

Variation of Housing Stock Estimates (1991-2011) – Buildings - Classic Family Dwelling, per NUTS II (%)

| Year | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-03** | 1.65 | 1.63 | 1.22 | 2.93 |
| **2003-04** | 1.59 | 1.57 | 1.59 | 2.64 |
| **2004-05** | 1.18 | 1.16 | 1.16 | 2.18 |
| **2005-06** | 1.30 | 1.26 | 1.68 | 2.37 |
| **2006-07** | 1.17 | 1.13 | 1.51 | 2.22 |
| **2007-08** | 1.10 | 1.05 | 1.76 | 1.99 |
| **2008-09** | 1.02 | 0.99 | 1.60 | 1.56 |
| **2009-10** | 0.85 | 0.84 | 1.05 | 1.35 |
| **2010-11*** | 0.67 | 0.66 | 0.66 | 1.02 |
| **1991-01** | 10.61 | 10.66 | 7.32 | 12.43 |
| **2001-11** | 11.04 | 10.76 | 12.91 | 19.80 |
| **1991-11** | 22.82 | 22.57 | 21.17 | 34.69 |

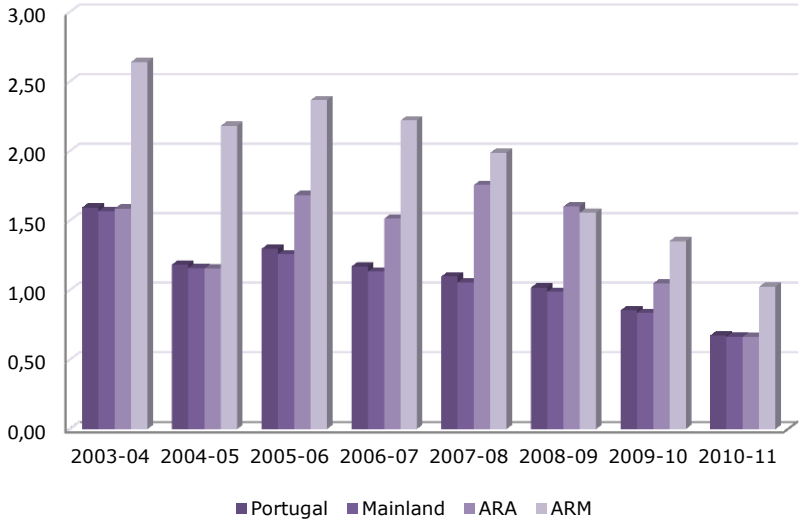



**Figure 1.23**

Change rate in Housing Stocking Estimatives (1991-2011) - Buildings for Housing by Classical - NUTS II (%)

Analyzing the context in absolute terms (Table 1.56), from 1991 to 2011 there was an increase in Portugal of 657, 313 buildings for Family Dwelling, distributed by Portugal Mainland (616,458), the ARA (17,215) and the ARM (23,640).

As for the decadal evolution of this growth, 1991-2001 to 2001-2011, there was an increase of the trend in Portugal (46,145), Portugal mainland (34,136), in the ARA (5,313) and in the ARM (6,696). Thus, the absolute values recorded during the period of 2001-2011 will be equal, compared to the total of the series (from 1991-2011) in Portugal to 53.51%, in Portugal mainland to 52.77%, in the ARA to 65.43 and in the ARM to 64.16%.

**Table 1.56**

Variation of Housing Stock estimates (1991-2011) - Buildings for Classic Family Dwelling per NUT II (no.)

| Years | Portugal | Mainland | ARA | ARM |
|---|---|---|---|---|
| **2001-03** | 52,528 | 49,217 | 1,064 | 2,247 |
| **2003-04** | 51,611 | 48,128 | 1,401 | 2,082 |
| **2004-05** | 38,926 | 36,123 | 1,037 | 1,766 |
| **2005-06** | 43,182 | 39,697 | 1,528 | 1,957 |
| **2006-07** | 39,438 | 36,162 | 1,397 | 1,879 |
| **2007-08** | 37,446 | 34,081 | 1,645 | 1,720 |
| **2008-09** | 35,135 | 32,234 | 1,527 | 1,374 |
| **2009-10** | 29,776 | 27,549 | 1,015 | 1,212 |
| **2010-11*** | 23,687 | 22,106 | 650 | 931 |
| **1991-01** | 305,584 | 291,161 | 5,951 | 8,472 |
| **2001-11** | 351,729 | 325,297 | 11,264 | 15,168 |
| **1991-11** | 657,313 | 616,458 | 17,215 | 23,640 |

**Source**: INE, Stocking House Estimates

Regarding the density of buildings and residential dwellings, this indicator has been helping to build an image of pressure that constructions play over the territory. Despite the obvious physical differences that set the three analyzed regions of Portugal (NUTS II), there is an increasing trend in the number of buildings per km$^2$ (Table 1.56 and 1.57) particularly in the ARM with a variation of 23.55% in the period 1991-2011.

The analysis of this indicator should be read together with the number of residential dwellings per km$^2$ (Table 1.57 and 1.58): there is an increasing urban pressure on geographic space. Once again, under this context, the ARM stands, in all years, from the other regions, exceeding 100 residential dwellings per km$^2$ (2001: 124.56; 2011: 154.27). From 1991 to 2011, there is an increase of 55.38%.

**Table 1.57**

Housing Stock Estimates 1991-2011 – Density of Buildings and Residential Dwellings (no./km2), per NUT II

| Year | Buildings | | | | Residential dwellings | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991** | 31.28 | 30.70 | 35.02 | 85.07 | 45.79 | 45.55 | 36.30 | 99.28 |
| **2001** | 34.65 | 34.01 | 37.99 | 96.49 | 55.42 | 55.20 | 40.23 | 124.56 |
| **2011*** | 37.73 | 37.02 | 41.64 | 105.11 | 62.61 | 62.21 | 46.33 | 154.27 |

**Source:** INE, Housing Stock Estimates

* Information based on Completed Works estimates

**Table 1.58**

Variation on Housing Stock Estimates 1991-2011 – Density of Buildings and Residential Dwellings, per NUT II (%)

| Years | Buildings | | | | Residential Dwellings | | | |
|---|---|---|---|---|---|---|---|---|
| | Portugal | Mainland | ARA | ARM | Portugal | Mainland | ARA | ARM |
| **1991-01** | 10.77 | 10.81 | 8.47 | 13.42 | 21.03 | 21.18 | 10.83 | 25.46 |
| **2001-11** | 8.89 | 8.84 | 9.62 | 8.93 | 12.98 | 12.69 | 15.16 | 23.85 |
| **1991-11** | 20.62 | 20.60 | 18.90 | 23.55 | 36.73 | 36.56 | 27.64 | 55.38 |

## 1.8 Agriculture and Livestock

In the period under review the agriculture sector suffers a marked evolution due to deep structural changes in the sector. One of its main drivers is the Common Agricultural Policy and its effects on Portugal.

The introduction of more sustainable practices of protection of the soil and water and the extensification of production, along with some abandonment of the activity, are the causes for the performance of this sector, particularly in terms of emissions of greenhouse gases.

As an economic activity, in 2009 the Portuguese agriculture sector accounted for a Gross Value Added (GVA) at constant prices, of 2642.5 million euros (INE, 2013). Despite the dimension of the numbers, it shows a declining trend across the analyzed series, as represented by the reading of tables 1.58 and 1.59, an extended scenario to the Net Value Added (NVA) indicator.

This image is reinforced by comparing the extreme values of the time series (Table 1.59), in this case the years of 1989 and 2009. This financial exercise reports a decline of 15.80% GVA of this economic sector, a scenario that becomes worse concerning NVA, which has a higher decline of 3.70 p.p. (19.50% total), a circumstance that may be interpreted as a decrease in profitability.

As for the Portuguese arable land (Table 1.59), it should be noted that it records a widespread decrease as shown by the numbers presented in the Total Coverage of Arable Land Area (1989: 5,316,160 hectares; 1999: 5,188,938 hectares; 2009: 4,709,131 hectares).

**Table 1.59**

| Year | GVA (p.c.2006) | NVA (p.c.2006) | Arable Land Area – Portugal | | | | | A.C.I.F UUA/annual [29] |
|---|---|---|---|---|---|---|---|---|
| | | | Total | UAA | W. and F. without under cover crops[30] | NALA | Other areas | |
| | *$10^6$ Euros* | | *hectares* | | | | | *kg/ha* |
| **1989** | 3,138.2 | 2,411.5 | 5,316,160 | 4,005,573 | 978,259 | 245,110 | 87,219 | na |
| **1990** | 3,271.2 | 2,545.9 | Na | Na | Na | Na | na | na |
| **1991** | 3,279.5 | 2,568.3 | Na | Na | Na | Na | na | na |
| **1992** | 3,025.1 | 2,331.4 | Na | Na | Na | Na | na | na |
| **1993** | 2,624.0 | 1,949.6 | 5,158,217 | 3,949,550 | 880,552 | 224,720 | 103,395 | na |
| **1994** | 2,674.4 | 2,008.6 | na | na | na | na | na | na |
| **1995** | 2,755.5 | 2,100.7 | 5,084,776 | 3,924,621 | 816,364 | 220,425 | 123,366 | 81 |
| **1996** | 2,813.9 | 2,165.1 | Na | Na | na | Na | na | 89 |
| **1997** | 2,591.0 | 1,964.0 | 4,949,393 | 3,822,125 | 815,214 | 210,017 | 102,037 | 87 |
| **1998** | 2,368.8 | 1,758.2 | na | na | na | na | na | 78 |
| **1999** | 2,872.7 | 2,216.9 | 5,188.938 | 3,863,094 | 1,008,374 | 202,898 | 114,573 | 75 |
| **2000** | 2,684.0 | 2,019.6 | Na | Na | na | Na | na | 83 |
| **2001** | 2,585.6 | 1,927.1 | Na | Na | na | Na | na | 80 |
| **2002** | 2,897.2 | 2,207.7 | Na | Na | na | Na | na | 81 |
| **2003** | 2,666.0 | 1,975.7 | 4,888,500 | 3,725,190 | 891,520 | 182,369 | 89,421 | 71 |
| **2004** | 2,967.3 | 2,264.5 | na | na | Na | Na | na | 83 |
| **2005** | 2,529.2 | 1,833.6 | 4,779,428 | 3,679,587 | 851,027 | 160,689 | 88,125 | 69 |
| **2006** | 2,713.9 | 2,018.5 | Na | Na | na | Na | na | 45 |
| **2007** | 2,616.0 | 1,919.0 | 4,408,426 | 3,472,939 | 721,828 | 136,409 | 77,250 | 64 |
| **2008** | 2,735.4 | 2,038.3 | na | na | na | na | na | 51 |
| **2009** | 2,642.5 | 1,941.3 | 4,709,131 | 3,668,145 | 842,208 | 127,691 | 71,087 | 39 |
| **2010** | 2,613.8 | 1,921.9 | na | na | na | na | na | 48 |
| **2011** | 2,556.3 | 1,860.1 | na | na | na | na | na | 44 |

**Source**: INE, 2013

This scenario acquires a higher consistency when cross matched with the extreme years (1989-2009) of the series under analysis (Table 1.60). The Non-Arable Land Area (NALA) indicator is a good example of that

[29] Apparent Consumption of Inorganic Fertilizers UAA / annual (data updated on the 4th of October 2013).
[30] Woods and Forests without under cover crops.

situation, representing a decrease of 47, 90%, as well as the indicators in the Other Areas (18.50%), in the Woods and Forests without under cover crops (13,91% ) or in Usable Arable Area (UAA) (8,42%).

**Table 1.60**

| Year | Variation of the Arable Land Area- Portugal | | | | |
|---|---|---|---|---|---|
| | Total | UAA | Woods and florests without under cover crops | NALA | Other areas |
| | % | | | | |
| **1989-93** | -2.97 | -1.40 | -9.99 | -8.32 | 18.55 |
| **1993-95** | -1.42 | -0.63 | -7.29 | -1.91 | 19.32 |
| **1995-97** | -2.66 | -2.61 | -0.14 | -4.72 | -17.29 |
| **1997-99** | 4.84 | 1.07 | 23.69 | -3.39 | 12.29 |
| **1999-03** | -5.79 | -3.57 | -11.59 | -10.12 | -21.95 |
| **2003-05** | -2.23 | -1.22 | -4.54 | -11.89 | -1.45 |
| **2005-07** | -7.76 | -5.62 | -15.18 | -15.11 | -12.34 |
| **2007-09** | 6.82 | 5.62 | 16.68 | -6.39 | -7.98 |
| **1989-99** | -2.39 | -3.56 | 3.08 | -17.22 | 31.36 |
| **1999-09** | -9.25 | -5.05 | -16.48 | -37.07 | -37.95 |
| **1989-09** | -11.42 | -8.42 | -13.91 | -47.90 | -18.50 |

Comparing the extreme values of the series in question (1989 and 2009), Portugal (-49.99%), the Mainland region (-50.27%), the ARA (-4.19%) and the ARM (-17.63%) show a negative change rate of total Arable Land, trend that extends to the Permanent Crops indicator (Portugal: -12.50; Mainland: -12.13%; ARA: -57.62%; ARM: -32,54%).

These two indicators differ from the Permanent Pastures one, which displays a significant increase in the area belonging to this same use (Portugal: 112.96%; Mainland: 127.87%; ARA: 4.70%; ARM: 16.04%).

**Table 1.61**

Arable Land, Permanent Crops and Pasture (ha)

| Arable Land | | | |
|---|---|---|---|
| | **1989** | **1999** | **2009** |
| Portugal | 2.345.656 | 1.740.016 | 1.173.127 |
| Mainland | 2.330.327 | 1.725.887 | 1.158.805 |
| ARA | 12.607 | 11.860 | 12.079 |
| ARM | 2.722 | 2.269 | 2.242 |
| **Permanent crops** | | | |
| | **1989** | **1999** | **2009** |
| Portugal | 789.415 | 711.628 | 690.725 |
| Mainland | 780.966 | 705.232 | 686.221 |
| ARA | 4.769 | 3.662 | 2.021 |
| ARM | 3.679 | 2.735 | 2.482 |
| **Permanent Pastures** | | | |
| | **1989** | **1999** | **2009** |
| Portugal | 838.015 | 1.389.844 | 1.784.598 |
| Mainland | 736.521 | 1.284.056 | 1.678.288 |
| ARA | 101.044 | 105.273 | 105.790 |
| ARM | 449 | 515 | 521 |

**Table 1.62**

Variation of Arable Land, Permanent Crops and Pastures (%)

| Arable Land | | |
|---|---|---|
| **1989-99** | **1999-2009** | **1989-2009** |
| -25,82 | -32,58 | -49,99 |
| -25,94 | -32,86 | -50,27 |
| -5,93 | 1,85 | -4,19 |
| -16,64 | -1,19 | -17,63 |
| **Permanent crops** | | |
| **1989-99** | **1999-2009** | **1989-2009** |
| -9,85 | -2,94 | -12,50 |
| -9,70 | -2,70 | -12,13 |
| -23,21 | -44,81 | -57,62 |
| -25,66 | -9,25 | -32,54 |
| **Permanent Pastures** | | |
| **1989-99** | **1999-2009** | **1989-2009** |
| 65,85 | 28,40 | 112,96 |
| 74,34 | 30,70 | 127,87 |
| 4,19 | 0,49 | 4,70 |
| 14,70 | 1,17 | 16,04 |

**Source**: INE, 2013

Regarding Temporary Crops (Tables 1.63 and 1.64) and taking only into account the change rate recorded between 1989 and 2009 for the Total value of the indicator, there is a significant decreased in Portugal

(49.96%, equivalent to 946 823 ha), in the Mainland (50, 61%, equivalent to 946 392 ha) and in the ARM (36.66%, equivalent to 1.679 ha) of that same area. Nevertheless, in the ARA there was an increase of 6% (a value equivalent to 1,248 ha).

As for Temporary Grass, the trend is identical to the Total of Temporary Crops, distinguishing itself only by the size of relative change rate presented in Portugal (-57.35%), in the Mainland (-57.15%) and in the ARM (-47.06 %). The ARA could not be subjected to analysis due to the lack of statistical information.

**Table 1.63**

Area of temporary crops (ha)

| | Total | | | Temporary grass | | |
|---|---|---|---|---|---|---|
| | **1989** | **1999** | **2009** | **1989** | **1999** | **2009** |
| **Portugal** | 1,895,293 | 1,399,335 | 948,470 | 74,231 | 37,250 | 31,661 |
| **Mainland** | 1,869,929 | 1,378,415 | 923,537 | 73,865 | 37,246 | 31,652 |
| **ARA** | 20,784 | 17,355 | 22,032 | 349 | nd | nd |
| **ARM** | 4,580 | 3,565 | 2,901 | 17 | 4 | 9 |

**Source**: INE, 2013

**Table 1.64**

Area change in temporary crops (%)

| | Total | | | Temporary grass | | |
|---|---|---|---|---|---|---|
| | **1989-99** | **1999-2009** | **1989-2009** | **1989-99** | **1999-2009** | **1989-2009** |
| **Portugal** | -26.17 | -32.22 | -49.96 | -49.82 | -15.00 | -57.35 |
| **Mainland** | -26.29 | -33.00 | -50.61 | -49.58 | -15.02 | -57.15 |
| **ARA** | -16.50 | 26.95 | 6.00 | ne | Ne | ne |
| **ARM** | -22.16 | -18.63 | -36.66 | -76.47 | 125.00 | -47.06 |

Regarding the Annual Apparent Consumption of Inorganic Fertilizers in Usable Arable Area (Table 1.65), the registration of a gradual decrease in the quantities used per hectare is notorious. This trend can be applied in general across the series, only recording individual cases of growth such as in 1996 (89 kg/ha), in 2000 (83 kg/ha), in 2004 (83 kg/ha) and in 2007 (64 kg/ha). When comparing the extremes of the series (1999 and 2009), it shows a decrease of 36 kg/ha, the equivalent to 48.00% according to data registered in 1999.

This trend is - partly - explained by the data shown in Tables 1.63 and 1.64. Their readings indicate, during the same time period (1999-2009), a decrease of 32.22% of the area of temporary crops in Portugal.

This scenario becomes clearer after analyzing the entire time series (1989-2009), which illustrates a negative change rate of 49.96% (equivalent to 946,826 ha) in Portugal, 50.61% (equivalent to 946,39 ha) in the Mainland and 36.66% (equivalent to 1,679ha) in the ARM. The ARA is in the opposite trend analysis, showing with an increase of 6% (equivalent to 1,248 ha).

**Table 1.65**

| Year | GVA (p.c.2006) | NVA (p.c.2006) | Apparent Consumption of Inorganic Fertilizers/annual |
|---|---|---|---|
| | % | | |
| **1989-90** | 4.24 | 5.57 | na |
| **1990-91** | 0.26 | 0.88 | na |
| **1991-92** | -7.76 | -9.22 | na |
| **1992-93** | -13.26 | -16.38 | na |
| **1993-94** | 1.92 | 3.03 | na |
| **1994-95** | 3.03 | 4.59 | na |
| **1995-96** | 2.12 | 3.06 | 9.88 |
| **1996-97** | -7.92 | -9.29 | -2.25 |
| **1997-98** | -8.58 | -10.48 | -10.34 |
| **1998-99** | 21.27 | 26.09 | -3.85 |
| **1999-00** | -6.57 | -8.90 | 10.67 |
| **2000-01** | -3.67 | -4.58 | -3.61 |
| **2001-02** | 12.05 | 14.56 | 1.25 |
| **2002-03** | -7.98 | -10.51 | -12.35 |
| **2003-04** | 11.30 | 14.62 | 16.90 |
| **2004-05** | -14.76 | -19.03 | -16.87 |
| **2004-06** | 7.30 | 10.08 | -34.78 |
| **2006-07** | -3.61 | -4.93 | 42.22 |
| **2007-08** | 4.56 | 6.22 | -20.31 |
| **2008-09** | -3.39 | -4.76 | -23.53 |
| **2009-10** | -1.09 | -1.00 | 23.08 |
| **2010-11** | -2.20 | -3.22 | -8.33 |
| **1989-99** | -8.46 | -8.07 | na |
| **1999-09** | -8.01 | -12.43 | -48.00 |
| **1999-11** | -11.01 | -16.09 | -41.33 |
| **1989-11** | -18.54 | -22.86 | na |

Having the data contained in Tables 1.61 and 1.62 as a basis, the trend for a general decrease is clear. However, it changes according to the geographic location and the type of crop (Tables 1.61 and 1.62), of the total area belonging to those permanent crops.

This description should be reinforced with the interpretation of Figures 1.24 and 1.25 and the reading of Tables 1.63 and 1.64, which are meant to show the change rate whether in absolute values whether in relative values between the three NUTS I analysed in 1989, 1999 and 2009.

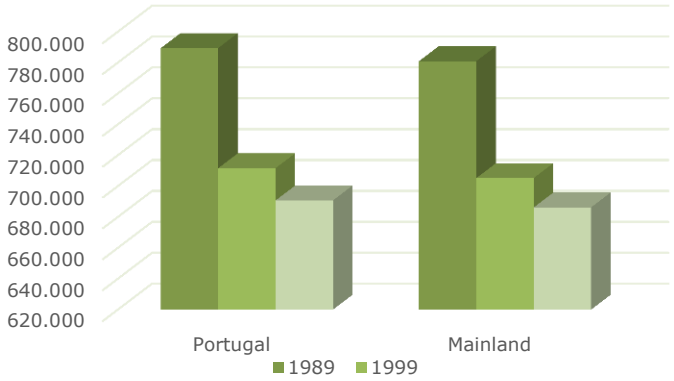



**Figure 1.24**
Total area of permanent crops by geographical location (NUTS-2002) – Portugal and Mainland

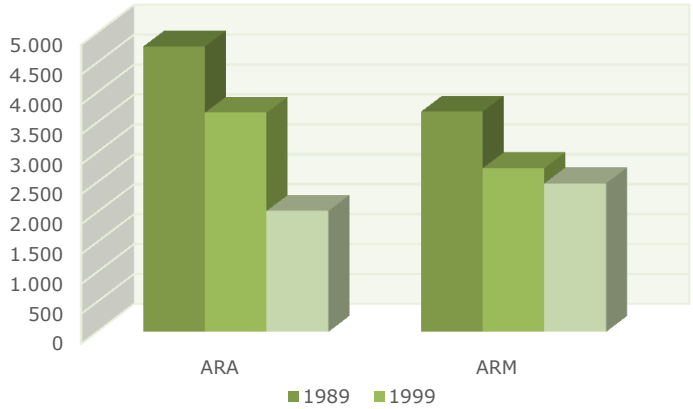



**Figure 1.25**
Total area of permanent crops by geographical location (NUTS-2002) – Authonomous Regions

As for the predominant type of crops in 2009 (see Table 1.66), the Mainland is dominated by Olive Groves and Vineyards. When combined these represent a total of 511,614 hectares, an amount equivalent to 74.56% of the total area of permanent crops in this statistical region.

With regard to olive groves, despite the reduction of the area belonging to this type of permanent crop, the significant growth of the produced quantity over the last two decades (see Tables 1.67 and 1.68) should be underlined. This efficiency growth is checked through the Relative Change Rate indicator of Total olives produced in an olive grove, in particular in the timeline of 1999-2009, a period registering an increase of 27.19%, equivalent to 90,415 tons.

By contrast, the autonomous regions present a different scenario, which is essentially based on the vineyard and subtropical fruits. In this table, the ARA recorded a total of 1,361 hectares and the ARM a total of 1,980 hectares, which is the equivalent to 67.34% and 79.77% of the total, respectively. It should be noted that in the case of the ARA the situation changes when a third permanent crop, the citrus, is added, thus making this region (1,802 hectares, accounting for 89.16 % of the total) closer to the values presented by the ARM.

**Table 1.66**

Area of permanent crops (ha) by geographic location (NUTS-2002) and type; Decadal

| Type of crop | Portugal | | | Mainland | | |
|---|---|---|---|---|---|---|
| | **1989** | **1999** | **2009** | **1989** | **1999** | **2009** |
| Total | 789,415 | 711,628 | 690,725 | 780,966 | 705,232 | 686,221 |
| Fresh fruits | 76,266 | 52,746 | 40,127 | 75,715 | 52,342 | 39,746 |
| Citrus | 26,759 | 23,453 | 16,930 | 25,598 | 22,428 | 16,389 |
| Subtropical fruits | 3,047 | 2,612 | 3,048 | 1,042 | 1,197 | 1,764 |
| Nuts | 73,860 | 80,470 | 115,150 | 73,738 | 80,281 | 114,980 |
| Olive grove | 340,514 | 335,028 | 335,841 | 340,514 | 335,028 | 335,841 |
| Vineyard | 266,326 | 215,041 | 177,831 | 262,025 | 211,821 | 175,773 |
| Other crops | 2,643 | 2,277 | 1,799 | 2,334 | 2,135 | 1,728 |

| Type of crop | ARA | | | ARM | | |
|---|---|---|---|---|---|---|
| | **1989** | **1999** | **2009** | **1989** | **1999** | **2009** |
| Total | 4,769 | 3,662 | 2,021 | 3,679 | 2,735 | 2,482 |
| Fresh fruits | 290 | 185 | 103 | 261 | 219 | 278 |
| Citrus | 1,086 | 924 | 441 | 75 | 101 | 100 |
| Subtropical fruits | 767 | 670 | 435 | 1,239 | 745 | 849 |
| Nuts | 65 | 108 | 66 | 57 | 81 | 104 |
| Olive grove | 0 | 0 | 0 | 0 | 0 | 0 |
| Vineyard | 2,489 | 1,700 | 926 | 1,812 | 1,520 | 1,131 |
| Other crops | 73 | 73 | 50 | 236 | 69 | 20 |

**Source:** INE, 2013

**Table 1.67**

Total of olive production

| Year | Olive grove | Olive | |
|---|---|---|---|
| | | Table | Oil |
| | Tons | | |
| **1989** | 330,795 | 21,000 | 309,795 |
| **1999** | 332,563 | 11,698 | 320,865 |
| **2009** | 422,978 | 8,291 | 414,687 |

**Source**: INE, 2013

**Table 1.68**

Change rate in total olive production

| Ano | Olive grove | Olive | |
|---|---|---|---|
| | | Table | Oil |
| | % | | |
| **1989-1999** | 0.53 | -44.30 | 3.57 |
| **1999-2009** | 27.19 | -29.12 | 29.24 |
| **1989-2009** | 27.87 | -60.52 | 33.86 |

In what concerns inter-decadal and inter-regional change rate (1989, 1999 and 2009) and the area of permanent crops (see Tables 1.69 and 1.70), there is a significant and steady evidence in the decrease of vineyards in the Mainland. This assumes different proportions when comparing 1989 to 2009, when a total reduction of 86,252 hectares was registered from 1989 to 2009. These numbers are the equivalent of a relative value of 32.92%. The example mentioned above was the main absolute negative change rate recorded in this NUT I. The area belonging to Fresh Fruits has the highest negative variation (47.51%, the equivalent to a total of 35,969 hectares).

It should be noted that for the same time period, the mainland had a positive change rate of the area belonging to the Subtropical Fruits (69.29% or 722 hectares) and to the NUTs (55.93% or 41,242 hectares).

With regard to the Autonomous Regions, the ARA shows as major negative chante rate those concerning the Vineyards (62.80% or 1,563 hectares) and the citrus fruits (59.39% or 645 hectares). The ARM, in turn, also shows a decrease in the Vineyards (37.58% or 681 hectares). However, this was lower than the percentage recorded by other crops (91.53% or 216 hectares).

In the ARA, nuts register an increase (1 hectare or 1.54%). As for the ARM it shows more interesting values, particularly regarding the nuts (or 82.46% 47 hectares) and Citrus (33.33% or 25 hectares) crops.

**Table 1.69**

Change rate (absolute values) of the area of permanent crops (ha) by geographical location (NUT, 2002) and type; Decadal

| Type of crop | Portugal | | | Mainland | | |
|---|---|---|---|---|---|---|
| | 1989-1999 | 1999-2009 | 1989-2009 | 1989-1999 | 1999-2009 | 1989-2009 |
| Total | -77,787 | -20,903 | -98,690 | -75,734 | -19,011 | -94,745 |
| Fresh fruits [a] | -23,520 | -12,619 | -36,139 | -23,373 | -12,596 | -35,969 |
| Citrus | -3,306 | -6,523 | -9,829 | -3,170 | -6,039 | -9,209 |
| Subtropical fruits | -435 | 436 | 1 | 155 | 567 | 722 |
| Nuts | 6,610 | 34,680 | 41,290 | 6,543 | 34,699 | 41,242 |
| Olive grove | -5,486 | 813 | -4,673 | -5,486 | 813 | -4,673 |
| Vineyard | -51,285 | -37,210 | -88,495 | -50,204 | -36,048 | -86,252 |
| Other crops | -366 | -478 | -844 | -199 | -407 | -606 |

| Type of crop | ARA | | | ARM | | |
|---|---|---|---|---|---|---|
| | 1989-1999 | 1999-2009 | 1989-2009 | 1989-1999 | 1999-2009 | 1989-2009 |
| Total | -1,107 | -1,641 | -2,748 | -944 | -253 | -1,197 |
| Fresh fruits [a] | -105 | -82 | -187 | -42 | 59 | 17 |
| Citrus | -162 | -483 | -645 | 26 | -1 | 25 |
| Subtropical fruits | -97 | -235 | -332 | -494 | 104 | -390 |
| Nuts | 43 | -42 | 1 | 24 | 23 | 47 |
| Olive grove | 0 | 0 | 0 | 0 | 0 | 0 |
| Vineyard | -789 | -774 | -1,563 | -292 | -389 | -681 |
| Other crops | 0 | -23 | -23 | -167 | -49 | -216 |

a) Except citrus

**Table 1.70**

Change rate (relative values) of the area of permanent crops (ha) by geographical location (NUT, 2002) and type; Decadal

| Tipo de Cultura | Portugal | | | Mainland | | |
|---|---|---|---|---|---|---|
| | 1989-1999 | 1999-2009 | 1989-2009 | 1989-1999 | 1999-2009 | 1989-2009 |
| Total | -9.85 | -2.94 | -12.50 | -9.70 | -2.70 | -12.13 |
| Fresh Fruits[a] | -30.84 | -23.92 | -47.39 | -30.87 | -24.06 | -47.51 |
| Citrus | -12.35 | -27.81 | -36.73 | -12.38 | -26.93 | -35.98 |
| Subtropical fruits | -14.28 | 16.69 | 0.03 | 14.88 | 47.37 | 69.29 |
| Nuts | 8.95 | 43.10 | 55.90 | 8.87 | 43.22 | 55.93 |
| Olive grove | -1.61 | 0.24 | -1.37 | -1.61 | 0.24 | -1.37 |
| Vineyard | -19.26 | -17.30 | -33.23 | -19.16 | -17.02 | -32.92 |
| Other crops | -13.85 | -20.99 | -31.93 | -8.53 | -19.06 | -25.96 |

| Tipo de Cultura | ARA | | | ARM | | |
|---|---|---|---|---|---|---|
| | 1989-1999 | 1999-2009 | 1989-2009 | 1989-1999 | 1999-2009 | 1989-2009 |
| Total | -23.21 | -44.81 | -57.62 | -25.66 | -9.25 | -32.54 |
| Fresh fruits [a] | -36.21 | -44.32 | -64.48 | -16.09 | 26.94 | 6.51 |
| Citrus | -14.92 | -52.27 | -59.39 | 34.67 | -0.99 | 33.33 |
| Subtropical fruits | -12.65 | -35.07 | -43.29 | -39.87 | 13.96 | -31.48 |
| Nuts | 66.15 | -38.89 | 1.54 | 42.11 | 28.40 | 82.46 |
| Olive grove | - | - | - | - | - | - |
| Vineyard | -31.70 | -45.53 | -62.80 | -16.11 | -25.59 | -37.58 |
| Other crops | 0,00 | -31.51 | -31.51 | -70.76 | -71.01 | -91.53 |

a) Except citrus

With regard to livestock (Table 1.71), it should be noted that this analysis only takes in account the data collected under the General Agricultural Census (GAC) of 1989, 1999 and 2009 and they served as a basis for the elaboration of Table 1.72.

By analyzing, species by species, the variation recorded between 1989 and 2009, shows an increase in the actual number of cattle in Portugal (2.075%). Although in the ARA there is a similar scenario (27.417%), it is quite the opposite in the Mainland (-1.593 %) and in the ARM (-54.488%).

As to swine, there is a decrease in the number of units in Portugal (-21.566%); such trend is also true in the NUT I of the Mainland (-22.096%) and in the ARM (-9.385%). The ARA is in a general opposite position, exhibiting a growth of 3,949%. In what concerns sheep, there is a similar scenario regarding this species, which has different percentage values. Thus, Portugal records a decrease of 24.148 %, the Mainland one of 24.068% and the ARM a decrease of 57.397%.

As for goats, the numbers indicate a negative change rate in all geographical locations of this time period series and the lowest decrease in the ARA (25.746%) should be underlined.

Equidae is the species under analysis that shows the highest negative change rate, from which the ARA stands out with 72.478%. Rabbits are, in turn, in the opposite situation, only presenting positive variations in their units. The ARA is the region where there is the highest growth, one of 947.030%.

Poultry presents a widespread positive variation in the number of units, with the exception of the ARA that displays a decrease of 20,508%.

**Table 1.71**

Total of animals units by species and geographical location – Portugal and NUT I - (No.)

| **Portugal** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989** | 1,401,206 | 2,439,199 | 2,926,278 | 720,522 | 150,890 | 31,152,651 | 480,294 |
| **1999** | 1,415,188 | 2,418,426 | 2,929,765 | 537,241 | 96,471 | 42,631,471 | 1,673,702 |
| **2009** | 1,430,285 | 1,913,161 | 2,219,639 | 420,711 | 56,014 | 35,351,548 | 1,395,143 |
| **Mainland** | | | | | | | |
| **Year** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989** | 1,196,077 | 2,380,233 | 2,912,043 | 697,471 | 140,862 | 30,140,943 | 474,660 |
| **1999** | 1,172,437 | 2,332,864 | 2,917,719 | 519,018 | 90,544 | 41,397,586 | 1,654,957 |
| **2009** | 1,177,019 | 1,854,306 | 2,211,173 | 405,627 | 53,243 | 34,369,250 | 1,358,415 |
| **ARA** | | | | | | | |
| **Year** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989** | 195,235 | 40,670 | 3,400 | 10,798 | 9,963 | 607,380 | 2,828 |
| **1999** | 238,396 | 61,894 | 4,951 | 9,063 | 5,885 | 676,718 | 5,882 |
| **2009** | 248,763 | 42,276 | 3,850 | 8,018 | 2,742 | 482,820 | 29,610 |
| **ARM** | | | | | | | |
| **Year** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989** | 9,894 | 18,296 | 10,835 | 12,253 | 65 | 404,328 | 2,806 |
| **1999** | 4,355 | 23,668 | 7,095 | 9,160 | 42 | 557,167 | 12,863 |
| **2009** | 4,503 | 16,579 | 4,616 | 7,066 | 29 | 499,478 | 7,118 |

**Source**: INE, 2013

**Table 1.72**

Decanal change rate of the total of animal units in Portugal and NUT I (%)

| Portugal | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Years** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989-1999** | 0.998 | -0.852 | 0.119 | -25.437 | -36.065 | 36.847 | 248.474 |
| **1999-2009** | 1.067 | -20.892 | -24.238 | -21.690 | -41.937 | -17.076 | -16.643 |
| **1989-2009** | 2.075 | -21.566 | -24.148 | -41.610 | -62.878 | 13.478 | 190.477 |
| **Mainland** | | | | | | | |
| **Years** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989-1999** | -1.976 | -1.990 | 0.195 | -25.586 | -35.721 | 37.347 | 248.662 |
| **1999-2009** | 0.391 | -20.514 | -24.216 | -21.847 | -41.197 | -16.978 | -17.918 |
| **1989-2009** | -1.593 | -22.096 | -24.068 | -41.843 | -62.202 | 14.028 | 186.187 |
| **ARA** | | | | | | | |
| **Years** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989-1999** | 22.107 | 52.186 | 45.618 | -16.068 | -40.931 | 11.416 | 107.992 |
| **1999-2009** | 4.349 | -31.696 | -22.238 | -11.530 | -53.407 | -28.653 | 403.400 |
| **1989-2009** | 27.417 | 3.949 | 13.235 | -25.746 | -72.478 | -20.508 | 947.030 |
| **ARM** | | | | | | | |
| **Years** | **Cattle** | **Swine** | **Sheep** | **Goats** | **Equidae** | **Poultry** | **Rabbits** |
| **1989-1999** | -55.983 | 29.362 | -34.518 | -25.243 | -35.385 | 37.801 | 358.411 |
| **1999-2009** | 3.398 | -29.952 | -34.940 | -22.860 | -30.952 | -10.354 | -44.663 |
| **1989-2009** | -54.488 | -9.385 | -57.397 | -42.332 | -55.385 | 23.533 | 153.671 |

In terms of indicators of environmental performance of arable lands, the aspects taken into account are the following: the nutrients balance, energy consumption, agriculture in organic production and the practice of direct seeding or minimum tillage.

According to the indicator balance per hectare of agricultural land (Table 1.65), there is a register of a decrease in the quantities of nitrogen (-57.58%) and phosphorous (-62.50%) in 2009 when compared to 1999.

**Table 1.73**

| **Year** | **Balance per hectare of agricultural land** (total agricultural land) | | ***Outputs*** | | ***Inputs*** | | **Balance** | |
|---|---|---|---|---|---|---|---|---|
| | Nitrogen | Phosphorous | Phosphorous | Nitrogen | Phosphorous | Nitrogen | Nitrogen | Phosphorous |
| | kg/ha | | Ton | | | | | |
| **1995** | 38.00 | 10.00 | 34,767.00 | 192,788.00 | 75,007.00 | 341,785.00 | 148,997.00 | 40,240.00 |
| **1996** | 42.00 | 10.00 | 35,417.00 | 199,911.00 | 74,451.00 | 365,154.00 | 165,243.00 | 39,034.00 |
| **1997** | 43.00 | 10.00 | 34,588.00 | 195,522.00 | 72,261.00 | 361,193.00 | 165,671.00 | 37,673.00 |
| **1998** | 38.00 | 9.00 | 34,878.00 | 204,801.00 | 67,374.00 | 347,489.00 | 142,688.00 | 32,496.00 |
| **1999** | 33.00 | 8.00 | 37,907.00 | 227,485.00 | 69,622.00 | 355,532.00 | 128,047.00 | 31,715.00 |
| **2000** | 40.00 | 9.00 | 36,370.00 | 223,793.00 | 72,474.00 | 375,992.00 | 152,199.00 | 36,104.00 |
| **2001** | 37.00 | 8.00 | 35,690.00 | 220,270.00 | 66,519.00 | 360,164.00 | 139,894.00 | 30,829.00 |
| **2002** | 36.00 | 8.00 | 36,718.00 | 230,765.00 | 66,985.00 | 367,293.00 | 136,528.00 | 30,267.00 |
| **2003** | 21.00 | 9.00 | 35,810.00 | 226,042.00 | 70,322.00 | 306,439.00 | 80,397.00 | 34,512.00 |
| **2004** | 25.00 | 12.00 | 37,215.00 | 232,885.00 | 84,348.00 | 327,551.00 | 94,666.00 | 47,133.00 |
| **2005** | 18.00 | 8.00 | 34,921.00 | 232,687.00 | 64,992.00 | 301,402.00 | 68,715.00 | 30,071.00 |
| **2006** | 11.00 | 4.00 | 37,425.00 | 242,462.00 | 53,064.00 | 283,236.00 | 40,774.00 | 15,639.00 |
| **2007** | 17.00 | 6.00 | 36,464.00 | 243,278.00 | 60,197.00 | 307,299.00 | 64,021.00 | 23,733.00 |
| **2008** | 12.00 | 3.00 | 38,204.00 | 248,728.00 | 50,729.00 | 293,390.00 | 44,662.00 | 12,525.00 |
| **2009** | 14.00 | 3.00 | 37,898.00 | 245,304.00 | 48,430.00 | 297,345.00 | 52,041.00 | 10,532.00 |

**Source**: OECD, 2013

With regard to energy consumption (Table 1.74), the direct on-farm shows that in 2010 (343,000 Tep), a reduction of its values compared to what was registered in the whole time series. The difference shown was even higher when compared to the year of 2000 (714,000 Toe). This trend differs from the one exhibited by the Total National, which is emphasized by a growth of the consumed energy. This fact can be verified with the analysis of the indicator Share of agriculture in total national.

**Table 1.74**

| Year | Energy Consumption | | |
|---|---|---|---|
| | Direct on-farm | Total National | Share of agriculture in total national |
| | 1,000 Toe | | % |
| **1990** | 459.00 | 11,804.00 | 3.90 |
| **1991** | 462.00 | 12,259.00 | 3.80 |
| **1992** | 462.00 | 12,700.00 | 3.60 |
| **1993** | 460.00 | 12,832.00 | 3.60 |
| **1994** | 470.00 | 13,411.00 | 3.50 |
| **1995** | 480.00 | 13,740.00 | 3.50 |
| **1996** | 479.00 | 14,533.00 | 3.30 |
| **1997** | 533.00 | 15,069.00 | 3.50 |
| **1998** | 601.00 | 16,054.00 | 3.70 |
| **1999** | 649.00 | 16,778.00 | 3.90 |
| **2000** | 714.00 | 17,745.00 | 4.00 |
| **2001** | 506.00 | 17,963.00 | 2.80 |
| **2002** | 473.00 | 18,418.00 | 2.60 |
| **2003** | 455.00 | 18,371.00 | 2.50 |
| **2004** | 527.00 | 18,877.00 | 2.80 |
| **2005** | 514.00 | 18,958.00 | 2.70 |
| **2006** | 396.00 | 18,747.00 | 2.10 |
| **2007** | 394.00 | 18,992.00 | 2.10 |
| **2008** | 357.00 | 18,474.00 | 1.90 |
| **2009** | 350.00 | 18,260.00 | 1.90 |
| **2010** | 343.00 | 18,158.00 | 1.90 |

**Source**: OECD, 2013

By analyzing Organic Farming (Tables 1.75 and 1.76), there is a significant area growth along the time series, a trend which is occasionally interrupted in 1996 (-9.92%), in2008 (-8.15%) and in 2009 (-26.70%).

Despite the implementation, in 2010, of a new methodology for calculating values based on information provided by the reports of Certification Bodies, the data presented in table 1.68 allow a comparison between the years 1994 (7,183.00 ha) and 2011 (220,385.95 ha). In this case there is a positive absolute variation of 213,202.95 hectares, which equates to 2,968.16%.

**Table 1.75**

| Year | Organic Farming |
|---|---|
| | ha |
| **1994** | 7,183.00 |
| **1995** | 10,192.40 |
| **1996** | 9,181.50 |
| **1997** | 12,193.00 |
| **1998** | 29,533.48 |
| **1999** | 47,973.77 |
| **2000** | 50,001.00 |
| **2001** | 70,857.00 |
| **2002** | 91,006.00 |
| **2003** | 120,729.00 |
| **2004** | 169,895.56 |
| **2005** | 212,377.00 |
| **2006** | 215,145.20 |
| **2007** | 233,475.00 |
| **2008** | 214,442.32 |
| **2009** | 157,178.96 |
| **2010**[31] | 210,981.18 |
| **2011** | 220,385.95 |

**Source**: GPP, 2013

**Table 1.76**

| Ano | Variation of Organic Farming area |
|---|---|
| | % |
| **1994-95** | 41.90 |
| **1995-96** | -9.92 |
| **1996-97** | 32.80 |
| **1997-98** | 142.22 |
| **1998-99** | 62.44 |
| **1999-00** | 4.23 |
| **2000-01** | 41.71 |
| **2001-02** | 28.44 |
| **2002-03** | 32.66 |
| **2003-04** | 40.72 |
| **2004-05** | 25.00 |
| **2005-06** | 1.30 |
| **2006-07** | 8.52 |
| **2007-08** | -8.15 |
| **2008-09** | -26.70 |
| **2009-10** | 34.23 |
| **2010-11** | 4.46 |
| **1994-11** | 2,968.16 |

Regarding no-tillage (table1.77), this is an important practice for the national conditions regarding the increase of soil organic matter, as well as for its subsequent sequestration of carbon. It is noted that this practice has been growing in the usable area, from 3,503.10 ha in 2008 to 24,342.73 hectares in 2012, the equivalent to an increase of 594.89%.

**Table 1.77**

| Year | No-Tillage |
|---|---|
| | ha |
| **2008** | 3,503.10 |
| **2009** | 9,854.26 |
| **2010** | 22,355.43 |
| **2011** | 23,692.05 |
| **2012** | 24,342.73 |

**Source**: IFAP, 2013

## 1.9 Land use, land use change and forestry

**LULUCF Inventory Framework**

When considered in its entirety, the LULUCF sector has turned from a net-source of emissions in 1990 to an overall net-sink in 2011.

In 2011 the net-sink from the LULUCF sector was estimated at 5.1Mt$CO_2$eq, a reduction of 15.6Mt compared to 1990, or an average reduction in emissions of 600Kt$CO_2$ per year.

The main contributors for this change have been an increase in removals in forest land and in other land and reductions in emissions in cropland and grassland. The trends in other sources and land-uses are much

[31] From 2010 a new methodology is used, based on information from reports of Certification Bodies for the calculation of values (source: CPP, 2013).

smaller in scale, and it should be noted that fires have a rather erratic behaviour, mostly driven by changes in weather patterns from year to year.

The main drivers for this change have been changes in land-use patterns over time, and the introduction of policies for increasing afforestation, improving the system for the prevention and combat of forest fires (introduced after the big fire seasons of 2003 and 2005) and the introduction of carbon sequestration incentives in agricultural and grassland soils.

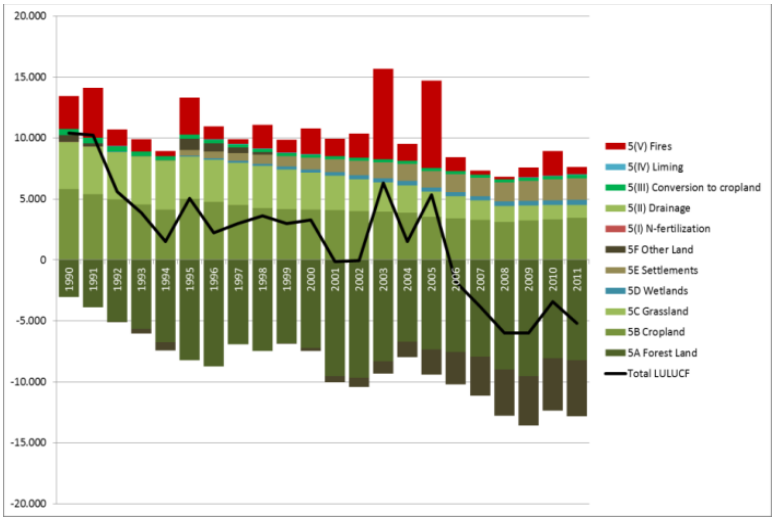



**Figure 1.26**
Overview of reported emissions and removals in the LULUCF Sector

**Representation of Land-Areas and Land-Use Changes**
Portugal has 9,220,671 ha, divided in the Mainland with 8,908,893 ha (96.6%), the ARA with 231, 676 ha (2.5%) and ARM with 80,102 ha (0.9%).

Under the Portuguese constitutional law, the ARA and ARM are each an Autonomous Region, and as a result of that legal status the information sources (used for activity data) for each region are not exactly the same.

The sections below describe how the data on land-use and land-use change were derived in each of the 3 regions. The approaches used vary according to territory and time period under consideration from Approach 1 (total land-use area, no data on conversions between land-uses) and Approach 3 (spatially-explicit land-use conversion data), with a predominance for the later.

**Land-Use Data Stratification**
The same land-use stratification is used in all 3 regions, despite the different sources of land-use data used in each of the regions. A total of 19 land-use categories were used.

**Mainland Portugal**
The land-use and land-use change data for Mainland Portugal 1970-2012 was divided into two different time periods: 1970-1995 and 1995-2012.

This separation was needed due to the quality of available information, where the period 1995-2012 can be estimated using an approach type 3 (spatially-explicit land-use conversion data), while the data for the period 1970-1995 only allowed for the use of an approach type 1 (total land-use area, no data on conversions between land-uses). The full methodology is described in the NIR 2013.

The results for the full time series 1970-2012 are presented in Figure .

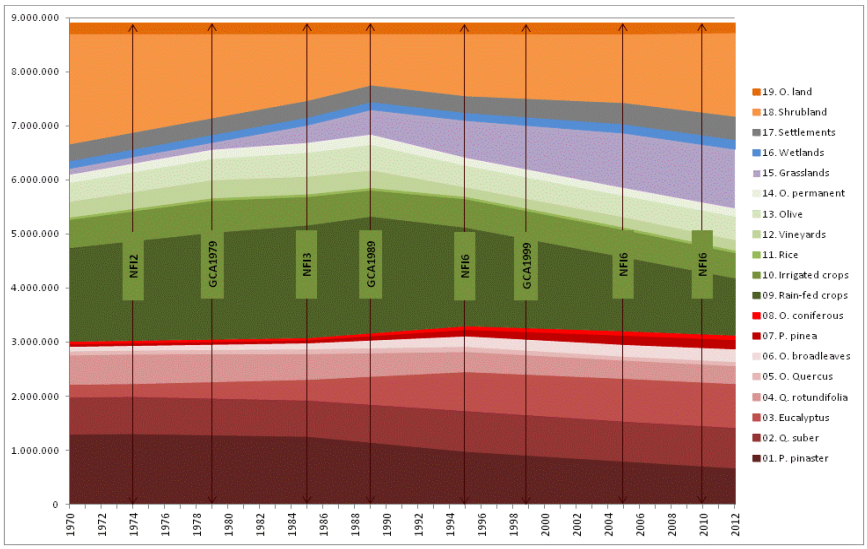



**Figure 1.27**

Changes in Total Land-Use in Mainland Portugal and Main Information Sources Used

The resulting Annual Land-use Change Matrices were derived for the entire period. An example is shown in the table below.

**Table 1.78**

Annual Land-use changes in the period [2005-2012]

| 2010 \ 2005 | P. pin | Q. sub | Eucal | Q. rot | O. Que | O. Br | P. pnea | O. Com | Rf crps | Ir crps | Rice | Vine | Olive | O. Perm | Grassl | Wetl | Settl | Shrub | O. land | Annual Gains 2005-2010 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P. pinaster | | 5 | 390 | 0 | 50 | 255 | 40 | 55 | 1.132 | 316 | 5 | 70 | 81 | 5 | 837 | 0 | 65 | 4.457 | 207 | 7.971 | 34.083 |
| Q. suber | 170 | | 210 | 100 | 40 | 35 | 200 | 10 | 1.380 | 35 | 0 | 5 | 60 | 0 | 1.021 | 0 | 0 | 641 | 0 | 3.907 | |
| Eucalyptus | 3.891 | 40 | | 0 | 30 | 620 | 75 | 60 | 1.462 | 358 | 0 | 45 | 73 | 20 | 1.082 | 0 | 35 | 3.438 | 118 | 11.348 | |
| Q. rotundifolia | 10 | 65 | 20 | | 0 | 20 | 25 | 0 | 288 | 0 | 0 | 0 | 10 | 10 | 213 | 0 | 0 | 300 | 0 | 960 | |
| O. Quercus | 125 | 0 | 15 | 0 | | 20 | 0 | 0 | 207 | 55 | 0 | 0 | 0 | 0 | 153 | 0 | 5 | 321 | 5 | 907 | |
| O. broadleaves | 575 | 10 | 350 | 10 | 35 | | 5 | 240 | 1.099 | 400 | 5 | 40 | 70 | 60 | 813 | 10 | 30 | 2.128 | 45 | 5.927 | |
| P. pinea | 155 | 20 | 115 | 10 | 0 | 10 | | 5 | 512 | 0 | 0 | 0 | 20 | 5 | 379 | 0 | 0 | 272 | 5 | 1.509 | |
| O. coniferous | 195 | 0 | 135 | 0 | 0 | 75 | 0 | | 217 | 15 | 0 | 5 | 15 | 5 | 161 | 0 | 0 | 726 | 5 | 1.554 | |
| Rain-fed crops | 1.515 | 790 | 1.064 | 505 | 83 | 446 | 130 | 181 | | 2.480 | 13 | 1.266 | 914 | 533 | 0 | 26 | 137 | 7.934 | 520 | 18.538 | 41.073 |
| Irrigated crops | 213 | 5 | 177 | 0 | 25 | 120 | 0 | 5 | 1.725 | | 65 | 670 | 105 | 210 | 1.276 | 20 | 55 | 300 | 25 | 4.996 | |
| Rice | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 105 | | 0 | 0 | 0 | 13 | 5 | 0 | 0 | 5 | 145 | |
| Vineyards | 178 | 20 | 42 | 10 | 10 | 65 | 0 | 15 | 1.641 | 845 | 0 | | 205 | 190 | 1.214 | 0 | 15 | 455 | 20 | 4.926 | |
| Olive | 83 | 40 | 67 | 40 | 10 | 60 | 5 | 20 | 4.217 | 900 | 0 | 240 | | 135 | 3.120 | 5 | 5 | 325 | 10 | 9.282 | |
| O. permanent | 43 | 0 | 57 | 0 | 0 | 65 | 0 | 20 | 969 | 640 | 20 | 265 | 55 | | 717 | 0 | 20 | 300 | 15 | 3.186 | |
| Grasslands | 1.411 | 736 | 992 | 471 | 78 | 415 | 121 | 169 | 23.448 | 2.311 | 12 | 1.180 | 852 | 497 | | 24 | 128 | 7.394 | 485 | 40.724 | 40.724 |
| Wetlands | 5 | 5 | 35 | 70 | 5 | 20 | 10 | 0 | 448 | 50 | 5 | 0 | 30 | 0 | 332 | | 0 | 130 | 180 | 1.325 | 1.325 |
| Settlements | 726 | 30 | 504 | 25 | 5 | 160 | 40 | 15 | 1.072 | 850 | 0 | 105 | 260 | 155 | 793 | 10 | | 670 | 700 | 6.121 | 6.121 |
| Shrubland | 15.599 | 1.020 | 3.833 | 479 | 370 | 1.280 | 270 | 865 | 22.353 | 915 | 0 | 565 | 845 | 410 | 16.537 | 40 | 230 | | 4.371 | 69.982 | 73.232 |
| O. land | 544 | 5 | 410 | 5 | 5 | 90 | 30 | 5 | 503 | 135 | 5 | 20 | 75 | 30 | 372 | 45 | 80 | 890 | | 3.251 | |
| Annual Losses 2005-2010 | 25.437 | 2.791 | 8.417 | 1.726 | 746 | 3.757 | 950 | 1.666 | 62.691 | 10.412 | 130 | 4.476 | 3.671 | 2.266 | 29.033 | 185 | 805 | 30.682 | 6.717 | 196.559 | |
| | 45.491 | | | | | | | | 83.646 | | | | | | 29.033 | 185 | 805 | 37.399 | | | |

**Autonomous Region of Azores**

For the ARA, the main sources of information available were:

1. COS 2007 – full wall-to-wall map
2. IFRAA 1987 and IFRAA 2007 – Regional Forest Inventory
3. RGA 1999 and RGA 2009 – General Census of Agriculture

The basis for the estimation of land-use and land-use change in the ARA was the COS2007 combined with growth rates estimated using the IFRAA and RGA, respectively for forest land and cropland and grassland. The full methodology is described in the NIR 2013.

The results for the full time series 1970-2012 for the Azores are presented in Figure 1.28.

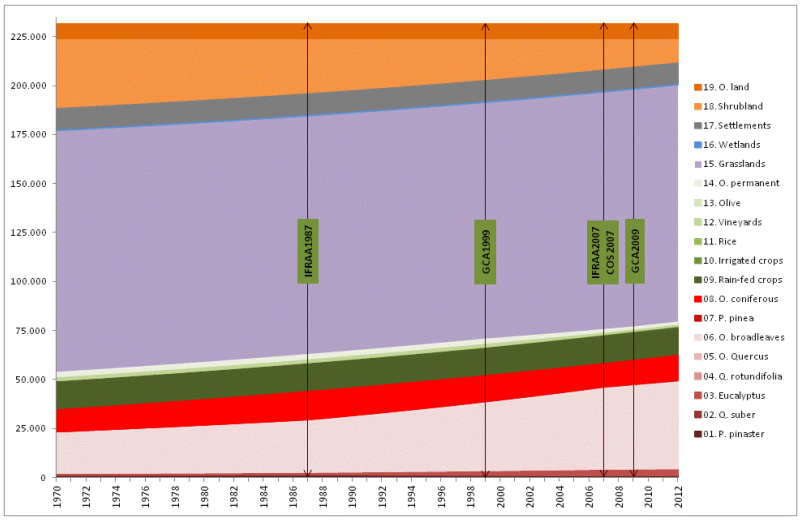



**Figure 1.28**

Changes in Total Land-Use in the ARM and Mainland

**Autonomous Region of Madeira**

For ARM, the main sources of information available were:

1. CLC 1990 and CLC 2006 – full wall-to-wall map from Corine Land Cover
2. IFRAM 2004 – Regional Forest Inventory
3. RGA 1999 and RGA 2009 – General Census of Agriculture

The basis for the estimation of land-use and land-use change in ARM was the CLC 1990 and CLC 2006 combined with growth rates estimated using the IFRAM and RGA, respectively for forest land and cropland and grassland. The full methodology is described in the NIR 2013.

The results for the full time series 1970-2012 for ARM are presented in Figure 1.29.

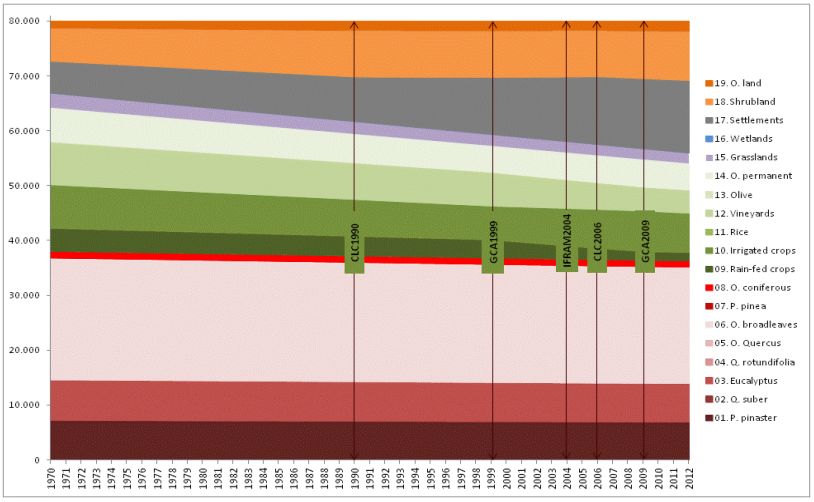



**Figure 1.29**

Changes in Total Land-Use in ARM and Main Information Sources Used

**Overview of Annual Land-Use Estimates for Portugal**

The compilation of the estimates for land-use in Portugal, derived from the estimates made for Mainland Portugal, the ARA and ARM is presented in Figure 1.30.

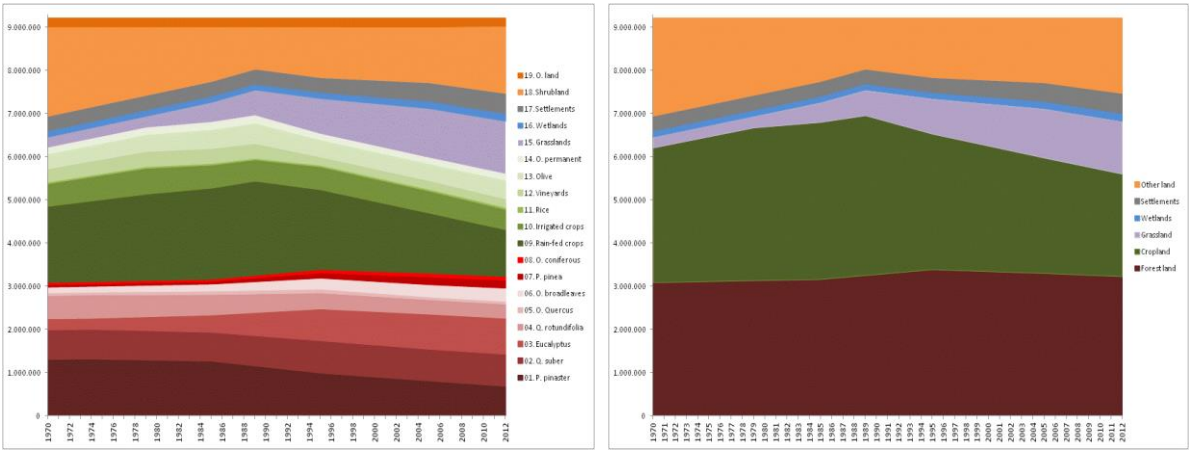



**Figure 1.30**

Changes in Total Land-Use in Portugal

**Allocation of Land-use and Land-use Change to UNFCCC Reporting Categories**

The allocation of each of the 19 land-use categories to each of the UNFCCC reporting categories was described in Table 1.78.

The allocation of land to the sub-categories land remaining land and land X converted to land Y was made using the annual land-use changes assuming a 20 year conversion period.

Land conversions within each broad UNFCCC reporting categories (e.g. changes from Pinus pinaster to Eucalyptus) were also estimated and used for estimating emissions and removals, but were reported as "Land remaining Land" (in the previous example, as "forest land remaining forest land").

Although some lands may be considered as unmanaged (e.g. "shrubland") the area and emissions estimates include the total of the territory.

The results of this exercise are presented in Figure 1.31.

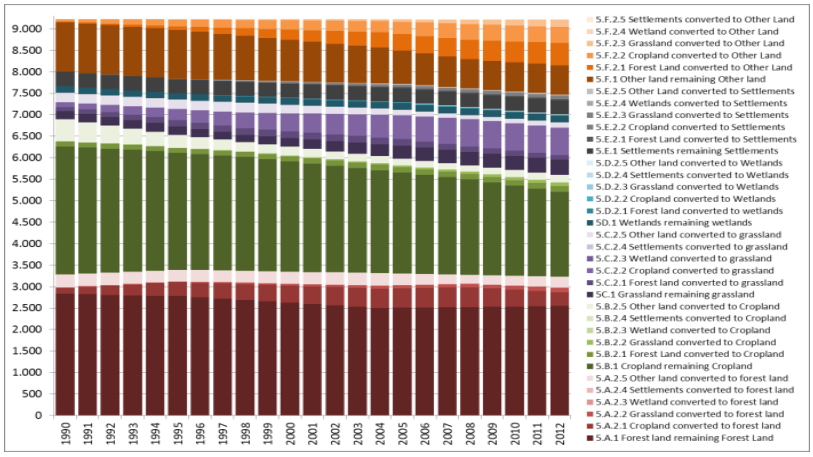



**Figure 1.31**

Total Areas per UNFCCC Reporting Categories

**Allocation Land-use and Land-use Change to KP Accounting Categories**

The allocation of each of the 19 land-use categories to each of the KP activities was made in a way that responds to the specific activity definitions under the KP LULUCF accounting rules.

For Afforestation and Reforestation all lands converted to forest "since 1990" were considered.

Harvested areas under Afforestation and Reforestation (reporting category A.1.2.) were estimated based on the rotation period of the main forest species. The only forest type that was able to complete a full rotation cycle during the Commitment Period was Eucalyptus plantations (first harvesting at 12 years). With the exception of the areas described above, all other areas under AR were considered as not-harvested and were reported under category A.1.1.

For Deforestation all lands converted from forest to other land-uses "since 1990" were considered. Forest Management Areas were estimated using the total forest area (all areas are considered managed) in each reporting year deducted from the areas considered under "Afforestation and Reforestation "Areas under "Cropland Management" were estimated considering the total area of cropland reported in each year of the Commitment Period, deducted from the areas converted to cropland from forest land during the Commitment Period (reported under deforestation) and added the areas converted from cropland to non-Kyoto activities during the Commitment Period (i.e., conversions to wetlands, settlements or other land).

Conversions from cropland to grassland were reported as "grazing land management". Conversions between different cropland types were estimated and used in estimating emissions and removals, but the relevant conversion areas were included as "cropland management".

Estimates for the base year were made considering the area of "Cropland management" in 1990 as the same as the total area of cropland in 1990.

A similar procedure was used to estimate areas under "Grazing land Management".

A summary of the areas reported under the KP, per activity, is presented in Figure 1.32.

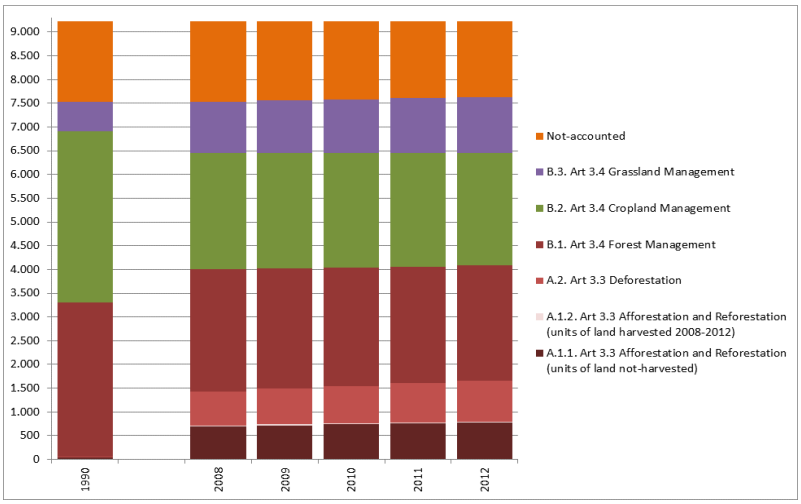



**Figure 1.32**
Total Areas per KP LULUCF Accounting Categories

**Forest Land (CFR 5.A)**

Forest land has decreased slightly over the last years, despite the increases in afforestation areas. Nevertheless, forests have been a net-sink since 1990, with annual values ranging between -3 MtCO2eq and -9.6 MtCO2eq.

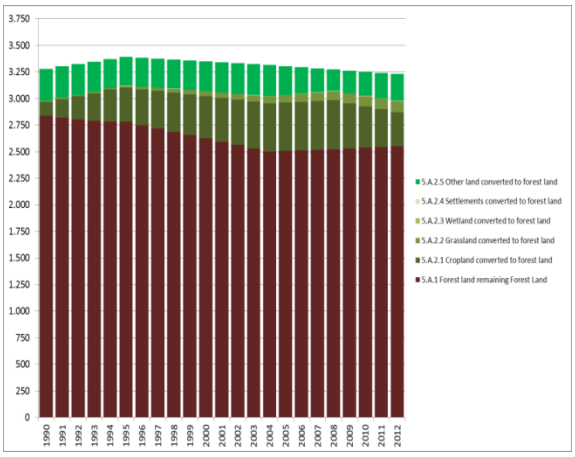



**Figure 1.33**
Areas of Forest Land per Reporting Category

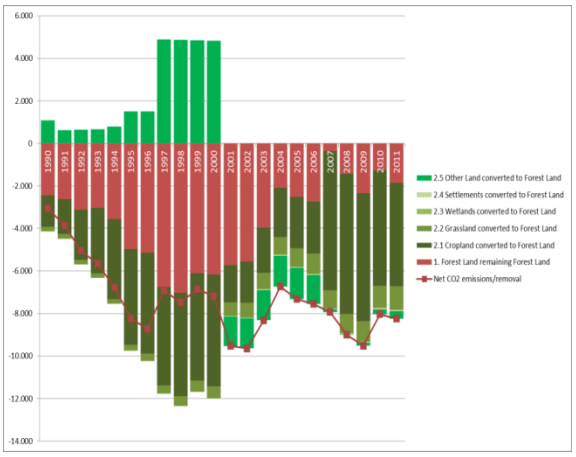



**Figure 1.34**
Total Emissions and Removals in Forest Land

**Cropland (CRF 5.B)**

The areas of cropland have been reduced significantly over the last years, mostly for conversion to grasslands, forest land and other land. Throughout the whole period, croplands have been a net-source of emissions, with a clear trend for emission reductions over time, determined mostly by the reduction in area and the introduction of new activities for carbon sequestration.

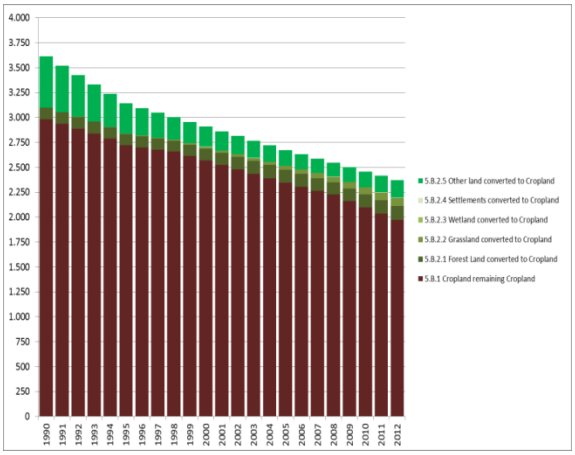



**Figure 1.35**
Areas of Cropland per Reporting Category

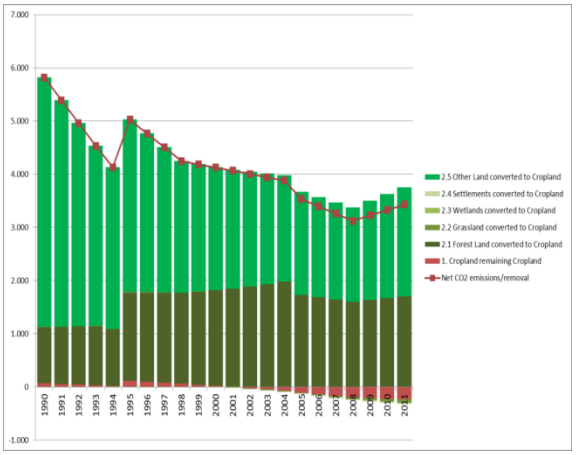



**Figure 1.36**
Total Emissions and Removals in Cropland

**Activity in Cropland: No tillage**

A special activity, taking place usually in lands with rain fed cropland is reported and accounted for under "cropland remaining cropland": no tillage. This practice eliminates the need for tilling the soils through direct seeding and fertilisation, which results in a significant increase in soil organic matter and, in turn, in increased sequestration.

Portugal supports this activity through the programme of agri-environmental measures, where farmers commit to use only no-till techniques. IFAP is responsible for those contracts with farmers, for controlling that the activity is carried out properly and for the compilation of areas supported by the state. This information is also used as activity data for emissions reporting.

According to research carried out in Portugal by Carvalho et al. (2012), soil organic carbon content increases on average, compared with conventional tilling techniques, by 0,721tC/ha/year over a 10 years period. This value and transition period has been used for reporting this activity.

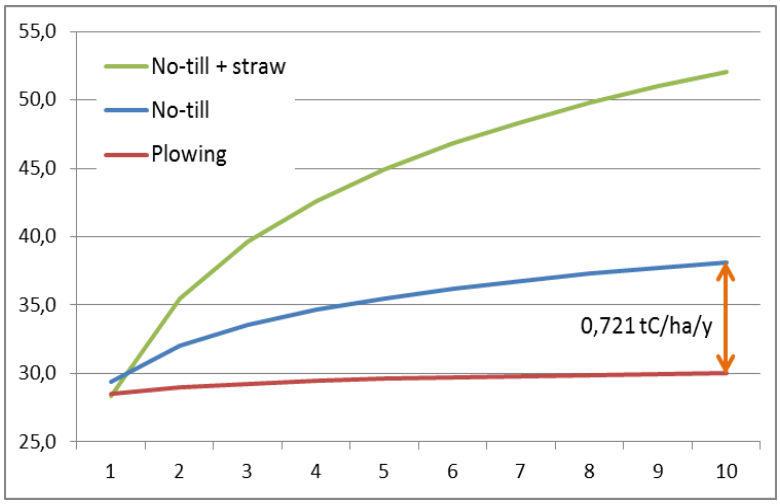



**Figure 1.37**
Increase in Carbon Stock (tC/ha) in Soils in Conventional vs No-Tillage techniques

**Grassland (CRF 5.C)**

Contrary to cropland, the areas of grassland have seen a substantial increase since 1990, with most of the area coming from cropland (rain-fed annual crops). The conversion from agriculture to grasslands usually results in an increased sequestration, while the conversions from forest land and other land result in increased emissions. The net-balance has favoured emissions, although these have been heavily reduced since 1990. More recently the introduction of incentives for biodiverse pastures has allowed for an increase in sequestration rates.

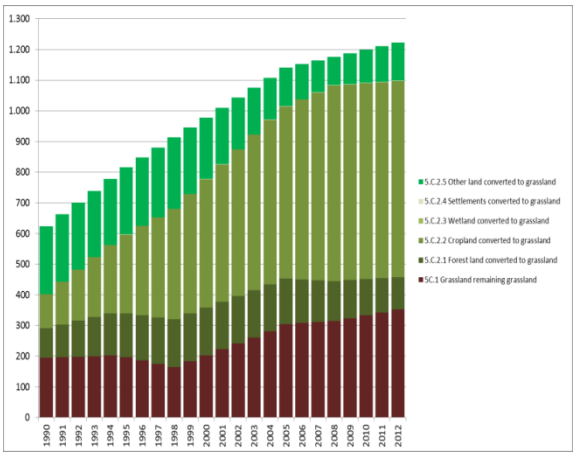



**Figure 1.38**
Areas of Grassland per Reporting Category

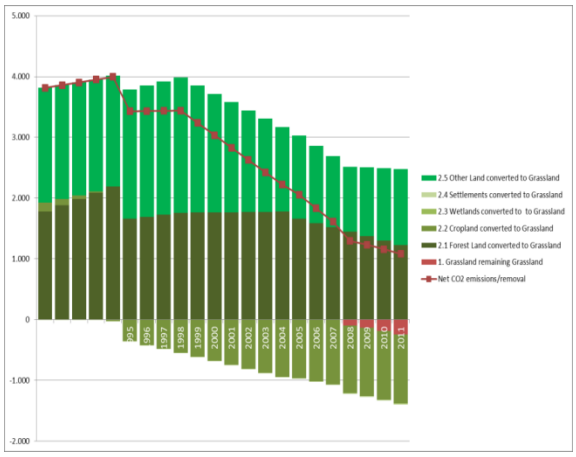



**Figure 1.39**
Total Emissions and Removals in Grassland

**Activity in Grassland: Sown Biodiverse Permanent Pastures Rich in Legumes**

A special activity, taking place in grazed lands is reported and accounted for under "grassland remaining grassland": SBPPRL sown biodiverse permanent pastures rich in legumes.

These pastures are grazed directly by cattle, sheep or goats and result from the seeding with improved and selected seeds. The term biodiverse comes from the large number of species and varieties that are used to

establish the pasture (up to 20 on the same spot). This allows for great plasticity of the pasture and a capacity to adjust to different soil and inter-annual conditions. The extensive use of legumes allows for an extra benefit of stopping the need for nitrogen fertilization, thus reducing also direct and indirect emissions from N fertilization.

They are considered permanent pastures as the seed mixed used allows for its use for grazing over periods exceeding 10 years. In its older example some of these pastures with over 25 years are still in use. During that period no tilling of the soil is required and as a consequence of no-tilling and increased productivity an accumulation of organic matter in the soil takes place.

That accumulation of soil organic carbon is then translated into C sequestration factor and included in the estimations of emissions and removals. Because the sequestration factor was defined as the additional soil C of this activity compared with conventional pastures, the results of this calculation are then added to the totals of grasslands, calculated as explained above.

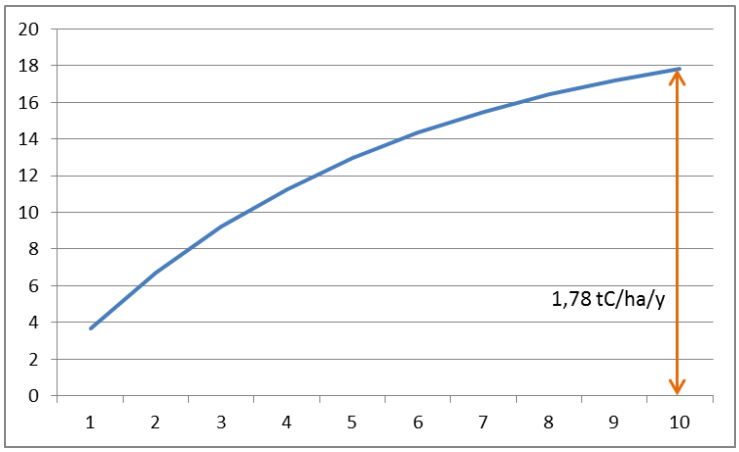



**Figure 1.40**
Increase in Carbon Stock (tC/ha) in Soils in SBPPRL vs conventional pastures

Portugal supports this activity through the 2 projects carried out by Terraprima and financed by the Portuguese Carbon Fund, where farmers commit to convert conventional pastures or rain-fed crops into SBPPRL. These pastures are also supported by CAP funds under Portuguese Rural Development Program, on Organic Farming and Integrated Production conversion and installation of new pastures. IFAP is responsible for the control of farmer's declarations of activities, and Terraprima and the Portuguese Carbon Fund control that the activity is carried out properly. This information is also used as activity data for emissions reporting.

**Wetlands (CRF 5.D)**

The area of wetlands remaining wetlands has remained fairly constant and the increase in wetland areas is due to the construction of artificial reservoirs, which are included in this land use category. An on-going programme to increase the water storage and hydro-electricity production capacity will likely maintain this trend in the future. As expected under these trends, wetlands are a net-source of emissions, although not a very significant one.

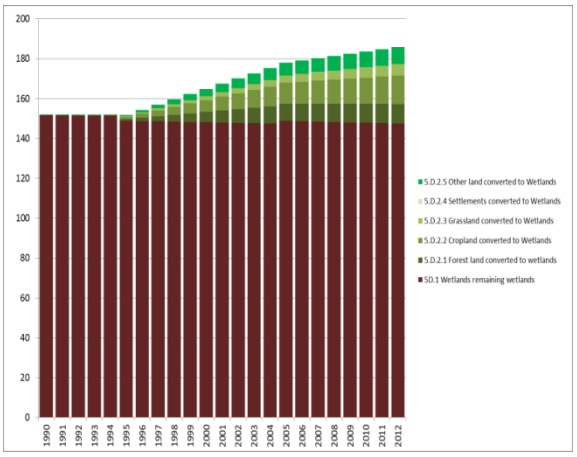



**Figure 1.41**
Areas of Wetlands per Reporting Category

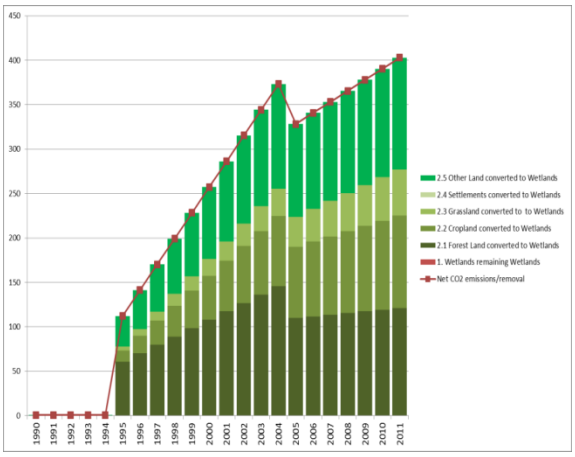



**Figure 1.42**
Total Emissions and Removals in Wetlands

**Settlements (CFR 5.E)**

Over the past 2 decades Portugal has witnessed an enormous growth in the building of infrastructure and urban expansion. As a consequence the areas under settlements have increased since 1990. As expected under these trends, settlements are a net-source of emissions, although not a very significant one.

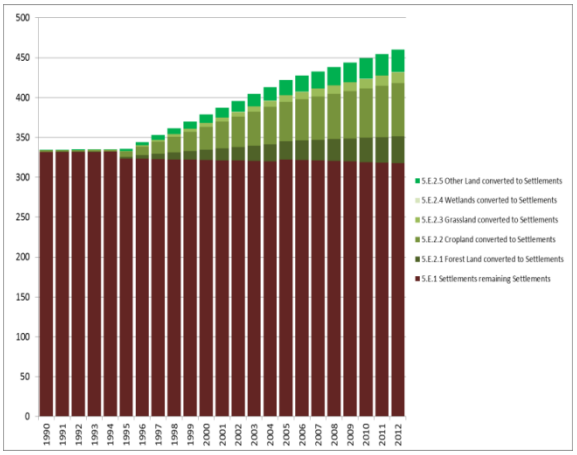



**Figure 1.43**
Areas of Settlements per Reporting Category

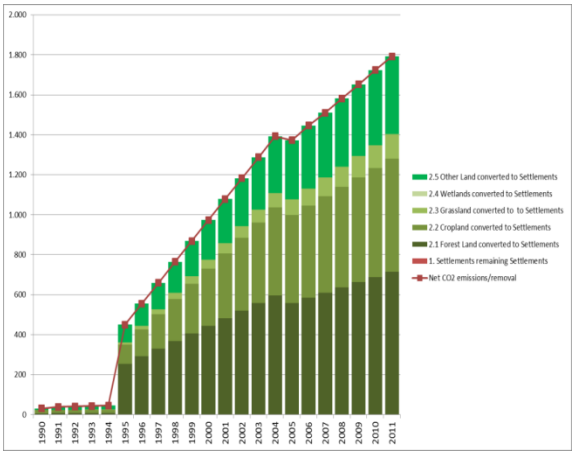



**Figure 1.44**
Total Emissions and Removals in Settlements

**Other Land (CRF 5.F)**

The category other land is a very dynamic one, with substantial areas of land being converted to other land-uses and vice-versa. In particular the dynamics between other land, forest land and cropland are very high. Increases in Other Land are mostly explained by agriculture abandonment and by degradation of forests to non-forest land, mostly due to recurring forest fires. Despite this high land use dynamics, the higher carbon stocks of other land compared to rain-fed agriculture more than compensate the emissions from the loss of forests, resulting in Other Land being a significant net-sink of 4.6Mt$CO_2$eq in 2011.

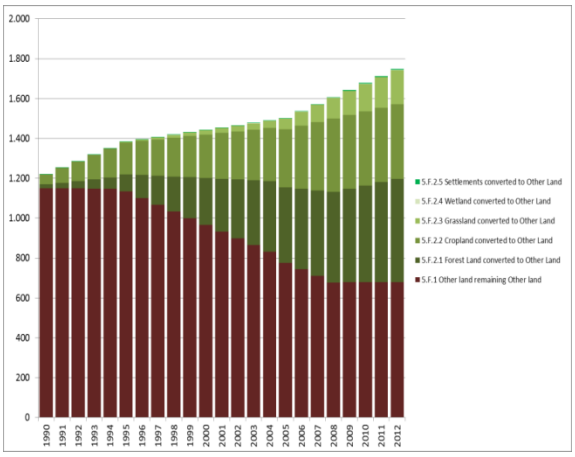



**Figure 1.45**
Areas of Other Land per Reporting Category

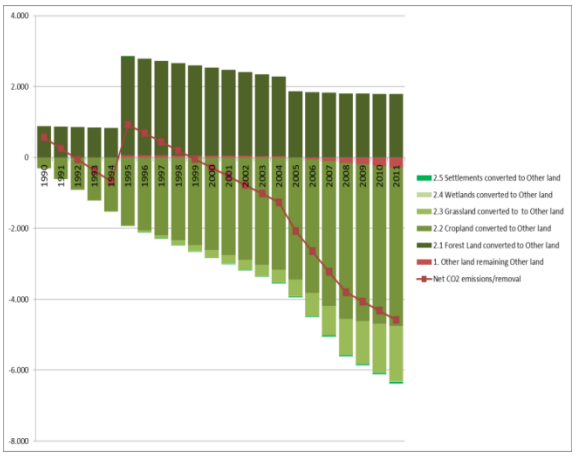



**Figure 1.46**
Total Emissions and Removals in Other Land

**Emissions from Biomass Burning (CRF 5(V))**

Forest Fire are an important source of emissions in Portugal. Emissions are estimated as the sum of:

- Direct $CO_2$ emissions, i.e., $CO_2$ emissions that occur *during the fire*
- Direct non-$CO_2$ emissions, i.e., $CH_4$ and $N_2O$ emissions that occur *during the fire*
- Indirect $CO_2$ emissions, i.e., $CO_2$ emissions that occur *after the fire, but as a consequence of the fire*, i.e., from tree mortality caused by wildfires

The main source of burnt areas are the fire reports issued every year by the National Forest Authority, currently the Institute for Nature Conservation and Forestry (ICNF 2001-2012). The reports are derived from satellite imagery and the results cover all burnt areas, divided by forest, shrubland and agriculture.

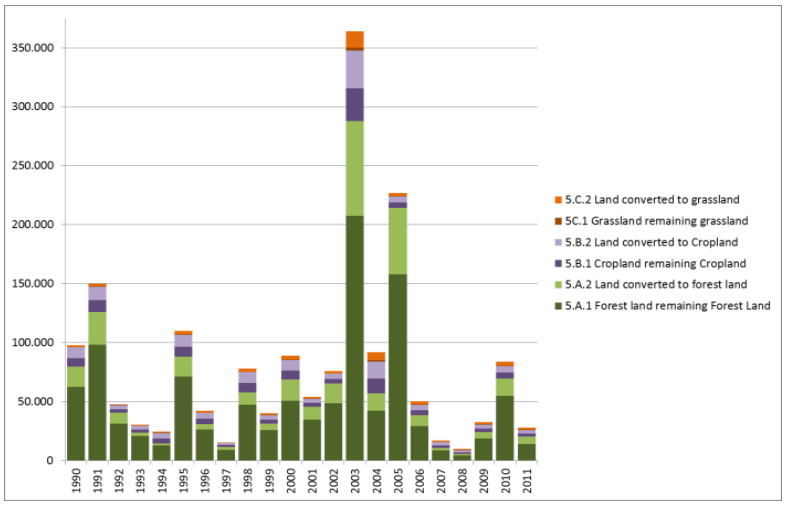



**Figure 1.47**
Burnt Areas per Reporting Category

The results of the emissions estimations are presented in the figure below.

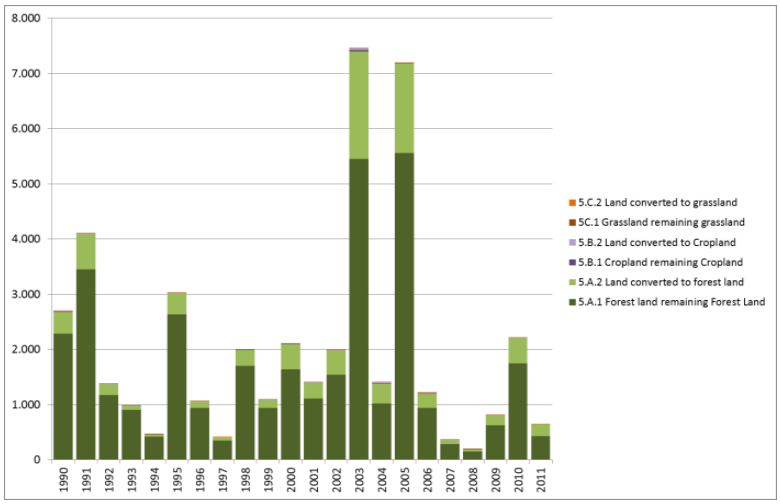



**Figure 1.48**
Total Emissions from Biomass Burning per Land-use Category

## 1.10 Waste

### 1.10.1 Municipal Solid Waste

**Portugal Mainland**

By 2010 there was an increasing trend in the production of Urban (Municipal) Waste (MW) in Portugal mainland. However, in the following two years this trend suffered a reverse largely due to the economic crisis the country is experiencing (Figure 1.49). In 2012 the total production of MW in Portugal mainland was about 4.528 million tons, and there has been a decrease of about 7.4% over the previous year. Notwithstanding, the production of MW in 2012 still shows an increase of about 5% compared to the production in 2000 (4.295 million tons).

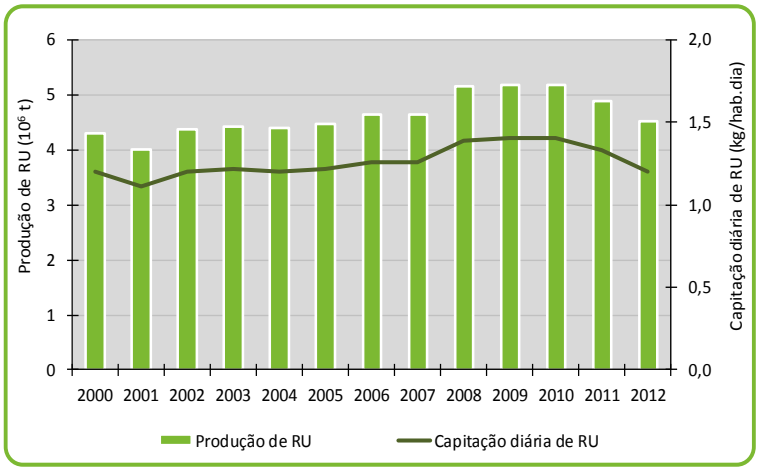
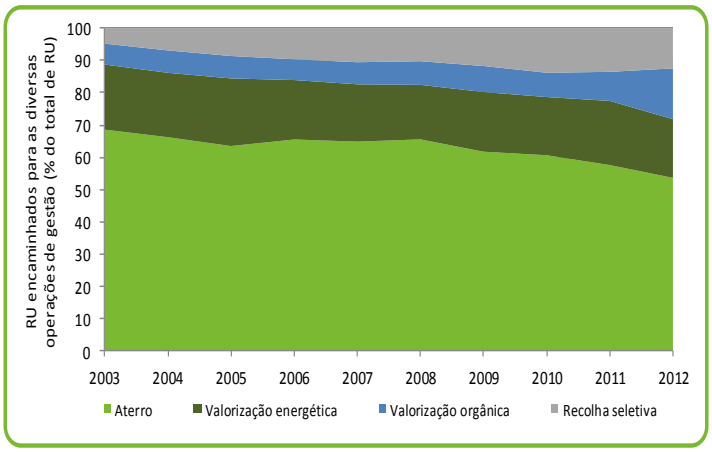



**Figure 1.49**
MW production and daily collection in Portugal mainland
**Source** : APA, 2013

The analysis of the per capita MW production shows that in 2012 the annual collection per capita was of 454 kg / per day , which corresponds to a daily production of MW about 1.2 kg / per capita. The latest available numbers for the EU-27 indicate that the average European collection in 2010 per capita was of 502 kg/ per

year. In terms of regions, the one of Lisbon and Tagus Valley has the highest MW production, followed by the Northern Region, with 38% and 33%, respectively, in 2012.

Landfilling is still the main destination of the MW. In 2012, 54% of the MW produced in Portugal mainland were deposited in managed landfills, which corresponds to a decrease of about 4% over the previous year. From the rest of the MW produced in 2012, 18% is incinerated with energy recovery, 12% is recycled through a selective collection and 16% is organic composting and anaerobic digestion, as shown in Figure 1.95. There was an increase of organic recovery - composting (7% more than in 2011) and a decrease in the MW with a final destination of energy recovery and recycling of respectively 2% and  %, compared to 2011.




Landfills/Energy Recovery/Organic Recovery/Selective collection

**Figure 1.50**

MW management operations systems in Portugal mainland

Source: APA, 2013

**The Autonomous Region of Azores**

According to the annual MW data, declared by the authorities of the ARA between 2000 and 2010 there was a growing trend of MW production, with the exception of the years 2004 and 2005, when there was a slight decrease. Comparing the production of the years 2000 and 2010 there is an increase of about 39%. The increase in recent years may be due to an improvement in the recording system (Figure 1.51).

The estimated MW collection per capita in the various islands of the archipelago, in 2010, varied from 1.1 kg to 1.9 kg per day.

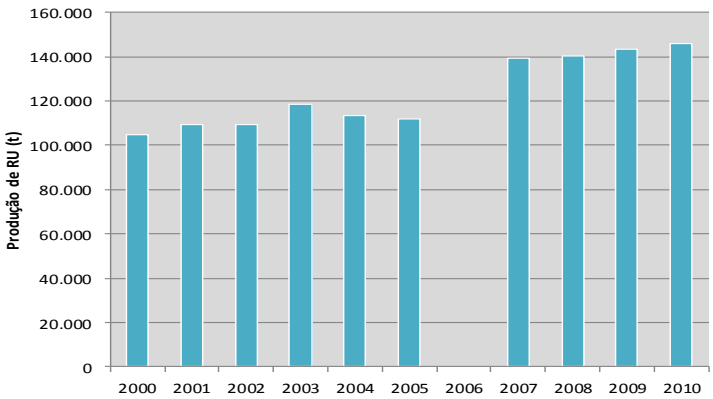



**Figure 1.51**

MW production in the ARA

**Source**: SRAM 2012

Regarding the final destination of the MW produced in the ARA, it appears that the situation still needs some improvements, particularly with regard to the existence of open dump sites and dumps. However, although only three of the nine Azorean islands have landfills, according to available data the majority of MW go to these facilities (Figure 1.52). [atenção legenda da figura]

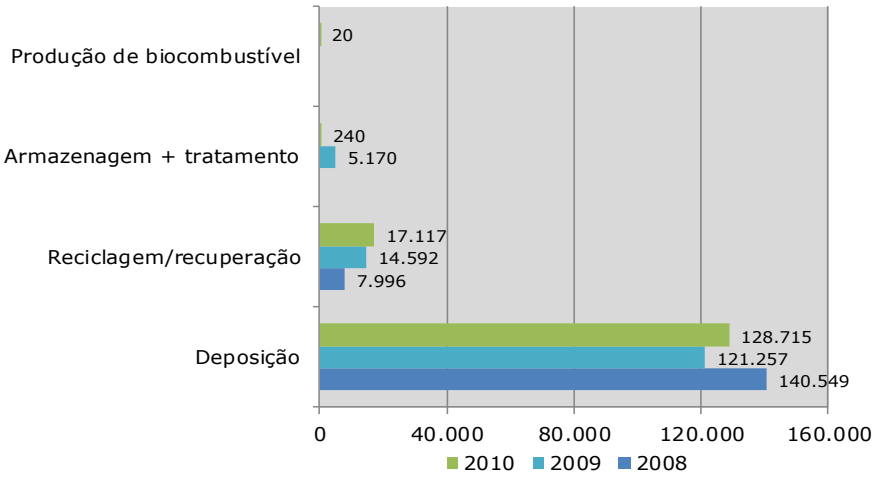



**Figure 1.52**
Final destination of MW in the ARA
**Source** : SRAM 2012

In the period between 2008 and 2010 the number of licensed operators to MW management, of managing bodies on specific MW streams working in the ARA, of facilities and diversity of operations in that archipelago has increased. During this period some selective collection systems were implemented, such as: collection systems for various waste streams, such as mineral waste oils, used tires, WEEE, packaging waste, expired medications and batteries waste and used accumulators.

**The Autonomous Region of Madeira**

In the period between 2010 and 2012; and according to data reported in the Integrated Information System of the Portuguese Environment Agency (SIRAPA), the annual MW output in the ARM suffered a decreasing trend of about 14 % (Figure 1.98). In 2012 the MW production in the ARM was 114 281 tons, which corresponds to a 427 kg / annual /per capita, an inferior amount to that in Portugal mainland.

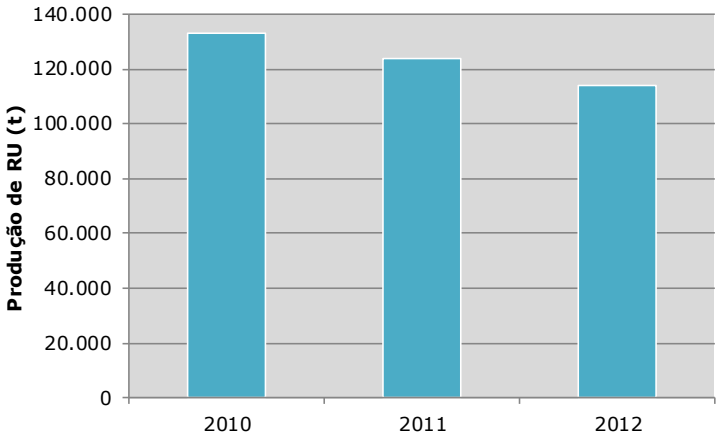



**Figure 1.53**
MW production the Autonomous Region of Madeira
**Source**: APA, 2013

Of the total production in 2012, 87% was collected indiscriminately, and only 13% are selective collection. The main final destination of MW in the ARM is energy recovery (86% in 2012), only 1% of the MW goes to landfills (Figure 1.54). [atenção legenda da figura]

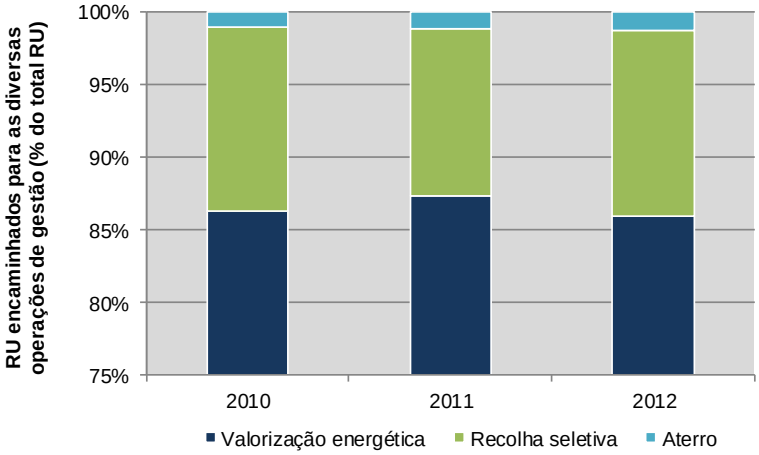



**Figure 1.54**
MW management operations systems in the ARM
**Source**: PEA, 2013

## 1.10.2 Non-municipal Waste

In 2010 about 32.9 million tons of non-municipal waste (NMW), 1.6 million of which are hazardous (about 5% of the total NMW) (Figure 1.55), were produced. Between 2009 and 2010 the global NMW production increased significantly due to a growth of MW production. The sectors that contributed the most to NMW production were Construction immediately followed by Trade and Services sectors. [legenda da figura]

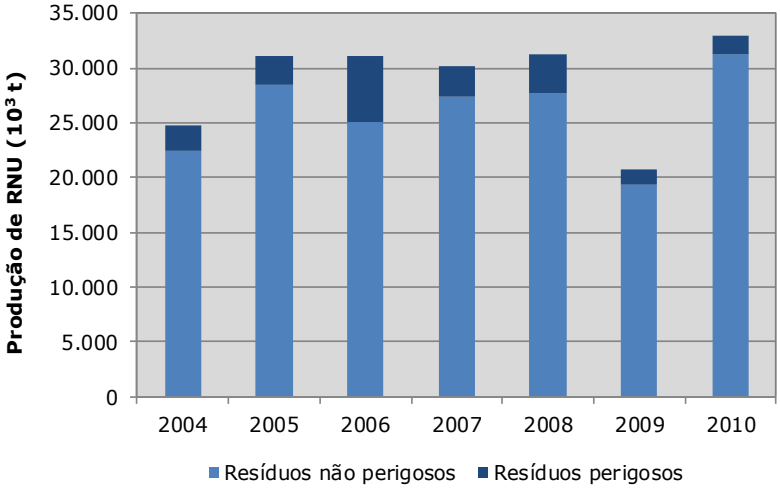



**Figure 1.55**
Non-municipal waste production
**Source**: APA, 2013

As for the final destination of NMW, in 2010, about 17 million tons went to recovery operations and 15 million tons were eliminated, as shown in Figure 1.56. In the previous year 12 million tons of UMW have been recovered and about 9 million tons have been eliminated. [legenda da figura]

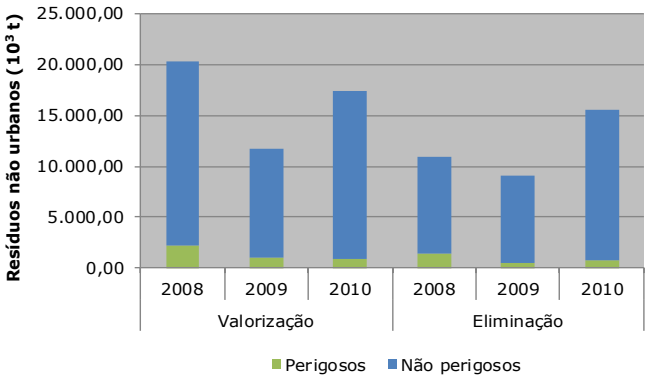



**Figure 1.56**
Non-municipal waste according to major management operations
**Source**: APA, 2013

## 1.10.3 Recovery of methane in landfill

Management operations and waste treatment, municipal and non-municipal, are a emission source of GHG. The main gas produced is methane (CH4), which results from anaerobic digestion of organic waste.

In Portugal mainland, the collection of methane from landfills for energy production has shown an increasing trend; and in 2011, 177 kt $CH_4$ were produced. Of these, around 33 kt were burned, which corresponds approximately to 18% of the total amount of biogas burned (Figure 1.57).

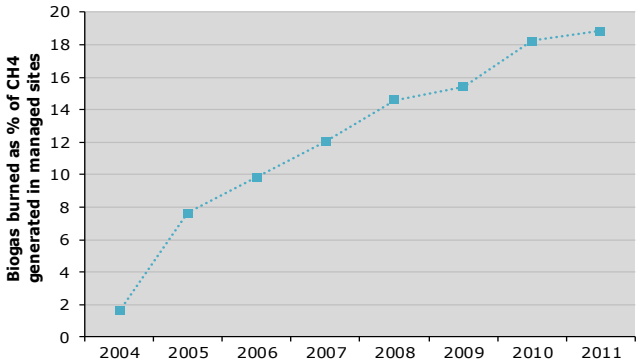



**Figure 1.57**
Percentage of biogas burned as $CH_4$ generated in Portugal Mainland
**Source**: APA, 2013

## 1.10.4 Specific waste systems

In recent years Portugal has been witnessing, both at national and Community level, the emergence of integrated systems on management waste that are already established as for the following specific waste streams: packaging and packaging waste, used lubricating oils, used tires, WEEE, waste batteries and accumulators and end of life vehicles.

**Amount of generated and recycled materials**

Table 1.79 presents provisional data for the year 2012 on specific waste stream. The data show the performance of the managing bodies of integrated systems and of non-integrated operators in the network of managing bodies whenever such information is available.

**Table 1.79**

Amount of materials recovered and managed for specific waste systems (tons)

| Specific waste streams | Amount of generated and recycled materials | | | | |
|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 |
| **Packaging and packaging waste** | | | | | |
| Waste production | 1.784.849 | 1.719.274 | 1.664.296 | 1.565.838 Rv | 1.574.736 |
| Total recycled | 1 662 967 (Rv) | 1.131.921 | 1.020.580 Rv | 984.620 Rv | 892.246 |
| Of which: energy recovery | 90.439 | 101.370 | 96.589 Rv | 70.035 Rv | n.d. |
| **Used Oils** | | | | | |
| Total placed on the market | 77.135 | 68.936 | 70.302 | 64.416 | 55.508 |
| Waste production | 41.169 | 36.767 | 38.080 | 36.964 | 29.809 |
| Total generated | 31.695 | 29.578 | 30.097 | 28.024 | 25.451 |
| Total recycled | 28.253 | 27.078 | 26.837 | 24.744 | 23.110 |
| Of which: recovery energy | 0 | 0 | 0 | 0 | 0 |
| **Used tires** | | | | | |
| Total placed on the market | 83.139 | 78.349 | 83.294 | 72.785 | 62.431 |
| Waste production | 90.304 | 86.959 | 89.058 | 78.881 | 65.231 |
| Total generated | 96.210 | 89.575 | 94.373 | 90.373 | 78.268 |
| Total recycled | 96.210 | 89.575 | 94.373 | 90.373 | 78.268 |
| Of which: energy recovery | 23.504 | 21.878 | 25.759 | 25.144 | 24.483 |
| **Electrical and Electronic Equipment** | | | | | |
| Total placed on the market | 173.812 | 169.049 | 157.065 Rv | 129.732 | 117.001 |
| Total generated | 41.231 | 45.190 Rv | 46.660 Rv | 55.779 | 39.808 |
| Total recycled | 35.463 | 38.733 Rv | 40.549 Rv | 50.140 | 35.204 |
| **Waste Batteries and accumulators** | | | | | |
| Total placed on the market | 2.472 | 2.371 | 30.900 | 30.780 | 27.500 |
| Total generated | 479 | 497 | 34.664 | 30.946 | 32.187 |
| Total recycled | 479 | 497 | 30.982 | 30.392 | 32.069 |
| **End of life vehicles** | | | | | |
| Total generated | 95.691 | 95.703 | 96.242 Rv | 71664 Rv | 81.226 |
| Total recycled | 83.468 Rc | 83.159 Rc | 82.937 Rv | 62995 Rv | 72.666 |
| Of which: energy recovery | 6.103 | 2.477 | 3.815 Rv | 3551 Rv | 963 |

### Packaging and packaging waste

In 2012 Portugal had a production of about 1.575 million tons of packaging waste (PW) (provisional data). Over the past three years there has been a slight decrease in the amounts used by this type of waste (Figure 1.58). [legenda da figura]

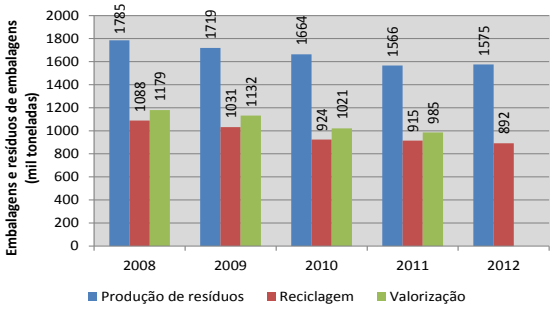



**Figure 1.58**

Recycled and recovered amounts due to packaging waste production[32]

**Source**: APA, 2013

[32] The 2012 data are provisional. The value of energy recovery in 2012 has not been determined yet, which influences the overall recovery. It is assumed that the amount of packaging waste generated is equivalent to the amount placed on the market since these residues have a short lifetime.

In 2012 the PW recycling rate was estimated at 57%, a slightly lower number than in the previous year (58%), which has met and exceeded the target for 2011 (55%). To date there are no available data referring to energy recovery in 2012, so it is impossible to assess its target achievement in terms of global recovery (In 2011, there was an increase of 63%, exceeding the imposed target of 60%).

**Target achievements**

Annex II-1 show the established targets for the legislation on specific waste streams as well as the Community Directives transposed into national law.

**Table 1.80**

Obtained rates in 2012 for specific waste stream[33]

| Specific Waste stream | Collection | Reuse and prepare for reuse | Regeneration | Recycling | Recovery |
|---|---|---|---|---|---|
| Packaging waste | - | - | - | 57% | 57% |
| Used Oils | 85% | - | 49% | 82% | 100% |
| Used Tires | 120% | 22% | - | 82% | 100% |
| Waste Electric and Electronical Equipment | 3,8 kg/per capita | - | - | | |
| Waste batteries and accummulators | Portable: 31% | - | - | na | na |
| End of life Vehicles | - | - | - | 83% | 88% |

At national level, the achievement of the collection targets for 2012 regarding specific used oils stream, used tires and waste batteries and portable accumulators. As for the used oils, 2012 was the first year when the collection rate was achieved. This situation is due to an increase in the amounts collected as well as to the benchmark calculation rate, in other words due to a reduction in the amounts of oils placed on market. The amounts of WEEE collected show a collection rate of 3.8 kg/ per capita so the collection target of 4kg/ per capita was considered to be achieved.

As for packaging and packaging waste stream, the estimated recycling rate for 2012 exceeded the national target set for 2011. Regarding used oils, the performance of the managing body allowed to constant achievement to the recycling target to 2006, condition defined in its licensing. Regarding the national recycling target set for 2011 in the legislation (75% of collected used oils), the performance of the managing body allowed its achievement with a rate of 91% ( including regeneration). Also thanks to the performance of the managing body for used tires, its annual target was reached (the target of this managing body is 69% of used tires collected annually and not reused or prepared for reuse). As for end of life vehicles, the estimated reuse/recycling rate for 2012 was above the one in 2006. In terms of goals for components reusing/ recycling, the materials and substances of waste electrical and electronic equipment reached their global target regarding all categories, in 2012.

The recovery target set for used tires was achieved in 2012. The recovery waste set for used oils was also achieved: the majority of used oils were sent to recovery; only pre-treatment waste was sent to elimination. Regarding end-of-life vehicles, the estimated reuse/recovery rate for 2012 was above the one recommended in national and Community legislation (85%) in 2006. As for waste electrical and electronic equipment, all global recovery targets, in all the different equipment categories, were achieved.

[33] **Notes**:

- The recycling rate achieved in the used oil stream was calculated with reference to the amount of collected oils and those which are not submitted to regeneration, that is, differs from the target calculation form according to the legislation of 2011.
- The rates obtained in used oils, used tires, waste electrical and electronic equipment are related to the results of the managing bodies of integrated systems.
- The rate on recycling and recovery obtained in the End of Life Vehicles stream includes the reuse.
- The estimated rates obtained in Packaging Waste and End of Life Vehicles are at national level. The recovery rate in the packaging stream does not include energy recovery.
- The recycling rate in waste electrical and electronic equipment includes reuse.

### 1.10.5 Planning Instruments

The national strategy on waste, as well as its goals and targets are reproduced in the several planning instruments.

The Portuguese Waste Management Plan (PNGR) was approved for 2000. This Plan was opened to public consultation in 2011. The strategic and operational goals presented in this project planning are in accordance with the waste management guidelines established in the Waste Framework Directive. The NWMP project aims to guide future waste management at a macro level and involves specific sectorial planning to achieve the previously mentioned plan, in each specific waste production area.

In the context of municipal waste it is worth noting that the Portuguese Strategic Plan for Municipal Solid Waste Management (PERSU II), approved and published by Ordinance 187/2007, of February 12th, which reviewed the PERSU I, also integrated and reviewed the Portuguese Strategy to Reduce Biodegradable Municipal Waste in Landfill (ENRRUBDA), approved in 2003, and the Intervention Plan for Municipal and Solid Waste or Equivalent (PIRSUE), approved in 2006. The PERSU II gave priority to the dislocation of biodegradable municipal waste from landfill, the recycling and recovery of packaging waste and reduce emissions of greenhouse gases. The latter goal is achieved at the cost of recycling, incineration with energy recovery and use of compost, which replaces the use of fertilizers. The PERSU II is being reviewed and is expected to carry out the Strategic Environmental Assessment.

The 2011-2016 Strategic Plan for Hospital Waste (PERH) is approved and published by Ordinance no. 43/2011 of 20th of January, having been duly approved its Environment Declaration on Strategic Environmental Assessment.

In terms of industrial waste, the Strategic Plan for Industrial Waste Management (PESGRI) 2013-2020 in force by 2015, is under review, after which the National Industrial Waste Prevention Plan (PNAPRI). The PESGRI will be subject to a Strategic Environmental Assessment.

Under the national program of administrative and legislative simplification (Simplex), the APA, IP, has a Registration Integration System of the Portuguese Environment Agency (SIRAPA), which is a "gateway " so that the organizations subject to registration, required or volunteer in accordance with applicable law, can communicate environmental information concerning its activities. Thus adding the whole system of information on organizations and institutions in one and seeking to avoid double information. The registered information includes integrated waste registration chart (MIRR), concerning production, transport, transaction, recovery and waste disposal, a vital information so that Portugal can achieve its reporting obligations on these matters at national, Community and international level, in particular with regard to the Waste Statistics Regulation and the Waste Framework Directive, as well as the public availability of updated information on the sector

In regional terms, the CEOS Strategic Waste Management Plan of the Azores (PEGRA) was approved by Regional Legislative Decree no. 10/2008/A, May 12th. The PEGRA lasts for seven years, during the period of 2007-2013, and covers the following types of waste: municipal, industrial, forestry, agricultural and hospital.

The Regional Waste Information System (SRIR) was created under the PEGRA and the legal framework for waste management in the Autonomous Region of the Azores. The SRIR, regulated by Ordinance No. 96/ 2009 of 27/11, is a strategic tool for managing information comprising an online database of individual access where companies and organizations must declare all the information about waste production and management in the ARA. A statistical module that allows the processing of information by competent and duly authorized entities is also available.

# 2 INFORMATION ON THE NATIONAL GREENHOUSE GASES INVENTORY SYSTEM

## 2.1 National System for the Estimation of Emissions by Sources and Removals by Sinks of Air Pollutants

The establishing of the National System for the Estimation by Sources and Removals by Sinks of air Pollutants (SNIERPA) is an obligation of the commitments made at international and Community level[34], aiming to ensure the preparation and annual reporting of a reliable and transparent inventory which ensures consistency, comparability, completeness and accuracy of the estimates that were made.

The SNIERPA which was established through Council of Ministers Resolution 68/2005, of the 17th of March, includes a set of institutional and legal definitions, as well as the procedures designed to ensure the estimation of emissions by sources and removals by sinks of air pollutants, their communication and the all files that contain relevant information.

For the sake of efficiency, the Portuguese national system, whose relevant obligations include only GHG emissions not covered by the Montreal Protocol, has been broadened over a wider group of air pollutants, allowing not only improvements in the information quality, but also in an optimization of human and material resources applied to the preparation of the inventory. Thus, the SNIERPA includes, in addition to greenhouse gases, acidifying and eutrophication gases, with the inclusion of particulates, heavy metals and persistent organic pollutants in order to meet the requirements set by the Convention on Long-range Transboundary Air Pollution (CLRTAP) and its respective protocols.

The evolution of obligations linked to recent or upcoming commitments at international and EU level will impose in the near future the change and update the Council of Ministers Resolution 68/2005 of the 17th of March.

### 2.1.1 General description on the National System

The national system aims to ensure in a timely preparation the inventory of air pollutants (INERPA), in accordance with the guidelines defined at international and EC level in order to facilitate in more cost-effective way the tasks of GHG inventory planning, implementation and management.

In order to ensure the preparation of the annual emissions inventory within the defined deadlines, the key element of the national system is the definition of responsibilities of the various entities that integrate the system. In this sense, the national system established by Council of Ministers Resolution 68/2005, of the 17th of March clearly defines the entities relevant for its implementation , based on the principle of Institutional cooperation.

Three bodies are established with differentiated responsibilities. These are:

1. Responsible Body[35] which is he APA, IP, being responsible for: INERPA`s overall coordination and updating; the inventory`s approval, after consulting the focal points and eventually the Involved

[34] Under the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, Decision 20/CP.7 Guidelines for national systems for the estimation of anthropogenic greenhouse gas emissions by sources and removals by sinks, under article 5 (1) of the Kyoto Protocol, has led to the establishment of the national system until January 1st , 2007; at Community level, Decision 280/2004/EC of the European Parliament and of the Council of the 11st February in order to set a mechanism for monitoring Community greenhouse gases (GHG) emissions and to implement the Kyoto Protocol, which anticipated, given that, the obligation to establish a national system until December 31st of 2005.

35 APA, IP, Rua da Murgueira, 9/9A, 2610-124 Amadora; Eduardo Santos, eduardo.santos@apambiente.pt.

Entities; and its submission to international and community bodies to which Portugal is associated, in the several communication of information formats, thus ensuring compliance with the adopted requirements and directives;

2. Focal Points (FP), bodies subordinated to the sector, work with APA, IP, and are responsible for fostering intra and inter-sectorial cooperation to ensure a more efficient use of the available resources;
3. Involved Entities that may be public or private bodies which generate or hold information which is relevant information to the INERPA, and which actions are subordinated to the Focal Points or directly to the Responsible Body.

**Table 2.1**

List of bodies that contribute information relevant to the preparation of INERPA, by sector and institutional level defined by SNIERPA

| **Setor de atividade** | **Main source cathegories /sinks** | **Focal Points** | **Involved Bodies** |
|---|---|---|---|
| | | | Public |
| Statistics | | | |
| National (1) | | INE | |
| Energy (1) | | DGEG | |
| Environment (2) (3) | | APA | |
| Energy | Combustion of fuels | | |
| | Industry energy | DGEG | |
| | Industry and civil construction | | |
| | Transport | GEE | |
| | *Road* | | GEE |
| | *Rail* | | IMT |
| | *Aviation* | | INAC |
| | *Sea* | | Port Administration |
| | Fugitive fuel emissions | DGEG | |
| | Solid fuels | DGEG | |
| | Fuel and natural gas | DGEG | Directorate General for Energy (the Azores), Directorate General of Commerce, Industry and Energy (Madeira) |
| Industrial processes and products use | Mineral Products | INE, DGAE | |
| | Chemical industry | INE, DGAE | |
| | Metal production | INE, DGAE | |
| | Electronics industry | INE, DGAE | |
| | Solvent use and other products | INE, DGAE | |
| Agriculture and Forestry | Animals | GPP | DGAV, INIAV,IFAP |
| | Enteric fermentation | | |
| | Manure management | | |
| | Land use | | |
| | Forestry | ICNF | |
| | Agriculture | GPP | DGADR,IFAP |
| | Land use change | DGT | |
| Waste | Land disposal of solid waste | APA/ DRES | |
| | Biological treatment of solid waste | APA/ DRES | |
| | Incineration of waste | APA/ DRES | |
| | Water waste management | APA/ DRH | ERSAR |
| | Others | | |

(1) Cross-cutting (almost) all sectors of activity.
(2) Relevant data from the implementation of the Large Combustion Plants and Integrated pollution prevention and control directives.
(3) Data and information relevant under Directive 2003/87/EC, Regulation 842/2006 and Regulation 166/2006.

Additional provisions to deal with the supplementary information under Kyoto Protocol refer mainly to arrangements to account for further requirements concerning Art. 3.3 and 3.4.

An inter-institutional work group was created (WG 3.3 & 3.4) in the scope of the National Inventory System (SNIERPA) in order to work on the definition of the methodology to identify the areas and account for the emissions/removals (Figure 2.1). The representation of these multiple entities in WG 3.3 & 3.4 aims at gathering the necessary competences, data and knowledge required to comply with the reporting and accounting requirements of these activities.

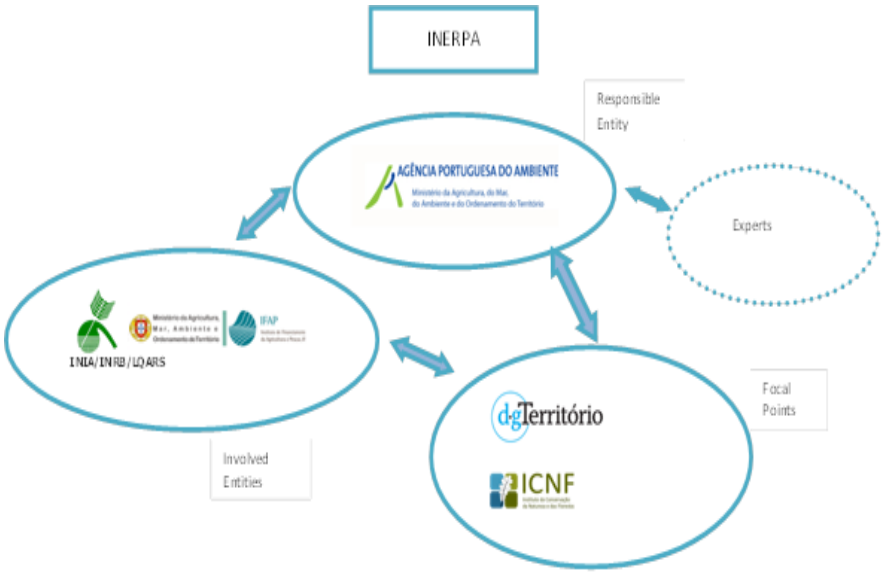



**Figure 2.1**
Main elements of Working Group 3.3&3.4
**Source**: NIR, 2013

The national system includes the following instruments:

- an average inventory recalculation system;
- a Methodological Development Program (PDM),
- a Quality Assurance and Control System (QA/QC), and
- a Documentation and Archiving System.

### 2.1.2 Planning and Quality

Two instruments of the SNIERPA ensure, in technical and methodological terms, the accuracy, completeness and reliability of the inventory: the Methodological Development Program (PDM) and the Quality Assurance and Control System (QA/QC) (Figure 2.2).

The PDM aims at identifying and defining a calendar for the application of methodological developments to the emissions estimated from the different subcategories of sources or sinks defined in the INERPA, by engaging experts with recognized expertise in the inventory preparation process. It is a fundamental instrument in the planning of activities of all relevant entities.

The QA/QC System includes an application program a Manual of Procedures for QA/QC. Its aim is to provide a set of verification (basic and technical) procedures to ensure the accuracy, completeness, transparency, reliability and representativeness of the emissions estimated and of the removal of air pollutants.

The results achieved with the application of the QA/QC system will provide one of the main inputs to the annual preparation of the PDM. QA/QC procedures identify the areas of the INERPA with the most significant problems. The PDM allocates priorities to the resolution of problems identified through the QA/QC.

The full implementation of these two instruments is important in ensuring that the national system is effectively implemented in the context of the Kyoto Protocol.

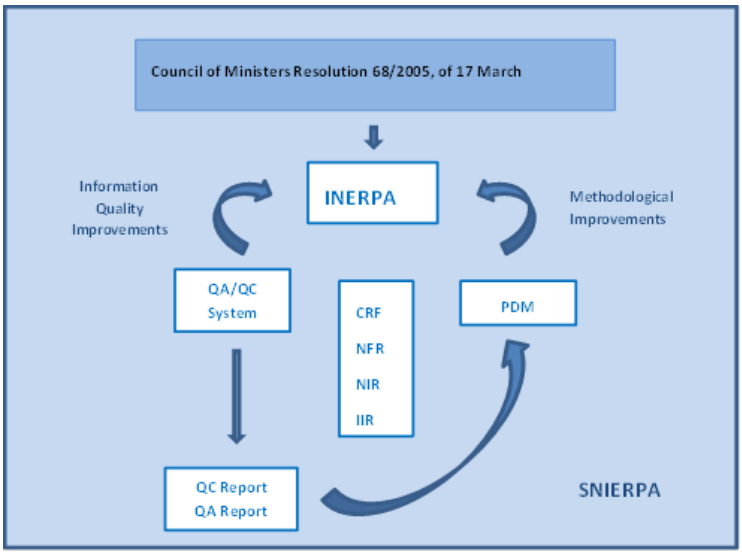



**Figure 2.2**
Linkages amongst the various elements of the SNIERPA
**Source**: NIR 2013

### 2.1.3 Management

The SNIERPA´s management includes tasks that are mainly aimed at ensuring the application of these instruments, both in terms of annual time planning and achievement of medium and long-term objectives.

Each year, typically in June according to the agreed calendar of INERPA, the APA, IP, the coordinator of GT SNIERPA, organizes a kick off meeting to plan and launch, in coordination with the sectorial focal points and the involved entities, the work for the following inventory submission(s). Bilateral meetings occur as necessary as consequence of this meeting aiming at discussing the specific issues related to each sector and to agree on the actions to be implemented in the framework of SNIERPA during this inventory compilation regarding the next submission.

The emissions calculations are performed by APA, IP. However many other institutions and agencies contributed to the inventory process, providing activity data, sectorial expert judgment, technical support and comments. All calculation and reporting rely in a set of different Excel spreadsheet workbooks which had been developed in order that all information and calculations occur automatically.

The information received from the several data suppliers is stored in its original format (paper or magnetic). A copy of this information is converted into the working workbooks, where data is further processed, linkage made and calculations performed, maintaining hence the integrity of the original data sources.

The informatics system has been developed to answer to the various international obligations and national needs. At present, the different demands refer to: UNFCCC (CRF format); UNECE/CLRTAP (NFR format); LCP Directive (NFR format); as well national needs such as the State of Environment Reports. There is independency between emission calculations and the required structure necessary for each obligation which allows flexibility in the inventory.

In what refers to the maintenance of the annual inventory documentation, the information is archived in a way that enables each inventory estimate to be fully documented and reproduced if necessary. When major

changes are done in methodology and emission factors, older spreadsheets are frozen and work restarts with copies of those spreadsheets, making a clear reference to the period when they were used. Minor corrections, which do not affect the estimations, are not stored due to storage area limitations.

## 2.2 Methodologies, Quality and Uncertainties

The inventory was calculated in accordance with internationally accepted recommendations and guidelines[36]. Key categories analysis of the 2013 (1990 to 2011) inventory was based on a tier 1 methodology. This consists of a level analysis of each source (based on the emissions values) and a trend analysis (based on the time series trend for the period 1990 - 2011), enhanced by a set of qualitative criteria to identify additional uncertain and incomplete sources.

The QA/QC System, defined in the context of the SNIERPA, consists of the Program of Quality and Assurance and the Manual of Quality Control and Assurance. The first defines the calendar for the application of general procedures (QC1), the specific procedures for each source sub-category (QC2) and the quality assurance procedures (QA) listed in the manual. The various procedures listed in the manual have been drawn on the basis of the Good Practice Guide (GPG) guidelines of the IPCC guidelines and adapted to the specific characteristics of the Portuguese INERPA preparation.

QC1 procedures are organized by checklists which include : basic checks on the accuracy of data acquisition processes (e.g. transcription errors); checks calculation procedures, data and parameters; cross-checking for consistency of common data across categories, verification of the National Inventory Report (NIR) and Common Report Format (CRF) tables. Finally, documentation and archiving procedures enable future data handling for inventory recalculation. Moreover, the QC2 procedures include technical verifications of the emission factors, the activity data and comparisons of the results obtained with different approaches.

The QA consists of an elaborated system of procedures to review parameters, activity data, emissions factors, as well as to validate the applied methodologies; this system is run by agents that have not been directly involved in the development and compilation of INERPA.

Formal reports are produced following QC and QA procedures and made available for consultation.

The 2013 INERPA´s submission, in the context of SNIERPA´s implementation, was submitted to QC1, including the CRF tables and the NIR, and QC2 procedures (which results are referred in the NIR). The QA procedures were carried out in the frame of the PDM.

The main objective of the uncertainty assessment is to aid the prioritization of efforts towards improving the accuracy of future inventories and methodologies. The level of uncertainty in the emissions estimates are due to the natural variability of some emissions processes, incomplete knowledge of emissions sources and their identification, the errors and gaps in data collection and statistical information, incorrect choice and calculation of emissions factors and parameters due to monitoring data errors, and expert studies and assessments.

A Tier 1 methodology was used to estimate total inventory uncertainty for each year, as well as the uncertainty in the emissions trends. This method of analysis attaches uncertainty values to the activity data and the emissions factors, for each pollutant, and uses error propagation rules to combine the uncertainty

[36] *UNFCCC Reporting Guidelines on Annual Inventories, Intergovernmental Panel on Climate Change; The Revised 1996 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas* (IPCC, 1997); *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000); *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (IPCC, 2003).

estimates of each of the individual sources in the overall value. According to the IPCC's GPG, uncertainty considerations for the Global Warming Potential are not considered.

The uncertainty analysis was applied CO2, CH4, N2O, HFC and SF6 emissions, and considers emissions in terms of CO2 equivalents.

The uncertainty of the growing emissions trend between 1990 and 2011 is 12,3%. The uncertainty of values is defined within a 95% confidence interval; values for activity data, emissions factors and emissions estimate have a 95% probability of confinement within confidence limits.

## 2.3 Emissions Trends : 1990-2011

In accordance with the National Emissions Inventory 2013[37] (relative to 2011), GHG emissions, without land use and land use change and forestry[38] emissions (LULUCF), accounted for 70.0 Mt $CO_2$, an increase of 14.8% relative to the 1990 level. Under the EU Burden Sharing Agreement, Portugal is bind to limit its emissions in the first commitment period to 27% compared to the 1990 level.

After the rapid growth during the 90s, national emissions slowed down in the early 2000s. In more recent years, especially after 2005, there was a decrease of national emissions. In 2011, national emissions were about 20.5% below the ones observed in 2005 (Figure 2.3).

This trend clearly shows that the evolution of the Portuguese economy was characterized by a strong growth associated to an increase in the demand for energy and mobility in the 90s and to a stabilization of the emissions in the early 2000s. The last one is mainly due to an increase of the integration of natural gas and a growth in the implementation of renewable energies, which supported a consistent reduction of national emissions since 2005. The latest emissions still reflect a stagnation in the Portuguese economy.

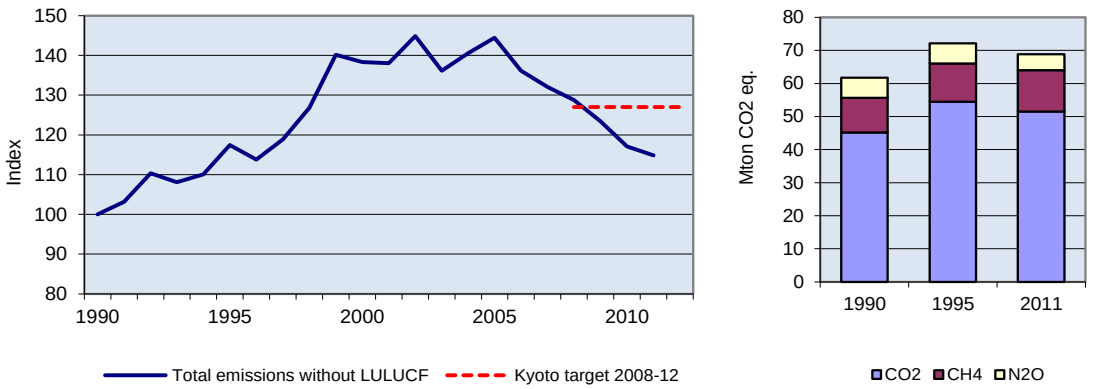



**Figure 2.3**
Evolution of the GHG national emissions (without LULUCF)
**Source**: APA, 2013

The energy sector, including transports, remains in 2011 as the main responsable for GHG emissions, accounting for 69.5% of the national total GHG emissions. The $CO_2$ is the leading GHG emitted at national level, which represented about 74% of the total emissions in 2011, reportable to the energy sector prominence and their fossil fuel dependency.

37 Available in www.apambiente.pt (submitted on May 24th, 2013).

38The sector of land use change and forestry is not taken into account since the compliance measurement of the Kyoto Protocol is different from the one carried out in the United Nations Framework Convention on Climate Change (UNFCCC).

## 2.4 Analysis by Gas

The GHG with the largest national emissions representation, about 74%, (Figure 2.4) is, in 2011, the $CO_2$ because of energy sector and fossil fuels related activities. Its growth compared to 1990 (14.1%) reflects an increase of the emissions in the energy sector. Compared to 1990, only $N_2O$ emissions have decreased (-19.2%) due to the reduction of emissions from agriculture. In turn, the increase in $CH_2$ emissions (21.3% compared to 1990) is mostly due to the growth of emissions in the waste sector (Figure 2.5).

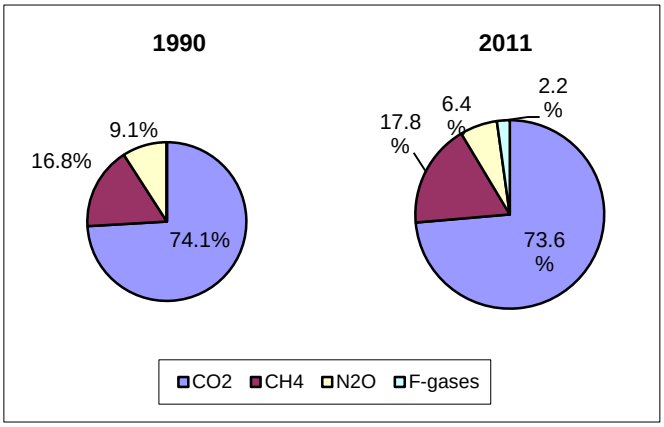



**Figure 2.4**
National emissions by gas, in 1990 and 2011
**Source**: APA, 2013

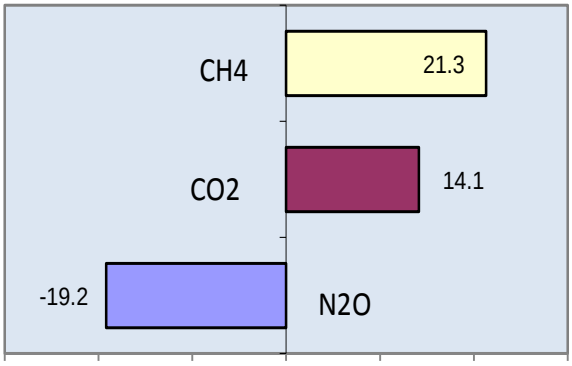



**Figure 2.5**
Evolution of national emissions by gas 1990 - 2011
**Source**: APA, 2013

$CO_2$ is mainly caused by the burning of fossil fuels in energy related activities (IPCC sector 1). Other non-energy production processes, such as cement production (category 2A), are also significant emissions amounts of $CO_2$.

The $CH_4$ is mainly produced through anaerobic decomposition of organic matter in biological systems, such as urban waste and livestock waste, wastewater treatment systems or enteric fermentation in animal. Other sources that are equally responsible for $CH_4$ emission include the burning of biomass, natural gas and oil distribution and the incomplete burning of fossil fuels.

$N_2O$ is associated to direct and indirect emissions from agricultural soils, mostly related to the use of synthetic fertilizers and manure from cattle, nitrogen fixing by leguminous crops and incorporation of agricultural residues in the soil. Other significant sources include the chemical industry (nitric acid production), wastewater treatment, burning of fossil fuels (mainly in the transport sector) and burning of

biomass (forest fires, agricultural residues, biomass combustion in the residential sector and waste incineration).

Fluorinated gases reported under the context of CRF encompass hydrofluorocarbons (HFC) and sulphur hexafluoride ($SF_6$). HFC are the result of leaks in the production, operation and decommissioning of cooling and air conditioning equipments, foams, fire protection equipment and inhalators. $SF_6$ result from losses in electricity distribution systems, circuit breakers and metal-clad substations.

## 2.5 Analysis of Key Drivers

The key drivers explaining the reduction in emissions since 2005 are, among others:

1. the "cruise speed" use of natural gas,
2. an unprecedented implementation of renewable energy,
3. the gradual implementation of biofuels in transport,
4. energy efficiency in sectors covered by the EU ETS,
5. the " green" car tax reform and, finally,
6. the present economic crisis (especially in the period 2009-12).

Meteorological parameters, such as precipitation, which have a high interannual variability, also have a significant influence on hydroelectric power production, thus influencing in a very significant manner the fluctuations in emissions. The higher values of the Index of Hydroelectric power production (IPH) correspond to the minimum emissions in public electricity and heat production categories, as in some case in 1996, 2003 or 2010. The reverse situation is also true, namely in 1992, 1999, 2002 or 2005 (Figure 2.6).

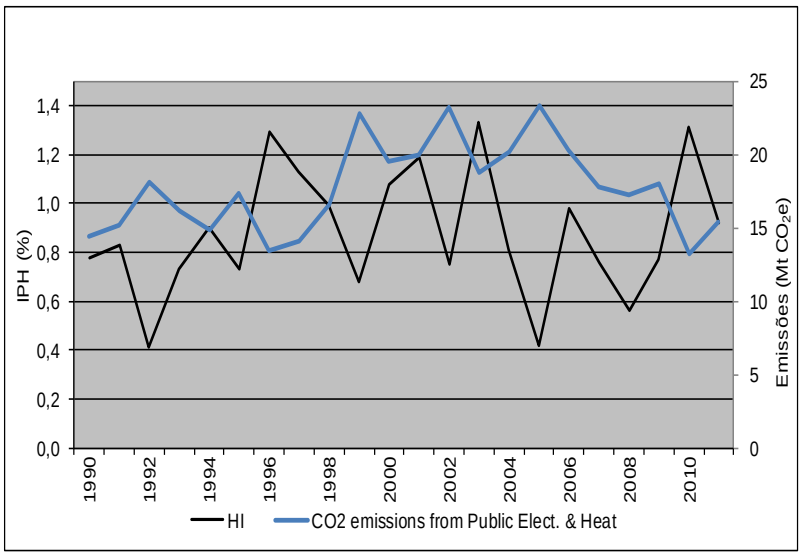
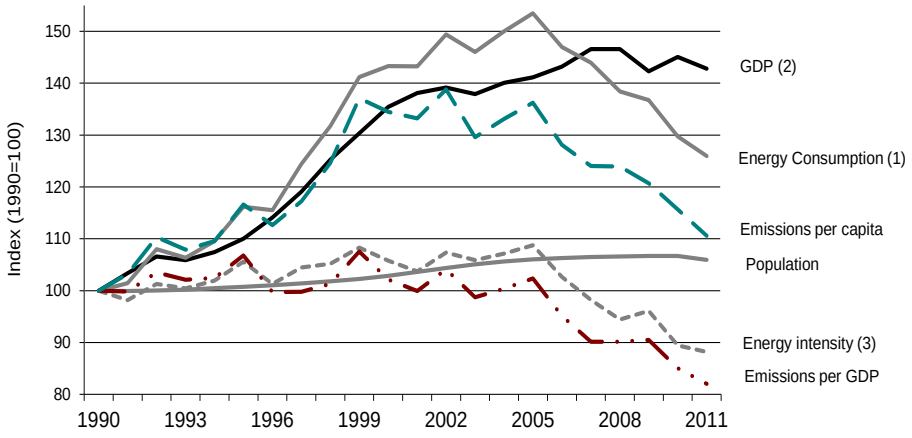



**Figure 2.6**
Index of Hydroelectric Production and emissions from Public Electricity and Heat Production
**Source**: APA, 2013

An analysis of the GHG emissions per unit of GDP shows that only in 2005 Portugal managed to decouple GHG emissions and the GDP, resulting from a "decarbonisation" of the economy, that is, a slight decrease in carbon emissions of the economy, trend that preceded the current economic crisis (Figure 2.7).




**Notes**:
(1) Primary Energy Consumption; (2) GDP at 2005 prices; (3) Energy Consumption per GDP.
Sources: INE, DGEG

**Figure 2.7**

GHG emissions per capita, per unit of GDP and energy consumption

**Source**: APA, 2013

There are many factors in the basis of this trend, among them: the growing implementation of less polluting energy sources such as natural gas, the introduction of more efficient combined cycle gas thermal electric plants, the increasing growth of energy from renewable energy sources (wind and water mainly) and energy and technology efficiency improvements. Efficiency improvements in the transport sector (car fleet renewal) and in the housing sector (buildings certification) may also explain these trends. Despite the significant reduction in carbon intensity of GDP, when compared to the rest of Europe, Portugal is above the European average(Table 2.2).

**Table 2.2**

Carbon Intensity of the GDP (constant 2000 prices) in Portugal and in Europe

| t CO2e./euro | 1990 | 2010 |
|---|---|---|
| Portugal[a] | 652 | 521 |
| EU-15[b] | 595 | 386* |
| EU-27[b] | 735 | 450* |

a **Source**: Portugal: NIR 2012
b **Source**: EU 15 and 27: Greenhouse gas emission trends and projections in Europe 2011 - Tracking progress towards Kyoto and 2020 targets – Country profiles (AEA, 2011)

## 2.6 Analysis by Sector

In accordance with the Convention reporting guidelines, emission estimates are grouped into six sectors: Energy (1), Industrial Processes (2), Solvent Use (3), Agriculture (4), Land Use, Land Use Change and Forestry (LULUCF) (5), and Waste (6).

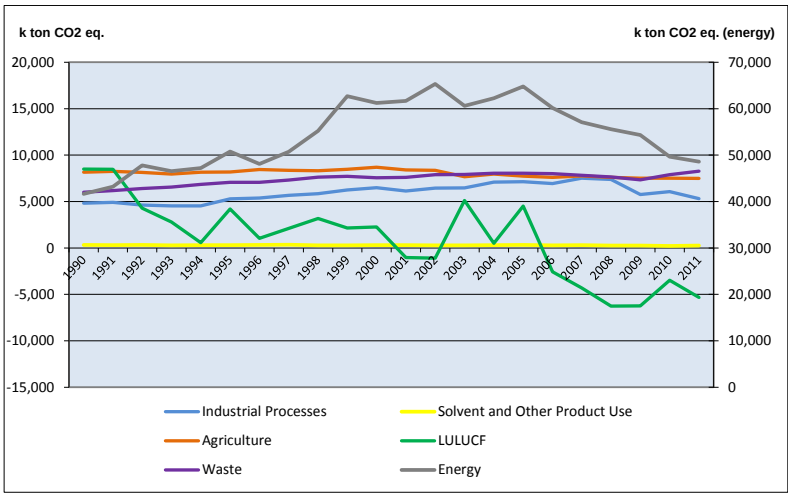



**Figure 2.8**

Evolution of sectoral emissions in Portugal (1990-2011)

**Source**: APA, IP, 2013

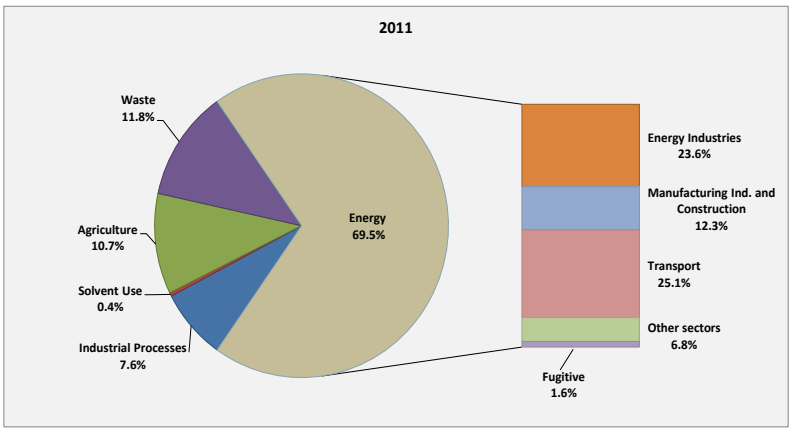



**Figure 2.9**

Distribution of na tional emissions by sector in 2011

**Source**: APA, IP, 2013

In 2011 the energy sector, including transport, was still responsible for the major GHG emissions, representing 69.5% of national emissions, and it has shown an increase since 1990 about 16.8% (Figure 2.9).

The transport sector, greatly dominated by road traffic, was one of the sectors that registered the highest growth in the period 1990-2011: 70.2% (Figure 2.8). However there has been, particularly since 2010, a reduction of emissions in this sector.

The sectors of waste, agriculture and industrial processes showed a similar weight (11.8%, 10.7% and 7.6%, respectively). However, the waste sector and the industrial processes sector have shown an upward trend since 1990 (38.1% and 10.1%, respectively), while the agriculture sector recorded a decrease in the emissions trend (-8.0%) (Figure 2.8).

**Table 2.3**

Variation of sectorial emissions between 1990-2011

| Setor | Variation 1990-2011 (%) |
|---|---|
| Energy | 16.8 |
| Combustion | |
| - Energy production and transf. | 1.2 |
| - Transport | 70.2 |
| - Industry | -12.7 |
| - Residential/services | 0.8 |
| Fugitive Emissions | 201.5 |
| Industrial Processes | 10.1 |
| Solvent use | -19.1 |
| Agriculture | -8.0 |
| Waste | 38.1 |

Estimates to land use, land use change and forestry (LULUCF) sector, which was considered a liquid sink of $CO_2$ in the whole period (1990-2010), suffered a substantial revision during the whole time period of 2010/11, to which corresponds a sequestration of 5,3 Mt $CO_2$ e. in 2011.The large fires that occurred in 2003 and 2005 are responsible for its increase and show a significant reduction in the sequestration capacity.

# 3. INFORMATION ON POLICIES AND MEASURES

## 3.1 Policy Instruments during the 2008-2020 period

Public policies on climate change are now an integral part of a set of sectoral policies in Portugal. In fact, in areas such as energy and industry within the European Union Trade Emissions Licensing, "carbon dimension" is now part of the strategic and economic considerations of the companies concerned. In the agriculture and forestry sector there is a growing awareness of the important contribution to mitigate the emissions of greenhouse gases and to enhance its sink capacity. Even in areas with major challenges such as transport, some steps have already been given in terms of "decarbonization of the fleet of vehicle for instance in terms of natural gas in urban bus fleets or the electric vehicle program.

In this context, it is worth stressing the contribution of other policy instruments in the reduction of national emissions as is the case of the Energy Strategy, the National Action Plan for Energy Efficiency (PNAEE), the National Renewable Energy Program (PNAER), the Electric Mobility Program in Portugal, the Energy Efficiency Program in Public Administration - ECO.AP, among others .

In 2020, the European Union has established as Community target a reduction of 20% of greenhouse gases emissions regarding 1990. At European level, the sectors covered by the European Emission Trading System must have a reduction of 21 % over 2005 and 10 % in the other sectors compared to 2005.

The sharing of efforts among Member States was defined by EC Decision no. 406/2009 of 23rd April. In this context, Portugal should limit, between 2013 and 2020, the increase in greenhouse gas emissions from sectors which are not covered by the European Union Trade Emissions Licensing by +1 % compared to 2005 (excluding LULUCF).

Target measures of 20 % of renewable energy sources in final energy consumption and an increase of energy efficiency by 20 % were some of the measures adopted, under the context of the Climate Change Package. In this context Portugal has a target of 31 % of renewable energy sources in final energy

consumption, of which 10 % in transport. However, at a domestic level, more ambitious energy efficiency goals were established, including an overall reduction of primary energy consumption of 25 % and a specific 30% target for the State.

In order to face the climate change challenges within commitments for the period after 2012, through Council of Ministers Resolution no. 93/2010, of 26th of November, the Government ordered the preparation of the following essential instruments:

i. National Low Carbon Road map (RNBC): The RNBC aims to determine a set of paths for cost-effective emissions reductions(for long - term targets concerning the national GHG emissions reduction) and its subsequent policy options, taking into account the national contribution to the EU target for 2050 (work completed in 2012);
ii. National Climate Change Program for the period of 2013-2020 (PNAC 2020): It should establish policies, measures and instruments with the aim of responding to the annual limitation of greenhouse gases emissions for sectors not covered by the European Union Trade Emissions Licensing; predict sectoral responsibilities, funding and monitoring and control mechanisms (ongoing work in 2013).

Portugal is fully committed to meeting climate change challenges, not only the presents targets but also looking towards 2020 and beyond.

Work on the new National Climate Change Program with a focus on 2020 and 2030 is ongoing and is expected to be concluded in the second quarter of 2014.

## 3.2 Policies and Measures

Tables 3.1 to 3.5 show the policies and measures considered under PNAC2006 and their projected effects under deadlines established by the Kyoto Protocol (2008-2012) and regarding 2020. These are the latest projections concerning policies and measures , and they are expected to be implemented within the same scope of work for the PNAC2020 (for policies and measures being implemented and for others that may be identified for implementation).

Table 3.6 shows the results of the annual monitoring exercise of policies and measures under the website *cumprirquioto.pt*. More information about the underlying methodology can be found on the website.

**Table3.1:**

Policies and Measures for the energy supply, industry, construction and public works and other (including residential and services) sub-sectors

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020** |
| **MRe1**"E4, E-RES" Program (replaced by MA2007e1) | Reduction of GHG emissions from electricity production through the increase in generation from renewable energy sources (meeting a 39% target of gross electricity consumption by 2010 with RES) | $CO_2$ $CH_4$ $N_2O$ | Economic (investment subsidies and specific tariffs for E-RES generation) | Implemented | MEID | 280 | HS[39]:1273; LS[40]:893 |
| **MRe2**(New) Expansion Plan of the electricity production system (replaced by MA2007e2 | Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010) | $CO_2$ $CH_4$ | Regulatory | Implemented | MEID | | NA |
| **MRe3.**Energy Efficiency in Buildings | Increase energy efficiency in buildings by about 40% through the adoption of new regulation(s) on acclimatisation and thermal behaviour of buildings, in substitution of present regulations | $CO_2$ $CH_4$ $N_2O$ | Regulatory | Implemented | MEID | 90 | HS:500; LS:331 |
| **MRe4.** Solar Hot Water for Portugal Program (AQSpP) | Promotion of domestic water heating by solar energy. Initial target of 1 million $m^2$ of solar panels installed by 2010 (around 150 000 $m^2$ per year) altered to sustaining in 2005 and 2006 the growth rate of past few years. An installation rate of 100 000 $m^2$/year is considered for the following years (2007-2020), with the entry into force in 2006 of new legislation | $CO_2$ $CH_4$ $N_2O$ | Economic (tax incentives) | Implemented | MEID | 101 | HS:322; LS:312 |
| **MRe5.** IPPC Directive (Integrated Prevention and Pollution Control) | The IPPC Directive was transposed to internal legislation by Decree-Law 194/2000, of 21 August. | $CO_2$ $CH_4$ | Regulatory | Implemented | MAOT | No Evaluation | |

[39] HS: High Scenario.

[40] LS: Low Scenario.

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2e$/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020** |
| **MAe1.** Energy efficiency improvement in the electricity generation sector | Reduction of the rate of loss in the energy transport and distribution network to 8.6%[41] by 2010 | $CO_2$ $CH_4$ $N_2O$ | Regulatory | Implemented | MEID | 146 | HS: 217 LS:113 |
| **MAe2.** Energy efficiency improvement in the energy supply systems, considering electricity generation from co-generation | Increase in electricity generated from co-generation systems, up to a share of 18% of the gross national consumption of in 2010. | $CO_2$ $CH_4$ $N_2O$ | Economic (investment subsidies and specific tariffs for co-generation) | Implemented | MEID | 200 | HS:185 LS:103 |
| **MAe3.** Improvement in energy efficiency from the electricity demand-side | Reduction of electricity consumption by about 1000 GWh by 2010 | $CO_2$ $CH_4$ $N_2O$ | Regulatory | Implemented | MEID | 795 | HS:420 LS:340 |
| **MAe4.** Promotion of electricity produced from renewable energy sources | Increase installed capacity of units of electricity generation from RES to yield up to 5100 MW of wind power | $CO_2CH_4$ $N_2O$ | Economic (Investment subsidies and specific tariffs for E-RES generation) | Implemented | MEID | 370 | HS:0 LS:0 |
| **MAe5.** Introduction of natural gas in the Autonomous Region of Madeira | Substitution of the most polluting fuels and diversification of energy sources in the Autonomous Region of Madeira | $CO_2$ $CH_4$ $N_2O$ | Regulatory | Planned | Regional Government Autonomous Region of Madeira | 5 | HS:NA LS:NA |
| **Ar1.** Realignment of the tax burden on diesel fuel for heating (residential sub-sector) | Tax harmonization between diesel fuel for heating and for transport by 2014[42] | $CO_2$ $CH_4$ $N_2O$ | Economic/ Fiscal | Implemented | MEID | 14 | HS:54 LS:53 |

[41] This measure impacts electricity on EU-ETS facilities.

[42] The reduction potential includes the indirect effect of the increase in emissions in the electricity generation system.

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020** |
| **MAs1** Realignment of the tax burden on diesel fuel for heating (services sub-sector) | Tax harmonization between diesel fuel for heating and for transport by 2014[43]n diesel fuel | $CO_2$ $CH_4$ $N_2O$ | Economic/ Fiscal | Implemented | MEID | 59 | HS:330 LS:323 |
| **MAi1.** Increase in tax on industrial fuels | Changing the fuel tax (ISP) on industrial fuels, so as to create an incentive structure for GHG emissions reduction[44] | $CO_2$ $CH_4$ $N_2O$ | Economic/ Fiscal | Implemented | MEID | 78 | HS:102 LS:93 |
| **MAi2**. Review of the Regulation on the Management of Energy Consumption (RGCE) | Defining of a new RGCE that promotes energy efficiency in the industrial sector through voluntary agreements[45] | $CO_2$ $CH_4$ $N_2O$ | Voluntary Agreement Regulatory | Implemented | MEID | 32 | HS:60 LS:54 |
| **MAi3.** Incentives to the substitution of fuel oil co-generation by natural gas generation | Reduction or phasing-out of the tariff for co-generation using fuel oil[46] | $CO_2$ $CH_4$ $N_2O$ | Economic | Implemented | MEID | 189 | HS:196 LS:196 |
| **MA2007e1** – replacing MRe1 | Renewable energy: increase to 45% the goal of electricity generation in 2010 by renewable sources (previously of 39%)[47] | $CO_2$ | Economic (investment subsidies and specific tariffs for E-RES generation) | Implemented | MEID | 458* | NA |

[43] The reduction potential includes the indirect effect of the increase in emissions in the electricity generation system.
[44] This measure has impact on EU-ETS facilities
[45] The reduction potential includes the indirect effect of the increase in emissions in the electricity generation system
[46] This measure has impact on EU-ETS facilities.
[47] This measure has impact on EU-ETS facilities

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020** |
| **MA2007e2** – replacing MRe2 | Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010)[48]<br>MA2007e2/scenario 1 – use rate of an average 37% in the 2008-2012 period for all (existing and new) NGCCP plants<br>MA2007e2/scenario 2 - use rate of an average 40% in 2008-2012 period for all (existing and new) NGCCP plants | $CO_2$ | Regulatory | Implemented | MEID | (MA2007e2/Scenario 1) 144*<br>(MA2007e2/Scenario 2) -155* | NA |
| **MA2007e3** – (new) | Co-combustion of biomass: 5% to 10% substitution of the coal in Sines and Pego thermic power plants by biomass or Waste Derived Fuel.[49]<br>MA2007e3/scenario 5%<br>MA2007e3/scenario 10% | $CO_2$ | Regulatory | Planned | MEID | (MA2007e3/Scenario 5%] 380*<br>(MA2007e3/Scenario 10%] 761* | NA |

[48] This measure has impact on EU-ETS facilities

[49] This measure has impact on EU-ETS facilities

**Table 3.2:**

Policies and Measures for the transport sector

| Designation of P&M | Objectives and/or affected activities | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | **2010** | **2020** |
| **MRt1.** Auto-Oil Program: Monitoring of the Agreement with Atomobile Manufacturers Associations | Reduction of the carbon intensity of light passenger vehicles transport, with increasingly restrictive consumption (and $CO_2$ emissions) standards, to reach the 120 g $CO_2$e/km target by 2010 | $CO_2$ $CH_4$ $N_2O$ | Voluntary Agreement | Implemented | MFAP MAI | 175 | NA |
| **MRt2.** Expansion of the Lisbon Metro (ML)- extension of the Blue Line; extension of the Yellow Line; Red Line | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, through the expansion of the Lisbon Metro network | $CO_2$ $CH_4$ $N_2O$ | Economic (increase in the supply of public transport) | Implemented | MOPTC | 14.8 | NA |
| **MRt3.** Construction of the Metro Sul do Tejo | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, by the construction of a new light metro network | $CO_2$ $CH_4$ $N_2O$ | Economic (increase in the supply of public transport) | Implemented | MOPTC | 13 | NA |
| **MRt4.** Construction of the Oporto Metro (MP) | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, through the construction of the Oporto Metro network | $CO_2$ $CH_4$ $N_2O$ | Economic (increase in the supply of public transport) | Implemented | MOPTC | 30.4 | NA |
| **MRt5.** Construction of the Metro Ligeiro do Mondego (MLM) | Promotion of modal transfer, and consequent reduction in carbon intensity of the global transport activity through the construction of a light metro network | $CO_2$ $CH_4$ $N_2O$ | Economic (increase in the supply of public transport) | Implemented | MOPTC | NA | NA |
| **MRt6.** Improve services provided by CP (reduction in travel time) between Lisbon-Oporto; Lisbon-Castelo Branco; Lisbon-Algarve | Promotion of modal transfer, and consequent reduction in carbon intensity of the global transport activity through supply changes (reduction in travel time) between Lisbon-Oporto; Lisbon-Castelo Branco and Lisbon-Algarve, and consequent increase in the competitiveness of the railway system. | $CO_2$ $CH_4$ $N_2O$ | Economic (increase in the supply of public transport) | Implemented | MOPTC | 78 | NA |
| **MRt7.** Enlargement of the fleet of vehicles powered by natural gas of CARRIS and of the STCP | Intensity of heavy passenger vehicle transport, through the enlargement of the fleet of public vehicles powered by natural gas (of CARRIS and of the STCP), and the substitution of diesel-powered vehicles | $CO_2$ $CH_4$ $N_2O$ | promotion of the investment in vehicles powered by natural gas) | Implemented | MOPTC | 1.2 | NA |

| Designation of P&M | Objectives and/or affected activities | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2e$/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | **2010** | **2020** |
| **MRt8.** Incentive Program for the dismantling of End-of-Life Vehicles | Promotion of the renovation of the car stock, in order to reduce carbon intensity of light passenger vehicles, through the provision of monetary incentives for the substitution of end-of-life vehicles.<br>4200 vehicles over 10 years old are expected to be decommissioned annually from 2005 | $CO_2$<br>$CH_4$<br>$N_2O$ | Economic (monetary incentives for the acquisition of new vehicles) | Implemented | MFAP | 2.9 | NA |
| **MRt9.** Reduction of interurban motorway speeds | Promotion of the reduction of speeds and consequent reduction of the carbon intensity of road transport by lowering the average motorway speed by about 6 km/h, comparatively to year 2000 in the frame of an accident prevention program | $CO_2$<br>$CH_4$<br>$N_2O$ | Regulatory/ Information | Implemented | MAI | 0.6 | NA |
| **MRt10.** Biofuels Directive (Replaced by MA2007t1) | Reduction in the consumption of fuels responsible for the emission of GHG through the promotion of the use of biofuels in the transport sub-sector (2%-2005;<br>5.75%-2010) | $CO_2$<br>$CH_4$<br>$N_2O$ | Regulatory and Economic (concession of subsidies to investment and proper tariffs for biofuels) | Implemented | MEID | 1149 | NA |
| **MAt1**. Reduction of Taxis´ service days | Reducing the number of service days to a maximum of 6 days per week | $CO_2$<br>$CH_4$<br>$N_2O$ | Regulatory | Planned | MEID | 3.9 | NA |
| **MAt2.** Enlargement of the fleet of taxi vehicles powered by natural gas | Promotes the shift to natural gas in 200 vehicles | $CO_2CH_4$<br>$N_2O$ | Economic (promotion of investment in natural gas-powered vehicles | Planned | MEID | 0.2 | NA |

| Designation of P&M | Objectives and/or affected activities | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2e$/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | **2010** | **2020** |
| **MAt3.** Review of the current tax regime on private vehicles | Energy efficiency improvements of the car stock through the revision of the present taxation regime on private vehicles, so that $CO_2$ emissions are factored in the calculation of the tax (representing at least 60% of the total value of the tax from 2008)[50] | $CO_2$ $CH_4$ $N_2O$ | Economic and Tax | Implemented | MFAP | 7.7 | NA |
| **MAt4.** Metropolitan Authority of Lisbon Transports | Modal transfer of 5% (pkm/pkm) by 2010 | $CO_2$ $CH_4$ $N_2O$ | Regulatory and Economic (change in the supply of public transport) | Implemented | MEID | 245.4 | NA |
| **MAt5**. Metropolitan Authority of Oporto Transports | Modal transfer of 5% (pkm/pkm) by 2010 | $CO_2$ $CH_4$ $N_2O$ | Regulatory and Economic (change in the supply of public transport) | Implemented | MEID | 101.5 | NA |
| **MAt6.** Incentive Program for the dismantling of End-of-Life Vehicles (further objectives) | Extra 500 vehicles decommissioned annually relative to the 4200 considered in measure MRt8 | $CO_2$ $CH_4$ $N_2O$ | Economic (monetary incentive for the acquisition of new vehicles) | Implemented | MFAP | 0.4 | NA |
| **MAt7.** Regulation on Energy Management in the Transport Sector | 5% reduction of the consumption factor of freight transport | $CO_2$ $CH_4$ $N_2O$ | Regulatory | Implemented | MEID | 18.1 | NA |
| **MAt8.** Railway connection to Aveiro Sea Port | Transfer of 1553 kt of freight to maritime transport, yearly, from 2007 | $CO_2$ $CH_4$ $N_2O$ | Economic (change in the supply of freight transport | Implemented | MEID | 40 | NA |
| **MAt9.** Motorways of the Sea | Transfer of 20% of international road freight traffic to maritime transport | $CO_2$ $CH_4$ $N_2O$ | Economic (change in the supply of freight transport) | Implemented | MEID | 150 | NA |
| **MAt10.** Logistical Platforms | Development of the National Logistics System | ND | Economic | Implemented | MEID | On Evaluation | NA |

[50] The impact of this instrument is considered under the full compliance with the Auto-Oil Program.

| Designation of P&M | Objectives and/or affected activities | GHG | Type of Instrument | Implementation Status | Implementing Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | **2010** | **2020** |
| **MAt11.** Restructuring of supply of CP (national railway) service | Renovation of trains and changes at the supply level (schedules and frequency of services, new connections/services, etc.) so as to capture $261x10^6$ tkm of the road transport mode. | $CO_2$ $CH_4$ $N_2O$ | Economic | Implemented | MEID | 44.4 | NA |
| **MA2007t1** replacing MRt10. Biofuels Directive | Biofuels Directive– increase of the 5.75% goal to 10% in 2010 regarding biofuels incorporation tax in the road fuels | $CO_2$ | Economic (concession of subsidies to investment and proper tariffs for biofuels) | Adopted | MEE | 655* | NA |

**Table 3.3:**

Policies and Measures for the Agriculture and Livestock sector

| Designation of P&M | Objectives and/or affected activities | GHG | Type of Instrument | Implementation Status | Implementation Bodies | **Expected annual average GHG reduction (kt $CO_2$e/year)** | |
|---|---|---|---|---|---|---|---|
| | | | | | | **2010** | **2020** |
| **MRg1. IPPC Directive (Integrated Prevention and Pollution Control)** | Implementation of the IPPC Directive | - | Regulatory | Implemented | - | No Evaluation | NA |
| **MAg1. Evaluation and promotion of carbon sequestration in agricultural soil** | Adoption of cropland management and grazing land management activities, under the Art. 3(4) of the Kyoto Protocol | $CO_2$ | Economic | Implemented | MAOT | 500 | NA |
| **MAg2. Treatment and energy recovery of livestock waste** | Reduction in methane emissions resulting from manure management through the conversion of medium and large manure management systems (headcount over 1000) to anaerobic biodigestors with energy recovery<br>945 000 heads associated to the Liz, Oeste, Algarve, Setubal e Rio Maior systems. | $CH_4$<br>$N_2O$ | Economic (Promotion of investment in waste-to-energy recovery systems) | Implemented | MAOT | 429 | 507 |

**Table 3.4:**

Policies and Measures for the Forestry sector

| Designation of P & M | Objective and /or affected activity | GHG | Type of Instrument | Implementation Status | Implementation Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020 |
| **MRf1. Program for the Sustainable Development of Portuguese Forests (in the context of IIIFSP)** | Promote the sustained increase in forested area, through financial support and incentives to new tree plantations | $CO_2$ | Economic (financial support and incentives to the establishment of new tree plantations) | Implemented | MAOT | 3743 | 4300 |
| **MAf1. Promotion of carbon sink capacity of forests** | Increase in the carbon sink capacity of Portuguese forests, through the improvement of forestry management (forest stands in place on the 1st of January 1990). | $CO_2$ | Economic | Implemented | MAOT | 800 | NA |

**Table 3.5**

Policies and Measures for the Waste Management sector

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementation Bodies | Expected annual average GHG reduction (kt $CO_2$e/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020 |
| **MRr1. Directive on Packaging and Packaging Waste** | Decree-Law 366-A/97, of 20 December, transposed the EC Directives that manage the flow of packaging and related waste (Directive 94/62/CE of the European Parliament and Council, of 20 December, altered by Directive 2004/12/CE of the European Parliament and Council, of 11 February) imposing recovery and recycling objectives for packaging waste. The following targets, to be met by the 31st December 2011, were defined:<br>- recovery: of at least 60% of waste<br>- Recycling:<br>Overall: 55-80%<br>Glass: 60%<br>Paper: 60%<br>Metals: 50%<br>Plastics: 22,5%<br>Wood: 15% | $CO_2$<br>$CH_4$<br>$N_2O$ | Economic | Implemented | MAOT | 900 | NA |
| **MRr2. Landfill Directive** | Decree-Law 152/2002, of 23 May, transposed Directive 1999/31/CE of the Council, of 26 April, on the disposal of waste to landfills, establishes the need to define a national strategy to reduce biodegradable municipal waste (BMW) destined to landfills. Maximum percentage of BMW disposed in landfills in relation to the BMW production in 1995 (targets):<br>2006(75%)<br>2013(50%)<br>2016(35%) | $CH_4$ | Economic | Implemented | MAOT | 363 | NA |

| Designation of P&M | Objective and/or affected activity | GHG | Type of Instrument | Implementation Status | Implementation Bodies | Expected annual average GHG reduction (kt $CO_2e$/year) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2010 | 2020 |
| **MRr3. IPPC Directive (Integrated Prevention and Pollution Control)** | The IPPC Directive was transposed to internal legislation by Decree-Law 194/2000, of 21 August. Waste Management (Category 5) includes a set of activities of Annex I of DL 194/2000. Improvement of environmental performance of facilities covered with regard to: discharges to the atmosphere, water and soil; waste production; use of raw materials, energy efficiency, noise, risk prevention and management, among others (Time Horizon: 2007-2010) | $CO_2$ $CH_4$ | Regulatory | Implemented | MAOT | The Environmental Licences for waste management facilities (Category 5) already issued in the context of IPPC, in particular for atmospheric emissions control, do not specify any level of environmental performance to be fulfilled, but rather impose the periodic monitoring of emissions. As such, the IPPC Licensing, as defined to date, is a rather ineffective instrument for GHG reduction. However, the information collected (quantities and composition of waste, atmospheric emissions, etc.) will allow for future monitoring of the reference scenario defined for the waste sector | |

**Table 3.6**

Results of the monitoring of the implemented policies and measures (cumprirquioto.pt)

| | Policies and Measures | | Monitoring (%) | | | | | Variance $CO_2$ 08-12 (Gg) | Observations |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2008 2/7/08 | 2009 15/8/10 | 2010 2/2/11 | 2011 | 2012 | | |
| | **ENERGY** | | | | | | | | |
| 1 | MRe1. "E4, E-RES" Program (replaced by MA2007e1) | MEID | * | * | * | * | * | * | See MA2007e1 |
| 2 | MRe2 – (New) Expansion Plan of the electricity production system (replaced by MA2007e2 | MEID | 100 | 100 | 100 | 100 | 100 | 0 | Replaced by MA2007e2 |
| 3 | MRe3. Energy Efficiency in Buildings | MEID | 75 | 122 | 119 | 114 | 109 | 0.016 | In 2012, provisional data from January to May. |
| 4 | MRe4. Solar Hot Water for Portugal Program (AQSpP) | MEID | 87 | 145 | 188 | 127 | - | 17.55 | |
| 5 | MAe1. Energy efficiency improvement in the electricity generation sector | MEID | 103 | 112 | 103 | 103 | - | 30.57 | Regarding 2011, estimated data |
| 6 | MAe2. Energy efficiency improvement in the energy supply systems, considering electricity generation from co-generation | MEID | 84 | 87 | 87 | 91 | - | -94.27 | Data from 2012 will be available by the end of the first semester of 2013. |
| 7 | MAe3. Improvement in energy efficiency from the electricity demand-side | MEID | 100 | 128 | 162 | 203 | - | 1,544.59 | Data from 2012 will be available by the end of the first semester of 2013. |
| 8 | MAe4. Promotion of electricity produced from renewable energy sources | MEID | * | * | * | * | * | * | See MA2007e1. |
| 9 | MAe5. Introduction of natural gas in the Autonomous Region of Madeira | RGARM | 0 | 0 | | | | -10 | Implementation postponed – restarting after 2012. |
| 10 | MAr1. Realignment of the tax burden on diesel fuel for heating (residential sub-sector) | MEID | 100 | 0 | 100 | 100 | 100 | -14.00 | |
| 11 | MAs1 Realignment of the tax burden on diesel fuel for heating (services sub-sector) | MEID | 100 | 0 | 100 | 100 | 100 | -59.00 | |
| 12 | MAi1. Increase in tax on industrial fuels | MEID | 100 | 100 | 100 | 100 | 100 | 0 | Objective achieved. |
| 13 | MAi2. Review of the Regulation on the Management of Energy Consumption (RGCE) | MEID | 100 | 100 | 100 | 100 | 100 | 0 | Objective achieved. |
| 14 | MAi3. Incentives to the substitution of fuel oil co-generation by natural gas generation | MEID | 0 | 0 | 100 | 100 | - | -378.00 | Data from 2012 will be available by the end of the first semester of 2013. |
| 15 | MA2007e1 – replacing MRe1 | MEID | 109 | 105 | 112 | 113 | - | 3,069.43 | Provisional data (2011) |
| 16 | MA2007e2 – replacing MRe2 | MEID | - | - | 75 | 75 | - | -48,47 | Started in 2010. Provisional data from 2011. |
| 17 | MA2007e3 – (new) | MEID | - | - | - | - | - | - | Started in 2010. |

| | Policies and Measures | | Monitoring (%) | | | | | Variance $CO_2$ 08-12 (Gg) | Observations |
|---|---|---|---|---|---|---|---|---|---|
| | | | 20082/7/08 | 2009 15/8/10 | 20102/2/11 | 2011 | 2012 | | |
| | **TRANSPORT** | | | | | | | | |
| 18 | MRt1. Auto-Oil Program: Monitoring of the Agreement with Automobile Manufacturers Associations | MEID | 102 | 97 | 94 | 9,698 | | -165.82 | Results from the 1st semester of 2012. |
| 19 | MRt2. Expansion of the Lisbon Metro (ML)- extension of the Blue Line | MEID | 110 | 93 | 108 | 105 | 53 | -3.13 | Results from the 1st semester of 2012. |
| 19 | MRt2. Expansion of the Lisbon Metro (ML)- extension of the Yellow Line | MEID | 81 | 65 | 78 | 71 | 36 | -17.50 | Results from the 1st semester of 2012. |
| 19 | MRt2. Expansion of the Lisbon Metro (ML)- extension of the Red Line | MEID | - | - | 75 | 61 | 30 | -13,90 | Started in 2010. Results from the 1st semester of 2012. |
| 20 | MRt3. Construction of the Metro Sul do Tejo | MEID | 1,65 | 21 | 25 | 25 | 11 | -27,97 | Results from the 1st semester of 2012. |
| 21 | MRt4. Construction of the Oporto Metro (MP) | MEID | 51 | 49 | 47 | 51 | 26 | -73,19 | Results from the 1st semester of 2012. |
| 22 | MRt5. Construction of the Metro Ligeiro do Mondego (MLM) | MEID | - | - | - | - | - | - | Started in 2010 |
| 23 | MRt6. Improve services provided by CP (reduction in travel time) between Lisbon-Oporto | MEID | 115 | 110 | 106 | 96 | 40 | 9,94 | (The $CO_2$ indicator in on review). Results from the 1st semester of 2012. |
| 23 | MRt6. Improve services provided by CP (reduction in travel time) between Lisbon-Castelo Branco | MEID | 76 | 77 | 72 | 53 | 16 | 3,85 | (The $CO_2$ indicator in on review). Results from the 1st semester of 2012. |
| 23 | MRt6. Improve services provided by CP (reduction in travel time) between Lisbon-Algarve | MEID | 101 | 102 | 96 | 78 | 42 | 2,97 | (The $CO_2$ indicator in on review). Results from the 1st semester of 2012. |
| 24 | MRt7. Enlargement of the fleet of vehicles powered by natural gas of CARRIS | MEID | 100 | 120 | 120 | 120 | 120 | -2,74 | Results from the 1st semester of 2012. |
| 24 | MRt7. Enlargement of the fleet of vehicles powered by natural gas of the STCP | MEID | 100 | 100 | 71 | 71 | 71 | -2,90 | Results from the 1st semester of 2012. |
| 25 | MRt8. Incentive Program for the dismantling of End-of-Life Vehicles | MOPTC | - | - | - | - | - | - | See MAt6. |
| 26 | MRt9. Reduction of interurban motorway speeds | MAI | - | - | - | - | - | - | |
| 27 | MRt10. Biofuels Directive (Replaced by MA2007t1) | MEID | - | - | - | - | - | - | See MA2007t1. |
| 28 | MAt1. Reduction of Taxis´ service days | MEID | 95 | - | - | - | - | -2,31 | |
| 29 | MAt2. Enlargement of the fleet of taxi vehicles powered by natural gas | MEID | 3 | - | - | - | 1,5 | -0,47 | |
| 30 | MAt3. Review of the current tax regime on private vehicles | MOPTC | 95 | 92 | 86 | 80 | 72 | - | Without any associated environment efficiency.<br>Results from the 1st semester of 2012. |
| 31 | MAt4. Metropolitan Authority of Lisbon Transports | MEID | 32 | 12 | 26 | 26 | | -178,71 | |
| 32 | MAt5. Metropolitan Authority of Oporto Transports | MEID | - | - | - | - | - | - | |

| | Policies and Measures | | Monitoring (%) | | | | | Variance $CO_2$ 08-12 (Gg) | Observations |
|---|---|---|---|---|---|---|---|---|---|
| | | | 20082/7/08 | 2009 15/8/10 | 20102/2/11 | 2011 | 2012 | | |
| 33 | MAt6. Incentive Program for the dismantling of End-of-Life Vehicles (further objectives) | MOPCT | 726 | 849 | 794 | 59 | 0 | | |
| 34 | MAt7. Regulation on Energy Management in the Transport Sector | MEID | 0 | - | - | - | - | -6,03 | |
| 35 | MAt8. Railway connection to Aveiro Sea Port | MEID | 68 | 30 | - | - | 10 | -43,47 | The length of the Railway Road is here integrated after a Test Phase during the month of April, 2010. Results from the 1st semester of 2012. |
| 36 | MAt9. Motorways of the Sea | MEID | - | - | - | - | - | n/a | Information not available |
| 37 | MAt10. Logistical Platforms | MEID | - | - | - | - | - | n/a | Without any associated environmental efficiency. |
| 38 | MAt11. Restructuring of supply of CP (national railway) service | MEID | 105 | 73 | 65 | 65 | 34 | -320,34 | Results from the 1st semester of 2012. |
| 39 | MA2007t1 replacing MRt10. Biofuels Directive | MEID | 37 | 62 | 51 | 51 | - | -3.031,30 | Provisional data from 2011. |
| | **FORESTRY** | | | | | | | | |
| 40 | MRf1. Program for the Sustainable Development of Portuguese Forests (in the context of IIIFSP) | MAOT | 75 | 75 | 74 | - | - | -2739,53 | Provisional data. |
| 41 | MAf1. Promotion of carbon sink capacity of forests | MAOT | 127 | 127 | 127 | - | - | 645,31 | |
| | **AGRICULTURE** | | | | | | | | |
| 42 | MAg1. Evaluation and promotion of carbon sequestration in agricultural soil | MAOT | 92 | 74 | 79 | - | - | -263,32 | |
| 43 | MAg2. Treatment and energy recovery of livestock waste | MAOT | 0 | 0 | - | - | - | -622 | |
| | **WASTE** | | | | | | | | |
| 44 | MRr1.Directive on Packaging and Packaging Waste | MAOT | 139 | 125 | 147 | 192 | - | - | Without any associated environmental efficiency. |
| 45 | MRr2. Landfill Directive | MAOT | 71 | 64 | 58 | 182 | - | -267,01 | Information not available regarding 2012. |

**Source**: www.cumprirquioto.pt, March 2013
For more information on the applied methodology visit the website

**Table 3.7:**

Referênciação das políticas e medidas do PNAC2006 with the Common and Coordinated Policies and Measures (CCPM)

| Sector | Common and Coordinated Policies and Measures (CCPM) | Policies and Measures (CCPMS) |
|---|---|---|
| Cross-cutting | Integrated pollution prevention and control (IPCC) (Dir 96/61/EC) | MRe5. IPPC Directive (Integrated Prevention and Pollution Control)<br>MRr3. IPPC Directive (Integrated Prevention and Pollution Control) |
| | Emissions trading scheme (Dir 2003/87/EC) | NAP - Portugal |
| | Kyoto Protocol project mechanisms (Dir 2004/101/EC) | No estimation available for this CCPM |
| Energy (supply side) | Electricity production from renewable energy sources (Dir 2001/77/EC) | MRe1. "E4, E-RES" Program<br>MRe4. Solar Hot Water for Portugal Program (AQSpP)<br>MAe1. Energy efficiency improvement in the electricity generation sector<br>MAe4. Promotion of electricity produced from renewable energy sources<br>MA2007e1 – Renewable energy: increase to 45% the goal of electricity generation in 2010 by renewable sources (previously of 39%)<br>MA2007e2 – Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010)<br>MA2007e3 – Co-combustion of biomass: 5% to 10% substitution of the coal in Sines and Pego thermic power plants by biomass or Waste Derived Fuel. |
| | Promotion of cogeneration (Dir 2004/8/EC) | MAe2. Energy efficiency improvement in the energy supply systems, considering electricity generation from co-generation |
| | Internal market in natural gas (Dir 98/30/EC) | MAe5. Introduction of natural gas in the Autonomous Region of Madeira<br>MAi3. Incentives to the substitution of fuel oil co-generation by natural gas generation<br>MRe2 – (New) Expansion Plan of the electricity production system (without changes from MA2007e2)<br>MA2007e2 – Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010) |
| | Taxation of energy products and electricity (Dir 2003/96/EC) | MAr1. Realignment of the tax burden on diesel fuel for heating (residential sub-sector)<br>MAs1 Realignment of the tax burden on diesel fuel for heating (services sub-sector)<br>MAi1. Increase in the tax on industrial fuels |
| | Internal electricity market (Dir 2003/54/EC) | No estimation available for this CCPM |
| | Emissions from large combustion plants (Dir 88/609/EEC) | No estimation available for this CCPM |
| Energy (Consumption side) | Energy performance of buildings (Dir 2002/91/EC) | MRe3. Energy Efficiency in Buildings |
| | End-use efficiency and energy services (Dir 2006/32/EC) | MAe3. Improvement in energy efficiency from the electricity demand-side<br>MAi2. Review of the Regulation on the Management of Energy Consumption (RGCE) |
| | Ecodesign requirements for energy-using products (Dir 2005/32/EC) | No estimation available for this CCPM |
| | Efficiency requirements for new hot-water boilers (Dir 92/42/EEC) | No estimation available for this CCPM |

| Sector | Common and Coordinated Policies and Measures (CCPM) | Policies and Measures (CCPMS) |
|---|---|---|
| | Motor challenge program | No estimation available for this CCPM |
| | Eco-management and audit scheme (EMAS) (Reg No 761/2001) | No estimation available for this CCPM |
| | Energy labelling of household appliances (Dir 2003/66/EC (refrigerators - freezers), 2002/40/EC (electric ovens), 2002/31/EC (air-conditioners), 99/9/EC (dishwashers), 98/11/EC (lamps), 96/89/EC (washing machines), 96/60/EC (washer-driers) and 92/75/EC | No estimation available for this CCPM |
| | energy-efficiency labelling for office equipment (Reg no. 2422/2001) | No estimation available for this CCPM |
| | Efficiency fluorescent lighting (Dir 2000/55/EC) | No estimation available for this CCPM |
| | Voluntary agreement with car manufacturers to reduce specific $CO_2$ emissions (ACEA, KAMA, JAMA) | MRt1. Auto-Oil Program: Monitoring of the Agreement with Automobile Manufacturers Associations |
| **Transports** | Shifting the balance between modes of TRA:, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004) | MRt2. Expansion of the Lisbon Metro (ML)- extension of the Blue Line; extension of the Yellow Line; Red Line<br>MRt3. Construction of the Metro Sul do Tejo (MST)<br>MRt4. Construction of the Oporto Metro (MP)<br>MRt5. Construction of the Mondego Light Metro (MLM)<br>MRt6. Supply changes (reduction in travel time) between Lisbon-Oporto; Lisbon-Castelo Branco; Lisbon-Algarve<br>MAt4. Metropolitan Authority of Lisbon Transports<br>MAt5. Metropolitan Authority of Oporto Transports<br>Mat10. Logistical Platforms<br>MAt11. Restructuring of CP (national railway) supply service |
| | Promotion of Clean and energetically efficient transport vehicles (Dir 2009/33/EC) | MRt7. Enlargement of the fleet of vehicles powered by natural gas of CARRIS and of the STCP<br>MRt8. Incentive Program for the dismantling of End-of-life vehicles<br>MRt9. Reduction of motorway speeds<br>MAt1. Reduction of Taxis´ service days<br>MAt3. Review of the current tax regime on private vehicles to improve energy efficiency on the new automobile national fleet<br>MAt6. Incentive Program for the dismantling of End-of-Life Vehicles (further objectives)<br>MAt7. Regulation on Energy Management in the Transport Sector<br>Mat8. Railway connection to Aveiro Sea Port |
| | Biofuels Directive (Dir 2003/30/EC) | MRt10. Biofuels Directive (applied to the transport sector)<br>MA2007t1 - Biofuels Directive– increase of the 5.75% goal to 10% in 2010 regarding biofuels incorporation tax in the road fuels |
| | Labelling of new passenger cars (Dir 1999/94/EC) | No estimation available for this CCPM |
| | Integrated European railway area (2nd + 3rd Railway package) (COM(2002)18 final) | No estimation available for this CCPM |

| Sector | Common and Coordinated Policies and Measures (CCPM) | Policies and Measures (CCPMS) |
|---|---|---|
| | Environmental performance freight transport (Marco Polo Program) | MAt9. Motorways of the Sea |
| Industrial Waste | HFC emissions from air conditioning in motor vehicles (Dir 2006/40/EC) | No estimation available for this CCPM |
| Agriculture | Support for rural development (Reg (EC) No 1783/2003 amending a number of other Regulations) | MAg1. Evaluation and promotion of carbon sequestration in agricultural soil<br>MAg2. Treatment and energy recovery of livestock waste<br>MAf1. Promotion of forests carbon sink capacity |
| | Nitrates Directive (Dir 91/676/EEC) | No estimation available for this CCPM |
| | Common rules for direct support schemes under CAP (Regulation (EC) No 1782/2003) | No estimation available for this CCPM |
| | Transition to rural development support (Reg (EC) No 2603/1999) | No estimation available for this CCPM |
| | Agricultural production methods compatible with environment (Reg (EEC) No 2078/92) | No estimation available for this CCPM |
| | Aid scheme for forestry measures in agriculture (Reg (EEC) No 2080/92) | MAf1. Promotion of carbon sink capacity of forests |
| | Emission by engines to power agricultural or forestry (Dir 2000/25/EC) | No estimation available for this CCPM |
| | Pre-accession measures for agriculture and rural development (Reg (EC) No 1268/1999) | No estimation available for this CCPM |
| Waste | Packaging and packaging waste (Dir 94/62/EC, 2004/12/EC, 2005/20/EC) | MRr1. Packaging and Packaging Waste Directive |
| | Landfill Directive (Dir 1999/31/EC) | MRr2. Landfill Directive |

Due to the current macroeconomic environment (particularly, the reduction in energy consumption, the increase of energy supply and the funding constraints), Portugal redefined its priorities in terms of energy efficiency and renewable energy targets (Cabinet Resolution 20/2013, of 10th April), through the revision of National Energy Efficiency Action Plan (PNAEE) and National Renewable Energy Action Plan (PNAER).

The integration of these two Plans, PNAEE and PNAER, allows a concerted action for the accomplishment of the national and European energy objectives, minimizing the investment costs and increasing the national competitiveness.

Therefore, aiming to create synergies and facilitating the decision making, the Portuguese Government deliberated to review the PNAEE and the PNAER, taking into account the alignment of their objectives, in function of the primary energy and of the energy contribution impact for the greenhouse gases emissions reduction.

In this context, the main common lines for the revision of the PNAEE and the PNAER were:

- National Plans' objectives in function of primary energy;
- New measures or the reinforcement of the existing measures with lower costs and easy implementation;
- Structured assessment of the measures impacts in each National Plan;
- Joint monitoring system of the National Plans.

Revised objectives of PNAEE and PNAER aim to:

- Meet all the commitments assumed by Portugal, in the context of EU policy;
- Reduce the greenhouse gases emissions;
- Reinforce the diversification of primary energy sources, contributing for the increase of the security of energy supply in the country;
- Increase the energy efficiency in economy, in particular in the Public Administration, contributing for the reduction of public expenditure and for the efficient use of the resources;
- Contribute for the increase of economic competitiveness, through the reduction of the energy consumptions.

**Energy Efficiency Strategy – PNAEE 2016**

The Cabinet Resolution 20/2013 defined a new Energy Efficiency Strategy – NEEAP 2016, which transforms the energy efficiency in a policy priority, taking into account that the energy efficiency increments promote the environmental protection and the energy security with a favorable cost-benefit relation.

The PNAEE 2016 gives continuity to the majority of measures established in PNAEE 2008, including or removing some of the foreseen actions, in function of its stage and potential of implementation relating to its cost. This Plan also includes the measures established under the Energy Efficiency EU Directive.

The main objective of PNAEE 2016 is to project new actions and targets for 2016, in articulation with PNAER 2020, integrating the concerns, related with the reduction of primary energy for 2020, established in the new Energy Efficiency Directive, based on three action axes:

- Adjustment of the energy efficiency measures to the current economic and financial context;
- Monitoring methods, in accordance with the European guidelines and the creation of a macro vision of the impact of the National Energy Efficiency Program;
- Redefinition of PNAEE governance model.

In terms of values, the PNAEE 2016 establishes the following objectives:

**By 2016:**

- Final Energy Savings – 1501 ktoe, corresponding to a reduction of energy consumption of approximately 8.2%, regarding to the average consumption for the period 2001-2005 (18368 ktoe);

**By 2020:**

- Primary Energy Savings, that allows a reduction of 25% in the consumption compared to 2007 (corresponding to a maximum limit of 22.5 Mtoe in the primary energy consumption). The models foresee that Portugal will reach a reduction of 26% in the consumption by 2020, accomplishing the national objective of 25%;
- Moreover, Portugal also established a specific objective for the State Sector of 30% in the reduction of its consumption;

The PNAEE 2016 covers six specific areas: Transports, Residential and Services, Industry, State, Behavior and Agriculture. These areas aggregate ten programs, that integrate several energy efficiency improvement measures, oriented for the energy demand.

**Transport**

Transport include the following energy efficiency improvement measures:

- Eco-Car, that aggregates the measures on energy efficiency improvement in the vehicles;
- Urban Mobility, that covers the measures related with the need to promote the use of collective transports in urban areas;
- Energy Efficiency System in the Transports, that integrates measures, aiming to increase the use of passenger rail networks, as well as to reinforce the energy management of transport fleets.

**Table 3.8**

Measures for the area of Transports

| Programs | Measures |
|---|---|
| **Eco-Carro** | Green taxation – Revision of the taxation regime for private vehicles; Green tire; Mobi.E: Promotion of the acquisition of electrical vehicles. |
| **Urban Mobility** | Promotion of the sustainable mobility and adoption of good practices; Use of transports and mobility solutions more energy efficient |
| **Energy Efficiency System In the Transports** | Supply of passenger rail transport; Regulation of the management of the energy consumptions in the transports; Support of the installation of equipments to fill the tires with nitrogen; Fleet management system and promotion of eco-driving. |

**Source**: DGEG, 2013

**Residential and Services**

Residential and Services includes the following energy efficiency improvement measures:

- Home and Office Renewal, that integrates a set of measures in order to increase the energy efficiency in the lighting, appliances and spaces rehabilitation;
- Energy Efficiency System in the Buildings, that joins the measures which result from the energy certification in the buildings;
- Integration of thermal renewable energy sources/Thermal Solar Energy, regarding the measures on the promotion of a higher integration of renewable energy sources in the residential and services buildings and equipments.

**Table 3.9**
Measures for the area of Residential and Services

| Programs | Measures |
|---|---|
| **Home and Office Renewal** | Promotion of more efficient equipments;<br>Efficient lighting;<br>Efficient window;<br>Efficient insulation;<br>Green heat. |
| **Energy Efficiency System in the Buildings** | Energy certification system in the residential buildings;<br>Energy certification system in the services buildings. |
| **Thermal Solar Energy** | Residential thermal solar energy;<br>Services thermal solar energy. |

**Source**: DGEG, 2013

### Industry

Industry covers a program, designated by Energy Efficiency System in the Industry, that includes the revision of the Management System of Intensive Energy Consumption (SGCIE).

**Table 3.10**
Measures for the area of Industry

| Programs | Measures |
|---|---|
| **Energy Efficiency System in the Industry** | Transversal measures in the SGCIE; Specific measures in the SGCIE; Other sectors of SGCIE |

**Source**: DGEG, 2013

### State

State includes a program designated by Energy Efficiency in the State, with a set of measures associated to the energy certification in the State's buildings, the Energy Efficiency Action Plans under the Energy Efficiency Program in the Public Administration – ECO.AP, the transport fleets of State and the public lighting.

**Table 3.11**
Measures for the area of State

| Programs | Measures |
|---|---|
| **Energy Efficiency in the State** | Energy certification in the State's buildings and energy efficiency management contracts; Energy Efficiency Action Plans in the Public Administration – ECO.AP; More efficient transports in the State; Efficient public lighting |

**Source**: DGEG, 2013

### Behavior

Behavior integrates measures that aim to promote habits and attitudes of energy efficient consumers, such as the recommendation of efficient products, through awareness and communication campaigns.

**Table 3.12**
Measures for the area of Behavior

| Programs | Measures |
|---|---|
| **Communicate Energy Efficiency** | Energy in the schools; Energy in the transports; Energy at home; Energy at work; Smart meters. |

**Source**: DGEG, 2013

**Agriculture**

Agriculture, sector which integrates for the first time the PNAEE designated by Energy Efficiency in the Agrarian Sector, has the purpose of developing actions in order to reduce the energy consumptions.

**Table 3.13**

Measures for the area of Agriculture

| Programs | Measures |
|---|---|
| **Energy Efficiency in the Agrarian Sector** | Energy efficiency in the agrarian sector |

**Source**: DGEG, 2013

***Renewable Energy Strategy – PNAER 2020***

Portugal submitted its first National Renewable Energy Action Plan (PNAER 2010) to the European Commission in 2010.

Following PNAER, Portugal developed a set of solutions in the energy renewable area, in particular, a pilot zone for wave technologies, technology demonstration projects on solar energy, several PV power stations in the South of the country and developed two industrial wind energy clusters in the North.

The Cabinet Resolution 20/2013 defined a new Renewable Energy Strategy – PNAER 2020, aiming to adjust the energy supply to the demand and to review the objective of each renewable energy source in the national energy mix, bearing in mind namely the maturity of the technologies and their competitiveness.

The PNAER 2020 foresees to reduce 18% of the total installed capacity for renewable energy in 2020, in relation to PNAER 2010. The share of electricity produced from renewable energy in PNAER 2020 is higher (59,6% vs 55%), as well as the global target (34,5% against the target of 31%).

**Table 3.14**

Contributions foreseen for each RES in Portugal for 2020 (MW)

| Technologies | Installed Capacity |
|---|---|
| Hydro | 8940 |
| Geothermal | 29 |
| Solar | 720 |
| Tides, waves and oceanics | 6 |
| Wind | 5300 |
| Biomass | 828 |
| **Total** | 15824 |

**Source**: DGEG, 2013

The PNAER 2020 establishes measures for three different sectors: Heating and Cooling, Electricity, Transports.

**Heating and Cooling**

The measures for the sector of Heating and Cooling are:

- Thermal Solar Energy: Promotes the installation of solar thermal systems in the residential sector and in the swimming pools and sporting venues, as well as the renewal of old thermal solar systems;
- Green Heat: Promotes the installation of more efficient energy systems in buildings and better environmental performance;

- Registration of installers of small renewable systems: Creates a national system of registration for installers and small renewable systems (thermal solar energy, heat pumps and biomass systems).

**Electricity**

The measures for the sector of Electricity are:

- General Regime: Introduction of a general remuneration regime;
- Market Facilitator: Operationalization of the market facilitator role;
- Origin Guarantees: Operationalization of the Entity Issuer of Origin Guarantees;
- Biomass Power Plants: Creation of a decentralized biomass power plant network;
- Mini generation: Reformulation and fusion of the current programs of micro generation and mini generation;
- One Stop Shop Electricity: Establishment of procedures of licensing for the renewable power plants;
- National Dam Plan: Development of the new dams, reinforcements of capacity, and installation of pumping systems;
- Offshore Energy Pilot Zone: Operationalization of the pilot zone (S. Pedro de Moel), extending the scope to the offshore wind energy;
- Over-equipment for the Wind Farms: Increase of capacity through the over-equipment of the existing wind farms;
- Appreciation of Forest Biomass: allocation of incentives for the forest biomass power plants.

**Transports**

The measures for the Transport sector are:

- Biofuels: Promotes the use of endogenous resources and waste for the production of biofuels;
- Electric Mobility: Increases the use of electric vehicles.

**Heating and Cooling, Electricity and Transports**

The common measures to the three sectors are:

- European Support Framework 2014-2020: Identifies the need of funding and the adequate instruments to support RES projects;
- Biomethane: Evaluates the potential of the biomethane in Portugal;
- Center of Competences in the area of Biomass: Improves the Biomass Center for Energy;
- Geothermal: Characterizes the national territory in terms of geothermal resources.

## 3.3 Domestic Action and implementation of Kyoto Protocol mechanisms

Portugal`s Performance in the context of the Kyoto Protocol. The Kyoto Protocol establishes that the European Union, as a whole, is obliged to reduce greenhouse gases (GHG) emissions by 8% compared to the numbers registered in 1990. According to a commitment of shared responsibilities at Community level, it was established that Portugal could increase its emissions by 27 % compared to 1990. However, it could not exceed, in the period 2008-2012, the 381.94 million tons of equivalents of $CO_2$ (Mt $CO_2$e), which represents an annual average of 76.39 Mt $CO_2$e .

In terms of limiting GHG emissions, Portugal is currently in compliance with the targets set for 2008-2012. In fact, the most recent data emissions confirm a downward trend since 2005 suggests, which indicates that Portugal will have started a process of decoupling between economic growth and greenhouse gas emissions. In fact, national emissions for the year 2011 were approximately 14.8% higher than in 1990. However, this indicator corresponds to a decrease of 20.5% compared to 2005.

In 2013, as in previous years, Portugal put into practice a revaluation of the variance of achievement for the national targets according to Kyoto. Putting aside land use activities and land use change and forestry (LULUCF), this analysis allows to estimate variance from the Kyoto target in +0.6 Mt $CO_2$e (surplus) with a range that varies from +3.7 Mt $CO_2$e, in a lower emissions scenario and -2,1 Mt $CO_2$e in a higher emissions scenario. According to the accounting of the LULUCF activities, the Kyoto target should be achieved in any of the studied scenarios: the variance is estimated at 20.7 Mt$CO_2$e (surplus of compliance) with an interval ranging from +52.7 Mt $CO_2$e in a lower emissions scenario and greater contribution of LULUCF activities and +6.0 Mt $CO_2$e, in a higher emissions scenario and smaller contribution of LULUCF activities. However, the accounting of LULUCF activities may be subject to adjustments due to international reviews the to the Portuguese adopted methodologies.

The Portuguese Carbon Fund has also a volume of 6.3 Mt $CO_2$e carbon credits to cover any future balance that may be necessary to make taking into account the uncertainty associated with the accounting of LULUCF activities.

Thus, the most recent estimated data concerning the Portuguese achievement trajectory under Kyoto concludes, at this stage, that Portugal will most certainly comply with its target. This is mainly due to a recent steady trend (since 2005) of the decarbonization of the economy, which precedes the current economic crisis.

Since 2005 there are several reasons for emissions reduction, namely:

i. Use of natural gas replacing other more carbon intensive fossil fuels;
ii. Unprecedented penetration of renewable energies;
iii. Beginning of scale penetration of biofuels in transport;
iv. Energy efficiency in the sectors covered by the EU ETS;
v. "Green" tax reform on vehicles;
vi. and finally the present economic crisis (especially in 2009-12).

Since 2001 Portugal has a Climate Change Strategy, a document framing the development of policies in this matter.

The achievement of national targets on climate change under the Kyoto Protocol for 2008-2012 was based on the following key instruments:

i. **The National Program for Climate Change (PNAC)**, which includes a set of policies and measures of sectoral implementation to the reduction of greenhouse gas emissions;
ii. **The National Allocation Plan of Emissions Licenses (PNALE II)** for 2008-2012, which sets out the conditions to which facilities covered by the European trade of GHG emission licenses (ETS) are subject;
iii. **The Portuguese Carbon Fund (FPC)**, a Portuguese state financial instrument for acting on the carbon market to ensure compliance with national targets on climate change issues, making use of the flexibility mechanisms of the Kyoto Protocol and supporting national projects to reduce emissions;
iv. **The National Strategy for Climate Change Adaptation** (ENAAC), structured under the following objective: information and knowledge; reduction of the vulnerability and increase of responsiveness; participation, awareness and promotion; international cooperation.

Additionally, the Portuguese Carbon Fund created a Support Projects Program in Portugal to support projects or groups of projects on national territory that would lead to reductions/ removals of greenhouse gas emissions under the Kyoto Protocol. This way they would be contributing to the achievement of national

targets to combat climate change. Projects approved under this program will allow a reduction/ removal of greenhouse gases emissions around 3 Mt by 2014 of Carbon Sequestration, particularly in Vegetation Control and Biodiverse Grasslands and in the reduction of $N_2O$ emissions in Industry.

The FPC also supports the MOBI.E. project. Phases I and II of the project should be supported by the Innovation Fund Support. The Portuguese Carbon Fund supports the project in its third moment, phase III, which is associated with the construction of the charging network. The potential for reducing $CO_2$ emissions associated with the Program for Electric Mobility in Portugal is estimated at 920 334 t $CO_2$ by 2020.

Public policies on climate change are now an integrated part of a set of sectoral policies in Portugal. In fact, in areas such as energy and industry within the European trade emission licenses, the "carbon dimension" is now part of the strategic and economic considerations of the companies involved. In Agriculture and Forestry there is also a growing awareness about the important contribution that the sector can make to mitigate greenhouse gases emissions. Even in areas with major challenges such as transport, steps are being given in terms of "decarbonization" of fleet vehicles, for instance, the natural gas urban bus fleets or the electric vehicle program.

In this context, it is worth highlighting the contribution of other policy instruments to the reduction of national emissions as is the case of the National Action Plan for Energy Efficiency (PNAEE), the National Plan for Renewable Energy (PNAER), the Program for Electric mobility in Portugal, the Energy Efficiency Program in Public Administration - ECO.AP, among others.

As a Community target, the European Union has established a reduction of at least 20 % of greenhouse gases emissions within the acceding countries. At European level, the sectors covered by the European Emission Trading System must have a reduction emissions of 21 % in 2005 and of 10 % in the remaining sectors.

The effort sharing among Member States was defined by EC Decision no. 406/2009 of 23$^{rd}$ April. Therefore, Portugal should limit, from 2013 to 2020, the increase in greenhouse gas emissions of the sectors that are not covered by the EU ETS to +1 %, compared to 2005 .

Under the Energy Climate Package others targets have been defined, for instance renewable energy sources should make up 20% of the final energy consumption and there should be an increase in energy efficiency of 20 %. Accordingly, Portugal has defined a 31% target for renewable energy sources in final energy consumption, of which 10 % should be in the transport sector.

The XIX Government´s program advocates a substantial improvement in energy efficiency, setting a 30% target for energy efficiency for the country. The Government`s Program also includes the combat to climate change and development of a low carbon economy, investing in mitigation through the reduction of national emissions.

## 3.4 Information on National and Regional Programs and/or Legislation Initiatives, and Coercive Administrative Procedures

Environmental protection is regulated by the Framework Law on the Environment (Law 11/87 of 7 April)[51]. This law postulates a general protection principle which is that all citizens have the right to an ecologically balanced human environment and the duty of protecting it, while the State is entrusted with improving the quality of life, both individual and collective, through the activities of its institutions, as well as through grassroots and community initiatives.

This Framework Law contains a series of clauses on preventive and repressive interventions, concerning the environment, which can be carried out by the Public Administration, such as: articles 33 and 36, on licensing and emergency situations; article 42, on administrative embargos; and article 47, on environmental infractions. In short, the Law defines the institutions responsible for environmental policy and their main types of intervention.

Such law, in coordination with the other sectoral policies, sets the frame for Portugal's climate change policy, namely through national and Community legislation for the implementation of the UNFCCC and the Kyoto Protocol.

As an EU Member State, Portugal is subject to compliance with Community rules, and in particular the extensive body of legislation with relevance to climate change policy, namely the Burden Sharing Agreement (Council Decision 2002/358/EC of 25 April), which determines the GHG emissions limitation objective (following from article 4 of the Protocol), and Decision 280/2004/EC, of the European Parliament and Council, of 11 February 2004, on the creation of a mechanism for monitoring Community GHG emissions and for implementing the Kyoto Protocol. The recently adopted Regulation (EU) n.º 525/2013 of the European Parliament and of the Council of 21 May 2013 (monitoring mechanism regulation – MMR) repealed and replaced this Decision.

## 3.5 Participation at ICAO and IMO Decision-making Process

Portugal has participated regularly and systematically in the discussions on emissions from the international air and maritime transport sub-sectors, both at UNFCCC and Community levels (namely with regard to aviation), as well as in following developments by the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO).

The National Civil Aviation Institute (INAC) is the responsible body for following issues relating to GHG emissions from the international civil aviation sector, ensuring the country's participation at the various international fora, both at the level of the ECCA[52] at the meetings of Director-Generals, and the ICAO, at the plenary sessions of the Assembly.

The Port and Sea Transport Institute (IPTM) has been directly involved in the International Maritime Organisation through meetings of the Marine Environment Protection Committee.

[51] The analysis of the Framework Law on the Environment hereby presented was authored by Professor Dr. Diogo Freitas do Amaral and can be read at http://www.diramb.gov.pt/data/basedoc/TXT_D_9134_1_0001.htm

[52] European Conference on Civil Aviation.

Portugal has ratified the Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL) approving the Decree Law 1/2008 (January the 9th).

## 3.6 Efforts for the Minimization of Adverse Effects

Portugal's contribution to the minimisation of the adverse effects of climate change in other Parties, particularly developing countries, is carried out through a strong commitment to implementing the Convention and the Kyoto Protocol.

As such, the policies and measures implemented, adopted or foreseen in PNAC, targeting the six GHG of the Kyoto Protocol through its broad portfolio of instruments and wide-ranging coverage of all sectors of the economy, make up a significant effort by the Portuguese Government to address climate change, including the minimization of adverse effects of such policies.

In some cases, such as measures pertaining to the diversification of primary energy sources (namely shifting to natural gas), there can simultaneously be positive effects on Portugal's emissions reduction and in the economy of some fossil fuel exporting countries.

## 3.7 Information on the Use of Mechanisms Foreseen in Articles 6, 12 and 17 of the Kyoto Protocol

By the end of 2012, the FPC has budgeted around 124.8 M € (payments amount were around 96.9 M €), corresponding to about 11.8 Mt $CO_2$e. Following a risk analysis[53] of the portfolio funds performed by CECAC fund portfolio, it is estimated that the investments made correspond to about 8.1 Mt $CO_2$e., of which 7.3 Mt $CO_2$e. concerns credits prior to 2012. By the end of 2013 the Carbon Fund had received in its account about 6.8 Mt $CO_2$e.

## 3.8 Information on the Portuguese Registry

Directive 2009/29/EC adopted in 2009, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, the EU Member States who are also Parties to the Kyoto Protocol plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries - in particular Decision 13/CMP.1 and decision 24/CP.8.

The consolidated platform which implements the national registries in a consolidated manner (including the registry of EU) is called Consolidated System of EU registries (EU-ETS R) and was developed together with the new EU-ETS-R on the basis the following modalities:

53 The risk analysis to carbon funds, based on a risk management tool developed by the FPC, has demonstrate a "underperformance" on the capacity of delivery of carbon credits initially planned, in time to be used to satisfy the Kyoto target (2012-13). This trend of "underperformance" carbon funds is cross-cutting to the market and have to do with the fact that CDM projects are subject to significant delays.

1. Each Party retains its organization designated as its registry administrator to maintain the national registry of that Party and remains responsible for all the obligations of Parties that are to be fulfilled through registries;
2. Kyoto transactions are forwarded to and checked by the UNFCCC Independent Transaction Log (ITL), which is responsible for verifying the accuracy and validity of those transactions;
3. The transaction log and registries continue to reconcile their data with each other in order to ensure data consistency and facilitate the automated checks of the ITL;
4. All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other, notably:
   a. With regards to the data exchange, each national registry connects to the ITL directly and establishes a distinct and secure communication link through a consolidated communication channel (VPN tunnel);
   b. The ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes such that those actions cannot be disputed or repudiated;
   c. With regards to the data storage, the consolidated platform continues to guarantee that data is kept confidential and protected against unauthorized manipulation;
   d. The data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries;

In addition, each consolidated national registry keeps a distinct user access entry point (URL) and a distinct set of authorization and configuration rules.

Following the successful implementation of the EU-ETS R platform, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all relevant transaction and holdings data were migrated to the CSEUR platform and the individual connections to and from the ITL were re-established for each Party.

The following changes to the national registry of Portugal have therefore occurred in 2012, as a consequence of the transition to the EU-ETS R platform:

The Portuguese Registry administrator changed the person's name and contact information has been updated, but the entity remains the same.

Cooperation arrangement - The Consolidated System of EU registries was certified on 1 June 2012 and went to production on 20 June 2012.

A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

This description includes:

- Readiness questionnaire
- Application logging
- Change management procedure
- Disaster recovery
- Manual Intervention

- Operational Plan
- Roles and responsibilities
- Security Plan
- Time Validation Plan
- Version change Management

A new central service desk was also set up to support the registry administrators of the consolidated system. The new service desk acts as 2nd level of support to the local support provided by the Parties. It also plays a key communication role with the ITL Service Desk with regards notably to connectivity or reconciliation issues.

The Portuguese local support of service desk is made by a subcontractor.

Database structure and capacity of national registry - In 2012, the EU registry has undergone a major redevelopment with a view to comply with the new requirements of Commission Regulation 920/2010 and Commission Regulation 1193/2011 in addition to implementing the EU-ETS R.

The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the Data Exchange Standards (DES). All tests were executed successfully and lead to successful certification on 1 June 2012.

- Conformance to technical standards - The overall change to a Consolidated System of EU Registries triggered changes the registry software and required new conformance testing. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

During certification, the consolidated registry was notably subject to connectivity testing, connectivity reliability testing, distinctness testing and interoperability testing to demonstrate capacity and conformance to the DES. All tests were executed successfully and lead to successful certification on 1 June 2012.

- Discrepancies procedures - The overall change to a Consolidated System of EU Registries also triggered changes to discrepancies procedures, as reflected in the updated manual intervention document and the operational plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.
- Security - The overall change to a EU-ETS R also triggered changes to security, as reflected in the updated security plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

- List of publicly available information - The following Public information is available on the EUTL site:
  - Account list
  - Transaction info
  - Public Reports and includes:
  - Unit holding permissions

- Account holdings
- Project list
- Annex I & II projects
- Transaction info

Note that representatives names and contact information is confidential, except when account representatives themselves request its disclosure. Some information is only visible after 5 years of the concerned year (Account holdings) and one year after the concerned year (Transaction info).

Internet address - The internet address of the Portuguese registry is:
https://ets-registry.webgate.ec.europa.eu/euregistry/PT/index.xhtml

All generic information about the Portuguese registry can be found at the internet address:
http://www.apambiente.pt/index.php?ref=77&subref=873
http://www.apambiente.pt/index.php?ref=17&subref=295&sub2ref=668

Data integrity measures - The overall change to a Consolidated System of EU Registries also triggered changes to data integrity measures, as reflected in the updated disaster recovery plan. The complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries.

Test results - On 2 October 2012 a new software release (called V4) including functionalities enabling the auctioning of phase 3 and aviation allowances, a new EU ETS account type (trading account) and a trusted account list went into Production. The trusted account list adds to the set of security measures available in the EU-ETS R. This measure prevents any transfer from a holding account to an account that is not trusted.

The previous Annual Review recommendations - Public Information was corrected to reflect the information on SEF tables.

# 4 GREENHOUSE GASES EMISSIONS PROJECTIONS

## 4.1. Summary of GHG Emissions projections

The following sections seek to describe, with the necessary detail, the behavior of the main sub-sectors of the energy and industrial processes, such as the installed capacity, the energy production sector and final energy consumption in buildings (residential and commercial), industry and transport.

In the context of TIMES_PT model, emissions that were not covered by this model, as for example fugitive emissions and fluorinated gases, were estimated based on the results obtained by the activity model, especially in the refining, distribution of petroleum products and natural gas sectors; and by the refrigeration level used in the various sectors. The results were subsequently added to the energy sector ones.

The projections reported are those used in the elaboration of the National Low Carbon Roadmap (RNBC) in 2011. These provide information up to 2050 under different scenarios. Recently in 2013 an update on projection in the context of the National Programme on Climate Change 2020 (PNAC) were undertaken. This work is still ongoing and expected to be concluded in the second quarter of 2014. Nontheless some preliminary results of the updated reference scenario projections are presented in this chapter.

## 4.2. Overview of the projection model

Projection methodology:
The RNBC was built on a set of modeling exercises to the time horizon of 2050 which, on the other hand is supported by the evolution of macroeconomic scenarios in Portugal, results in coherent projections of relevant variables for each study .

The studies to support the RNBC elaboration were launched in 2010 by the Climate Change Commission Executive Committee (CECAC), including a study directed to the energy sector, industrial processes and waste and another dedicated to the agriculture, forestry and land use sectors:

i. The RNBC 2050 - *National Low Carbon Roadmap* - modeling greenhouse gases - energy and waste , developed by E.VALUE - Environment and Economy Studies and Projects, SA, by CENSE - Center for Environmental and Sustainability Research ;
ii. Modeling paths of carbon emissions for agriculture , forestry and land use in Portugal in the coming decades (2010-2050), to support the preparation of the RNBC developed by Agroges - Studies and Projects Society .

The studies took place between July 2011 and March 2012 and were supported in common socioeconomic scenarios. The adopted approach to the construction of future scenarios in national economy did not take into account concrete, plausible to happen in a near future, visions. Instead it chose paths that determine, in an approximate way, e.g. establishing maximum and minimum) a range where the future path of the country will be, with reasonable probability. Political, social or economic rupture elements that may lead to a structural change of the Portuguese economy are not also taken into account. Thus, two national socioeconomic scenarios are studied: a Low scenario and a High scenario, which represent two economic and social contrasting development models :

i. The **LOW SCENARIO** is based on the development model followed in the last 15 years, focusing primarily on investment in non-tradable goods, corresponding to a slow economic growth strongly dependent on the external environment. This continuity implies the maintenance of strategies and of the dominant features of economic agents´ behavior. It is characterized by the maintenance of high levels of the public debt and little ability to attract investment, along with a low level of public confidence in government and markets and low ability to influence and intervene in society on the public opinion part. These factors are visible in the high tax evasion and in low levels of motivation and subsequent low labor force productivity.
ii. The **HIGH SCENARIO** represents a detour in the path and national strategy development, corresponding to the rebirth of the Portuguese economy , translated by an increase of competitiveness and economic restructuring of the country. Therefore the investment in tradable goods translated into a national re - industrialization and a bet on value-added services are of the utmost importance. A highly motivated population with high trust rates catalyzes the State restructuring and the national economy by reducing the values of the grey economy and the public debt. A greater ability to attract investment, together with a skilled population and industry with a high capacity for innovation allow the renovation and modernization of the national industrial fabric. Therefore this scenario requires a more marked economic growth and the modernization of society as well as a human development higher than of the Low Scenario.

The two contrasting scenarios - High and Low scenario - intend to represent, respectively, the upper and lower limit of economic development, to which correspond two contrasting patterns of needs for energy services. While the first scenario has a more bold evolution of GDP (3 %/ year for the 2016-2050 period) and an increase in population, the second is guided by a lower economic growth (1 %/ year for the 2016-

2050 period) and a decrease in the population. These scenarios are not predictions and their contrasting performance attempts to fit a wide range of possible futures, probably contained between the maximum and minimum now modeled. However, the macroeconomic scenarios for 20202 turn out to be very similar.

The referred socio-economic scenarios had as a starting point the work done by the Foresight and Planning Department, of the former MAOT, for 2030 and the New Energy Technology Portugal 2050 study.

In the case of studies related to the **energy sector and industrial processes**, the technologic partial equilibrium model TIMES_PT is adopted to foresee energy demands and related calculation of emissions. This is an optimization model of the entire national energy system validated by national peers. It is loaded with the best available information on the evolution of the technical characteristics and costs of energy technologies and does not include any tax or supporting new technologies policy, basing the decision on the criteria of cost-effectiveness resulting from that information. As for the emissions that were not covered by TIMES_PT model, like fugitive emissions and fluorinated gases, they were not imposed any emissions reduction target. However, these emissions were estimated based on the results obtained by the activity model, especially in the refining, petroleum products distribution and natural gas areas , and the refrigeration level used in the various sectors.

In the study of agriculture, forestry and land use alternative scenarios were built for the future development of agriculture and forestry in Portugal (again considering a High scenario and a Low scenario) based on a set of key factors for the sector, such as:

i. The macroeconomic and financial environment;
ii. The future behavior of the world prices of products and agricultural and forestry production factors;
iii. The result of on-going multilateral negotiations (the Doha Round) and bilateral (EU / MERCOSUR) within the international trade of agricultural products;
iv. The future of public policies with impact on agriculture and forestry in Portugal;
v. The technology evolution.

The High and Low scenarios correspond, respectively, to a very positive and negative expectation for the sector and were built based on the predictable evolution of the future economic viability of the existing agricultural holdings.

Regarding **waste and wastewater**, the results globally used were the ones underlying socioeconomic scenarios that have direct effects on the quantification of activity levels in various sectors. The construction of the high and low scenarios is supported by a series of assumptions about the possible evolution of treatment and final disposal systems. As in previous studies, they correspond, respectively, to a more or less rapid introduction of certain practices or technologies that will determine emissions of this sector.

The integration of the two partial studies for the construction of low-carbon paths was done from its final results and it comes, in essence, from the juxtaposition of the Low and High scenarios produced in each of these studies, thus defining the paths of total national emissions.
Note that the national totals do not include the results on land use and land use change since they have their own accounting rules and, as such, cannot simply be added to the results of the remaining sectors[54]. These

[54] These accounting rules were defined for the first commitment period (2008-2012), being different from those recently approved for implementation in 2013-2020. There are no accounting rules for land use for the post-2020 period. The results are, for the measurement of goals, strongly influenced by accounting rules adopted each period.

results were calculated but are going to be presented in separate tables and graphics. These should not, for the purposes of analysis, be added to the other emission categories.

For the purpose of this report, the results used to 2020 are related to the RNBC of the **ET_CBSM**, which are based on CBSM scenario regarding the energy sector and industrial processes (without any limit emissions) in conjunction with Low scenario of waste and agriculture sectors.

**Emissions projections to 2050 under the Low Carbon Roadmap**

The evolution of total emissions of greenhouse gases by 2020 is illustrated in Figure 4.1 comprising:

1. Total historical emissions 1990-2010;
2. Emissions from the energy sector (combustion and industrial processes) directly accounted by the TIMES_PT model;
3. Fugitive emissions from fuels;
4. Emissions arising from manufacturing and use of fluorinated gases;
5. Emissions from the agriculture sector;
6. Emissions from the waste sector (including wastewater).

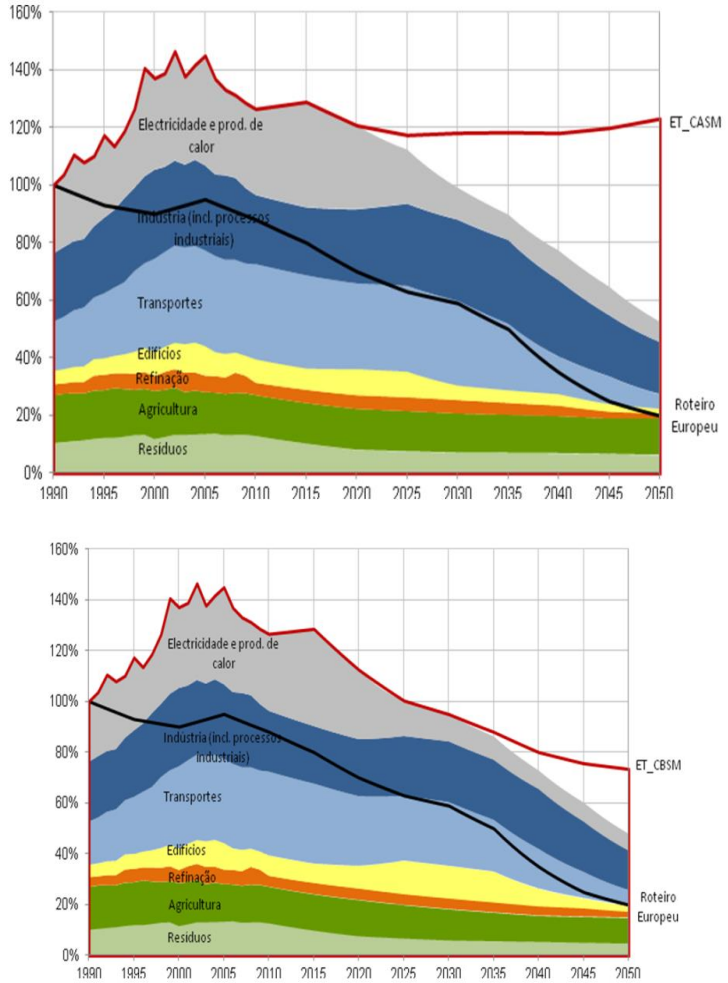



**Figure 4.1**

**Description of the TIMES_PT model**

The TIMES_PT is a technological model of linear optimization which results from the implementation of a generation of economy – energy – environment optimized models, with a TIMES[55] technology base, in Portugal.

The generic structure of TIMES can be adapted by each user to simulate a specific energy system, at local system national or multi-regional. TIMES_PT was initially developed under the European Project NEEDS, integrating a Pan European TIMES model used to estimate total European costs (including externalities) of energy production and consumption. The ultimate goal of any TIMES is to satisfy the demand for energy services at the minor cost. In order to do that, investment options and the operation of some technologies, as well as the primary energy sources and energy exportations and importations, according to the following equation:

$$NPV = \sum_{r=1}^{R} \sum_{y \in YEARS} (1 + d_{r,y})^{REFYR-y} \bullet ANNCOST(r, y)$$

NPV: actualizes net value of total costs
ANNCOST: annual total cost
d: actualization rate
r: region
y: years
REFYR: reference year for the actualization
YEARS: years in which costs exist (all costs for the modeling period + past years when costs where defined for past investments + the number of years after technology life time, in case there are decommissioning costs)

For each year, the TIMES models calculate the current sum of the total costs, expect the income. In the case of TIMES_PT model, the costs taken into account are the investment, operation and maintenance costs (fixed and variable) of the various production technologies and energy consumption. The Income usually considered in TIMES models include subsidies and materials recovery, which are not considered in the TIMES_PT model. More information about TIMES development and their equations can be obtained in [ 7 ] .

The TIMES_PT model represents the Portuguese energy system from 2000 to 2050, including the following sectors:

1. Primary energy supply (refining and synthetic fuels production, import and local resources);
2. Electricity production;
3. Industry (cement, glass, ceramics, steel, chemical, paper and pulp, lime and other industrials);
4. Residential;
5. Commercial and Services;
6. Agriculture , forestry and fisheries (only the energy consumption), and
7. Transport.

In each sector the monetary, energy and materials fluxes are modeled according to the various production technologies and energy consumption, including mass balances for some industry sectors.

The simplified structure of the TIMES_PT model is shown in figure X, as well as its main inputs and outputs.

[55] TIMES is an acronym for *The Integrated Markal-EFOM System.* Both Markal - *Market Allocation* and EFOM - *Energy Flow Optimization Model* are based technology energy models developed by the IEA in the 80s and 70s, respectively. This model was developed by ETSAP (*Energy Technology Systems Analysis Program*) of the International Energy Agency.

The implementation of TIMES_PT requires a set of exogenous inputs, namely:

1. Demand for energy services;
2. Technologies' technical and economic characteristics for the base year and the future (e.g. efficiency, input/output ratio, availability, investment, operation and maintenance costs and actualization rate);
3. Availability of primary energy sources in the present and in the future, especially the potential for the use of endogenous energy resources, and
4. Policy restrictions (e.g. energy production targets or reduction of emissions).

Based on these elements, it is possible to obtain from the TIMES_PT model a series of outputs, such as:

1. Inherent costs to the energy system;
2. Energy flows inherent to each sector;
3. Technological options, including the installed capacity in the electricity production sector;
4. Energy imports and exports;
5. Use of indigenous resources, and
6. Emissions by sector.

Presently emissions considered by the model include the GHG emissions generated by combustion and industrial processes, and do not include fugitive emissions associated with the production, storage and distribution of fossil fuels and emissions of F-gases.

Note that the TIMES, being a partial equilibrium model, does not consider the economic interactions outside the energy sector, as for instance the implications in the activity of other economy sectors (e.g. impact of wind energy in the metal sector) or the implications in the activity of national sectors dictated by changes in international demand for their goods or services. Furthermore, the TIMES model does not take into account irrational aspects that influence investment in new and more efficient technologies, e.g. motivated by aesthetic preferences or social status which mainly occurs in the acquisition of end-use technologies. Thus, the model assumes that agents have perfect knowledge of the market, present and future. Finally it should be emphasized that the based technology models such as the TIMES_PT do not accommodate market decisions based on price, instead they make choices based whether technologies or energy resources costs. For this reason, the solutions found show the best options in terms of cost - effectiveness and hence competitiveness, *lato sensu*.

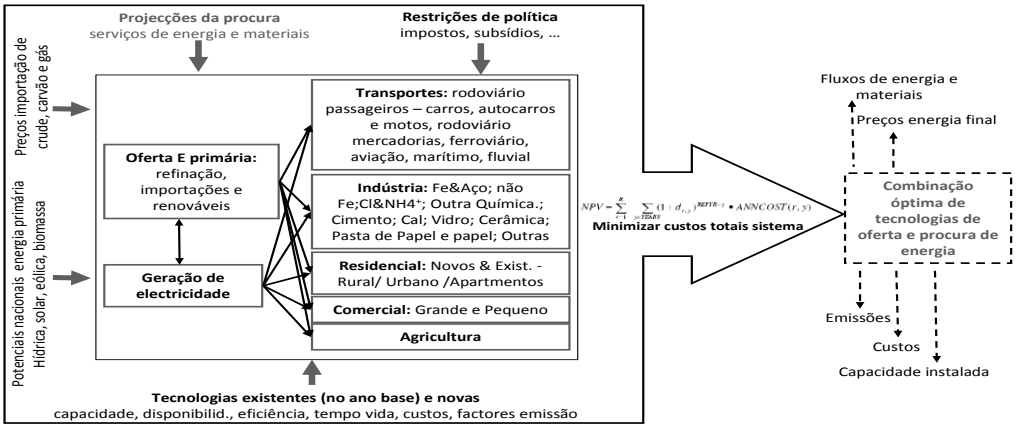



**Figure 4.2**
Simplified structure of the TIMES_PT
**Source**: RNBC

### 4.2.3. Emissions and Removals of Land Use and Land Use Change

With regards to baseline values for calculating emissions, the inventories used were the National Forestry Inventory, of the National Forestry Authority, and the various Agricultural Census of the National Statistics Institute. These values differ from the information base used in the National Emissions Inventory, 2011, and are therefore only presented in the 2009-2020 series since the historical data (1990-2009) are not directly comparable[56].

Note also that, contrary to what happens in all other sectors, there are special rules for this sector in what regards emissions and sequestration, which in practice mean that the values reported in the inventory cannot be simply added to the remaining sectors. How much of this sink is going to be used for compliance with emissions reduction targets will still be the subject of international negotiation, reason why any scenario about these rules would be, at this stage, purely speculative[57].

Therefore the objective of this sub - study was to realize, in a first place, how the "sink sign" evolves over time based on established scenarios, e.g., answering the question: Will the land use sector be a bigger or smaller carbon dioxide liquid sink compared to what it was in 2009 ?

The methodology used in the estimation of future forestry areas was based on the work of GEOTERRA, and Integrated Services and Studies, Ltd. and supplemented by numbers provided by the National Forestry Authority, regarding rates of regeneration of burnt areas, conversion rates of bushes into populations and forestry fire data by populations in the last decades.

Portugal´s area was classified according to four categories: forestry, agricultural crops, pastures, and other areas. Due to the lack of information the emissions/ sequestration occurred in the ARM and the ARA were not estimated. On the other hand, emissions from forest fires were also estimated.

In both scenarios, the land use and land use change sector will remain responsible for the liquid sequestration of greenhouse gases.

### 4.2.4 . Waste and wastewater

In the national context, the recent National Waste Management Plan (PNGR) presents itself as a strategic document to guide policy for waste management for the next years and to inform about the development of specific sectoral plans, in a more detailed way (PERSU II , PESGRI , [ ... ]). The PNGR presents a clear vision regarding waste management: "To promote an integrated waste management in the lifecycle of products, centered in a circular economy which should guarantee a greater efficiency in the use of natural resources."

In the development of sectoral policy options, Portugal will necessarily have to deepen the analysis on options and technologies (low carbon), costs, *trade-offs* and uncertainties.

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[56] The National Emissions Inventory provisionally used areas by Land Use surveys made by *Corine Land Cover*. This information base still not have all mandatory report requirements. However, there are some ongoing projects aimed at the production of official information on this matter, already used for 2013 submission. In this context and because the results of these studies are not yet available, it was an AGRO.GES option to directly use the results of the agricultural census and national forestry inventories for this study.

[57] For example, in Portugal, and in the 2008-2012 period, are only usable to meet targets for reducing emissions of around 800,000 tons / year of $CO_2$ sequestration, even though the actual sequestration of forestry management in Portugal is much higher.

At the moment there are two perspectives on emissions related to waste management issues that begin to juxtapose: a sectoral approach and a lifecycle approach. While the first is now essential to monitor emissions and respond to international commitments (e.g. Kyoto Protocol), it begins to become clear that the latter is the preferred approach for the evaluation of policies for waste management in the medium and long term, and in an integrated perspective.

**Activity levels**

Note that in 2009 the selective collection reached the 101 kg per capita, in Portugal, while the EU27 average exceeded 200 kg per capita.

The management scenario, which has great options like the ground deposition (DEP DIR), the selective collection (RS and RSM RUB), the mechanical and biological treatment (MBT) and energy recovery (VAL ENE) is associated to the biological treatments (CC and CA) from two sources (selective and undifferentiated) collection, and three great sub products are generated: recyclable - REC (from selective collection, BMR and energy recovery), CDR (from the selective collection and BMR) and Compound - COMP (from MSW and RUB).

**Table 4.1**

Production and management scenarios of MW

| | 2005 | 2010 | | 2020 | |
|---|---|---|---|---|---|
| | | LS | HS | LS | HS |
| **Prodution MW (kt)** | 4,766 | 5,369 | 5,352 | 4,863 | 4,593 |
| ***per capita (kg)*** | *457* | *509* | *507* | *460* | *422* |
| **DEP DIR (kt)** | 2,838 | 3,180 | 3,141 | 1,118 | 785 |
| **%** | *60%* | *59%* | *59%* | *23%* | *17%* |
| **RSM (kt)** | - | 481 | 481 | 924 | 873 |
| **%** | - | *9%* | *9%* | *19%* | *19%* |
| **RS RUB (kt)** | - | 109 | 109 | 438 | 413 |
| **%** | - | *2%* | *2%* | *9%* | *9%* |
| **TMB (kt)** | - | 527 | 527 | 1,313 | 1,240 |
| **%** | - | *10%* | *10%* | *27%* | *27%* |
| **VAL ENE (kt)** | - | 1,072 | 1,094 | 1,070 | 1,282 |
| **%** | - | *20%* | *20%* | *22%* | *28%* |

DEP DIR - Direct Deposition in landfill| RSM - Selective Collection of Materials| RS RUB - Selective Collection of Organic TMB - Biological and Mechanical Treatment| VAL ENE - Energy Recovery

**Industrial waste**

It is estimated a IW production around 25 Mt|39 Mt (Low|High scenario), of which about 2% are typologies related to organic waste that will deposition as a final destination.

Values were calculated based on the evolution of GVA in industry, and measured by minimum (Low Scenario: €100 kg/103) and maximum (High Scenario: 80 kg/103 €) thresholds of waste production of GDP per unit.

**Municipal wastewater**

The scenarios present the production of domestic wastewater, expressed in terms of organic load (BOD5 t). The scenarios differ fundamentally in the quantitative organic load to deal with. The distribution by types of management / treatment was defined based on the information framework, for 2009, of the INSAAR (National Inventory of Water Supply and Wastewater Treatment) and on the general assumption of an increase in secondary and tertiary treatments that will involve a transfer of charge from the liquid phase to muds, inducing a greater potential for GHG emissions (anaerobic treatments).

**Table 4.2**

Domestic wastewater: activity levels

| *t CBO5* | 2005 | 2010 | 2020 | |
|---|---|---|---|---|
| | | | LS | HS |
| **Without Draining** | 62,815 | 42,189 | 18,515 | 19,074 |
| **With Draining (disposals without/ treatment)** | 17,131 | 12,701 | 4,629 | 4,768 |
| **Collective septic tanks** | 11,421 | 6,942 | 6,942 | 6,942 |
| **Primary Treatments** | 16,446 | 20,116 | 14,623 | 14,972 |
| **Secondary/Terciary Treatments** | 75,334 | 107,908 | 125,796 | 129,935 |
| **Mud Treatment** | 45,270 | 41,318 | 60,932 | 62,732 |
| **Total** | 228,417 | 231,173 | 231,436 | 238,423 |

**Industrial wastewater**

The production scenarios of industrial wastewater, expressed in terms of chemical load (tCQO) and population equivalents (PE), refer to the following sectors:

a) food and beverages;
b ) textile;
c ) Fur and leather;
d ) wood and wood products;
e) chemical industry, and
f ) petrochemical refineries.

It is estimated that the production of industrial wastewaters, expressed in population equivalents, is between 34 to 51 million (Low | High scenario) .

**Sector emissions**

Compared to 1990, there were reductions between -25 % | -22 % compared to 1990 (scenarios Low | High)

**Pre -2005 emissions**

Due to the type of the emissions associated to ground deposition (methane as the main constituent of biogas production and whose emission is delayed in time) the representativeness of the emissions associated to quantitatives grounded before time (pre -2005 emissions) was assessed.

The estimated contribution of emissions associated to (CRF 6A), prior to 2005, to total emissions from the waste sector is, in 2020, estimated at about 17%, decreasing gradually .

**Trade -off sector**

Development scenarios and the methodology employed in the sector (sectoral approach) involve a significant emissions trade-off (between 1.0 and 1.14 Mt $CO_2$e) associated with energy recovery from MSW and RDF. It should be noted that, on the other hand, other transfers will occur with a positive impact on other sectors (e.g. materials and compound) whose quantification is only possible through a lifecycle approach .

**Contribution of subsectors**

Between 2010 and 2020 it is estimated a change in the contribution of various sectors. Overall the emissions associated to waste disposal (6A1 and 6A2), where most significant reductions should occur, lose weight for energy recovery (6C/1A1) and for wastewater management (6B1 and 6B2).

**Emissions projection 2030 under the PNAC2020**

In 2013, new projections were undertaken in the context of the work of PNAC2020 that update the emission projection scenarios, considering all adopted and implemented policies until the 1st of September 2013. The projection parameters used are shown in Table xx. No update work was undertaken on LULUCF.

**Table 4.3**

Projection parameters (required if used in projections)

| Activity | Suggested units | Units reported | Historic values | | | | | Scenario 'with existing measures' | | | | Scenario 'with additional measures' | | | | | Member State notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2010 | 2015 | 2020 | 2025 | 2030 | |
| **General economic parameters** | | | | | | | | | | | | | | | | | EUR 2006 (constant prices). |
| 1a. Gross Domestic Product | Value (€) GDP at constant prices (not derived from purchasing power parity). | euros 2000 | 94005746940 | 103429783535 | 127316906127 | 132674719345 | 136372236885 | 129515863113 | 141738694264 | 164313993585 | 190484952808 | 136372236885 | 129515863113 | 141738694264 | 164313993585 | 190484952808 | Historical: INE (2013). Produto Interno Bruto. Instituto Nacional de Estatistica; until 2018: IMF (2013). World Economic Outlook. International Monetary Fund. "018-2030: RNBC (2012). Roteiro Nacional de Carbono. |
| 1b. Gross domestic product growth rate | Annual growth rate (%) | % | | 1,9% | 4,2% | 0,8% | 0,6% | -1,0% | 1,8% | 3,0% | 3,0% | 1,7% | -1,0% | 1,8% | 3,0% | 3,0% | |
| 2a. Population | Thousand people | Thousand people | 9877 | 10043 | 10257 | 10503 | 10573 | 10552 | 10566 | 10579 | 10677 | 10573 | 10552 | 10566 | 10579 | 10677 | INE. 2009. Projecções de população residente em Portugal 2008-2060. Instituto Nacional de Estatística. March 2009. Lisbon; INE, CENSOS 2011. |
| 2b. Population growth rate and base year value | % of value | % of value from 1990 | | 2% | 4% | 6% | 7% | 7% | 7% | 7% | 8% | 7% | 7% | 7% | 7% | 8% | |
| 3. International coal prices | € per tonne or GJ (Gigajoule) | €2000/GJ | 1,3 | 1,2 | 1,1 | 2,1 | 2,5 | 2,6 | 2,7 | 2,7 | 2,8 | 2,5 | 2,6 | 2,7 | 2,7 | 2,8 | IEA, ETP2012 - Energy Technology Perspectives 2012 |
| 4. International oil prices | € per barrel or GJ (Gigajoule) | €2000/GJ | 2,9 | 2,4 | 5,3 | 8,5 | 8,3 | 9,8 | 11,6 | 12,1 | 12,4 | 8,3 | 9,8 | 11,6 | 12,1 | 12,4 | IEA, ETP2012 - Energy Technology Perspectives 2013 |
| 5. International gas prices | € per $m^3$ or GJ (Gigajoule) | €2000/GJ | | | 5,5 | 6,5 | 4,3 | 5,2 | 6,2 | 6,8 | 7,4 | 4,3 | 5,2 | 6,2 | 6,8 | 7,4 | IEA, ETP2012 - Energy Technology Perspectives 2014 |

**Global BAU**

"Global BAU" is based on the specific carbon intensity of sectors 1 (Energy), 2 (Industrial Processes); 4 (Agriculture); and 5 (Waste) in 1990. Real emissions and GDP data come from the Portuguese NIR (APA, 2013) and Pordata (2013).

The estimation of "Global BAU" up to 2030 is based on GDP estimates (3% growth per year). Given its dependency of GDP projections, this methodology is considered to be sufficiently robust up to 2020.

**Sectoral BAUs**

Sectoral BAUs are based on 2010 energy intensity *(Ci/Px*) where *Ci* represents the 2010 consumption of each fuel by each sector (*i*) and *Px* represents 2010 energy demand, pKm, tKm or industrial production.

The same pattern of energy consumption of 2010 is then projected up to 2030 on the basis of the estimated evolution of the same indicators, as used in the TIMES_PT model.

Energy intensity per fuel are then multiplied by a specific emission factor (fuel and GHG) to obtain the annual carbon intensities and annual emissions.

The following tables and graphs illustrate the results of the methodology used and compare BAU emissions with actual and projected with measures emissions.

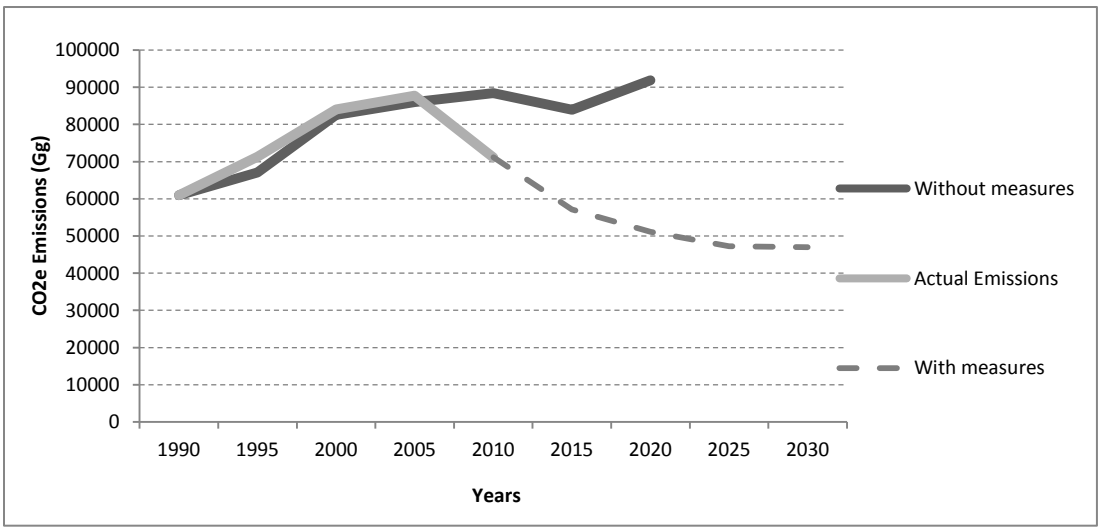



**Figure 4.3**

**Table 4.4**

Global BAU

| | GHGs Source Categories | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CO2 equivalent (Gg) | | | | | | | | |
| **Without Measures (base 1990)** | 1,2 - Energy, Industrial Processes | 46,799 | **51,491** | **63,382** | **66,050** | **67,890** | **64,477** | **70562** | | |
| | 4 - Agriculture | 8,160 | **8,978** | **11,052** | **11,517** | **11,838** | **11,242** | **12,303** | | |
| | 6 - Waste | 5,995 | **6,596** | **8,119** | **8,461** | **8,697** | **8,260** | **9,039** | | |
| | | 60,954 | 67,065 | 82,553 | 86,027 | 88,425 | 83,979 | 91,904 | | |
| **Actual Emissions** | 1,2 - Energy, Industrial Processes | 46,799 | 56,048 | 67,740 | 71,913 | 55,732 | | | | |
| | 4 - Agriculture | 8,160 | 8,181 | 8,693 | 7,743 | 7,517 | | | | |
| | 6 - Waste | 5,995 | 7,065 | 7,572 | 8,047 | 7,907 | | | | |
| | | 60,954 | 71,294 | 84,005 | 87,703 | 71,156 | | | | |
| | | | 6% | 2% | 2% | -20% | | | | |
| **REF (with measures)** | 1,2 - Energy, Industrial Processes | | | | | 55,732 | **49,480** | **43,775** | **40,101** | **40,047** |
| | 4 - Agriculture | | | | | 7,517 | **7,297** | **7,078** | **6,893** | **6,708** |
| | 6 - Waste | | | | | 7,907 | **354.22** | **301.48** | **286.56** | **259.33** |
| | | | | | | 71,156.00 | 57,131.79 | 51,153.58 | 47,279.77 | 47,013.50 |

**Table 4.5**

Sectoral BAUs (without measures)

| GHGs Source Categories | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| | CO2 equivalent | | | | |
| **Public Electricity and Heat production** | **12,234.4** | **13,363.1** | **14,097.8** | **15,162.2** | **16,312.9** |
| CO2 | 12,119.5 | 13,237.6 | 13,965.4 | 15,019.9 | 16,159.8 |
| N2O | 108.4 | 118.4 | 124.9 | 134.4 | 144.6 |
| CH4 | 6.5 | 7.1 | 7.4 | 8.0 | 8.6 |
| **Petroleum Refinary** | **2,315.8** | **2,790.5** | **2,511.5** | **2,511.5** | **2,511.5** |
| CO2 | 2,302.5 | 2,774.5 | 2,497.0 | 2,497.0 | 2,497.0 |
| N2O | 12.0 | 14,4 | 13.0 | 13.0 | 13.0 |
| CH4 | 1.4 | 1.6 | 1.5 | 1.5 | 1.5 |
| **Agriculture/Forestry/Fisheries** | **1,422.8** | **1,652.2** | **1,736.3** | **1,888.9** | **2,056.1** |
| CO2 | 1,125.1 | 1,346.5 | 1,408.9 | 1,517.8 | 1,635.1 |
| N2O | 91.0 | 106.8 | 111.8 | 121.3 | 131.8 |
| CH4 | 206.6 | 198.9 | 215.6 | 249.8 | 289.3 |
| **Commercial/Institutional** | **1,255.9** | **1,191.2** | **1,268.0** | **1,386.2** | **1,499.9** |
| CO2 | 1,248.2 | 1,183.9 | 1,260.3 | 1,377.7 | 1,490.8 |
| N2O | 6.6 | 6.3 | 6.7 | 7.3 | 7.9 |
| CH4 | 1.0 | 1.0 | 1.0 | 1.1 | 1.2 |
| **Transports (without aviation and marine)** | **17,768.3** | **17,556.1** | **18,852.0** | **20,029.4** | **21,335.6** |
| CO2 | 17,425.4 | 17,218.1 | 18,484.1 | 19,634.3 | 20,910.4 |
| N2O | 304.0 | 299.7 | 325,7 | 349.3 | 375.5 |
| CH4 | 38.9 | 38.2 | 42.2 | 45.8 | 49.8 |
| **Residential** | **2,743.0** | **2.622.3** | **2,825.9** | **2,987.5** | **3,196.6** |
| CO2 | 2,497.0 | 2.387.1 | 2,572.5 | 2,719.6 | 2,909.9 |
| N2O | 57.75 | 55.21 | 59.49 | 62.90 | 67.30 |
| CH4 | 188.2 | 180.0 | 193.9 | 205.0 | 219.4 |
| **Manufacturing Industries and Construction and Industrial Processes** | **13,771.9** | **11,983.9** | **12,413.7** | **12,622.5** | **12,661.2** |
| CO2 | 13,308.9 | 11,571.3 | 11,979.4 | 12,142.2 | 12,129.8 |
| N2O | 392.3 | 348.3 | 366,9 | 406.0 | 449.4 |
| CH4 | 70.7 | 64.3 | 67.4 | 74.3 | 82.0 |
| **Waste** | **368.3** | **358.1** | **376.1** | **397.9** | **423.5** |
| CO2 | 18.0 | 17.0 | 19.0 | 21.0 | 23.0 |
| N2O | 2.0 | 2.0 | 2.0 | 2.3 | 2.5 |
| CH4 | 348.3 | 339.1 | 355.1 | 374.6 | 398.0 |
| **Total** | **51,880.3** | **51,517.5** | **54,081.4** | **56,986.1** | **59,997.4** |
| CO2 | **50,044.7** | **49,736.1** | **52,186.6** | **54,929.5** | **57,755.8** |
| N2O | **872.1** | **839.8** | **893.0** | **970.2** | **1,056.0** |
| CH4 | **861.6** | **830.1** | **884.2** | **960.1** | **1,0497** |

***Notes**:*

*2010 was a very wet year (HPI=1,31).*

*2010 emissions for final energy end use sectors are a result of the final energy consumption by fuel reported by DGEG Energy Balance and generic Emission factors by fuel.*

*2015-2030 emissions are a result of the 2010 energy intensity combined with each sector energy demand growth (e.g. pKm, residential energy demand, services energy demand)*

*3 .Solvent and Other Product Use emissions are not considered.*

*HFCs, PFCs and SF6 emissions are not considered since it was impossible to build a consistent BAU scenario (without measures) based on 1990/1995 emissions*

*B. Fugitive Emissions from Fuels are not considered*

**Table 4.6**

Sectoral BAUs (with measures)

| GHGs Source Categories | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| | CO2 equivalent | | | | |
| **Public Electricity and Heat production** | **12,234.4** | **14,385.0** | **7,980.0** | **4,736.1** | **5,398.7** |
| CO2 | **12,119.5** | 14,323.8 | 7,926.3 | 4,680.1 | 5.336.2 |
| N2O | **108.4** | 56.1 | 49.2 | 51.0 | 57.0 |
| CH4 | **6.5** | 5.1 | 4.5 | 5.0 | 5.5 |
| **Petroleum Refinary** | **2,315.8** | **2,044.6** | **1,911.5** | **1,991.1** | **1,326.9** |
| CO2 | **2,302.5** | 2,029.0 | 1,898.2 | 1,977.6 | 1,315.2 |
| N2O | **12.0** | 14.5 | 12.1 | 12.3 | 10.9 |
| CH4 | **1.4** | 1.2 | 1.1 | 1.2 | 0.8 |
| **Agriculture/Forestry/Fisheries** | **1,422.8** | **1,330.0** | **1,373.7** | **1,459.3** | **1,551.8** |
| CO2 | **1,125.1** | 1,046.0 | 1,094.5 | 1,179.1 | 1,270.2 |
| N2O | **91.0** | 86.1 | 89.4 | 95.3 | 101.7 |
| CH4 | **206.6** | 197.9 | 189.8 | 184.9 | 179.9 |
| **Commercial/Institutional** | **1,255.9** | **886.8** | **856.3** | **886.5** | **984.7** |
| CO2 | **1,248.2** | 877.1 | 848.3 | 878.5 | 968.7 |
| N2O | **6.63** | 7.2 | 7.7 | 7.7 | 8.1 |
| CH4 | **1.0** | 2.6 | 0.3 | 0.3 | 8.0 |
| **Transports (without aviation and marine)** | **17,768.3** | **15,683.7** | **15,437.4** | **15,217.8** | **15,005.5** |
| CO2 | **17,425.4** | 15,458.2 | 15,125.7 | 14,883.8 | 14,660.1 |
| N2O | **304.0** | 196.9 | 286.5 | 308.0 | 319.7 |
| CH4 | **38.9** | 28.6 | 25.2 | 26.0 | 25.7 |
| **Residential** | **2,743.0** | **1,625.8** | **1,766.8** | **1,723.0** | **1,696.7** |
| CO2 | **2,497.0** | 1,365.2 | 1,454.7 | 1,544.2 | 1,506.5 |
| N2O | **57.7** | 59.6 | 69.7 | 42.6 | 45.1 |
| CH4 | **188.2** | 201.0 | 242.4 | 136,2 | 145.2 |
| **Manufacturing Industries and Construction and Industrial Processes** | **13,771.9** | **12,514.5** | **11,289.9** | **12,323.0** | **12,401.3** |
| CO2 | **13,308.9** | 12,282.9 | 11,061.4 | 12,078.1 | 12,167.6 |
| N2O | **392.3** | 175.1 | 175.2 | 197.0 | 185.8 |
| CH4 | **70.7** | 56.5 | 53.3 | 47.9 | 47.8 |
| **Waste** | **368.3** | **354.2** | **301.5** | **286.6** | **259.3** |
| CO2 | **18.0** | 13.7 | 13.7 | 13.7 | 13.7 |
| N2O | **2.0** | 2.0 | 2.0 | 2.3 | 2.5 |
| CH4 | **348.3** | 338.5 | 285.7 | 270.5 | 243.1 |
| **Total** | **51,880.3** | **48,824.7** | **40,917.0** | **38,623.3** | **38,6249** |

**Notes***:*

*2010 was a very wet year (HPI=1,31). For the projections a average HPI (0,92) year is used.*

*2010 emisisons for final end use sectors are a result of the final energy consumption by fuel by sector reported by DGEG Energy Balance and generic Emission factors by fuel. 2010 emissions for refinary and elc are as reported by NIR, 2013*

*2015-2030 emissions are a result of TIMES PT model for energy and own calculations for Waste and non energy Agriculture*

*3 .Solvent and Other Product Use emissions are not considered.*

*HFCs, PFCs and SF6 emissions are not considered since it was impossible to build a consistent BAU scenario (without measures) based on 1990/1995 emissions*

*B. Fugitive Emissions from Fuels are not considered*

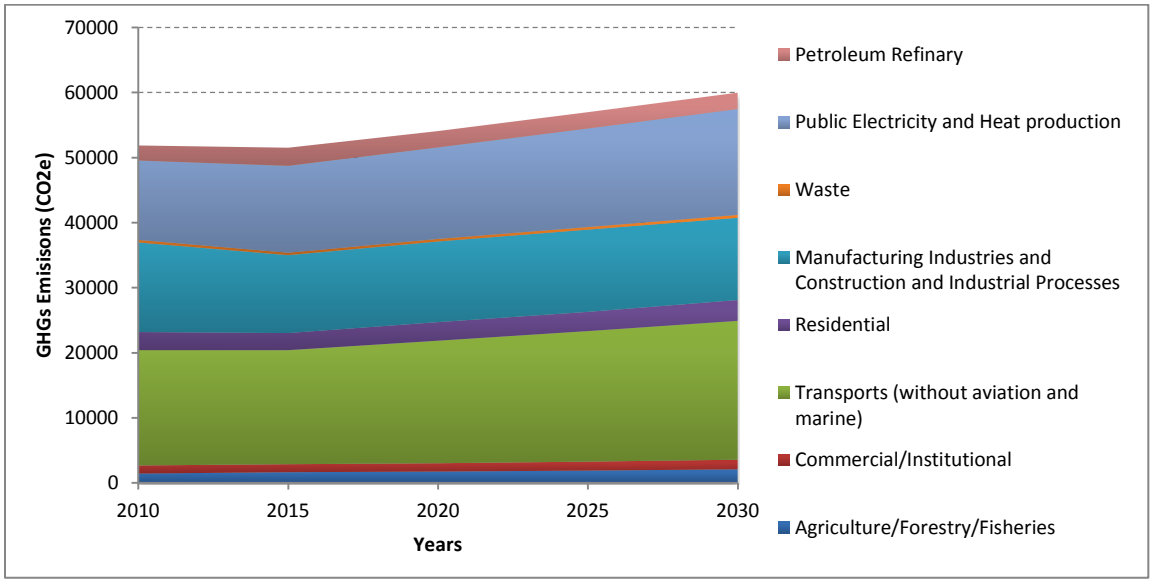



**Figure 4.4**
Sectoral BAUs (without measures)

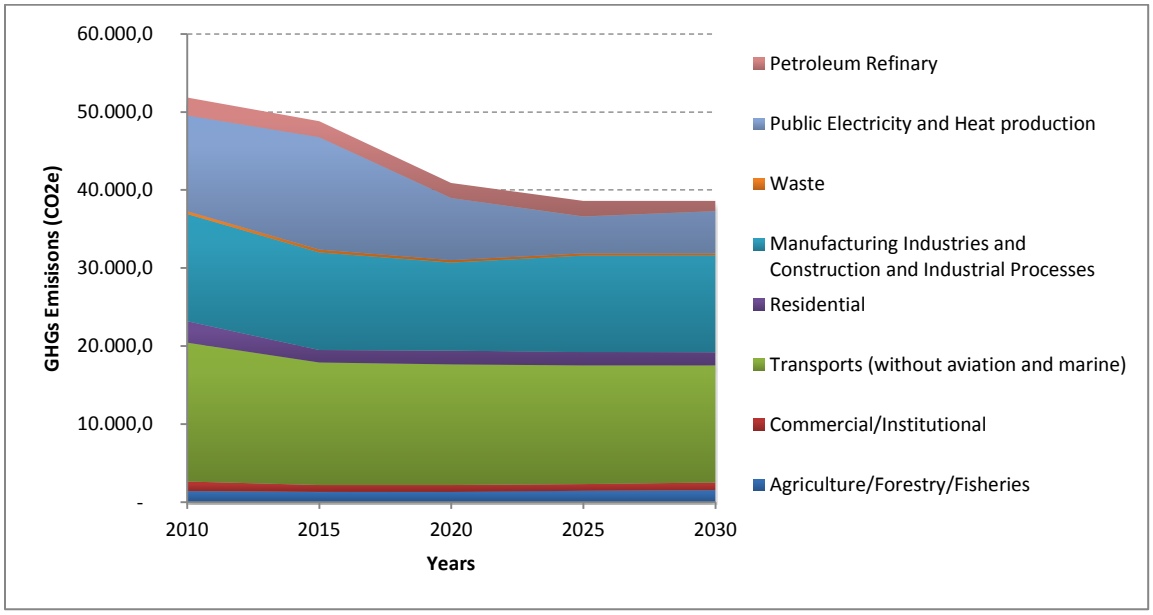



**Figure 4.4a**
Sectoral BAUs (with measures)

**Table 4.7**

GHG emissions avoided (compared to BAU): assessment of aggregate effect of policies and measures

| GHGs Source Categories | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| | CO2 equivalent | | | | |
| **Public Electricity and Heat production** | | **1,021.9** | **6,117.9** | **10,426.2** | **10,914.3** |
| CO2 | | 1,086.1 | 6,039.1 | 10,339.8 | 10,823.6 |
| N2O | | 62.3 | 75.8 | 83.4 | 87.6 |
| CH4 | | 1.9 | 3.0 | 3.0 | 3.1 |
| **Refinary** | | **745.9** | **600.0** | **520.4** | **1,184.5** |
| CO2 | | 745.5 | 598.8 | 519.4 | 1,181.8 |
| N2O | | 0.0 | 0.9 | 0.6 | 2.0 |
| CH4 | | 0.4 | 0.4 | 0.3 | 0.7 |
| **Agriculture/Forestry/Fisheries** | | **322.2** | **362.6** | **429.7** | **504.4** |
| CO2 | | 300.5 | 314.4 | 338.7 | 364.9 |
| N2O | | 20.7 | 22.4 | 26.0 | 30.1 |
| CH4 | | 1.0 | 25.8 | 64.9 | 109.4 |
| **Commercial/Institutional** | | **304.3** | **411.7** | **499.7** | **515.3** |
| CO2 | | 306.8 | 411.9 | 499.3 | 522.1 |
| N2O | | 0.9 | 1.0 | 0.4 | 0.1 |
| CH4 | | 1.6 | 0.7 | 0.8 | 6.7 |
| **Transports (without aviation and marine)** | | **1,872.4** | **3,414.6** | **4,811.6** | **6,330.1** |
| CO2 | | 1,760.0 | 3,358.4 | 4,750.5 | 6,250.3 |
| N2O | | 102.8 | 39.2 | 41.3 | 55.8 |
| CH4 | | 9.6 | 16.9 | 19.7 | 24.1 |
| **Residential** | | **996.5** | **1,059.1** | **1,264.4** | **1,499.8** |
| CO2 | | 1,022.0 | 1,117.8 | 1,175.3 | 1,403.4 |
| N2O | | 4.4 | 10.2 | 20.3 | 22.2 |
| CH4 | | 21.0 | 48.5 | 68.8 | 74.2 |
| **Manufacturing Industries and Construction and Industrial Processes** | | **530.6** | **1,123.8** | **299.6** | **260.0** |
| CO2 | | 711.6 | 918.0 | 64.2 | 37.8 |
| N2O | | 173.3 | 191.7 | 209.0 | 263.6 |
| CH4 | | 7.8 | 14.1 | 26.4 | 34.2 |
| **Waste** | | **3.9** | **74.7** | **111.3** | **164.2** |
| CO2 | | 3.3 | 5.3 | 7.3 | 9.3 |
| N2O | | - | - | - | - |
| CH4 | | 0.6 | 69.4 | 104.1 | 154.9 |
| **Total** | | **2,968.8** | **6,446.5** | **7,416.3** | **9,273.7** |

**Table 4.8**

Emissions in the "with measures" scenario per GHG: CO2 emissions:

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) |
| **1. Energy** | **40,609.21** | **49,543.85** | **60,037.48** | **63,360.66** | **48,248.00** | 45,055.31 | 38,990.52 | 35,148.33 | 34,722.56 |
| A. Fuel Combustion (Sectoral Approach) | 40,333.54 | 48,804.55 | 59,337.81 | 62,354.34 | 47,229.11 | 44,042.89 | 38,073.95 | 34,229.48 | 33,802.43 |
| 1. Energy Industries | 16,260.71 | 19,808.31 | 21,490.46 | 25,330.66 | 14,421.99 | 16,352.75 | 9,824.56 | 6,657.65 | 6,651.35 |
| 2. Manufacturing Industries and Construction | 9,759.04 | 10,854.38 | 12,646.58 | 10,555.23 | 9,137.66 | 8,208.00 | 8,489.42 | 8,354.94 | 8,015.93 |
| 3. Transport | 10,139.78 | 13,322.41 | 19,157.18 | 19,586.09 | 18,711.58 | 16,193.87 | 16,362.4 | 15,615.12 | 15,389.79 |
| 4. Other Sectors | 4,070.32 | 4,738.14 | 5,948.86 | 6,809.80 | 4,872.35 | 3,288.27 | 3,397.53 | 3,601.77 | 3,745.36 |
| 5. Other | 103.69 | 81.30 | 94.73 | 72.56 | 85.52 | --- | --- | --- | --- |
| B. Fugitive Emissions from Fuels | 275.67 | 739.31 | 699.67 | 1,006.32 | 1,018.89 | 1,012.42 | 916.56 | 918.85 | 920.13 |
| 1. Solid Fuels | 8.65 | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO |
| 2. Oil and Natural Gas | 267.02 | 739.31 | 699.67 | 1,006.32 | 1,018.89 | 1,012.42 | 916.56 | 918.85 | 920.13 |
| **2. Industrial Processes** | **4,296.59** | **4,721.30** | **5,571.85** | **5,665.41** | **4,171.24** | 3,363.31 | 3,489.97 | 3,787.28 | 4,113.87 |
| A. Mineral Products | 3,493.38 | 3,949.09 | 4,460.68 | 4,753.85 | 3,999.67 | 3,195.87 | 3,318.50 | 3,603.87 | 3,917.47 |
| B. Chemical Industry | 632.69 | 559.28 | 873.01 | 789.11 | 107.65 | 101.91 | 104.48 | 111.69 | 119.61 |
| C. Metal Production | 170.08 | 212.57 | 237.87 | 122.06 | 63.68 | 65.30 | 66.75 | 71.47 | 76.53 |
| D. Other Production | 0.44 | 0.36 | 0.29 | 0.39 | 0.25 | 0.23 | 0.23 | 0.24 | 0.26 |
| E. Production of Halocarbons and $SF_6$ | | | | | | | | | |
| F. Consumption of Halocarbons and $SF_6$ | | | | | | | | | |
| G. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **3. Solvent and Other Product Use** | 231.04 | 207.78 | 244.46 | 222.23 | 203.18 | | | | |
| **4. Agriculture** | | | | | | | | | |
| A. Enteric Fermentation | | | | | | | | | |
| B. Manure Management | | | | | | | | | |
| C. Rice Cultivation | | | | | | | | | |
| D. Agricultural Soils | | | | | | | | | |
| E. Prescribed Burning of Savannas | | | | | | | | | |
| F. Field Burning of Agricultural Residues | | | | | | | | | |
| G. Other | | | | | | | | | |
| **6. Waste** | **12.52** | **12.78** | **9.43** | **16.89** | **18.14** | **13.72** | **13.72** | **13.72** | **13.72** |
| A. Solid Waste Disposal on Land | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| B. Waste-water Handling | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C. Waste Incineration | 12.52 | 12.78 | 9.43 | 16.89 | 18.14 | 13.72 | 13.72 | 13.72 | 13.72 |
| D. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **7. Other *(as specified in Summary 1.A)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| | | | | | | | | | |
| **Total CO2 emissions excluding CO2 from LULUCF** | **45,149.36** | **54,485.70** | **65,863.22** | **69,265.18** | **52,640.56** | **48,432.34** | **42,494.21** | **38,949.33** | **38,850.15** |
| | | | | | | | | | |
| **Memo Items:** | | | | | | | | | |
| **International Bunkers** | **2,847.05** | **2,717.63** | **3,627.56** | **3,788.63** | **4,222.25** | **0** | **0** | **0** | **0** |
| Aviation | 1,461.08 | 1,610.05 | 1,977.23 | 2,251.04 | 2,604.05 | | | | |
| Marine | 1,385.97 | 1,107.58 | 1,650.34 | 1,537.59 | 1,618.20 | | | | |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | 10,673.94 | 10,297.46 | 10,959.01 | 10,479.17 | 11,940.76 | | | | |

**Table 4.9**

CH4:

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) |
| **1. Energy** | **27.20** | **23.23** | **28.25** | **35.89** | **40.60** | **17.85** | **24.41** | **17.00** | **18.35** |
| A. Fuel Combustion (Sectoral Approach) | 22.23 | 21.03 | 19.10 | 16.00 | 12.75 | 13.76 | 18.65 | 10.12 | 10.88 |
| 1. Energy Industries | 0.21 | 0.25 | 0.30 | 0.38 | 0.37 | 0.30 | 0.27 | 0.29 | 0.30 |
| 2. Manufacturing Industries and Construction | 1.30 | 1.47 | 1.64 | 1.74 | 1.58 | 2.62 | 2.46 | 2.20 | 2.19 |
| 3. Transport | 4.12 | 4.42 | 3.83 | 2.53 | 1.62 | 1.38 | 1.22 | 1.25 | 1.24 |
| 4. Other Sectors | 16.59 | 14.88 | 13.33 | 11.35 | 9.17 | 9.46 | 14.71 | 6.37 | 7.15 |
| 5. Other | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | --- | --- | --- | --- |
| B. Fugitive Emissions from Fuels | 4.97 | 2.20 | 9.15 | 19.89 | 27.85 | 4.10 | 5.76 | 6.88 | 7.46 |
| 1. Solid Fuels | 3.14 | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO |
| 2. Oil and Natural Gas | 1.83 | 2.20 | 9.15 | 19.89 | 27.85 | 4.10 | 5.76 | 6.88 | 7.46 |
| **2. Industrial Processes** | **0.91** | **1.12** | **1.47** | **1.69** | **1.78** | **1.58** | **1.62** | **1.72** | **1.83** |
| A. Mineral Products | 0.27 | 0.43 | 0.56 | 0.67 | 0.79 | 0.63 | 0.65 | 0.71 | 0.77 |
| B. Chemical Industry | 0.40 | 0.39 | 0.48 | 0.52 | 0.50 | 0.44 | 0.44 | 0.45 | 0.46 |
| C. Metal Production | 0.25 | 0.31 | 0.44 | 0.50 | 0.50 | 0.51 | 0.52 | 0.56 | 0.60 |
| D. Other Production | | | | | | | | | |
| E. Production of Halocarbons and $SF_6$ | | | | | | | | | |
| F. Consumption of Halocarbons and $SF_6$ | | | | | | | | | |
| G. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **3. Solvent and Other Product Use** | | | | | | | | | |
| **4. Agriculture** | **197.68** | **205.54** | **213.33** | **209.60** | **204.72** | **196.58** | **188.44** | **183.38** | **178.33** |
| A. Enteric Fermentation | 129.01 | 138.43 | 147.79 | 143.67 | 134.97 | 132.73 | 130.50 | 129.35 | 128.20 |
| B. Manure Management | 56.42 | 58.90 | 56.61 | 49.68 | 50.36 | 45.55 | 40.73 | 36.70 | 32.67 |
| C. Rice Cultivation | 10.80 | 6.94 | 7.62 | 15.38 | 18.44 | 17.51 | 16.58 | 16.81 | 17.04 |
| D. Agricultural Soils | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO |
| E. Prescribed Burning of Savannas | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F. Field Burning of Agricultural Residues | 1.45 | 1.27 | 1.32 | 0.88 | 0.95 | 0.79 | 0.63 | 0.52 | 0.41 |
| G. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **6. Waste** | **262.80** | **311.64** | **333.76** | **354.92** | **347.39** | 338.48 | 285.74 | 270.53 | 243.11 |
| A. Solid Waste Disposal on Land | 144.41 | 179.68 | 224.89 | 222.71 | 237.68 | 219.49 | 186.04 | 150.72 | 112.42 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B. Waste-water Handling | 118.39 | 131.96 | 108.86 | 132.19 | 109.69 | 117.15 | 97.56 | 117.62 | 128.47 |
| C. Waste Incineration | 0,00 | 0,00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| D. Other | NO | NO | NO | 0.00 | 0.00 | 1.83 | 2.12 | 2.17 | 2.21 |
| **7. Other *(as specified in Summary 1.A)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| **Total $CH_4$ emissions excluding $CH_4$ from LULUCF** | **488.59** | **541.53** | **576.81** | **602.10** | **594.49** | **554.50** | **500.21** | **472.63** | **441.61** |
| | | | | | | | | | |
| **Memo Items:** | | | | | | | | | |
| **International Bunkers** | 0.15 | 0.15 | 0.12 | 0.10 | 0.10 | 0 | 0 | 0 | 0 |
| Aviation | 0.12 | 0.13 | 0.10 | 0.07 | 0.08 | | | | |
| Marine | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | | | | |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | | | | | | | | | |

**Table 4.10**

N2O:

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) |
| **1. Energy** | **1.47** | **2.37** | **1.98** | **2.14** | **1.83** | **1.92** | **2.22** | **2.30** | **2.34** |
| A. Fuel Combustion (Sectoral Approach) | 1.46 | 2.36 | 1.98 | 2.13 | 1.82 | 1.91 | 2.21 | 2.29 | 2.34 |
| 1. Energy Industries | 0.20 | 0.25 | 0.40 | 0.48 | 0.39 | 0.23 | 0.20 | 0.20 | 0.22 |
| 2. Manufacturing Industries and Construction | 0.22 | 0.24 | 0.28 | 0.29 | 0.31 | 0.56 | 0.56 | 0.63 | 0.60 |
| 3. Transport | 0.27 | 1.07 | 0.72 | 0.71 | 0.59 | 0.65 | 0.94 | 1.01 | 1.05 |
| 4. Other Sectors | 0.77 | 0.80 | 0.58 | 0.64 | 0.53 | 0.46 | 0.51 | 0.44 | 0.47 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | --- | --- | --- | --- |
| B. Fugitive Emissions from Fuels | 0.01 | 0.01 | 0,01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1. Solid Fuels | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2. Oil and Natural Gas | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **2. Industrial Processes** | **1.67** | **1.50** | **1.82** | **1.81** | **0.96** | **0.19** | **0.19** | **0.19** | **0.19** |
| A. Mineral Products | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| B. Chemical Industry | 1.67 | 1.50 | 1.82 | 1.81 | 0.96 | 0.19 | 0.19 | 0.19 | 0.19 |
| C. Metal Production | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D. Other Production | | | | | | | | | |
| E. Production of Halocarbons and $SF_6$ | | | | | | | | | |
| F. Consumption of Halocarbons and $SF_6$ | | | | | | | | | |
| G. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **3. Solvent and Other Product Use** | 0.32 | 0.33 | 0.17 | 0.32 | 0.07 | | | | |
| **4. Agriculture** | **12.93** | **12.47** | **13.59** | **10.78** | **10.38** | **10.22** | **10.07** | **9.81** | **9.56** |
| A. Enteric Fermentation | | | . | | | | | | |
| B. Manure Management | 1.70 | 1.55 | 1.53 | 1.18 | 0.96 | 0.97 | 0.98 | 0.97 | 0.97 |
| C. Rice Cultivation | | | | | | | | | |
| D. Agricultural Soils | 11.16 | 10.85 | 11.99 | 9.54 | 9.37 | 9.21 | 9.06 | 8.82 | 8.57 |
| E. Prescribed Burning of Savannas | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F. Field Burning of Agricultural Residues | 0.07 | 0.06 | 0.06 | 0.05 | 0.05 | 0.04 | 0.03 | 0.02 | 0.02 |
| G. Other | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **6. Waste** | **1.49** | **1.64** | **1.79** | **1.91** | **1.92** | **2.01** | **2.01** | **2.30** | **2.49** |
| A. Solid Waste Disposal on Land | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B. Waste-water Handling | 1.49 | 1.63 | 1.78 | 1.88 | 1.87 | 1.85 | 1.85 | 2.14 | 2.33 |
| C. Waste Incineration | 0,00 | 0.00 | 0.00 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| D. Other | NO | NO | NO | 0.00 | 0.00 | 0.12 | 0.12 | 0.12 | 0.12 |
| **7. Other *(as specified in Summary 1.A)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| | | | | | | | | | |
| **Total $N_2O$ emissions excluding $N_2O$ from LULUCF** | **17.88** | **18.30** | **19.35** | **16.95** | **15.16** | **14.34** | **14.49** | **14.60** | **14.59** |
| | | | | | | | | | |
| **Memo Items:** | | | | | | | | | |
| **International Bunkers** | **0.08** | **0.07** | **0.10** | **0.10** | **012** | **0** | **0** | **0** | **0** |
| Aviation | 0.04 | 0.05 | 0.06 | 0.06 | 0.07 | | | | |
| Marine | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 | | | | |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | | | | | | | | | |

**Table 4.11**

SF6 and HFCs:

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) | (Gg) |
| **Emissions of HFCs(3) - (Gg $CO_2$ equivalent)** | **NA,NE,NO** | **66.27** | **319.04** | **848.05** | **1,515.03** | **2,210.94** | **2,471.51** | **1,066.18** | **549.73** |
| | | | | | | | | | |
| **Emissions of PFCs(3) - (Gg $CO_2$ equivalent)** | **NA,NE,NO** | **NA,NO** | **0.03** | **0.05** | **0.00** | **-** | **-** | **-** | **-** |
| | | | | | | | | | |
| **Emissions of SF6(3) - (Gg $CO_2$ equivalent)** | **NA,NE,NO** | **6.83** | **9.70** | **25.70** | **43.57** | **67.25** | **117.49** | **175.60** | **234.12** |

# 5 IMPACTS, VULNERABILITY AND ADAPTATION

All over the world - and in Portugal as well – people and organizations have been adapting to the local climate in which they are integrated, organizing their activities, the places where they live and many other aspects of their lives, so that they can take advantage of the positive aspects and protect themselves from future problems and limitations that the climate can put them.

The increase of knowledge and consciousness about climate change and about the verified and expected impacts across the natural systems, across the economic activity, across the social tissue and across the life of all citizens has been dictating an increasing interest on the development of climate change adaptation policies.

Following the priority that has been given in public policies to the climate change adaptation impacts, in 2010 Portugal adopted the National Climate Adaptation Strategy (ENAAC). It is the Portuguese Environment Agency ´s role, I.P., to coordinate the implementation of this strategy.

## 5.1 National Climate Change Adaptation Strategy (ENAAC)

The National Climate Change Adaptation Strategy (ENAAC) was adopted through the Resolution of the Council of Ministers 24/2010, 1st April. The ENAAC wishes to increase awareness on climate change, to keep an updated and available scientific knowledge on climate change and its impacts, as well as to reinforce the measures Portugal, like the International Community, will have to adopt concerning the control of climate change effects.

### 5.1.1 Objectives and strategic sectors of ENAAC

The ENAAC is structured under four objectives, namely:

1. Information and knowledge: to understand, identify and anticipate the vulnerabilities and climate change impacts across various sectors and the methodologies for the identification of adaptation measures, analysis of its feasibility and assessment of costs and benefits.
2. To reduce vulnerability and increase responsiveness: identify measures, set priorities, implement actions that reduce the vulnerability of various sectors to more likely and more disturbing climate change, and implement actions to improve the response efficiency to the impacts resulting from climate change, in particularly extreme weather events.
3. Participation, raising awareness and dissemination: raise a high level of involvement and public participation on the definition and implementation of the strategy.
4. To make know to citizens, businesses and other social agents the main expected impacts, as well as to disseminate good practices of sectoral adaptation.

   4. International cooperation: monitor international negotiations on climate change adaptation and support the implementation of adaptation actions in more vulnerable countries, particularly in the context of the CPLP.

In this strategy the chosen approach was based on the definition of domains and strategic sectors. This way we can identify the performance in terms of sectorial adaptation in a more consistent way.

In this phase nine strategic sectors have been identified. Each will develop actions, on a priority basis, having in mind its adaptation to the climate change effects: territory and urban development; water resources; safety of people and goods; human health; energy and industry; tourism; agriculture, forestry and fisheries; coastal areas and biodiversity.

### 5.1.2 ENAAC´s governance structure

An operation of a measure of this nature requires a dynamic and flexible organizational structure that allows the profiting of efforts and resources, developing and reinforcing partnerships. This way it is expected that the working group would be a motivating tool of the Portuguese society, of the different social partners and, individually, of each citizen, containing concrete actions to reduce vulnerability to climate change. To insure a right strategic implementation, this strategy already contemplates its corresponding monitoring and assessment mechanisms.

The implementation of the strategy will be supported by a coordination group, sectorial groups and a scientific panel (Figure 5.1).

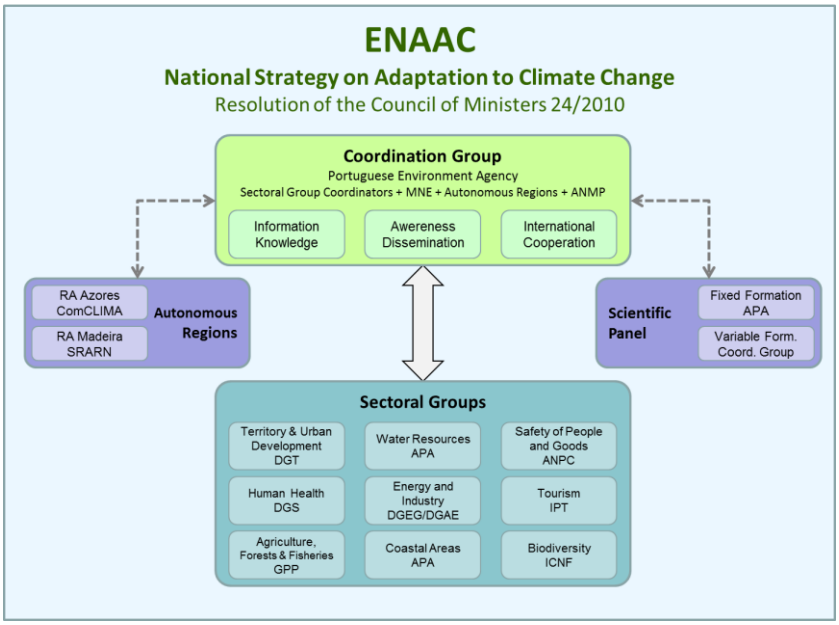



**Figure 5.1**

Organogram to the development and implementation of the ENAAC

### 5.1.3 Development of the Adaptation Measures

The identification of lines of action and adaptation measures to reduce or mitigate the impacts of climate change at the sectoral level was part of the mandate of the various sectoral groups in the 1st phase of the implementation of the ENAAC. In a general way this goal was achieved. Adaptation measures were singled out for most sectors, in some cases quite exhaustively (Table 5.1).

However, this is a need to carry out a comparative analysis of various sectoral proposals to ensure consistency in approach, strengthening synergies and complementarities and minimizing possible action inconsistencies and possible territorial impacts. At this stage of the work it has not been possible to adequately investigate this matter; goal which will looked after in the next phase of the implementation, in conjunction with several sectoral groups.

The prioritization in terms of performance is also another area that needs greater depth, particularly in the case of those sectors that compiled a considerable set of measures.

**Table 5.1**

Adaptation measures identified by the various sectoral groups (synthesis)

| **Agriculture, Forestry and Fisheries** |
|---|
| **Strategic Objective 1 - Increase resilience, reduce risks and maintain the ability to produce goods and services.**<br>**1.** National Plan to Combat Desertification;<br>**2.** Increase storage capacity and irrigation;<br>**3.** To Promote efficient use of water;<br>**4.** To strengthen bilateral cooperation with Spain;<br>**5.** To develop risk management systems;<br>**6.** Reconstitution of the productive capacity;<br>**7.** To strengthen warning systems and create preventive and emergency procedures;<br>**8.** To strengthen the adaptive component to AC in the territorial management tools, particularly in the Regional Forestry Management Plans (PROF);<br>**9.** To strengthen the necessary mechanisms and tools to improve forest management and decrease of abandonment;<br>**10.** To promote landscape connectivity;<br>**11.** Strategic plans for the recovery of high value aquaculture species;<br>**12.** To incorporate the revision or amendment of PNDFCI appropriate responses to potential climate change impacts;<br>**13.** Actions to prevent forest fires;<br>**14.** National Plan and Plant Health Protection against pests for agriculture and forestry;<br>**15.** Prevention and combat actions against harmful biotic agents for agriculture and forestry;<br>**16.** 16. National Program to fight invasive woody plants;<br>**17.** 17. To favor the production function in regions where it is expected an increase in productivity of the key species;<br>**18.** To enhance the role of forests and forest management in soil and water protection;<br>**19.** Forest management aiming the increase of resilience and vitality of forest stands;<br>**20.** To promote carbon sequestration capacity of forest ecosystems;<br>**21.** To support the diversification of products and services in forestry;<br>**22.** Recovery or rehabilitation of riparian forest and riparian vegetation;<br>**23.** To support the recovery of the longitudinal connectivity of rivers or sections considered priorities for the conservation of aquatic resources;<br>**24.** To adapt legislation for regulation and control of fishing and fishing management to the evolution of species, populations, communities or fish typologies;<br>**25.** To promote in situ conservation of plant and animal genetic heritage;<br>**26.** To encourage forms to enhance plant and animal genetic heritage.<br><br>**Strategic Objective 2 - Improve and transfer knowledge**<br>**1.** Identifying needs in Research and Development;<br>**2.** Scenarios of climate evolution of the variables relevant to agriculture;<br>**3.** Development of production models according to the climate; |

4. Study of the mechanisms of adaptation of production systems;
5. Development of a multidisciplinary scientific project within the forest sector and climate change;
6. Development of management models aimed at the use of natural resources;
7. National strategy for the conservation and improvement of genetic resources of forest trees, vegetables and livestock;
8. Establish a national network of arboretums;
9. To promote international cooperation;
10. Development of a communication strategy;
11. Development of training and extension programs;
12. Expanding the network of forests model and demonstration areas on the issues of climate change;
13. Guides of agricultural and forestry practices;
14. Development of contents and platforms for the dissemination of alien species impact information.

**Strategic Objective 3 - Monitoring and evaluating**

1. To monitor soil characteristics;
2. Design and implementation of exploration and monitoring programs of harmful biotic agents;
3. To monitor the evolution of forest and agricultural areas;
4. To monitor the classified forest habitats;
5. To implement a monitoring system to assess the evolution of the area occupied by invasive;
6. National program for monitoring fish populations of inland waters;
7. Monitoring of game species;
8. Framing in policies and plans the issues of climate change adaptation;
9. To monitor the implementation of adaptation measures;
10. Public intervention´s governance to the climate change adaptation.

**Biodiversity**

**Strategic Objective 1 - Information and knowledge**

1. To establish national plans for long-term research on the effects and adapting ways of freshwater fish species, of the most vulnerable amphibians and reptiles, of steppe birds and bats;
2. To develop integrated studies on biodiversity adaptation to climate change regarding the community, the ecosystem and the landscape;
3. To develop models to analyze the effects of climate change on biodiversity based on more detailed and consistent regional climate change scenarios;
4. To identify further needs for research on the effects and forms of adaptation of climate change in the context of biodiversity and establish appropriate research plans;
5. To revise statutes of threatened species based on criteria defined by IUCN;
6. To create monitoring of terrestrial and aquatic biodiversity programs at a national and regional level;
7. To create plans for monitoring and controlling unpredictable risk situations, such as fires, floods, droughts and heat waves;
8. To integrate data observation, monitoring and follow-up in a database

**Strategic Objective 2 – To reduce vulnerability and increase responsiveness**

1. To guarantee a diverse landscape that supports a network of corridors;
2. To maintain the functions and services of ecosystems more vulnerable to climate change;
3. To actively manage species and habitats to adapt to the effects of climate change (in situ and ex situ);
4. To reduce other anthropogenic pressures on biodiversity; to increment the use of Strategic Environmental Assessment (SEA) of plans and programs and the assessment of environmental effects and Environmental Impact Assessment (EIA) of projects as tools to support the decision process;
5. To analyze national reference documents for biodiversity in accordance with criteria of climate validation;
6. To review sectoral policies, associated plans and legislation and ensure its climate validation in terms of biodiversity;
7. To review the Basic Network of Nature Conservation regarding climate change issues;
8. To draw up action plans for vulnerable species and habitats;
9. To draw up management plans for Classified Areas.

**Strategic Objective 3 - To participate, raise awareness and dissemination**

1. To make available to society and decision makers the updated scientific knowledge on biodiversity adaptation to climate change;
2. To promote training actions on climate change contributing to the recovery of the most vulnerable species and habitats;
3. To implement an awareness program on climate change and biodiversity;
4. To mobilize and encourage the active participation of stakeholders in the discussion and propose measures for biodiversity adaptation to climate change.

**Strategic Objective 4 - To cooperate on international level**

1. To improve circulation and dissemination of information on biodiversity adaptation to climate change with CPLP countries;
2. To promote training actions on climate change contributing to the recovery of the most vulnerable species and habitats within the CPLP;
3. To improve circulation and ways to disseminate information on biodiversity adaptation to climate change with bodies of the European Union and the European Council;
4. To ensure sector coordination with guidelines for biodiversity adaptation to climate change issued at community and multilateral level;
5. To propose a revision of the statutes for the protection of species and habitats;
6. To promote and participate in cooperation projects in the Iberian and Mediterranean context.

**Energy**

**Linear infrastructures - transport and distribution of electricity**

1. Identification of the major weaknesses of the system and performance of additional studies to evaluate the possible expansion of the system in terms of its resilience, namely through ring systems or interconnections;
2. Identification of facilities subject to flood risk;
3. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, such as placement of walls, installation of pumps, placement of upper bound equipment, among others ;
4. Identification of facilities subject to risks of erosion;
5. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, such as the installation of containment structures of landslides, among others;
6. Identification of the major weaknesses of the system and additional studies to evaluate the expansion of the system in terms of its resilience;
7. For new lines, reshaping the parameters of calculation;

8. Identification of infrastructure subject to flood risk;
9. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, including different solutions of networks layout, use of " underwater " cables , etc.;
10. Identification of infrastructure subject to risks of erosion;
11. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, namely different solutions of networks layout, etc.;
12. Possible changes in the airline industry such as the lift of conductors, the use of other types of conductors, etc.;
13. Identification of infrastructure subject to flood risk;
14. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, including different solutions of networks layout, use of " underwater " cables , etc. ;
15. Identification of infrastructure subject to risks of erosion;
16. Technical and economic assessment of possible investments to be made in these facilities to reduce risks, including different solutions to the networks layout, etc.;
17. Identification of infrastructure subject to these risks;
18. Technical and economic assessment of possible investments to be made in these facilities to mitigate the risks, including different constructive solutions, such as reinforced supports, special conductors, etc.;
19. Identification of infrastructure subject to these risks;
20. Technical and economic assessment of possible investments to be made in these facilities to mitigate the risks, including better insulation coordination, etc.;
21. Need to perform more studies, particularly in the evaluation of the restrictions for network management;
22. Defining and implementing an Emergency Plan;
23. Education and training for management of crisis situations.

**Linear infrastructure - transport of petroleum products**

1. Analysis of the pipeline stress tests to assess the likelihood and extent of a possible structural allocation;
2. Technical and economic analysis of actions to strengthen the pipeline;
3. Temporary storage and forwarding of raw materials and oil products;
4. Improvements in planning and stock management of oil products, predicting failures or interruptions of service;
5. Training of employees and company´s partners in case of abnormal operation situations and performance in extraordinary emergency situation.

**Linear infrastructure – Gas transportation**

1. Training and awareness of those responsible for security at work;
2. Compliance with the applicable and required security measures undertaken;
3. Construction of protective walls;
4. How to avoid construction in flood zones;
5. Training and awareness of those responsible for on-site safety;
6. Compliance with the applicable and required on-site safety measures.

**Fixed infrastructures - electricity, raw materials supply and production and shipping of finished petroleum products and gas**

*Hydro power plants ( HP ) ; thermal power plants ( TP ) ; Wind farms ( WF ); Pressure reducing stations for natural gas ( PRNG ); refineries / storage and/or distribution of oil products ( PP ) ; Measure reduction gas posts ( MR / GP ); Autonomous Units of re-gasification of liquefied natural gas ( LNG )*

1. Widespread use of forecasting systems;
2. Internal and external emergency plans;
3. Business continuity plans;
4. Preventive maintenance of wind turbines, so that the over speed control systems of the blades can always be operational;
5. In the MR/GP: implementation of ring structures;
6. Need to develop additional work to corroborate the significance of these impacts;
7. In The WF: existence of teams on the ground, formed by operators and supervisors with the ability to intervene in few hours;
8. Verification of design criteria of infrastructure in height;
9. Training and awareness of those responsible for on-site safety;
10. Compliance with the required and applicable on-site safety measures.

*Thermal power plants ( TP ); refineries / storage and /or distribution of oil products (PP)*

1. Installing additional cleaning systems in central adduction to avoid the problem of the formation of excessive amounts of algae.

*Hydro Power Plants (HP); Thermal Power Plants ( TP ); Wind farms (WF); pressure reducing stations for natural gas ( PRNG ); refineries / storage and /or distribution of petroleum products (PP) ; Measure Reduction Gas Posts ( MR/GP ); Autonomous Units of re-gasification of liquefied natural gas (LNG )*

1. Widespread use of forecasting systems;
2. Internal and external emergency plans;
3. Business continuity plans;
4. Placement of auxiliary systems such as pumps with higher dimensions;
5. Installation of pumping systems in flood zones;
6. Construction of protection walls;
7. Duplication of supply circuits to surface dischargers and installation of diesel units for the exclusive use of dischargers;
8. Verification and hydraulic design criteria for drainage systems, liquid effluents treatment (waste and storm water) and containment basins of raw materials and finished oil products;
9. Verification of design criteria of infrastructure in height;
10. Avoid construction in flood zones;
11. Possible construction of flood retention areas, sized based on historical risk zone where the infrastructure is placed.

*Hydro Power Plants (HP); Thermal Power Plants ( TP ); Wind farms (WF); pressure reducing stations for natural gas ( PRNG ) ; refineries / storage and /or distribution of oil products ( OP ) ; Measure Reduction Gas Posts ( MR / GP ); GPL Posts (GPLP)*

1. Recourse to external supply of demineralized water (to compensate for water - steam circuit) through the use of external holes and public supply;
2. When possible, selection of reversible Groups in new projects that allow the production of electricity even in times of drought;

3. Cooling towers installation in new power plants instead of cooling systems of direct condensers, whenever appropriate.

*Hydro Power Plants (HP); Thermal Power Plants (TP); Wind farms (WF); Pressure Reducing Stations for Natural Gas (PRNG); refineries/ storage and/or distribution of oil products (OP), CT – Biomass*

1. Increase /revision of water use planning stored in reservoirs;
2. Need to check the windows operation of primary containment equipment (transport lines and equipment storage, etc.).
3. Need to develop additional work to corroborate the significance of these impacts in the performance of the refining sector, in a short term due to heat waves, and long- term under en effective rise of temperature;
4. CT Biomass - Change in storage conditions of raw materials and biomass, minimizing the risk of fire.

*Refineries / storage and /or distribution of petroleum products (PP)*

1. Verification of windows operation of loading and unloading of ships;
2. Verification of the structural conditions of potentially affected structures in existing process units and in new units under implementation;
3. Construction or remodeling of coastal protections, including transversal ones to improve the access of the ship to the port, or perpendicular ones as breakwaters;
4. Need to develop additional work to corroborate the significance of these impacts.

*CT – Biomass*

1. Current and future forest adaptation measures and society adaptation measures ( those who will implement the adaptation ) to tackle prospects;
2. Creation of mechanisms to monitor and control the risk of entry of new biotic agents through imports and through the promotion of an active forest management and the promotion of the research and development to the development of new ( and more effective ) measures to combat forest pests.

**Industry**

1. Optimizing the use of energy and water resources by industries:
   - Strengthening of the hydroelectric power;
   - Incentives for micro-generation.
2. Reuse of effluents;
3. Establishing a prioritizing plan on energy use (in case of extreme events);
4. Legislative review to ease supply of raw materials and avoid carbon leakage;
5. Strengthening and adjustment of port infrastructure;
6. Territory development with an inventory of the facilities in hazardous areas;
7. Bet on I&D and eco-innovation.

**Territory and Urban Development**

No measures have been identified.

**Water resources**

**Planning and management of water resources**

1. Controlling contamination in the aquatic environment by point source discharges;

2. Reducing contamination of the aquatic environment by nonpoint source discharges;
3. Controlling the water abstraction licensing;
4. Improving monitoring, forecasting and warning systems;
5. Better profit from the installed regularization and supply capacity;
6. Deepening the integrated management of surface and groundwater resources;
7. Deepening the processes of planning and integrated management of international river basins with the Kingdom of Spain;
8. Water reuse and compatibility of water use with its quality;
9. Desalination of seawater or brackish water;
10. Diversification of water sources and promotion of transfer capacity of water between basins or supply systems;
11. Promoting aquifers recharges, including through artificial recharge;
12. Construction of new dams;
13. Assessment of the change of the main risk factors of flood;
14. Changing of methodologies and criteria for the design of infrastructure;
15. Identification of flood risk areas and review of the Flood Risk Management Plans;
16. Strengthening flood protection infrastructures or appropriateness of the occupation of people and assets at risk areas;
17. Deepening the knowledge on the impacts of climate change on water resources and on their several dependent sectors;
18. Inventory and systematization of possible approaches and solutions for the adaptation and creation of a portfolio of solutions;
19. Development of information, communication and education platforms for the dissemination of available information and awareness and information of the various agents.

**Ecosystems and biodiversity**

1. Support to the adaptive capacity of sensitive species to climate change and their habitats;
2. Restoration of damaged habitats, including riparian zones and marginal wetlands;
3. Restoration of processes and of global ecosystem functions;
4. Promoting effective water management and use of biological resources;
5. Integrated management of all existing obstacles in each water network;
6. Reducing fragmentation of water and maintenance of environmental flows;
7. Reducing climate stress and possible primary and secondary impacts, as a result of foreseen adaptation measures for other sectors;
8. Implementing a long-term monitoring network (LTER) ;
9. Research on the climate change effects on species and aquatic ecosystems.

**Programs and adaptation measures to the Water Services**

1. Control of real and apparent losses;
2. Control of water consumption;
3. Diversification of water sources and interconnection of water supply systems;
4. Wastewater reuse for compatible uses and implementation of differentiated supply systems;
5. Assessment of the feasibility and possible promotion of seawater desalinating through renewable electricity resources;
6. Development and implementation of water safety plans (" multi - barrier " protection);

7. Tuning of water treatment schemes, installation of additional treatments and possible strengthening of the already installed capacity;
8. Control on excess inflows to the drainage system;
9. Control on inflows of rainwater to the wastewater treatment systems;
10. Reinforcement of self-cleaning conditions of the sewers and of the aseptic control;
11. Tuning of effluent treatment schemes, implementation of complementary treatments and enhancing of the capacity of drainage systems and treatment facilities;
12. Protection or relocation of infrastructure located in flood zones;
13. Promoting solutions to control rainwater at its source;
14. Installation of tide gates (check valves) in susceptible areas of sea flooding;
15. Interventions to strengthen or operate a system in order to increase the capacity of drainage systems;
16. Strengthening of the regulatory instruments of this sector and of the regulation and standardization;
17. Technological innovation.

**Agriculture and forestry**

1. Conservation of soil moisture;
2. Selection of crops with low water requirement or more tolerant to water scarcity;
3. Changing on harvesting operations;
4. Increase the efficiency of irrigation water applicability;
5. Improvement in water storage conditions to reduce evaporation losses;
6. Wastewater use;
7. Conservation and increase of water and organic matter;
8. Selection of the most appropriate tree species;
9. Prevention of fire risk;
10. Training and promotion of soil conservation techniques;
11. Research, training and dissemination of more efficient irrigation techniques;
12. Development of specific studies for permanent crops;
13. Research of different types of forests more suited to the new climate conditions.

**Health**

Implementation measures within:
the Heat and Cold Extreme Temperature Contingency Plan - Heat Module
National Surveillance program for Culicid Vectors

**Safety of People and Goods**

**Preventive or Mitigating Measures**

1. Restrictions on occupation of risk areas (PMOT);
2. Minimizing the risk of floods and droughts enhancing the permeability of flood areas, the protection of water lines and integrated water management in the watersheds;
3. Use of construction materials adapted to the aggravation of risks including heat waves, damming, coastal defense, (based on cost-benefit analysis);
4. Optimization of the available resource management - water.

**Preparatory measures**

1. Public information campaigns on climate change and on general and specific risks in case of extreme events;
2. Improvement of the monitoring systems;
3. Integrating the effects of climate change on Civil Protection and Emergency Planning and on several Contingency Plans.

**Emergency Response Measures**

1. Adequacy of the operational mechanism of the Civil Protection system to a higher intensity and to a higher occurrence of extreme events.

**Turism**

**Strategic Objective 1 - Information and knowledge**

1. Development of a multidisciplinary scientific project within the tourism sector and climate change sector;
2. Identification and inventory of tourism enterprises located in areas of risk (e.g., area subject to risk of flooding or erosion risks) ;
3. Implement a monitoring system that allows:
   - Assess the impacts from climate change on tourism ( e.g. through questionnaires designed for this purpose and aimed at tourists );
   - Assess the adaptation measures to climate change in tourism , its feasibility , costs and benefits (e.g. , using questionnaires designed for that purpose and serving the business sector).

**Strategic Objective 2 - Reduce vulnerability and increase responsiveness**

1. Monitor the implementation of adaptation measures in the tourism sector;
2. Valuing component of adaptation to climate change in territorial management tools, betting seriously and strongly in planning and land management in order to safeguard and mitigate many of the risks resulting from climate change, including:
   - Coastal erosion,
   - Deforestation and fire risks in more vulnerable regions ,
   - Floods.
3. To incorporate in the specific tourism strategies the appropriate responses to potential climate change impacts, such as:
   - To encourage the requalification and supply reduction, with particular emphasis on the coastline, through for instance relocation , retraining and rehabilitation operations of the existing one;
   - To promote the reduction of impacts caused by tourist facilities located in areas of risk:
     - Technical and economic evaluation of potential investments to be made in these facilities to reduce risks ( e.g., placement of walls , installation of pumps, replacement of equipment to higher quota, relocation of the building, among others );
     - Technical and economic evaluation of potential investments to be made in these facilities to reduce risks ( e.g. installation of containment structures for the moving of earth), among others.
   - To encourage the reduction of the soil sealing:
     - To rationalize the occupation of the territory with traffic roads;
     - To encourage the implementation of pedestrian, equestrian and clickable paths.
   - To discourage the occupation of the areas of risk;

- To promote the efficient use of natural resources in the tourism sector through:
  - Measures that reduce water consumption and safeguard groundwater resources ;
  - Use of treated wastewater and rainwater (possibly for the irrigation and maintenance of outdoor spaces and pools supply);
  - Use of native plant species adapted to the soil and climatic conditions;
  - Optimization in the use of energy resources.
- To Invest in the sustainable construction, I & D and eco-innovation through:
  - Valuation of innovative and integrating projects that are of a factor of differentiation and sustainability;
  - Use of construction materials adapted to the worsening of risks, such as heat waves (based on cost-benefit analysis);
  - Rehabilitation of the existing buildings at the expense of new ones.
- Betting on destinations which offer diverse tourism products and that promote the spread of demand in a balanced way, helping to reduce regional disparities and a crowding of coastal zones of the country, as well as to mitigate seasonality.

**Strategic Objective 3 - To participate, to raise awareness and to promote**

1. Development of a communication strategy:
   - Development of content and platforms for the disclosure of information on climate change impacts on tourism (e.g. sensitize entrepreneurs to the need of considering climate risks in their decisions , stressing real situations like a predictable decline in water resources, among others);
   - Carrying out public information campaigns on climate change and on the risks in general and particularly of extreme events ( e.g., disclosure of the predictable measures regarding the Heat and Cold Extreme Temperature Contingency Plan – Heat Module and the National Surveillance Program For Culicid Vectors (REVIVE);
   - The elaboration of practice guides to mitigate and adapt to climate change.

**Strategic Objective 4 - To cooperate internationally**

1. Promote international cooperation, particularly the exchange of experiences with other realities with similar vulnerabilities to the national ones as far as the tourism sector and climate change are concerned.

**Coastal Zones**

**Deepening and spreading knowledge**

1. Survey and update of high resolution aerial-hydrographic databases;
2. Implementation of a monitoring system;
3. Increasing of aerial resolution on assessment studies of impacts of climate change in coastal zone;
4. Deepening of knowledge about the territory and of the values at risk;
5. Inventory, mapping and assessment sands reserves and resources on the continental and insular platform;
6. Assessing the cost and effectiveness of interventions aimed at the correction of the sediment supply to coastal systems;
7. Improve the characterization of coastal aquifers in what regards vulnerability to saltwater intrusion;
8. Promotion of research on climate change and impacts on coastal zones;
9. Evaluation abandonment retreat measures versus protection;
10. Information and training.

**Risk management**

1. Improving the effectiveness of mitigating measures that are already part of the basic infrastructures of the maintenance activity;
2. Implementation of an early warning system and prevention from a meteorological over- ;
3. Safeguarding of groundwater resources.

**Strengthening of effectiveness and the coordination of the instruments of risk and coastal development management**

1. Introduction of the concept/image of safeguard range in all instruments management and of the coastal management of the national territory;
2. Inclusion of the climate change issue in instrument and coastal management;
3. Defining protection statutes for the resource in sands platform;
4. Enhancing effectiveness and enforcement of legal instruments that affect the occupation of territory vulnerable to flood.

### 5.1.4 Results of phase 1 of ENAAC and proposals for phase 2

**Balance of phase 1**

Phase 1 of ENAAC was marked by a strategic nature of its own, that is, instead of seeking immediate results in terms of long lists of possible adaptation measures, we wanted to introduce this subject in the concerns and analysis matrices of the several sectors of the Portuguese society. The decision to return the developmental competence of the sectoral analysis in adaptation to various coordinating entities (compared with an alternative scenario where, for example, it was hired a scientific study at a larger scale on this matter) had its origin in this concern.

This model also had, for the same reasons, some limitations. The fact that the scientific support for the development of the works at a coordinative level and sometimes at a sectoral level too have fallen short of what we wished it would be, ended up by limiting the depth of the analysis that we were able to make in some sectors. Therefore the quality of the final product was determined by the existing competencies in each sectoral group. Despite this factor (which could be considered a priori as limiting), it should be noted that many sectors have managed to moved forward in a remarkable way when identifying deeply impacts and vulnerabilities, knowledge gaps and the first listings of adaptation measures. This work basis will be crucial to Phase 2 of ENAAC.

The basic sector model (also marked by quite different work methodologies among the sectors) has adapted to a "variable geometry" of stakeholders and working methods relevant to each case. However, this makes the communication between the developed works among the several sectors and its comparability a challenge that needs to be better addressed in the future. In general terms this model can still be valid in the future but it can be improved if some analysis and common reporting tools, as well as some references (e.g. climate scenarios) are developed.

One aspect to bear in mind in the future organization of the works refers to the sharing of information by the various sectorial groups. The use of a document-sharing platform can be a solution for the identification and depth of synergies. Promoting cross-sectoral initiatives should be equally implemented in the next phase.

**Proposals for phase 2**

The next phase of ENAAC must be built on its strengths and try to address some of its weaknesses which were identified in the previous section. Thus, the Coordination Group suggests that the revision of ENAAC be done according to the following guidelines:

1. Maintaining the priority approach by sectoral groups, but with a reassessment of the number and structure of the sectoral groups, particularly in relation to the entities involved, the duplication of responsibilities between groups, the strengthening of currently not covered or poorly covered areas (e.g. Municipalities, infrastructures), the evolution of the structure of the central administration, the alignment with the sectors belonging to the European strategy and the identification of priority themes for the development of ENAAC;
2. Strengthening the interaction between sectors and developing a strategy based on its vulnerability assessment in order to have a more concrete planning of the adaptation measures. Assessing the possibilities to evolve into a National Climate Change Adaptation Plan, containing consensual and prioritized measures among all sectors;
3. Strengthening the ENAAC governance structure, covering in particular:
    a. Greater direct involvement of stakeholders, at the level of Ministries and / or Secretaries of State, to strengthen the support given to the development of the work of ENAAC[58];
    b. Development of some basic tools to all ENAAC´s works, including:
        i. Systematization and dissemination of technical and scientific information on climate change including:

[58] To readapt the model of the extinct Cimate Change Comission could be taken in consideration

ii. Monitoring of climate evolution based on observations;
iii. National and regional climate scenarios and the development of national narratives of climate change,
iv. Compilation of studies and sources of national and additional information about some platforms such as Climate - Adapt and Infobase;
v. Methodological harmonization for the development of models and criteria for the classification and description of adaptation measures;
vi. Using a sharing platform limited to members of the coordination group.

c. Definition of a formal system of collection and systematization of national activities relevant to climate change adaptation, which supports:
   i. The development of national priorities;
   ii. The EU and international reporting on this matter (MMR, National Communications and specific monitoring to be adopted within the European Strategy);
   iii. The reporting of the adaptive component of the supports provided under the National Strategic Framework (2014-2020).
d. Definition of a financial support system, giving priority to the integration of adaptation objectives in the Partnership Agreement for the 2014-2020 programming cycle of EU funds, developing and enacting by Decree -Law n . º 38/ 2013 of 15 March and Decree -Law 93/2010, of July 27, in particular:
   i. the implementation of adaptation measures in national territory;
   ii. projects of research and development that seek to address shortcomings of information on adaptation;
   iii. the projects of international cooperation on adaptation.
e. Increasing the participation and coordination with the ARA and ARM.

4. Introduction of legal obligations, including the instruments of territorial management, on adaptation and development of technical guidelines for these obligations in areas to be identified in the coordination group;

5. Extending the planning horizon of Phase 2 of ENAAC and its alignment with the essential aspects of climate policy for the 2013-2020 period.

## 5.2 Financing Adaptation to Climate Change

The Council of Ministers Resolution no. 24/2010 does not provide an associated financing mechanism, so the implementation of ENAAC has been borne by the budgets of the involved entities.

The difficulties of access to financing that the country is facing and the budget cuts that followed were quickly identified in ENAAC as potential limiting factors for the development and deepening of an adaptation policy in Portugal, which is often seen as a non-priority investment. This difficulty was felt by many of the sectoral groups that were immediately limited in their ability to hire external support to address weaknesses in its services (information, training, human resources).

Despite this general framework, it is possible to find funding opportunities dedicated to the theme of adaptation, some having started its developing.

In this regard, the framework of EU funds for the period 2014-2020 is in its final phase of consolidation and it should contribute significantly to the adaptation efforts in Portugal. There is a commitment to affect 20 % of all EU funds to investments that are relevant to the mitigation and adaptation to climate change. This opportunity, in addition to being effective, may be materialized in a significant support to national adaptation efforts, which in turn can be justified by the high vulnerability of much of the national territory to the effects of climate change.

***EEA Grants / ADAPT Program***

The EEA Grants 2009-2014 are a financial contribution from Norway, Iceland and Liechtenstein for the access and participation in the Single European Market. It is a financial support mechanism to underprivileged Member States of the European Union and it has the following general objectives:
1. To help reducing economic and social disparities in the European Economic Area;
2. Strenghening of bilateral relations between the Donor States (Iceland, Liechtenstein and Norway) and the Beneficiary States, seeking thereby the encouragement of a long-term cooperation.

Under this mechanism, Net appropriation to Portugal is € 53,603,750, having the Portuguese Government negotiated with the Donor Countries the thematic areas and the financing projects of programs on which this money would be spent. That agreement (signed in April 2012) resulted in the commitment to develop a support program to projects for adaptation to climate change. The competence and obligation for the development of this program were attributed to the Portuguese Environment Agency, as the managing entity for the Portuguese Carbon Fund. These assignments and as coordinator of ENAAC, APA involved the coordination group of ENAAC in all its phases, but particularly in the design phase of the program and in the identification of funding priorities .

The strategy of the ADAPT program is structured around four lines of action, namely:
1. A project to develop an Internet site called " Local Warming" in which will be produced and disseminated information related to regions and to past trends and future scenarios. Climatic indicators created for specific sectors of Portugal based on climate change scenarios on a global scale for IPCC AR5 will also be developed. The results will serve as a basis for other projects of this program and for the general public. The IPMA will be responsible for this project.
2. The application process "Adaptation Strategies at Local Scale" will select a project that consists in training local technicians on adaptation to develop local strategies to adapt to climate change, bearing in mind the integration of the concept of adaptation in municipal planning.
3. The application process "Climate Change in schools and Award " will select a major educational project, at a school scale, on climate change, which will focus on faculty training, the production of educational materials and the promotion of a competition on measures related to climate change to be applied to the school context.
4. The application process to "Sectoral Projects" will select a set of 4 to 10 sectoral projects which support work produced around the ENAAC, focusing on vulnerability assessment and cost-benefit analyzes of adaptation.

This strategy will also create a solid basis for work and fully available for subsequent work, indirectly promoting a dynamic continuity of the program (see next section).

The ADAPT program has a total budget of € 3,529,412.00 (€ 3,000,000.00 € EEA + 529,412.00 FPC). Its implementation will also include the contribution of the Direktoratet for Samfunnssikkerhet og Beredskap, a Norwegian agency that will represent the set of Donor States in the different procedural moments that characterize this program.

**Portuguese Carbon Fund**

In the context of Portugal´s contribution to the European effort in achieving the targets foreseen under the Kyoto Protocol (KP), the Portuguese Government XVII created through the Decree -Law No. 71/ 2006 the Portuguese Carbon Fund (FPC).

This financial/ economic instrument is an autonomous fund with a financial and administrative autonomy and its main duties are as follows[59]:
- Crediting emission of greenhouse gases (GHG) generated under the flexibility mechanisms of FP: Clean Development Mechanism (CDM), Joint Implementation (JI), International Emission Trading (IET).
- Crediting of GHG emissions, at competitive prices, through investment in funds managed by third parties or other instruments of the carbon market;
- Supporting projects in Portugal leading to a reduction of greenhouse gases, namely : Areas of energy efficiency; renewable energies, carbon sinks ; geological capture and sequestration of CO2; adoption of new technologies, whenever the return in terms of avoided emissions is to be recommended.
- Promotion of participation of public and private entities in the flexibility mechanisms of the FP;
- Support of international cooperation projects in the field of AC ;
- Support of infrastructural projects accounting GHG emissions and carbon sequestration in Portugal.

[59] Source:http://www.apambiente.pt/índex.php?ref=17&subref=162

In 2009, the Directive 2009/29/EC introduced changes to the Greenhouse gas emission allowance trading scheme that determined that the majority of emission allowances for the new period ( 2013-2020 ) would be auctioned instead of being allocated for free, as it had happened in the two previous periods (2005-2007 and 2008-2012).

Although this is clearly a mitigation policy, this directive also proved to be instrumental regarding the adaptation field by recommending that these auctions revenues should be invested in climate policy measures, including the funding for adaptation measures.

The decree-law 38/ 2013 transposing that directive set up 100 % of auction revenues as revenues of the Portuguese Carbon Fund, further stating that 30 % of the revenues that are not directly affected to the compensation for the extra cost of the renewable energies should be used in financing adaptation policy to climate change, including the implementation of ENAAC, including adaptation and co-financing programs under the Multiannual Financial Framework 2014-2020, which fosters the creation of a line of credit that did not exist previously.

Up to the date of this report, we are still waiting for a revision of the diplomas that will guide the FCP management and the investments to be made in the 2013-2020 period.

**Multiannual Financial Framework 2014-2020**

The European Council of June 2013 made a commitment to devote at least 20 % of EU funding to "climate" goals, including the present adaptation, by 2020. In this sense, in the final stages of approval, eligibilities have been foreseen in the various financial regulations. However, the decision regarding its allocation at national level is up to the Member States, in accordance with the Commission`s guidelines, under the Partnership Agreement.

In the case of the cross-cutting exercise in Public Administration, the schedule for the next period of Community funding adjusts ENAAC´s functioning in the extent that sectoral agencies should identify the performance in terms of sectoral adaptation to be integrated into national planning. In this sense, ENAAC`s coordination can contribute to the articulation, promoting the optimization exercise and ensuring the coherence of the proposals, as well as enhancing cross-sectoral synergies. Given the volume of financing involved, this exercise is considered of major importance in terms of the implementing strategy.

## 5.3 European Climate Adaptation Platform / Climate-Adapt

The Climate-Adapt Platform was developed to support the development in Europe of policies for adaptation to climate change. This is an initiative of the European Commission, managed and maintained by the European Environment Agency, that intends to help users to obtain and share information about:

- expected changes in the climate of Europe;
- Vulnerabilities of regions and of current and future sectors;
- Strategies of national and transnational adaptation;
- Case studies of adaptation and potential adaptation actions;
- Tools to support adaptation planning.

Portugal, as a Member State, was asked to prepare and disclose a summary of the information and of the national initiatives, contents which were integrated into the platform[60]. This contribution was compiled by the coordination of the ENAAC and validated by all sectoral groups. Briefly, it consisted in the following areas of information:

- Description of the legal framing structure to climate change adaptation;
- Identification of the sectors considered as priorities for adaptation in Portugal;
- Summary of the actions taking place at regional and local level;

[60] http://climate-adapt.eea.europa.eu/countries/portugal

- State of development of the various components that characterize the dynamics of adaptation in Portugal structured as follows : ENAAC, action plans, evaluation of impacts, vulnerability and adaptation, research programs, web portal, monitoring, indicators and methodologies;
- Dissemination of the Fifth National Communication under the Effort Sharing Agreement.

However, it should be noted that the contribution of this platform goes far beyond the simple repository of information on the development of the works done in the various Member States. Grouped by region and sector, the available information on impacts and vulnerabilities, good practices and adaptation measures is a wealth of information that will be extremely useful in the development of ENAAC`s future works.

## 5.4 National projects for climate change adaptation

The CIRCLE - 2 is a European network of 34 institutions from 23 committed countries to fund research and share knowledge on climate adaptation and the promotion of long - term cooperation among national and regional climatic change programs.

Within the activities of this net is the INFOBASE[61] initiative, an interactive database freely available on the internet to research projects on climate change adaptation.

The features of this database include a research by country, by sector or by type of information. There are 104 available references[62] on Portuguese projects or references containing information on Portugal (Table 5.2). However, it is also worth noting that the presented list does not exhaust all ongoing or already finished national projects of climate change adaptation. There are other important projects in this area, particularly in the context of scientific research activities. Currently there is no complete national database on this issue. A more comprehensive survey of national adaptation projects is expected in Phase 2 of ENAAC.

**Please see table 5.2** References on Portuguese projects or on Portuguese information mentioned in INFOBASE, CIRCLE2 at Anenex III.

In terms of practical implementation in the context of adaptation there are several examples that can be listed:

- Currently, under the program support projects of the Portuguese Carbon Fund, the agricultural and forestry projects (biodiverse grasslands and shrubland management) funding is ensured to projects that contribute both to the mitigation (by increasing carbon sequestration in soil) and adaptation (by improving the content of soil organic matter, fighting erosion and desertification, increasing the resilience of grassland and forest areas) to new climatic conditions.
- By being a strategic water reserve in the Alentejo region, the Alqueva Multipurpose Project is an important contribution to minimize the effects of long lasting droughts, identified as the most common scenarios of climate change. It can also enhance positive externalities in terms of climate change, such as the increase of the capacity for carbon sequestration in irrigated lands when compared to the non-irrigated ones. That is why it is considered one of the national key projects on adaptation.
- Under the Coastal Protection and Enhancement Action Plan 2012-2015 various contingency plans have been completed in prioritized locations: considering the use of set-back lines according to the rules of the Ovar – Marinha Grande Coastal Zoning Management Plan (implemented in Ovar and in Marinha Grande); introduction of systems for monitoring coastal dynamics and the evolution of the coastline (completed in São Pedro de Moel and Cape Espichel), risk assessment and vulnerability of the Portuguese continental coast (broadly completed).
- Some positive signs have been recorded in the world of business. For example EPAL, the largest production, transport and water distribution company in Portugal, which is always aware of the

[61] http://infobase.circle-era.eu/
[62] Query done on 27th September 2013

vulnerability of its activities under a likely climate change scenario, has recently completed a study to define medium and long term adaptation strategy for the company.

- One of the most serious impacts of climate change on the Portuguese territory concerns the increased risk of forest fires. At this level, the National Plan for Protection of Forests Against Fires has been a reference tool, articulating strategies and actions in this area, involving several entities, whether in the field of forestry, whether in the field of civil protection. The Plan is based on five Strategic Axes of operation covering three priority areas: Structural Prevention, Surveillance and Combat.

# 6. FINANCIAL COMMITMENTS, TECHNOLOGY TRANSFER AND INTERNATIONAL COOPERATION

## 6.1 The Portuguese cooperation

Over the years the work of the Portuguese Cooperation has been guided by three fundamental principles:

a) The historical and cultural relationship with African Portuguese Speaking Countries (PALOP) and East Timor;
b) The promotion of the Portuguese language;
c) Strengthening the role of Portugal in international coordination mechanisms.

To address the need for a more objective cooperation policy, the Cabinet approved, in 2005, A Strategic Vision for Portuguese Cooperation, which identifies as main mission of the cooperation:

> *To contribute towards achieving to a better and more stable world, especially in Portuguese-speaking countries, characterized by economic and social development and by the consolidation and strengthening of peace, democracy, human rights and the rule of law.*

The strategic guidelines of the Portuguese Cooperation, their priorities a sectoral and geographical level and the coordination procedures in the context of a multilateral cooperation are defined in this document.

In recent years coordination policies to the Portuguese development have been prepared taking into account international guidance in this matter, including *the Paris Declaration* and *Accra Agenda for Action* (AAA), both on the effectiveness of aid, and the *Code of Conduct on Complementarity and The Division of Labor in Development Policy* of the European Union (EU). Also within the aid effectiveness Portugal is committed to implement *the Busan Action Plan*, including the "New Deal for International Engagement in Fragile States" and the "Initiative for Gender Equality".

The Portuguese strategic Cooperation has been outlined in order to avoid dispersion of resources in favor of a more coherent logic, improving the rationality, efficiency and aid effectiveness. For this purpose, having been made an effort of concentration of the cooperation actions whether in terms of stakeholders, or in terms of actions and intervention sectors, the guideline of geographic concentration in the Portuguese-speaking countries continued, especially in PALOPs and East Timor. Portugal also tried to follow the principle of sectoral concentration in Education, Health, Security and Justice with a view to a sustainable development and fight against poverty, as a means to achieving the Millennium Development Goals (MDGs).

Portugal has a growing concern for policies coherence, having gradually come to include this issue in the formula of its public policies. The inclusion of references to the MDGs in national strategic documents, such as the Major Planning Options (GOP) and the National Strategy for Sustainable Development (ENDS), is a good example of that. It has also sought to minimize the impact of the implications of the several national

policies in the development of its partner countries by promoting greater coherence among them. As part of this effort, three key instruments play an important part: the Inter Ministerial Commission for Cooperation (CIC), the Development Cooperation Forum and the cited document *A Strategic Vision for Portuguese Cooperation*. It is currently being prepared a new strategy which, when approved, will replace the latter instrument.

Currently Portugal is facing financial constraints that did not exist in 2010. The adoption of measures to reduce the deficit led to budget cuts. Under the Commitment to Efficiency context the Central Administration Improvement and Reduction Plan (PREMAC), with mergers and extinctions of institutions and services, on the one hand, to make the most efficient and rational use of public resources management, and on the other, to meet the objectives of reducing public expenses to which the country is committed. With regard to cooperation to development a merger process has started between the Portuguese Institute for Development Support (IPAD) and the Instituto Camões, which was completed in July 2012, with subsequent reorganization and rationalization of services, giving place to the Camões, IP.

The merger between the two institutions, with different nature and objectives, took into account the principles that guide the development cooperation. During this process, there was a clear understanding, both at political and technical level, of the differences between the objective of promotion and internationalization of the Portuguese language and the Portuguese language understood as a tool for capability and development, including institutional and cultural.

Nevertheless, there may be synergies/ complementarities between the two areas. The Decree-Law no. 21/2012, of January 30$^{th}$ ensures the maintenance of the principles, rules of operation, organization and Portuguese cooperation management, keeping it to promote the development of the partner countries and the Statutes reiterate these principles. The search for efficiency, mutual accountability and a management for results must be considered to the functioning of the new institution.

In the framework of the public administration reform, the Camões, IP has the responsibility to coordinate all the Portuguese cooperation, which includes the supervision of the State budget in terms of Official Development Assistance (ODA), the binding preliminary opinion and assessment of all Portuguese cooperation. In addition to thematic meetings, it promotes coordination and articulation through the CIC (sectoral ministries) and the Development Forum (including the involvement of the civil society).

The CIC has started as a consultation forum among the various sectoral ministries that operate in the area of the development cooperation and exchange of information. In this Commission there is a debate on sectoral nature issues but also cross-cutting ones to the development cooperation in order to internally achieve greater coordination, coherence and complementarity of policies and practices between the different actors of the Portuguese Cooperation.

The Development Cooperation Forum arose from the need to achieve greater consistency in the formulation and implementation of public policies likely to affect the development of the poorest countries, this works as a space for consultation between the public and private sectors of cooperation, thus involving the private sector.

The Indicative Cooperation Programs (PIC) remain in the current context as the main instrument of Portuguese cooperation with partner countries (PALOP and East Timor - most of which LDC and fragile states), ensuring alignment and aid predictability. The Camões, IP coordinates their elaboration, monitors and evaluates their implementation. Thus, the coordination effort from each country is still anchored in the PIC in order to prevent dispersion.

Nowadays, the 2011-2014 Cabo Verde`s PIC and the Mozambique`s PIC from 2012 to 2015 are enacted. The PICs of São Tomé e Príncipe and East Timor are under negotiation and Angola`s PIC has not been

formalized yet. Regarding Guiné-Bissau, the Portuguese cooperation was reduced to interventions that benefit directly the population following the coup of April 12th, 2012 and having into account the position of Portugal towards the events, waiting for constitutional order to be restored, which will re-engage the dialogue with the authorities of this country.

As previously mentioned, a new strategic document for the Portuguese Development Cooperation is being prepared, a process which includes the participation of the main actors. This new document is based on the previous strategy while taking into account the changes that have occurred internationally in the context of development cooperation, seeking to give guidance on the necessary adjustments. It ensures continuity on the main priorities and value added of the Portuguese Development Cooperation as well as the achievement of the commitments made at international level. While this process is not completed, the previous strategy will remain in force.

While the above mentioned process is being carried out, new priorities in CIPs, such as "Entrepreneurship and Enterprise Development " and " Science and Technology Capabilities " "Support to Private Sector " and " Climate Change " have been introduced. Within this framework, new partnerships and new forms of design, such as triangular cooperation and *clusters* have already been developed.

The framing of these new areas is justified by the potential synergies and complementarity with the traditional areas / axis as well as with the major contribution in efforts to fight against poverty and the promotion of sustainable development, in line with the recent international trends.
In recent years the Portuguese Cooperation has been following closely the international negotiations on the environment and especially the climate change at the United Nations, OECD and CPLP level and actively participating in the development and implementation of strategic documents in this matter, as for example the National Climate Change Adaptation Strategy.

## 6.2 Main features of the Portuguese ODA

Table 6.1 shows the total amounts of the Portuguese ODA for the 2007-2011 period.

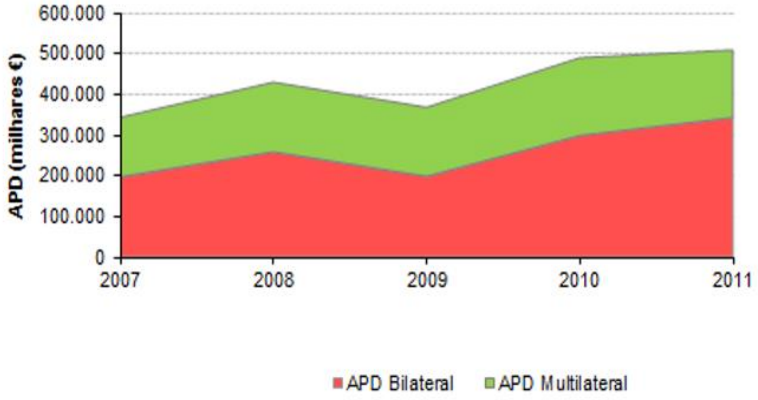
**Table 6.1**
Composition of the Portuguese ODA between 2007 and 2012

| | 2007 | | 2008 | | 2009 | |
|---|---|---|---|---|---|---|
| | 1,000€ | % | 1,000€ | % | 1,000€ | % |
| **Bilateral ODA** | 197,360 | 57 | 258,862 | 60 | 199,124 | 54 |
| **Multilateral ODA** | 146,366 | 43 | 171,093 | 40 | 169,033 | 46 |
| **TOTAL ODA** | **343,726** | **100** | **429,955** | **100** | **368,157** | **100** |

| | 2010 | | 2011 | | 2012 | |
|---|---|---|---|---|---|---|
| | 1,000€ | % | 1,000€ | % | 1,000€ | % |
| **Bilateral ODA** | 299,542 | 61 | 343,175 | 67 | 309,07 | 68,4 |
| **Multilateral ODA** | 190,422 | 39 | 165,890 | 33 | 142,765 | 31,6 |
| **TOTAL ODA** | **489,964** | **100** | **509,065** | **100** | **452** | **100** |

**Source**: Camões,P.I., 2013

From 2008 to 2012, the evolution of the Portuguese ODA had a positive overall trend, except in 2009 and 2012, when there was a slight reversal of the trend (Figure 6.1). Note that, in 2011, the Portuguese Cooperation has overcome the barrier of 500 M€, in net terms, ODA reached 509 M€.




**Source**: Camões, IP/ DPC

**Figure 6.1**
Bilateral and multilateral ODA in Portugal between 2007 and 2011

In 2011, the Portuguese ODA registered a positive variation of 3.90% (Table 6.2) comparing to 2010, despite the adverse conditions strongly marked by constraints of budgetary nature that justify a change in priorities due to the fact that Portugal is under an Economic and Financial Assistance Program (EFAP). Such economic and financial environment resulted in 2012 with a decrease of 9.9% of the Portuguese contributions to the Bilateral ODA and 13.9% to the multilateral ODA.

**Table 6,2**
Variation rate of the Portuguese ODA (Variation Rate at current price)

| | 2008/2009 | 2009/2010 | 2010/2011 | 2011/2012 |
|---|---|---|---|---|
| APD Bilateral | -23,28 | 50,57 | 14,76 | -9,93 |
| APD Multilateral | -0,90 | 12,61 | -13,11 | -13,94 |
| APD Total | -14,37 | 33,09 | 3,90 | -11,24 |

**Source**: Camões, IP/ DPc

The overall positive change rate of ODA in 2011 compared to 2010 was due to an increase in bilateral contributions. One of the reasons lies on the concession of lines of credit and loans to partners of Portuguese Cooperation Countries which represents a significant weight in overall ODA. Beyond that, the volume of 2012 Multilateral ODA followed the trend registred at 2011. The 2011 Portuguese ODA Contributions decreased as a result of a lower contribution (of 24 M€) of ODA through the EU and World Bank Group..

Regarding the 2009 Portuguese ODA, the downward trend relies on two main reasons. Firstly, a decrease of the Portuguese financial effort and secondly the beginning of the Republic of Angola repayment period which contributes to this decrease.

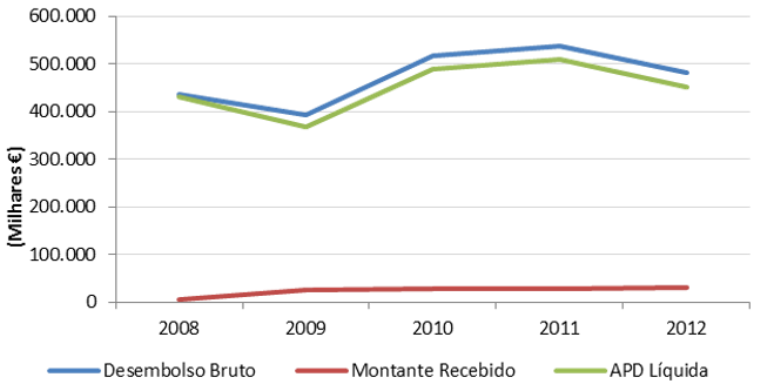



**Figure 6.2**
Evolution of Portuguese ODA between 2008 and 2012
**Source**: Camões, IP/ DPC

The ratio ODA / GNI amounted in 2012 to 0.28%, which represented a decrease compared to 2011 and 2010, whether in relative or absolute terms. Notwithstanding the efforts to increase the ODA, Portugal continues to fall short of the commitment to reach an ODA/ GNI ratio of 0.33%, which should have been achieved in 2006. As a way to fight financial crisis, the current period of control of the public deficit and budgetary consolidation has hampered the achievement of that of that target.

On average, the Portuguese Bilateral ODA is about 62% of Total ODA, while the Multilateral ODA shows a relative weight of 38% (Figure 6.3).

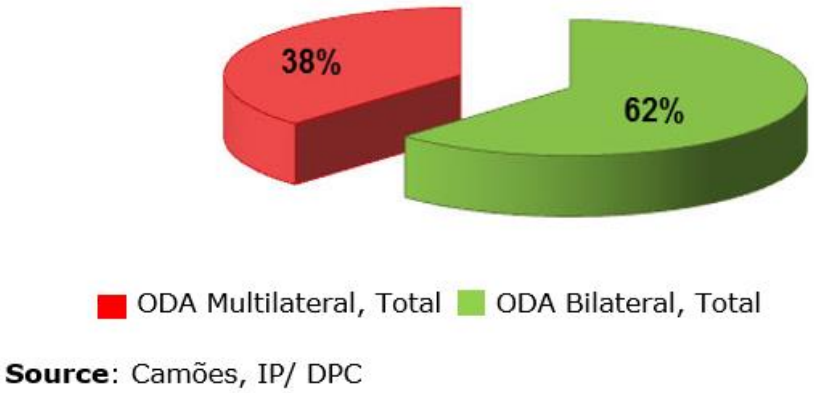
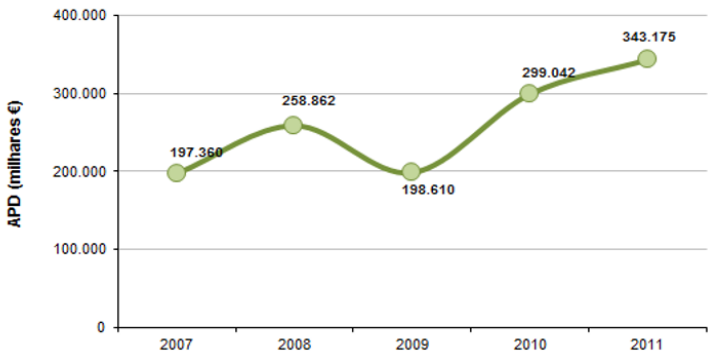



**Figure 6.3**
Average composition (2008-2012) of Portuguese ODA

## 6.3 Bilateral ODA

The Portuguese Bilateral ODA reached 309 M€ in 2012, representing 68% of the total Portuguese ODA that year (Figure 6.4). Despite the negative change rate registed (-9.9%), their average wheight remains equivalent comparing to 2011 (67%). On average, between 2008 and 2012 the Portuguese Bilateral ODA is equivalent a 62% of the total aid.

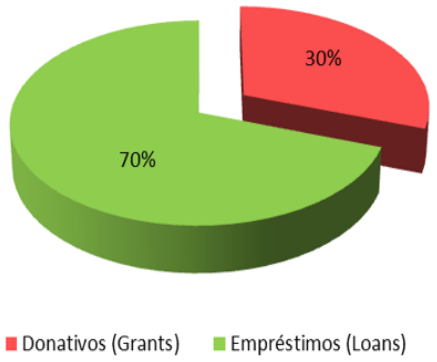



**Source**: Camões, IP/ DPC

**Figure 6.4**
Evolution of bilateral ODA

Between 2008 and 2012, the Grants component of bilateral ODA showed a tendency to decrease, and the Loans component (Concessional Loans and Lines of Credit) gained a strong expression, mainly in the last three years.

In 2012, the weight of the Loans component (Concessional Loans and Lines of Credit) totaled 70% of bilateral ODA, while the Donations component amounted to 30% (Figure 6.5).




**Source**: Camões, IP/ DPC

**Figure 6.5**
Type of funding in bilateral ODA in 2011 [atualizar para 2012]

The distribution of Grants of the Bilateral ODA by Aid Channel (the Aid Channel allows us to identify the entity responsible for implementing the cooperation program/ activity) reveals that the most used channel still is the Donor Government (72%). However, there have been reinforcing trends registering the use of other channels such as the Recipient Government and the National NGOs, which met the recommendation for promotion of synergies that provide greater involvement of civil society in the development process and transfer to the partner`s Governments the leadership and ownership of the development process.

In 2012 the provisional amounts of Portuguese ODA show a decrease compared to 2010 and 2012 largely due to the financial situation the country is facing.

**Geographic priorities**

Traditionally the Portuguese ODA has a strong geographical concentration in the community of Portuguese-speaking countries: PALOPs and East Timor. This trend was more marked in the last two years when, along with PALOP and East Timor, they received in 2010 and 2011, approximately 80% and 90% of the Portuguese Bilateral ODA, respectively (Figure 6.6), percentual values that descrease in 2012 (76%).

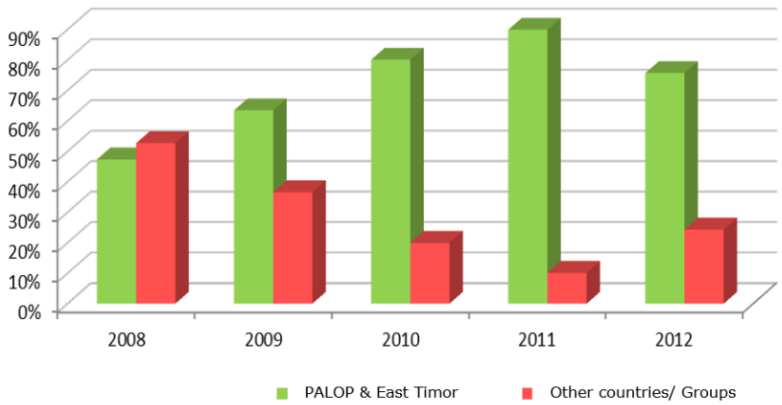



**Figure 6.6**
Geographic distribution of the Portuguese Bilateral ODA (%)
**Source**: Camões, IP/ DPC

The analysis of the Bilateral ODA distribution - Gross amounts (to avoid distortion in the analysis that is introduced concerning the received amounts), reveals that the countries that receive higher contributions are Cabo Verde and Mozambique, having received in 2011, in gross terms, and 133 e 68 M€, respectively (figure 6.7). A significant portion of these amounts is due to the funds channeled through Concessional Loans and Lines of Credit assigned to the construction of infrastructure and equipment and investments in the renewable energy sectors, environment and housing, among others.

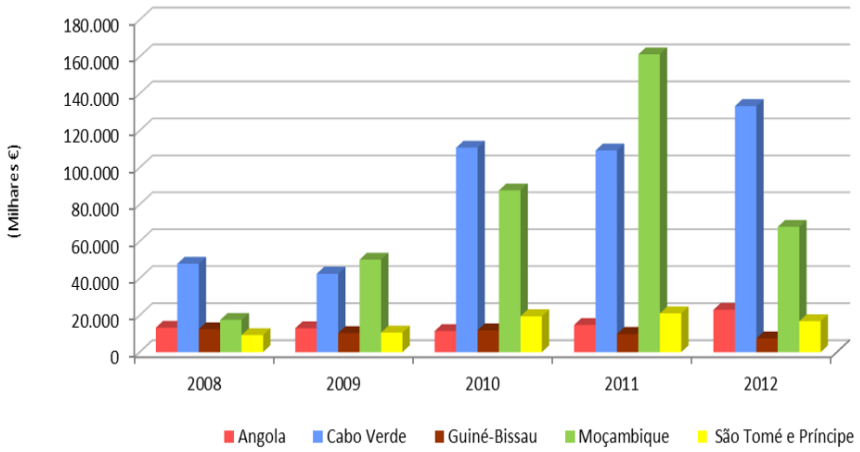



**Figure 6.7**
Portuguese Bilateral ODA – Gross Disbursements
**Source**: Camões, IP/ DPC

**Sectoral priorities**

In sectoral terms, the priorities of the Portuguese Cooperation, have been, over the past few years, rationalized, based on two main criteria. The first relates to the most pressing needs of partner countries, identified in documents of national development strategies. The second criterion relates to the specific added value of Portuguese Cooperation. The factors that confer Portugal potentialities rooted mainly in

Portuguese, pointing in historical knowledge, so for a concentration in education and training, and capacity building, from enhancing the administrative capacity of the State to promote conditions good governance.

Figure 6.8 illustrates that the register is , on average, a concentration in the sector grouping "Social Infrastructure and Services "(Education, Health, Population and Reproductive Health, Water and Sanitation , Government and Civil Society, Other Infrastructure and Social Services) the which accounted on average for the past five years, 40 % of bilateral ODA.

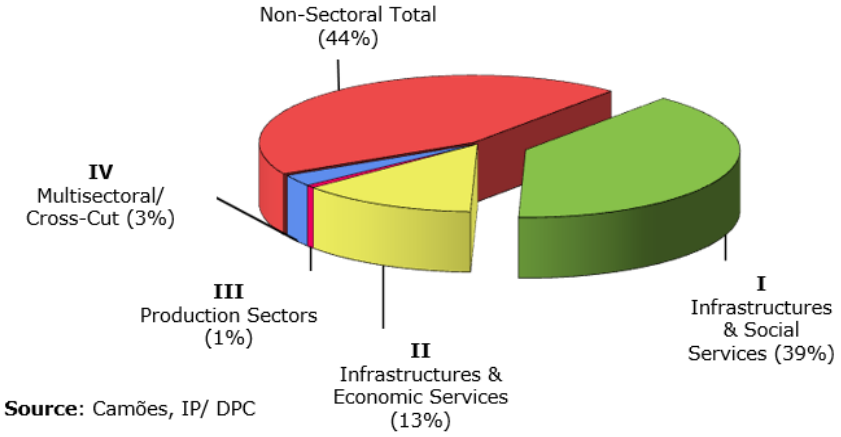



**Figure 6.8**
Sectoral distribution of Portuguese bilateral ODA

The second group is the aid one, by definition, "not allocable sectorally" and where aid programs, actions related to debt, humanitarian help, or support to refugees are included. This group represented in the last 5 years 44% of total bilateral ODA, in contrast to the 25% average in 2007-2010, which is a consequence of the increasing use of concessional Loans and Lines of Credit by some partner countries of the Portuguese Cooperation, such as Cabo Verde, Mozambique and São Tomé e Príncipe.

The third group is the Infrastructure and Economic Services (Transport, Communications, Banking and Financial Services), with 13% of bilateral ODA, for the same time period of analysis).

**Table 6.3**

Bilateral and regional contributions related to the implementation of the Conventions

| 2007 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Cabo Verde | | | | | | | 29,480 | | | |
| Guiné-Bissau | | | 192,117 | | | | 69,826 | | | |
| São Tomé e Príncipe | | | | | | | 28,999 | | | |

| 2008 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Cabo Verde | | | | | | | 43,329 | | | |
| Guiné-Bissau | 66,359 | | 58,236 | | | | 41,895 | | | |
| São Tomé e Príncipe | | | | | | | 28,999 | | | |
| Portuguese Speaking Countries | | | | | | | 11,000 | | | |

| 2009 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Cabo Verde | | | | | | | 33,000 | | | |
| Guiné-Bissau | | | 135,883 | | | | 41,895 | | | |
| São Tomé e Príncipe | | | | | | | 33,000 | | | |

| 2010 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Cabo Verde | 37,423,233 | | | | | | | | | |
| Guiné-Bissau | 15745 | | | | | | | 86,859 | | |
| Moçambique | | | 69,739 | | | | | | | |
| São Tomé e Príncipe | 96,778 | | | | | | | | | |
| Non-specified Developing countries | 41,812 | | | | | | | | | |

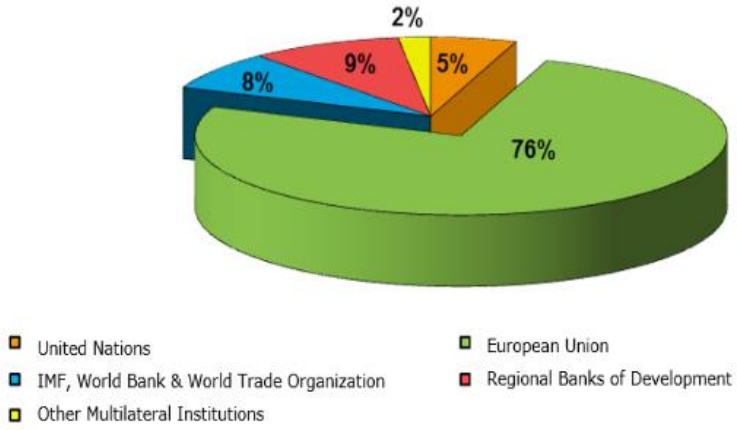
| 2011 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Angola | 19,880 | | | | | | | | | |
| Cabo Verde | 11,419,677 | | | | | | | 2,674 | | |
| Guiné-Bissau | 145,938 | | | | | | | 138,057 | | |
| Mozambique | 3,666,648 | | | | | | | | | |
| São Tomé e Príncipe | 56,804 | | | | | | | | | |
| Cuba | 55,922 | | | | | | | | | |
| El Salvador | | | | | | | 49,412 | | | |
| El Salvador | | | | | | | | | | 49,412 |

| 2012 | Mitigation | | | | | | | Adaptation | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recipient Country/region** | **Energy** | **Transport** | **Forestry** | **Agriculture** | **Waste Management** | **Industry** | **Capacity-building** | **Capacity-building** | **Coastal zone management** | **Other vulnerability assessments** |
| Guiné-Bissau | 83,327 | | | | | | | | | |
| Mozambique | | | 17,192 | | | | | | | |
| Cape Verde | 13,178,586 | | | | | | | | | |
| Mozambique | 1,109,766 | | | | | | | | | |
| São Tomé e Príncipe | 16,286 | | | | | | | | | |
| Mozambique | | | | | | | | | | 47,659 |
| El Salvador | | | | | | | | | | 12,353 |

## 6.4 Multilateral ODA

The Portuguese multilateral ODA is on average 38% ot the total aida. In 2012, the Portuguese contribution totaled 143 M€, which represents a decrease of 14% comparing to 2011. This decrease could be explain through a lower contriution to he EU and World Bank Group that represents a 24 M€ cutback comparing to 2011.

The major portion of the Portuguese multilateral aid is channeled to European Union Institutions (EU), especially through contributions to the European Development Fund (EDF) which finances EU aid for African, Caribbean and Pacific (ACP) countries, and to the budget of the European Commission's external aid that finances aid to developing countries not covered by the EDF. These contributions represented 76% of multilateral ODA. Whether contributions to the Regional Development Banks whether the contributions to the World Bank and World Trade Organization (WTO), accounted for 17% of multilateral aid (Figure 6.9). the UN institutions had channeled on average 5% of the total Portuguese Multilateral ODA.




**Source**: Camões, IP/ DPC

**Figure 6.9**
Average distribution Multilateral ODA (2007-2011)

**Table 6.4**

Financial contributions to multilateral institutions and programmes

| Institution or programme | Contribution (million USD) | | | | | |
|---|---|---|---|---|---|---|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| 1. World Bank | 17,171,725 | 40,934,660 | 2,578,868 | 21,196,468 | 20,958,472 | 1,735,219 |
| 2. International Finance Corporation | 0 | 0 | 625,640 | 0 | 0 | 0 |
| 3. African Development Bank | 11,494,160 | 17,639,259 | 16,243,118 | 16,280,409 | 2,033,660 | 2,387,743 |
| 4. Asian Development Bank | 5,670,890 | 5,975,169 | 6,614,678 | 6,310,689 | 6,627,920 | 6,105,398 |
| 5. European Bank for reconstruction and development | | | | | | |
| 6. Inter-Americam Development Bank | 220,825 | 1,146,257 | 1,303,863 | 526,291 | 552,489 | 824,382 |
| 7. United Nations Development Programme - specific programmes | 1,840,908 | 1,694,056 | 2,496,308 | 1,751,776 | 897,244 | 571,127 |
| 8. United Nations Environment Programme - specific programmes | 20,381 | 45,733 | 48,205 | 0 | 50,993 | 0 |
| 9. UNFCCC - Supplementary Fund | 0 | 273,916 | 137,690 | 87,005 | 54,499 | 96,865 |
| 10. Other | | | | | | |
| 10.1 UNICEF - The United Nations Children's Fund | 170,407 | 344,346 | 319,145 | 295,560 | 0 | 207,683 |
| 10.2 UNRWA - United Nations Relief and Work Agency | 99,255 | 91,313 | 100,156 | 139,883 | 0 | 245,821 |
| 10.3 WFP - World Food Programme | 105,524 | 101,725 | 0 | 0 | 0 | 102,410 |
| 10.4 UNHCR - Office of the UN High Commissioner for Refugees | 1,671,473 | 1,716,316 | 1,704,891 | 1,619,012 | 309,536 | 311,523 |
| 10.5 IFAD | 796,422 | 419,577 | 0 | 0 | 0 | 0 |
| 10.6 UNFPA - United Nations Population Fund | 203,261 | 184,825 | 348,141 | 0 | 347,608 | 0 |
| 10.7 Other UN | 9,743,915 | 9,068,081 | 11,143,542 | 12,102,704 | 9,340,362 | 10,209,573 |
| 10.8 EDF - European Development Fund | 35,055,441 | 42,065,484 | 44,589,620 | 45,055,150 | 48,104,867 | 38,431,877 |
| 10.9 EC - European Commission | 103,326,489 | 114,380,499 | 141,275,588 | 135,986,755 | 129,769,188 | 111876,607 |
| 10.10 EIB - European Investment Bank | 2,987,680 | 4,800,231 | 1,958,641 | 3,083,444 | 2,708,231 | 3,491,003 |
| 10.11 Regional Banks | 17,385,875 | 24,760,685 | 24,161,659 | 28,095,854 | 14,453,223 | 14,303,701 |
| 10.12 IFAD | | | | | | |
| 10.13 IMF - International Monetary Fund | | | | | | |
| 10.14 Other Multilateral | 10,998,489 | 7,398,376 | 6,323,924 | 3,730,925 | 3,547,432 | 1,517,206 |
| 10.15 EC for Part II of DAC | | | | | | |
| 10.16 Other Multilateral Institutions for Part II of DAC | | | | | | |

In order to contribute to the resolution of global environmental problems, including those arising from climate change, Portugal contributed to the Global Environment Facility (GEF), according the data in Table 6.5.

**Table 6.5**

| Kind of Flux | Currency | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| Commitment – Issuance of Promissory Notes (110) | USD* | 3,770,000 | 1,980,000 | 1,920,000 | 0 | 0 | 0 |
| | EUR | 2,753,985 | 1,372,734 | 1,378,752 | 0 | 0 | 0 |
| Disbursement – Use of Promissory Notes (311) | USD* | 2,500,000 | 3,030,000 | 1,900,000 | 2,170,000 | 1,210,000 | 995,630 |
| | EUR | 1,826,250 | 2,100,699 | 1,364,390 | 1,638,350 | 870,232 | 774,600 |

## 6.5 ODA Environment and Climate Change

In Portugal, ODA for environment has little expression regarding total values by virtue of the strategic priorities that essentially fall, as previously mentioned, in areas such as Education, Health, Security and Justice, in a perspective of sustainable development and the fight against poverty.

Regarding ODA related to climate change, particularly in what mitigation is concerned, it represented between 2007 and 2012 about 51% to 93% of ODA environment, having represented in the last three years more than 80%, as shown in Table 6.6.

**Table 6.6**

Climate change related ODA

| | | *Significant objective* | *Main objective* | APD Bilateral TOTAL - Mitigation |
|---|---|---|---|---|
| **2007** | € | 11,600,041 | 320,422 | 11,920,463 |
| | % | 97.3% | 2.7% | 100% |
| **2008** | € | 14,968,964 | 238,818 | 15,207,782 |
| | % | 98% | 2% | 100% |
| **2009** | € | 5,330,072 | 243,778 | 5,573,850 |
| | % | 95.6% | 4.4% | 100% |
| **2010** | € | 2,572,070 | 37,605,495 | 40,177,565 |
| | % | 6% | 94% | 100% |
| **2011** | € | 2,068,687 | 15,414,281 | 17,482,968 |
| | % | 12% | 88% | 100% |
| **2012** | € | 444,791 | 14,475,621 | 14,920,412 |
| | % | 3% | 97% | 100% |

| | | *Significant objective* | *Main objective* | APD Bilateral TOTAL - Adaptation |
|---|---|---|---|---|
| **2007** | € | 2,141,706 | 0 | 2,141,706 |
| | % | 100.00% | 0.00% | 100.00% |
| **2008** | € | 1,285,742 | 0 | 1,285,742 |
| | % | 100.00% | 0.00% | 100.00% |
| **2009** | € | 1,237,149 | 0 | 1,237,149 |
| | % | 100.00% | 0.00% | 100.00% |
| **2010** | € | 1,462,477 | 86,859 | 1,549,336 |
| | % | 94% | 6% | 100.00% |
| **2011** | € | 1,085,255 | 140,731 | 1,225,986 |
| | % | 89% | 11% | 100.00% |
| **2012** | € | 213,955 | 29,085 | 243,040 |
| | % | 88% | 12% | 100.00% |

**Source**: Camões, IP./DPC

These higher percentages that occurred between 2010 and 2012 are due primarily to the financing of renewable energy projects under the Line of Credit for Cabo Verde and two ongoing projects in Mozambique which were funded under the Portuguese Fast Start Implementation Initiative.

In a general way, Portugal has been paying particular attention to climate change, especially its integration in terms of development cooperation, thus seeking to follow through international guidelines.

Our country has been following the negotiations on adaptation under the United Nations Framework Convention on Climate Change and, at EU and OECD level, in the latter two cases, in particular with regard to the integration of adaptation climate change in development cooperation policy. In order to comply with the recommendations of the OECD and in line with what is advocated in the examination of the development cooperation policy in 2010, a number of initiatives were carried out, namely:

- Translation into Portuguese of the OECD Guide on "integrating adaptation to climate change in development cooperation";
- IPAD´s in-house awareness actions on integrating climate change in development cooperation;
- Action training on climate change adaptation and development cooperation, attended by technicians of public administration related to the area of Portuguese cooperation, including the most relevant sectoral ministries;

- In 2011, was held in Lisbon the 4th Lusophone Meeting on Environment and Development, in which particular attention was paid to climate change integration in development cooperation, attended by representatives of the Ministries of Foreign Affairs, External Affairs and Environment from the PALOP and TL;
- Actions to raise awareness on integrating climate change , in particular adaptation to the development policies among Portuguese teachers who participate in education programs (teacher training) with Angola and Guiné-Bissau;
- Strengthening the implementation of the OECD marker for adaptation, which aims at the classification of official development assistance (ODA);
- Creation of a working group responsible for the adequacy of forms, drafting new rules for submitting projects and new analysis criteria, aiming to integrate climate change adaptation in development cooperation.
- Regarding other initiatives in the disaster risk reduction area, a new eligible area was added. The "Resilience/ Risk Reduction Disaster" area belongs to the Support Mechanism to the Development Cooperation Project for Portuguese NGDO, a joint initiative between Calouste Gulbenkian Foundation, EDP Foundation, Luso - American Development Foundation, Portugal Foundation - Africa (promoting Foundations), with the support of Camões, IP, Cooperation and Language Institute. This initiative is intended to support financially NGDOs in developing applications for various international funding, a matter which requires preparation, knowledge and financial resources.

Under the initiative of fast climate change implementation (Fast Start), Portugal undertook towards the European Council (held on 10-11 December 2009) a contribution of EUR 36 million in 2010-12 to support the developing countries on measures on climate change - in particular with regard to strategies to reduce emissions, increase resilience and adaptation to the impacts of climate change and capacity building.

This national funding envelope falls within the framework of Community financial envelope which represents the European Union support for the same goals, amounting to EUR 7.2 billion in the 2010-12 period. This financial contribution should be considered as an instrument of development cooperation policy, with special focus on partner countries of Portuguese cooperation, and focused on actions related to climate change and actions that integrate climate change issues. In this sense the main target countries for national cooperation in this area are the Portuguese-speaking African countries and East Timor.

In order to operationalize this commitment, several technic and politic contacts were made, at different levels. These contacts led to the Memoranda of Understanding (MoUs) established between Portugal and preference-receiving countries (Angola, Cabo Verde, Mozambique, Guiné-Bissau, São Tomé e Príncipe, East Timor) (Table 6.7) . These MoUs serve as a framework for the submission and approval of projects under the Fast Start initiative and rest so far on a concrete expectation of commitment of approximately € 24 million. This amount represents, once implemented, approximately 66.7 % of the national commitment of Fast Start.

**Table 6.7**

Memoranda of Understanding (MoU) between Portugal and preferential countries in terms of cooperation, 2010-2012

| Country | Financial Envelope | Signature Date |
|---|---|---|
| Moçambique | 9 million Euros | March 2010 |
| Angola | 9 million Euros | November 2010 |
| Timor Leste | 1,5 million Euros | December 2010 (Conferência de Cancun) |
| Guiné-Bissau | 1,5 million Euros | February 2011 |
| São Tomé e Príncipe | 1,5 milhões de euros | março 2012 |
| Cabo Verde | 1,5 milhões de euros | junho 2012 |

Given the increasing interest and importance about the Environment, and climate change in particular, to the Portuguese cooperation, an inter-ministerial task force was formed in the wake of the Copenhagen

Conference, with representatives of the Ministry of Foreign Affairs and the Environment to coordinate this dossier.

In this context and with the purpose of regulating the application of fast start commitment of Portugal, the application rules of the Portuguese Initiative of Immediate Implementation applied to Climate Change as well as the responsibility for its implementation through the establishment of a working group (WG - Fast Start) were established by Cabinet order no. 15295/2010, of 11th October .

Apart from the seven projects supported by Camões, IP (ex -IPAD) that were integrated within Fast start (a total of 800 thousand euros), in 2011 the Portuguese Carbon Fund signed a contract for two projects in Mozambique, namely:

a) "Atlas of the renewables energies in Mozambique" envisaging the characterization of Mozambique renewable resources (solar, wind, hydroelectric, geothermal, biomass/ MSW, waves) and;
b) "Installation of photovoltaic systems in 50 villages" envisaging the installation of photovoltaic systems for the electrification of 50 villages in Mozambique.

In March 2013, Portugal concluded the approval process of five new fast start projects, namely:

a) "Capacity Building for the Low Carbon Resilient Development Strategies";
b) "National Energy Plan for Forest Biomass for Angola";
c) "Integrating Adaptation to Climate Change into Development planning" (IAMCD);
d) "Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique " ( MICOA );
e) "National Support Plan for Urban Sanitation regarding Emission Reduction and Adaptation to Climate Change" (PLASU - AC).

Note that the project "Development and implementation of a system for monitoring agro - forest vegetation" (SiMoFlor, with a budget of about 940 000 euros), also submitted and then analyzed with positive technical assessment, was not approved. its support was suspended for cooperation was minimized to direct support to population until the constitutional order is resumed and there is a re-engagement with the Guinean authorities democratically elected. For the same reasons, the participation of Guiné-Bissau in the project "Capacity Building for the Low Carbon Resilient Development Strategies" was also suspended and the approved budget revised accordingly (decrease of 350 thousand euros).

In this context it should be noted that, under the Fast Start bilateral cooperation, the following amounts are budgeted:

a) 24 million euros in MoUs;
b) Some 14,3 million euros in projects with Ministerial approval;
c) 10,9 million euros in contracts in progress/ completed;
d) 1,9 million euros in a project to be contractualized in a near future with the promoters.

**Table 6.8**

Total amount approved and distribution by major measures and by country

| **Total amount approved** | **14,259,547.09€** |
|---|---|
| Underpaid amount to *fast start* commitment | 21,740,452.91€ |
| Mitigation | 11,199,562.66€ |
| Adaptation | 2,115,155.02€ |
| Capacity building | 944,829.41€ |
| **Total** | **14,259,547.09€** |
| Bilateral cooperation | 14,250,207.09€ |
| Angola | 1,973,683.51€ |
| Cabo Verde | 566,545.11€ |
| Mozambique | 10,402,780.36€ |
| Guiné-Bissau | 635,181.00€ |
| São Tomé e Príncipe | 672,017.11€ |
| Timor Leste | - € |
| Multilateral cooperation | - € |
| Others | 9,340.00€ |
| **Total** | **14,259,547.09€** |
| % Achievement | 40% |

Until December 2012, payments were made amounting to 5.7 M€ (disbursement of about 69% of the total amount committed by contract, 24% of the total committed to MoUs, and about 16% of the total Fast Start commitment).

Furthermore, under the Fast Start initiative, there are still some projects whose assessment is being completed. These projects might be subject to Portuguese support and can amount to an additional contributions.

In addition to the amount recorded for the purposes of undertaking fast start, it should be noted that, through the co-financing of some projects, it was possible to mobilize an additional amount of funding for these countries of 1.6 M€ (in public and private financing).

Note also that the funds allocated by the FPC under the Fast Start initiative are counted as ODA but are extras for they are earmarked in its own budget (FPC) to cooperation projects in the area of climate change. Therefore, this is not a question of a diversion of funds that could be channeled to another type of cooperative actions for climate change theme (please see the Annex II – table 5.2 : full list of projects implemented under the fast start initiative).

With regard to the values of multilateral ODA intended to climate change, these have been reduced since 2010 because to date Portugal did not formalized any commitment regarding a potential national contribution to the 5th restoration of the GEF.

### 6.5.1 Technology transfer

In the field of technology transfer and considering the definition written in the Convention text, particularly item c, paragraph 1 and paragraph 5 of Article 4, in most cases the programs, projects and activities (PPA) developed by the Portuguese cooperation under the context of ODA involve technology transfer, practices and processes appropriate to each area of the PPA as well as the necessary Knowledge to implement these technologies.

Notwithstanding what was already said, it becomes difficult to specify a case since the policy of statistical report of the OECD/ DAC currently does not foresee a marker for the transfer of technology that allows the qualification of the PPA in this perspective or to specifically identify the technology or technologies transferred in each case . This omission at a reference statistical report level, does not mean that in the

review and approval process the identified technologies are not taken into account , and their assessment is not part of the criteria .

However, the Portuguese cooperation in the context of combating climate change has increased significantly since the creation (in 2005) of the Network of Climate Change Offices of CPLP countries (RELAC) seeking to develop actions in the area of training and developing cooperation activities particularly with its partner countries, including PALOPs - African Portuguese speaking countries and East Timor. In this context, the Portuguese Ministry of Environment started promoting some activities and projects, some of which focused on the know – how transfer, processes and technology for these countries, in different sectors, in line with the Strategic Vision for Portuguese Cooperation. More and more, Portugal wants to continue the cooperation focused on the energy sector and particularly on renewables. Here are two specific examples in the area of technology transfer that correspond to two projects conducted in Mozambique in recent years.

| | | | |
|---|---|---|---|
| **Project / Program**: Supply and Installation of Photovoltaic systems for the electrification of 50 villages in Mozambique | | | |
| **Objective**: aims to promote the use of renewable energies on solving specific problems of energetic nature, such as to provide clean water to education and health sectors of energy, education and rural health centers, establishing itself as a capacity building model for implementing projects of a Clean Development Mechanism. | | | |
| **Country:** Mozambique | **Sector:** Energy | **Total funding:** 3.85M€ | **Implementation years:** 2011-2013 (extension foreseen) |
| **Description:**<br>The project is to provide 50 remote villages, covering all provinces of Mozambique, with solar PV systems in schools and health centers and associated housing (teachers and nurses) that will allow basic access to electricity in a way to allow not only illumination but also refrigerators for vaccines and water pumping systems, thus given access to health and education to the population that does not have these resources. The project also provides training for local technicians to maintain the systems. | | | |
| **Factors that lead to the success of the project** : Education and the provision of basic health services to rural Mozambican population are two important vectors of PARPA - Action Plan for the Reduction of Absolute Poverty in Mozambique . Through the electrification of schools and rural hospitals several goals of great importance can be achieved, namely:<br>– Duplicate the training capacity of schools by enabling schools to be open at night , the most suitable for adult training period, which during the day are devoted to agricultural activities and grazing;<br>– Allow hospitals to have means for storage of drugs and vaccines ( Refrigerators and the possibility of better care at night.<br>By enabling the electrification of staff and physician´ homes, this action also has a great impact in creating better housing conditions for the technical staff , which translates in an increase of the ability to attract personnel. | | | |
| **Transferred Technology: solar photovoltaic** | | | |
| **Impact on GHG emissions**: The project does not foresee an Emission monitoring system; | | | |

| | | | |
|---|---|---|---|
| **Project / Program:** Atlas of the Renewable Energies of Mozambique | | | |
| **Purpose:** Mapping and assessment of renewable resources in Mozambique: Wind, Solar, Water Resources, Geothermal, Biomass / MSW, Waves | | | |
| **Country:** Mozambique | **Sector:** Energy | **Total funding:** 3.699.218,45 € | **Implementation Years:** 2011-2013 |
| **Description:**<br>Based on the objectives identified in the " New and Renewable Energy Development Policy", identification, location, characterization and evaluation of the potential of renewable resources have become a priority in Mozambique. To achieve this goal, this project conducted a mapping of the following potential sources of renewable energy: Solar, wind, water , hydro, geothermal, biomass / MSW and wave energy. This mapping is intended to be a basis for consultation and work for all renewable energy projects that will be developed in Mozambique. | | | |
| **Factors that lead to success of the project**: Create conditions and promote the development of projects that will maximize the use of existing and available natural resources in Mozambique. | | | |
| **Technology transfer:** The identification and characterization of renewable potential in order to create the foundation for the development of decentralized renewable energy projects, enabling a progressive electrification of the whole country and the creation of small local networks that will gradually be expanded and linked to other local networks and subsequently interconnected to the transmission system. | | | |
| **Impact on GHG emissions:** The project does not foresee an Emission monitoring system; | | | |

Portugal has also been involved in the translation of various technical documents related to climate change - the Manual for "Integrating Adaptation to Climate Change in Development Cooperation" was recently translated. This manual provides ways to identify approaches in order to integrate adaptation into national development policies, at a sectoral and project level, both in the urban and rural context.

Currently Portugal has, some in the analysis phase others in the initial implementation phase, more projects with its partner countries that fall in promoting technologies transfer, practices and processes in different sectors.

### 6.5.2 Strengthening institutional capacity

When it comes to development cooperation , including with the PALOPs and TL whether in the bilateral context or in the CPLP (Community of Portuguese Language Countries), Portugal has paid special attention to capacity building at institutional level. This is true both for PPAs that are exclusively dedicated to this matter and to the inclusion of a capacity building component in different PPAs, trying to adapt them to change demand, to State institutions, to strengths and weaknesses of existing national systems in the recipient countries in a way to produce capabilities of autonomous problem solving.

The PPAs supported by the Portuguese cooperation usually have a strong technical assistance component with strong focus on the development of national capacities. Portugal tries to pay special attention to the efficiency and aid principles embodied in the Declaration of Paris and developed in Accra and Busan, especially: leadership and control by beneficiaries so they can strategically earmark their resources; enhance existing capabilities as a starting point, avoiding the creation of parallel structures and systematically using to national systems for aid implementation; technical driven cooperation for the demand of partners.

Regarding cooperation projects on climate change, Portugal tries to lead beneficiaries to lead and control systematically using national systems for aid implementation. In this context, there are some project that should be highlight, in particular the projects developed in Mozambique with FUNAE (" 50 Villages " and " Atlas of the renewable energy ") and MICOA (" Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique ") and the development of projects with more than one country promoter, as in the case of " Capacity Building for the Low Carbon Resilient Development Strategies " and " Integrating

Adaptation to Climate Change into Development " projects involving Cape Verde , Mozambique and São Tomé e Príncipe.

# 7 Systematic Research and Observation

## 7.1 Scientific research

### 7.1.1 General Policy on Scientific Research Funding

The Foundation for Science and Technology (FCT) is the main public funding agency for science, technology and innovation in Portugal.

The FCT´s mission is the continuous promotion of the advancement of scientific and technological knowledge in Portugal, exploring the opportunities (that are necessary in all scientific and technological fields) to achieve the highest international standards of knowledge creation, and to stimulate their diffusion and contribution for the improvement of education, health and the environment, for life quality and public welfare in general.
This mission is mainly accomplished through the granting of funds following the assessment of the merit of proposals from institutions, research teams and individuals presented in calls and also through cooperative agreements and other forms of support in partnership with universities and other public or private institutions, in Portugal and abroad.

The results of the FCT activity are ultimately the individuals‘ additional contributions, research groups and institutions included in its grants portfolio.

**FCT ´s functions:**
• To promote, fund, monitor and evaluate scientific and technological institutions, programs and projects in Science and Technology, training and qualification of human resources;
• To promote the establishment and strengthening of support infrastructures to scientific research and technological development;
• To promote the diffusion and dissemination of culture and scientific and technological knowledge, and the teaching of Science and Technology, particularly when relevant for educational purposes, in collaboration with the Ciência Viva Agency;
• To encourage modernization, articulation, remediation and public availability of information sources in Science and Technology.

In a broad sense, Science and Technology embody exact sciences, natural and health sciences, engineering, social sciences and humanities.

### 7.1.2 Climate Change Related Research Projects

FCT supports more than 1,700 research teams, integrated in Research Units and national associate laboratories that develop research activities in the climate change area.

In the period between 2006 and 2012, FCT has funded more than 100 projects of scientific research on climate change, with a budget superior to € 15 million (Table 7.1).

**Table 7.1**

Scientific research projects relating to climate change funded by the FCT

| Year | No. of projects | Granted Funds |
|---|---|---|
| 2006 | 17 | 2,399,058.00 € |
| 2008 | 35 | 5,710,659.00 € |
| 2009 | 24 | 3,212,203.80 € |
| 2010 | 8 | 1,000,214.00 € |
| 2011 | 2 | 116,827.00 € |
| 2012 | 17 | 2,989,177.00 € |
| **Total** | **103** | **15,428,138.80 €** |

Since 2009, in the context of climate change, 29 research projects developed by national research teams have been or are being funded by the European Union through the Seventh Framework Program for Research and Technological Development of the European Union (Table 7.2). The total funding exceeds 180 million Euros.

**Table 7.2**

National research projects relating to climate change funded by the EU

| Starting date | No.of projects | Funding grants |
|---|---|---|
| 2009 | 4 | 23,484,071.66 € |
| 2010 | 8 | 49,457,519.94 € |
| 2011 | 5 | 34,032,725.84 € |
| 2012 | 5 | 17,531,619.10 € |
| 2013 | 7 | 59,351,246.80 € |
| **Total** | **29** | **183,857,183.34 €** |

## 7.2 Systematic observation

National plans relating to systematic climate observation are borne by the Portuguese Institute For Ocean and Atmosphere (IPMA), regarding the components of the atmospheric and oceanic observation, of the the Hydrographic Institute (IH), for the components of oceanic observation and of the Portuguese Environment Agency (APA), concerning the components of atmospheric and land observation.

Following are the descriptions of the various observation networks and systems as well as data processing installed in Portugal that contributed to the Global Climate Observing System (GCOS) as part of the observation networks defined in the observation programs of the World Meteorological Organization (WMO).

### 7.2.1 Observation Systems of atmospheric climate and atmospheric composition

As a member of the WMO and within the context of its global programs, Portugal develops and operates several atmospheric and climate observing networks, in particular the World Weather Watch (WWW) through the Global Observing System (GOS), but also the program of the Global Atmosphere Watch (GAW) and the World Hydrological Cycle Observing System (WHYCOS), also following the recommendations of the Instruments and Methods of observation Program (IMOP) and the World Climate Program (WCP) of the WMO.

In Portugal, the IPMA is the body that is responsible for carrying out the observations for meteorological and climatological purposes. Thus it has given continuity and development to its own scientific and technical activities which began in Portugal around the nineteenth century. These activities were mainly concerned about the availability and quality of long duration climate data series. These data are essential for studies of climate change, particularly in terms of trends and heat and cold extreme temperatures.

The IPMA has made all efforts to guarantee the operability of the network of weather stations, proceeding to their maintenance and to the quality control of the observations and their subsequent filing. In May 2013,

there were 158 weather stations operating in Portugal, 144 of which are automatic and 14 are conventional. All stations measure, among other climatic elements, the air temperature, the intensity and direction of the wind, humidity and precipitation. Furthermore almost all measure solar radiation and some measure atmospheric pressure. On the Continent there are 126 stations with a density of 05/01/1000 km2, in Madeira there are 14 stations with a density of 17/1000 km2 and there are 18 stations in the Azores with a density of 8/1000 km2. Out of these stations, nine elaborate a report using the CLIMAT code, which contains monthly climatological statistics and are monthly published through the global weather telecommunications system of the WMO.

Portugal belongs to the GSN network along with its three ground weather stations: one in the Mainland (Lisbon - belonging to the Geophysical Institute of the University of Lisbon), one in Madeira (Funchal Observatory - IPMA) and the Azores (Ponta Delgada/ Nordela-IPMA).

The activities of the station in Horta (the Azores) were partially interrupted due to difficulties within the staff.

Participation in the Global Observing System has not changed in recent years.

**Table 7.3**

Participation in the Global Climate Observing System

| | GSN | GUAN | GAW | CLIMAT* |
|---|---|---|---|---|
| No. of stations under Portuguese responsibility | 4 | 1 | 7 | 9 |
| No. of stations currently operating | 4 | 1 | 2 | 9 |
| No. of stations operating in accordance with the GCOS patterns | 3 | 1 | 2 | 9 |
| No. of stations operating in 2012 | 4 | 1 | 2 | 9 |
| No. of stations that provide data to international centers | 3 | 1 | 2 | 9 |

* Broadcasting of the CLIMAT reports (form code FM 71 – XII of the WMO)

With regard to aerologic observations, the IPMA continued the observation of a daily program in three national radiosonde stations - Lisbon, Funchal/ Madeira and Lajes / the Azores (operated by the Portuguese Air Force), which includes high resolution pressure measurement, temperature, humidity and wind up until more than 30 km altitude. The station of the Azores (508) integrates the GUAN network.

Observation activities in Portugal within the GAW program and EMEP programs (European Monitoring and Evaluation Program) of the UNECE (United Nations Economic Commission for Europe) and the CAMP (Comprehensive Atmospheric Monitoring Program) of the OSPAR (Oslo and Paris Commission) have been suspended since mid-2010, due to budget problems of the IPMA. However, the total measurements of ultraviolet radiation ozone in Madeira and the Azores are still registered by the Brewer spectrophotometer and by air samplers to measure the concentration of methane and carbon dioxide in the Azores.

Given the recent organizational changes at a ministerial and public authorities level relating to environment and related areas, the preparation of a national plan was initiated. This plan involves particularly the IPMA and the APA. It aims to the rehabilitation of the atmospheric composition observing systems and resumes the atmospheric chemistry monitoring in some stations of Portugal, those which meet the requirements of the GAW program.

The rehabilitation of the ultraviolet radiation observations through broadband sensors (UV - bio meters) is already ongoing. The two new detectors, which will be installed in Portugal in 2013, have already been acquired.

Portugal, through the IPMA, still performs observations on Terceira/ the Azores to the "Carbon Cycle Surface Flasks" project promoted by the "Carbon Cycle Greenhouse Gases group "(CCGG), the "Earth System Research Laboratory" (ESRL), the NOAA / U.S. Such observations are integratedin the "CCGG Cooperative

Air Sampling" network. The IPMA has also collaborated in the installation and operation (up to 2011) of a station on the island of Pico / the Azores, for the same project. Currently it keeps the observations on the "Surface ozone" project of the NOAA / ESRL / CCGG.

To complement the rainfall observation networks and also for purposes of weather forecasting and nowcasting, the IPMA has two weather radars operating in the Mainland (in the South Central regions). A third one is under construction in the northern region (expected to be completed in 2014). This third radar will complete the national network, covering all the Mainland. This network will be integrated with the weather radar networks of the Iberian Peninsula and Europe, within the OPERA program of the Eumetnet, similarly to what already happens with the two weather radars that the IPMA installed in the center and south of Portugal.

Portugal, particularly the IPMA and the APA, keeps files relating to the "Essential Climate atmospheric Variables" (ECV) which consist of several datasets from different types of weather observing systems ( in-situ and remote) and include records obtained in the observing systems near surface and in altitude. All information that integrates these files is previously validated, being systematically checked by data quality control processes, which follow international recommendations.

### 7.2.2 Ocean Climate Observing Systems

The IPMA participates in the Global Ocean Observing Systems featured in Table 7.4.

**Table 7.4**

Participation in the Global Ocean Observing System

| | VOS | SOOP | TIDE GAUGES | SFC DRIFTERS | SUB-SFC FLOATS | MOORE DBUOYS | ASAP |
|---|---|---|---|---|---|---|---|
| No. of platforms under Portuguese responsibility | 15 | 0 | 12 | 0 | 0 | 0 | 0 |

### 7.2.3 Global Terrestrial Observing System

Portugal participates in the TIGER project, funded by the European Space Agency (ESA, the English acronym), which began in 2009 and will end in 2013. The aim of this project consists in the supervision, monitoring and transmission of scientific know-how in the exploration and digital processing of satellite images of earth observation, used in the control and monitoring of climate change policies and in the water resources management in Africa. In addition to technical and scientific dissemination, the TIGER project seeks to encourage the development of information exchange networks and the development of methodologies between research institutes and universities, both African and European.

The Climate Change Initiative (CCI) is an ESA program, whose main objective is to boost the potential of the data files of the Earth Observation that ESA, together with its Member States, has been establishing over the past thirty years. This is a significant contribution to the databases of the "Essential Climate Variables" (ECV), which in turn are necessary to support the work of the United Nations Framework Convention on Climate Change. The CCI intends to promote a long term use of ECV products based on satellite data so that they can be used by data modeling teams and by researchers. The variable ECV will be aimed at data from multiple satellites (not only from ESA but also from other international collaborations) and will include specific information with respect to possible errors and uncertainties associated with these data. The CCI is a program with a funding of 75 M € which runs from 2009 until 2016. Portugal endorsed this program in 2008 with a financial contribution of 0.75M €. Currently they are three Portuguese projects in operation, aimed at three different variable ECVs: Fire Disturbance, Sea Level and Ocean Color.

**Table 7.5**

Participation in the Global Terrestrial Observing System

| | GTN-P | GTN-G | FLUXNET | Others* |
|---|---|---|---|---|
| No. of places under Portuguese responsibility | 0 | 0 | 0 | **16** |
| No. of places currently operating | 0 | 0 | 0 | **16?** |
| No. of places providing data to international data centers | 0 | 0 | 0 | **16** |
| No. of places operating in 2012 | 0 | 0 | 0 | **16** |

GTN-P (Permafrost) = 0, GTN-G (Glaciers) = 0, FLUXNET (Carbon) = 0

*Others: GTN-R (Rivers) = 16 hydrometric stations APA/INAG

### 7.2.4 Programs Based on Space Observation

Through the IPMA, Portugal has been involved in several projects on remote sensing data applications for a systematic monitoring of continental surfaces and therefore relevant for climate monitoring and identification of climate change impacts. The main themes and sources of funding of these projects are listed below.

***LSA SAF***

The EUMETSAT [63]- Satellite Applications Facility on Land Surface Analysis (LSA SAF) - is a project led by the IPMA whose main objective is the development of algorithms to obtain variables related to continental surfaces, including albedo, temperature and emissivity, radiative fluxes, parameters that characterize the state of the vegetation, evapotranspiration, identification, characterization and risk assessment of forest fires. Being essentially funded by the EUMETSAT, the LSA SAF aims primarily to exploration of the capabilities of the European meteorological satellites (Meteosat Second Generation and EUMETSAT Polar System).

The methodologies developed in the context of the LSA SAF are used for the production, archiving and distribution of satellite products related to the variables mentioned above. The LSA SAF intends to maintain a medium-long term service: data production was started in 2005; the current phase of the LSA SAF insures the data processing until 2017. Soon the new phase of the program (2017-2022) will be drawn. Note also that the LSA SAF will carry out reprocessing of albedo, temperature and vegetation emissions from forest fires in order to provide data for climate studies.

***Geoland-2***

The Geoland - 2 (Sep 2008 - Dec 2012) was funded by the 7th Framework Program - European Commission (EC), having been the pilot project of the GMES Land Monitoring Core Service (LMCS) - a service that aims to assist the Commission in monitoring and setting environmental policies, from various aspects that concern continental surfaces (surface patterning, land use, development of plant cover, crop forecasting, water resources, carbon emissions, etc.). In this project, the IPMA adapted techniques to obtain radiative parameters. These techniques were developed within the LSA SAF for IPMA´s production and from non-European geostationary satellites, including the GOES (USA) and the MTSAT (Japan).

***Copernicus – Global Land***

After the end of the Geoland - 2 project, the IPMA made a contract with the European Commission regarding the initial phase of Operation Copernicus (the new designation of the GMES program) and operation Global Land (2013-2016). In this context, the IPMA maintains an operational service for the determination of land surface temperature from a constellation of geostationary satellites (European, North American and Japanese). This service is part of a continuous monitoring program of the Earth's surface. It is still expected the reprocessing of variables with improved input data algorithms, which enable a retrospective analysis of surface variability.

***WACMOS-ET***

The WACMOS- ET project (Water Cycle Multi-mission Observation Strategy - EvapoTranspiration), funded by ESA ( 2012-2014 ), aims to improve the use of Earth observation data to estimate evapotranspiration, considering this an essential variable not only for the study of the climate but also for its applicability in water management and / or agricultural resources. As the surface temperature is an essential component of the radiative balance and thus of the energy balance at the surface, IPMA will develop and implement new algorithms to calculate the surface temperature from AATSR data. The AATSR is a particularly stable radiometric sensor designed to allow its use in climate monitoring.

[63] European Organization for the Exploitation of Meteorological Satellites

***MACC-II***
The MACC - II project (Monitoring Atmospheric Composition and Climate - Interim Implementation) corresponds to Copernicus pre - operational service (formerly known as GMES )Atmosphere. The MACC - II (2011-2014) aims to provide data on the composition of the atmosphere, both for monitoring present conditions, as for predicting distributions on the main atmospheric constituents. The MACC - II also provides reanalysis resulting from the combination of Earth observation data with atmospheric models. These reanalyzes provide information on air quality, global atmospheric composition and climate forcing of the last decade.

By calculating the power emitted by forest fires which was estimated from geostationary satellites, the IPMA helps with basic information for calculating the carbon emissions, aerosols, among others, emitted by this type of source.

### 7.2.5 Support for Developing Countries

In addition to the already mentioned participation in TIGER, through FCT is also involved in ERAfrica, an ERA-NET funded under the Seventh Framework Program for Research and Technological Development of the European Union, which aims to strengthen Science, Technology and Innovation cooperation between Europe andAfrica. Under this partnership, the FCT participated in the transnational call for collaborative projects on the theme "Interface of Social Challenges", in which the mitigation of climate change is one of the challenges.
Networks like INCO - NET are instruments of cooperation between European and third-country research. FCT participates in CAAST - NET PLUS, which aims to promote dialogue and bi-regional cooperation between Europe and sub-Saharan Africa. This initiative includes a work package on climate change.

The Iberoamerican Program of Science and Technology for Development CYTED) is an international program of multilateral scientific and technological cooperation. It was established in 1984 by agreement among 19 countries of Latin America, Spain and Portugal. This program of multilateral cooperation in Science and Technology of the Ibero-American region aims to foster collaboration in different fields ranging from basic research to technological development and innovation (with particular focus on the development of the countries of that region).

The CYTED has an area called Sustainable Development, Global Change and Ecosystems. Currently, there are some Portuguese researchers who are working in three networks in climate change area:
- Environmental indicators and programs for integrated environmental assessment;
- Methods of analysis and implementation of sustainable management of aquifers;
- Vulnerability, impacts and adaptation to climate change for water resources in Latin America. "

FCT also supports advanced postgraduate training in developing countries through the award of scholarships to candidates coming from these countries.

# 8. EDUCATION, TRAINING AND PUBLIC AWARENESS

## 8.1 General Policy Guidelines on Education, Training and Public Awareness

According to the Education basis system law[64](LBSE), the education system (SE) comprises pre - school education, school education and extracurricular education. School education includes primary, secondary and higher education. It integrates special arrangements and includes leisure-time activities. Public education is free in Portugal.

By focusing on education as a means of improving the performance of the human component within the process of economic development, in the context of education policies, Portugal is implementing a set of

[64] Law 46/86 of 14 October, subsequently amended by Laws 115/97 of 19 September and 49/2005 of 30 August.

measures[65] to increase productivity, competitiveness and social cohesion. Given the requirements that characterize modern society, knowledge is seen as the major support concern, as highlighted in the following examples:

- Reduction of scattered curriculum and reinforcement of nuclear subjects (Portuguese, Mathematics, History, Geography, Physics and Chemistry and Natural Sciences);
- Increasing rigor in the assessment process (introduction of national final exams in the First Cycle Mathematics and Portuguese);
- Anticipating the learning of Information and Communication Technologies;
- Promoting the teaching of English (required for a period of five years);
- Extension of pre-school education;
- Full school time schedule in the first cycle (Curriculum Enrichment Activities);
- "Mais Sucesso Escolar" (Better School Achievement) Program (MSEP);
- Portuguese as a second language;
- Offer Training and Education Courses for Basic Education;
- Diversification of the training offer (Professional Courses) in public schools;
- Alternative Curriculum Pathways (ACP).

With the extension of compulsory schooling to 12 years[66], all children and teenagers aged between 6 and 18 years are considered to be in mandatory school age (Table 8.1). Under this legal diploma, this mandatory stage ceases at the age of 18, even if the student has not obtained the diploma of secondary education. Thus, the aim is to increase the social, economic and cultural progress of the Portuguese people, ensuring inclusion and equal opportunities for all school-age youth.

**Table 8.1**
Compulsory Education

| Level | | Years of schooling | Age (years) |
|---|---|---|---|
| Basic | 1st cycle | 1.º - 4.º | 6-10 |
| | 2nd cycle | 5.º - 6.º | 10-12 |
| | 3rd cycle | 7.º - 9.º | 12-15 |
| Secondary | Scientific-Humanistic Courses<br>Artistic Specialized Courses<br>Professional Vocational Courses | 10.º, 11.º, 12.º | 15-18 |

This universe of measures made it possible to create the necessary conditions for the registration of a decrease in dropout rates and school failure, which resulted in an increase in enrollment rates, especially in secondary education (see Table 8.2).

**Table 8.2**
Actual school enrollment rate (%), by level of education / teaching by school year (2005/2006 to 2010/2011)

| | Pre-school | Education | | | |
|---|---|---|---|---|---|
| | | Basic | | | Secondary |
| | | 1st cycle | 2nd cycle | 3rd cycle | |
| **2005/2006** | 77.3 | 100 | 84.8 | 83.9 | 54.2 |
| **2006/2007** | 77.3 | 100 | 88.3 | 87.0 | 60.5 |
| **2007/2008** | 78.8 | 100 | 92.4 | 86.7 | 63.6 |
| **2008/2009** | 82.2 | 100 | 95.0 | 87.7 | 68.5 |
| **2009/2011** | 83.8 | 100 | 93.9 | 89.8 | 71.9 |
| **2011/2012** | 85.6 | 100 | 95.6 | 92.4 | 73.0 |

**Source**: Directorate General Statistics for Education and Science

**Citizenship education: curriculum framework**

The LBSE sets out how the SE should be organized, seeking to promote the development of the student´s personality, attitude and sense of citizenship, preparing him/her future at various levels (spiritual, aesthetic, moral and civic).

[65] Decree-Law 139/2012, of July 5
[66] Law 85/2009 of 27 August.

With the publication of Decree Law 139/2012, of July 5, the curriculum is reviewed. One of its guiding principles is the "Strengthening of the transversal character of education for citizenship and the establishment of a program of content and guidelines but not empowering it as compulsory subject" (Article 3). In this regard, the Directorate General for Education has developed, in collaboration with other partners in the public administration and civil society, documents that may be incurred as referential when addressing the different dimensions of citizenship, including the framework of Environmental Education for Sustainability (in preparation), which may be used and adapted depending on the options set in each context.

## 8.2 Primary, Secondary and Higher Education

In accordance with the LBSE, the pre-school education is intended for children between 3 years old and the age when entering compulsory education. Its attendance is optional but of a universal character from the age of 5. This is given in public (for free) or private kinder gardens.
Regarding education, it evolves according to a three leveled structure, namely: basic, secondary and higher.

**Basic Education**
Basic education lasts for nine years (from 6 to 15 years old) and is organized into three sequential cycles, the first of which lasts four year, the second lasts two and the third lasts three.

The 1st cycle works under a single teacher, the teaching here can be characterized as a global one and oriented to the development of basic skills in English Language, Mathematics, Environmental Studies and Expressions. Apart from the already mentioned information, curricular enrichment activities (English, Study support, Sports and Physical Activity, Music and other artistic expressions) are also promoted.

The 2nd and 3rd cycles operate on a multi-teacher system with specialized teachers in the different subject areas. The main objectives are the development of knowledge and skills that will ensure a common general preparation, enabling students to pursue studies through different available courses.

The teaching of ICT is introduced in the 7th grade through a (semi-annual or annual) subject that extends to the 8th Grade.

In basic education the learning of two foreign languages is compulsory (English, French, German or Spanish). Following the implementation of the curriculum revision, the introduction to the study of English is introduced in the 2nd Cycle, extending up to the 3rd Cycle (minimum five years). In the 3rd cycle begins the compulsory study of another language.

Throughout basic school students are subject to internal summative assessment, to which is added an external one called National Finals Exam (Portuguese and Mathematics) at the end of the 1st, 2nd and 3rd cycles. Students who successfully complete the 3rd cycle are assigned the Basic Education Diploma.

Apart from the general basic education, there is still a short generalized offer to the students who want to do the following modalities:

a) Artistic Specialized Courses ( EAE ) ;
b) Professional Vocational Courses ;
c) Basic education in the form of recurrent education.

**Secondary Education**
Secondary school is compulsory and comprises a three-year cycle (10th, 11th and 12th Years of schooling). It is organized according to different forms and both targeted for further study for the world of work.

Regarding the curriculum of the courses, it comprises three types of courses:

a) Scientific-humanistic courses (aimed to further study at a tertiary level);
b) Artistic Specialized courses (aimed to artistic training in specialized areas of visual arts, media, dance and music), allowing immediate entry into the world of work or further study in post – secondary non-higher education;
c) Professional Vocational Courses (intended to provide immediate entry into the world of work), which are organized by modules in different areas of training, also allowing further studies in post-secondary non-higher and higher education.

Within secondary school, Offer Courses are another option. Each has its own plans and is taught in private education institutions. Most of them assigned the student a dual certification.

To complete any secondary course students are subject to two summative assessments, one internal and another one external (national exams in certain disciplines provided by law). Students who have completed this level of education are assigned a secondary education diploma.

Students of professional courses and artistic specialized courses wishing to pursue higher-level studies are also subject to external summative assessment (national exams in certain subjects provided by law). Artistic specialized and professional vocational courses give a professional qualification diploma at level 4, while the scientific-humanistic courses confer a professional qualification diploma at level 3.

### 8.2.1 Education Post- secondary non-higher

The technological specialization courses (CET) provide specialized training in different areas of technology, allowing insertion into the world of work or the further study at university level. The training held in CETs is credited in the degree in which the student is admitted.

The successful approval of a technological specialized course expertise gives the student a diploma in specialized technology ( DET ) and a professional qualification at level 5. It can also provide access to a certificate of professional competence (CAP).

### 8.2.2 Education and Training for Youth and Adults

The education and training for young people and adults (ETYA) offers a new opportunity for individuals who have left school early or are at risk of leaving as well as for those who have not had the opportunity to attend it when young, and also to those seeking school for reasons of personal or questions of professional nature (lifelong learning). The ETYA allows acquiring a school certificate and/ or a professional qualification, as well as further studies at post-secondary non-higher or higher education.

The ETYA includes the following procedures:

- Recurrent education in basic and secondary school for students aged 16 or over in total or partial attendance, or over 18 years old in an attendance non-attendance school system;
- System of Recognition, Validation and Certification of Competences ( RVCC ) acquired throughout life, through formal, informal and non - formal, allowing students to obtain a dual academic and professional. This system takes place in "Novas Oportunidades" (New Opportunities) Centers;
- Education and Training Courses ( ETC ) for students aged 15 or over ;
- Education and Training Courses of Adults ( ETCA ) and Modular Training for students over 18;
- National System of Learning, a responsibility of the Employment Office and Vocational Training for young people over 15 years old.

### 8.2.3 Environmental education in the school curricula of basic and secondary

In the context of formal education, since the late 70s, contents and environmental issues have been integrated into school curricula. From the 80s onwards the opportunity for formal involvement of schools in

project methodologies, on which environmental issues are predominant, becomes a reality in the perspective of study and intervention at the local level.

In 2002 in basic school education the syllabus of subjects such as Geography, Natural Sciences and Physics and Chemistry were replaced by curricular guidelines, an action that strengthens the relationship between Science, Technology, Society and Environment (STS / E), thus promoting a critical approach to this form of economic and technological development. It is in this sense that issues relating to the proper management of natural resources (water, oceans, fisheries, atmosphere, biodiversity and forest) are addressed. This way it is possible to achieve a transversal approach to the various subjects or disciplines.

In Basic and Secondary Education, due to its transversality, Education for Citizenship was adopted in all syllabi. In this sense, the of the disciplines integrate the development of transversal skills in various aspects of education for citizenship, including environmental, road safety, consumer, health and Media education. In the specific case of syllabuses in Science areas the emphasis is placed on STS / E approach, in which the relationships established between Science, Technology, Society and Environment are the integrational matrix of the themes in the syllabi.
Examples of themes in syllabuses that address issues of climate change (CC):

**I) Basic Education:**

**a) Geography (3rd cycle):**
Theme 9: "Environment and Society ": Warming - Climate Change

**b) Physical and Natural Sciences (3rd cycle):**
Theme 4: Sustainability on Earth: Global Change
Weather Forecast and description; influence of human activity on the atmosphere (weather and climate). Suggested Activity : bearing in mind the need to extract, transform and use natural resources, advantages and disadvantages associated with these actions, students should reflect and suggest proposals for a rational management of resources, comparing them later on with current documents on this subject, for example, the Kyoto Protocol, signed on December 11, 1997. Discuss the controversy caused by this Protocol.

**c) Physics and Chemistry (10th year):**
Physics Unit 1 : From the sun to heating
Extra-classroom activities in which students can realize the implications of the greenhouse effect and of the negative consequences of the changes caused by the various human activities on the atmosphere.
Chemistry Unit 2 : Atmosphere and Radiation.

**II) Secondary Education:**

**a) Geology (12th year):**
Theme: The Earth, Yesterday, Today and Tomorrow.
Man as an environmental change agent; Global Warming. The contents addressed here concern the role of man as an agent of global warming, within the environmental concerns and the context of geological knowledge.

**b) Geography (12th year):**
Subthemes: Greenhouse effect and global warming.
Proposal of debates on the resolutions of world conferences.

## 8.2.4. Curricular Targets

In conjunction with the Syllabuses of each discipline, setting curricular targets becomes an indispensable reference for the development of education. It would allow a clarification of the syllabi as to set priorities in the definition of knowledge to be acquired and skills to be developed by students in different school years ( cf. Order 5306/2012 of 18 April).

Two examples of curricular targets of the 3rd cycle of Physics and Chemistry:

| Constitution of the material world | Energy sources and energy transfers |
|---|---|
| 1.2.To get to the conclusion that materials are limited resources and that it is necessary to use them properly ( recycling them and reusing them ) | 1.5. To identify renewable and non-renewable energy sources, to evaluate advantages and disadvantages of their use by society today and subsequent consequences on Earth´s sustainability, ( ... ) |

**Higher education**

The year 2005 is a milestone in the reform of the higher education system, within which a new European Credit Transfer System (ECTS ) is introduced in line with the Bologna principles. Although the new structure which is organized into three cycles of study was introduced in 2006, its full implementation in Portugal only happened after the academic year of 2009/2010.

The Portuguese Higher Education includes the university and the polytechnic education, both administered by public or private institutions, entities that are also distinguished by the nature of the institution involved (university and non-university, respectively). The private educational establishments obtain a prior recognition from the Ministry of Education and Science. It should be noted, though, that the higher education network integrates an institution of concordat education.

In higher education the following academic qualifications are conferred: Bachelor's Degree, Master's Degree and PhD Degree.

**Bachelor's degree**

The university and polytechnic institutions confer Degrees. In Polytechnics the studies leading to a bachelor´s degree typically involve 6 semesters that correspond to a total of 180 credits. In universities, the cycle of studies usually has a duration of 6 to 8 semesters, which corresponds to 180 or 240 credits.

**Master's Degree**

The university and polytechnic institutions confer the Master´s degree. The cycle of studies leading to a master´s degree has 90 to 120 credits and it usually lasts three to four semesters of students' work or, exceptionally and due to a stable practice established internationally, 60 credits and two-semesters respectively. In polytechnic education, the course of study must ensure the acquisition of a professional specialization.

In higher education, this degree must ensure the acquisition of an academic specialization, using the research activity or any other activity which develops professional skills. This degree may also be awarded after an integrated cycle of studies, with 300 to 360 credits, lasting between 10 and 12 semesters of work.

This degree is awarded to those who have passed all courses in the Master´s program and the public defense of a thesis, a project work or internship report, obtaining this way the number of credits needed.

**PhD Degree**

The PhD degree is awarded by universities and university colleges to students who have passed courses in the PhD program, if any, and the public defense of the thesis.

## 8.3 Training

The Foundation for Science and Technology (FST) promotes and supports advanced postgraduate training by assigning different types of scholarships through regular, competitive and seeking excellence contests.

In the period between 2008 and 2012, the FST has funded more than 200 PhD and post-doctorate scholarships in the field of climate change (Table 8.3).

**Table 8.3**

PhD and post-PhD scholarships funded in the field of climate change

| | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| PhD scholarship | 15 | 20 | 24 | 29 | 18 |
| Post-PhD scholarship | 25 | 20 | 21 | 22 | 27 |

The Polar Department makes the disclosure, through its portal page on the FST, of workshops and training activities to promote polar research, usually in CC themes.

## 8.4 Raising Public Awareness

**Projects / tenders**

For decades the ministries in charge of Education and the Environment have been cooperating in the development and support of Projects and initiatives on Environmental Education for Sustainability (EES), especially after signing in 1996 the collaboration agreement between the two parties. This cooperation protocol aims to promote environmental education in Portugal and it was put into action in several joint initiatives and with the creation of a teachers network with technical and pedagogical skills for the coordination and promotion of environmental projects developed in conjunction with Non-Governmental Organizations and "ecotecas" (Ecological Libraries) that coordinate EES` s specific projects with school communities.

In December 2005, the Ministries of Education and Environment signed the new Protocol on Cooperation to reinforce the articulation work between them.

Currently the teachers consists of six teachers in mobility in the following non-governmental organizations:

- ABAE / FEE Portugal;
- Quercus (National Association for Nature Conservation);
- GEOTA (Territory and Environment Management Study Group) ;
- ASPEA (Portuguese Association of Environmental Education);
- FAPAS ( Fund for the Protection of Wild Animals );
- SPEA ( Portuguese Society for the Study of Birds).

This cooperation has been accompanied by the Working Group on Environmental Education for Sustainability (GTEAS), which includes the entities with a more responsible saying in this matter (DGE, DGEstE - APA ICNF). The GTEAS was created by Joint Order 19191/2009 of the Secretary of State and Education and Secretary of State for the Environment and it has to monitor and implement planned actions in the cooperation protocol established between the tutelage of the Environment and Education.

Under this Protocol, since 2011, the GTEAS has been organizing annual seminars for the public presentation of the projects developed by the teachers network, to discuss the Environmental Education for Sustainability and to promote the sharing of experiences. The issue of climate change has been present in the seminars; for example, it is reported that the 2012 Seminar adopted the topic on "know and value climate change - Motions for a working group" from MAPFRE Foundation/ Antonio Guzmán Córdoba.

This teachers network in mobility, which in 2012/13 only had four teachers, involved 2801 schools, 308 municipalities (some of which participated in all network projects); 35008 students directly involved; 9270 teachers; 7047 participants in seminars and similar actions and 13,508 "other participants".

In the subject of Environmental Education for Sustainability (EAS), the Adaptation and Mitigation to climate change, Energy and GHG Emissions are themes developed in all projects. In addition to these specific partnerships, many others between the Education and Environment Ministries, Local Authorities, Universities, Government and Non-Governmental Institutions took place aimed at the development of various EES projects in schools and amongst the surrounding community, from which the following are highlighted:

**International Year of Forests**

The General Assembly of the United Nations (UN) adopted the Resolution A/RES/61/93 on December 20, declaring the year 2011 as the International Year of Forests. This resolution aimed to mobilize the community to ensure the management, conservation and sustainable development of forests worldwide.

The Secretary of State for Forestry and Rural Development, in partnership with the National Commission for UNESCO was responsible for the initiatives of the International Year in Portugal entity. The Executive Committee for the Commemoration of the International Year of Forests in 2011 joined 16 entities, including the DGIDC / ME.

In addition to the various actions undertaken, in particular, for each of the entities that have integrated the Executive Committee, five actions are highlighted:

- AIF -2011 Workshop opening
- Photo Contest and Book Editing
- Thematic conferences cycle on various aspects of forest (which took place throughout the year)
- School Competition: "Let's Discover the Forest"
- Forestry Gala

With the support of local authorities, businesses and other local partners, the Ministry of Education had particular responsibility in school contest, an initiative intended to involve students, teachers, schools, in the design of studies aimed at raising citizens awareness to manage and preserve forests in a sustainable way, highlighting their role in multiple aspects such as in carbon sinks.

**Project 80**

Project 80, running for its second year in 2013/2014, is a program of national scope, fostering the associative movement in schools. It seeks to promote education for sustainability, entrepreneurship and democratic citizenship. This project is a joint initiative of the Portuguese Environment Agency, the Directorate General for Education, the Portuguese Sport and Youth Institute, Quercus and *Green Project Awards*.

The target audience of this project are Students` Associations in Basic (3rd cycle) and Secondary schools that have develop one or more projects on sustainability, namely projects that promote efficient resources management, reduction of carbon and water footprint, biodiversity, entrepreneurship, social innovation and green economy, as well as volunteering or any other forms of citizenship and public participation.

**"Mission UP" Contest |" United for the Planet – Positive Brigades" Contest**

The Mission Up | United for the Planet is an educational project framed in Galp Energia's strategy, nationwide, dedicated to the topic of energy use, with particular focus in the areas of Sustainable Mobility, Energy Efficiency, Energy Footprint and Energy Sources.

The project is developed in schools through the "Positive Brigades" contest where students and teachers are challenged to organize teams or "brigades" with a specific mission who focuses on energy efficiency and sustainable mobility in and out of school. These "Positive Brigades" should suggest and implement actions within their colleagues, friends and parents to promote sustainable energy use. It is aimed at nationwide schools of the Basic (2nd and 3rd cycles), at children from 6 to 12, as well as their teachers, parents and guardians.

The Ministry of Education and Science, through the Directorate General of Education, together with the Portuguese Environment Agency, in partnership with other entities, support, monitor and disseminate the project and are also part of the jury.

In 2012/2013 the "Mission UP" | "United for The Planet" had about 1,700 adherents schools from the 1st and 2nd cycles. Of these, 275 participated in the "Positive Brigades" contest.

***Rock in Rio* Contest**

The major concern of *Rock in Rio* contest is to develop in students and in school community educational attitudes and behaviors for the sustainability and social solidarity.

The Third Edition of this contest was held in the 2011/2012 school year, a version of A Gymkhana. The gymkhana was addressed to students of the 1st, 2nd and 3rd cycles of basic education and secondary education.
This initiative was promoted by Better World and SIC Esperança in partnership with the Agency for Energy

(ADENE), Sociedade Ponto Verde (SPV) and Amb3E - Portuguese Association of Waste Management, with the support of the Directorate General Education (DGE), the Portuguese Environment Agency (APA) and the Water Institute, IP (INAG , IP), the Portuguese Mathematical Society (SPM), the National Reading Plan (PNL) and the Social Sponsorship of Rock in Rio - Lisbon 2012, in a joint effort to promote active citizenship.

The Gymkhana consisted of 5 physical tasks and an online game. The tasks and their outcomes are further described below:
- Packaging collection - more than 116 tons of packaging were forwarded to the yellow recycling bins.
- Bracelet "For a better world" - more than 162,000 euros raised by the students to add to the 100,000 euros donated by Rock in Rio were aimed at Music scholarships for young people in need. About 18,000 euros were invested in the participant schools.
- Energy efficient school - schools saved 4,944,620 kWh.
- Efficient School - efficient use of water - more than 150,000 $m^3$ of water were saved by schools.
- School Project "Electron" - about 1,000 tons of waste electrical and electronic equipment had an appropriate final processing.
- Gymkhana Online: 20,828 students enrolled in the Gymkhana Online with an average of 78% correct answers. 572 schools participated in the Gymkhana.

**School Project – "Electron"**
The "Electron" - School Project intended to raise awareness in students and in the school community for the correct handling of the Waste Electrical and Electronic Equipment (WEEE) through a combined effect of actions for the dissemination and training as well as the participation in an interschool contest.

This project addressed the students from the 2nd and 3rd cycles of Basic and Secondary education. It was promoted by the Amb3E (Portuguese Association Management Waste Electrical and Electronic Equipment), with the collaboration of DGE and APA and it worked annually since 2008/2009 to the academic year of 2011/2012.

The DGE and the Portuguese Environment Agency promoted and advertised the project to schools, as well as its pedagogical supervision, which implied the analysis and legal opinion on project support materials such as the site, the production of news and the sending of institutional e-mails, amongst other tasks / activities.

In the academic year of 2011/2012 the project was integrated in the Rock in Rio Gymkhana and counted with the participation of 572 schools.
During the 4 editions of this competition, in addition to raising awareness, schools collected about 5 tons of Waste Electrical and Electronic Equipment (WEEE) and they mobilized the local school community to the correct handling of WEEE.

**"Twist, your energy makes a difference" Project**
The "Twist - your energy makes a difference" project is aimed at secondary school students. Its main goal is to raise awareness in the entire educational community to the need for a more rational use of energy and the growing problems of climate change.

In its second edition, since 2011-2012, this initiative was promoted by EDP Universal Service in partnership with "Come out of your shell" - Consultancy in Sustainable Development and the National Commission for UNESCO, with the support of the DGE and the Portuguese Environment Agency, among other entities.

Each school can participate with a "twisters" group of four students and a teacher, who was previously in charge of developing school actions to identify energy efficient school measures, to raise awareness and involve all the school community. The Ministry of Education and Science, through the Directorate General for Education and the Portuguese Environment Agency in partnership with other entities supported, monitored and disclosed the project and were also part of the jury.

**"Eco Challenge " Project**
The "Eco Challenge" project, which took place in 2011-2012, had as its main objective the development of activities in order to raise awareness in the educational community concerning the importance of energy efficiency, in a sustainable development perspective. This project provided an electricity energy monitoring system at school which allows to assess consumption indicators for use in more efficient use of energy.

This initiative was promoted by EDP Universal Service in partnership with the ISA (Intelligent Sensing Anywhere Business Corporation), with support from the Ministry of Education and Science / Directorate General for Education.

Each school could participate with a group of four to six high school students and two teachers, whose mission was to raise awareness in the educational community so to promote the implementation of energy efficiency measures and to meet challenges launched on the online platform that supported the project.

A prize worth €10,000 was awarded to the winning school for the implementation of energy efficiency measures in their facilities. Each students belonging to the winning team also received a FNAC Certificate worth 500€. The installed systems are now property of those schools for future use, after the contest.

The Ministry of Education and Science, through the Directorate General for Education, in partnership with other supporting entities, monitored and disclosed the project, being also members of the jury.

**"The Environment is for Everyone – let's use the energy well" Project**

This educational project addressed the issues of energy efficiency and climate change in schools of the 2nd and 3rd cycles. The project was developed by EDP in conjunction with the *Sustainable Energy Europe* Campaign, the National Commission of UNESCO, the Portuguese Environment Agency, the Directorate General for Energy and Geology, ADENE (Energy Agency) and the Ministry of Education.

This project aimed to raise awareness among young people on the problems of climate change and the issue of energy efficiency.

The project included a contest to which schools had to produce a proposal including measures leading to an efficient use of energy.

The best projects received an award so that schools could implement the energy efficiency measures suggested. These had to be approved according to a category of "energy most efficient lighting", the use of solar panels for heating hot water and the investment on good air conditioning, among others.

In 2008, this project was recognized as one of the three best projects worldwide in the premium *Energy Globe Award* in the *Youth* category.

The project ran from 2005 to 2011 and had the participation of 1,847 schools, 854,896 students and 125 963 teachers.

**Eco XXI**

According to the underlying principles for the Agenda 21, the ECO XXI project aims to recognize best practices for sustainability developed at local level. Hence the implementation of a pedagogical action near local governments, considered privileged agents for the promotion of a sustainable development.

Thus the main objective of this project is the valuation of a number of aspects considered essential to a sustainable development, grounded on two pillars: education for sustainability and environmental quality.

The DGE and the APA, along with other entities, belong to the National Committee of the Eco XXI Project, which must support the implementation of the project, each monitoring its area of expertise and being part of the jury.

**Young Reporters for the Environment Program (YRE)**

The Young Reporters for the Environment Program is an international environmental education program developed by an international network of the Foundation for Environmental Education (FEE), which currently includes 22 countries and in Portugal is sponsored by the European Blue Flag Association (ABAE), the Portuguese Section of the Foundation for Environmental Education (FEE) since 1994.

The project aimed at high school students provides for the identification of a local environmental problem by the students, followed by its respective investigations, reporting and communication using the newspapers, the Internet and other media.

This work culminates in the presentation of news articles, photos, videos or PPT presentations depicting the

environmental problems which were the subject of research by the participating students. Annual contests are also on the agenda in order to reward the best ideas.

The DGE and the APA, along with other entities, belong to the the National Commission of the YRE Project, which has to directly and indirectly support the implementation of the project, do its technical pedagogical monitoring and be a jury in the contests that are associated with it .

**Eco - Schools Project**

"*Eco Escolas*" (Eco – Schools) project is an international environmental education program, which currently involves about 20,000 schools spread across 46 countries and in Portugal is sponsored by the ABAE, Portuguese Section of the Foundation for Environmental Education ( FEE ), since 1996.

The project aims to encourage schools to develop actions under the Environmental Education for Sustainable Development, providing them with training and support, especially methodology and teaching materials, and performing actions to facilitate the implementation of the program.

This project also focuses on the recognition of work done by schools, accomplished through an Eco- Schools Award and other awards for schools, teachers and students involved. The DGE and the APA, along with other entities, belong to the National Committee on Eco- Schools Project, which is responsible for a directly and indirectly support to the implementation of the project, for doing its technical pedagogical monitoring and for being members of that same jury.

Other initiatives to highlight:

- **"*Era uma vez a Terra*" Project (Once Upon the Earth) (2010-2011)**

This project was developed by APA in partnership with the Lisbon E-New and Lisbon City Council, with the support of other entities. It was targeted to basic schools, from the 1st to the 3rd cycles in the city of Lisbon. The number of individuals covered by the project was about 9905 (visitors to exhibitions, participants in the different actions, seminars, workshops, etc.).

- **European Year of Volunteering (2011)**

The European Year of Volunteering was celebrated in 2011. The APA was the representative authority for the protection of the environment in the National Commission of the European Year of Volunteering. In this context various activities were streamlined in terms of environmental citizenship, in partnership with non - governmental environmental organizations.

The Ministry of Education also joined the National Monitoring Committee and the National Council for Volunteering.

The "Return" for volunteering is an initiative that featured many different activities in the volunteering area in Portugal. It was on display in Picoas Forum, Lisbon, between the 3rd and 9th February 2011. It was visited by about 900 people per day. The environmental volunteering was present and was shared by some of the ENGOs from the National Register of the ENGOs and equivalent organizations (RNOE). Under the AEV -2001, APA launched an inquiry on environmental volunteering developed by the ENGOs, whose results were presented at a Seminar organized with the aim to discuss environmental volunteering in Portugal.

- **"*Zambujal melhora*" (Zambujal Improves)**

Since late 2008, as part of its policy of social and environmental responsibility, APA collaborates on various programs / lines of action such as the Action Program "Zambujal improves". This program is in progress in this neighborhood in conjunction with several partners such as the Department of Housing and Urban Renewal and the Intercultural School of Sports and Jobs, the Study Center for Social Intervention, Benfica Foundation, the Pastoral Care of Gypsies within the framework of "Problematic Neighborhoods" and within PORLisboa. As the education for a sustainable development is a tool that aims mainly to raise awareness and change individual behaviors and attitudes towards sustainability and the environment, APA intends to go on providing multidisciplinary activities not only targeting school communities as the one in Zambujal but also the overall district population, through the collaboration with the agenda of "Opportunity Area", giving

it a similar use as the one in the "Ecoteca" (Eco library). From 2011 to date, 80 actions with different themes have been put into practice (Climate Change Mitigation, waste, energy, water, etc.) involving 1850 participants from different ethnic groups living in the neighborhood of Zambujal.

- **European Blue Flag Program**

The European Blue Flag Campaign began on a European scale in 1987 and it was integrated in the program of the European Year of Environment. This initiative of the Foundation for Environmental Education (FEE) aims to raise the level of awareness of the general public (and policy makers in particular), the need to protect the marine and coastal environment and encourage further actions guiding to the resolution of local existing problems existing.

The award is given annually to beaches and marinas that meet a set of criteria for environmental, safety and comfort of users and information and environmental awareness.

The operational structure of the Campaign in Portugal as well as its decision process is based on the collaboration between public or private entities ( which includes APA ) with responsibilities and interests in the beaches.

The applications of the beaches are presented annually by the Regional Municipalities to the Directorate General for Environment and signed by more than one entity from that place and region.

Regarding the number of Environmental Education Activities for Beaches (criterion 2) and Marinas (criterion 4) about 1942 of them were analyzed and implemented, since 2011 up until now.

- **"*Chave Verde*" Program (Green Key)**

The "Green Key" program is a program of environmental quality and environmental education, within the international scope. It aims to gather in its network all hotel facilities that care about a better environment and that believe that having best environmental practices is a growing desire most of its clients. The APA is part of the National Jury which has a similar contribution in supporting the development of the project as to that of the International Jury. The composition of this Jury / Commission is a reflexion of the skills of each institution that addresses it according to the different areas covered by the award criteria. From 2011 to 2013, 96 applications were analyzed.

- **European Mobility Week**

From 16 to 22 September each year, the European citizens have the opportunity to enjoy a whole week dedicated to sustainable mobility. Its objective is to facilitate a broad debate on necessary changing behaviors regarding mobility, specifically what relates to the use of private cars. As usual, the CarFree Day will be the culmination of activities throughout the week.

The National Campaign shares the European objectives for the recovery of environmental quality in the cities of the Old Continent.

Main objectives:

- Encourage the development of behaviour compatible with sustainable development, and in particular the protection of air quality, to the mitigation of global warming and noise reduction;
- Raise awareness of the effects that the choice of a means of transport will have on the quality of the environment;
- Provide opportunities for citizens to travel on foot, by bike and use public transports instead of private car and also promote intermodality;
- To provide citizens an opportunity to rediscover their city or town, its people and its heritage in a more healthy and pleasant environment.

On average, each year 66 countries participate, involving 2,267,173 participants.

- Sustainable Mobility Exhibition and Climate Change Exhibition / Sustainable Development
  Between 2010 and 2013 presentations on sustainable mobility and climate change / Sustainable Development traveled the country, according to the requests of different entities, from schools to municipalities, NGOs, companies, among others, in a total of 22 sites.
  The exhibits have always been associated with the respective thematic events, aiming at schools or population in general.

## 8.5 Access to Information and Public Participation

### 8.5.1 Involvement of Environmental Non-Governmental Organizations

Non-governmental organizations (NGOs) and equivalent organizations are legally defined according to Law 35/98 of July 18. They play a vital and important role in the promotion, protection, awareness and valuation of the environment, developing activities of public interest with special emphasis in the field of Environmental Education for Sustainability.

Associations represent, in Portugal, a key instrument on the participation of populations and on the intervention in society.

On the 31st of December 2012, The National Register of ENGOs and equivalent organizations (RNOE) had one hundred and seventeen active associations distributed on national, regional, local and even equivalent levels.

## 8.6 Participation in International Activities

The Initiative for the IA consists in a European Space Agency (ESA) program, whose main objective is to promote the potential of the data files of Earth Observation that ESA together with its Member States has established over the last thirty years. This is a significant contribution to the databases of "Essential Climate Variables" (ECV), which in turn are necessary to support the UN Framework Convention for IA. ICC ´ s main objective is to promote a long term ECV products use based on satellite data so they can be used by data modeling teams and by researchers. The ECV variables are obtained by data from multiple satellites (not only from ESA but also resulting from international collaborations) and will include specific information on possible mistakes and uncertainties associated with these data. The ICC is a program with funding of 75 M € which runs from 2009 until 2016. Portugal endorsed this program in 2008 with a financial contribution of € 0.75M. Currently there are three Portuguese projects aiming at three different ECV variables: Fire, Sea Level and Ocean Color

The FCT funds the national representation in the Specialty Committee of the *European Science Foundation* on the Polar issue - European Polar Board (EPB) and the *Scientific Committee for Antarctic Research* (SCAR), organizations led to support and promote research in the polar regions through international cooperation and coordination of polar Programs and making the theme on Climate Change a priority in their working plans.

During 2009, The FCT instructed the process for the accession of Portugal to the Antarctic Treaty. This treaty has been nationally ratified in early 2010. During 2012, the Polar Department of the FCT instructed the process for the accession of Portugal to the Protocol to the Treaty for the Antarctica on Environmental Protection (Madrid Protocol), which is expected to be signed during the current year. The Portuguese participation in these international legal instruments allows the presence and regulated activity by polar national researchers in the Antarctic region, including the need for a certification of environmental impact of all scientific activities done in this region. The Given its environmental protective nature, the Madrid Protocol has great influence and impact on the promotion of Climate Change research area in the Antarctic region.

In June 2010 Portugal participated in the Children and Youth Conference – "Vamos Cuidar do Planeta" (Let's Take Care of the Planet) (CONFINT) held in Brasilia. This was an initiative of the Brazilian government integrated into the framework of the UN Decade of Education for Sustainable Development (2005-2014), in the Earth Declaration, the Treaty on Environmental Education for Sustainable Societies and Global Responsibility, and the Declaration of Human Responsibilities. This initiative was supported by the Ministry of Education (Department of Environmental Education, Literacy and Diversity Education - SECAD/MEC) and the Ministry of the Environment (Department of Institutional Articulation and Environmental Citizenship - SAIC / MNA) and the Fondation Charles Léopold Mayer (FPH). Concerning the theme of climate change (Earth, Water, Air and Soil), each country had the opportunity to participate in this event with a delegation of students who discussed the measures that could be implemented to build environmentally sustainable and socially fairer societies. In support of environmental education this event had the participation of 41 countries (maximum of 50) scattered over the five continents, including all CPLP countries (Community of Portuguese Language Countries).

In the school years of 2010/11 and 2011/2012, Portugal participated in the "Project U4energy". This contest was an initiative of the European Commission, promoted by the European Schoolnet. The Directorate General of Education was the Portuguese entity responsible for the dissemination, the support of the implementation of the initiative, the moderation of applications and the constitution of the jury evaluation, to which it belonged to. The targeted were teachers and students in primary and secondary education of different countries in Europe. This initiative aimed to promote a reflection on the habits of energy consumption and to improve energy efficiency in schools. The contest included three different contest categories:

- Category A - Energy efficiency measures at school;
- Category B - pedagogical actions to raise awareness on efficient energy use;
- Category C - school awareness campaign for energy efficiency.

# ANNEX I (1st biennial report)

## I. Information on Greenhouse gas emissions and trends

More detailed information can be found in chapter 2 of the Portuguese 6th National Communication (6CN).

The Portuguese national system aims to ensure in a timely preparation the inventory of air pollutants (INERPA), in accordance with the guidelines defined at international and EC level in order to facilitate in more cost-effective way the tasks of GHG inventory planning, implementation and management.

In order to ensure the preparation of the annual emissions inventory within the defined deadlines, the key element of the national system is the definition of responsibilities of the various entities that integrate the system. In this sense, the national system established by Council of Ministers Resolution 68/2005, of the 17th of March clearly defines the entities relevant for its implementation, based on the principle of Institutional cooperation.

Three bodies are established with differentiated responsibilities. These are:

1. Responsible Body[67] which is APA, I.P, being responsible for: INERPA`s overall coordination and updating; the inventory`s approval, after consulting the focal points and eventually the Involved Entities; and its submission to international and community bodies to which Portugal is associated, in the several communication of information formats, thus ensuring compliance with the adopted requirements and directives;
2. Focal Points (FP), bodies subordinated to the sector, work with APA, IP, and are responsible for fostering intra and inter-sectorial cooperation to ensure a more efficient use of the available resources;
3. Involved Entities that may be public or private bodies which generate or hold information which is relevant information to the INERPA, and which actions are subordinated to the Focal Points or directly to the Responsible Body.

Additional provisions to deal with the supplementary information under Kyoto Protocol (KP) refer mainly to arrangements to account for further requirements concerning Art. 3.3 and 3.4.

For ths purpose, an inter-institutional working group was created (WG 3.3 & 3.4) in the scope of the National Inventory System (SNIERPA) in order to work on the definition of the methodology to identify the areas and account for the emissions/removals for relevant activities (F.M; G.M; A.M.). The representation of these multiple entities in WG 3.3 & 3.4 aims at gathering the necessary competences, data and knowledge required to comply with the reporting and accounting requirements of these activities.

The national system includes the following instruments:

- an average inventory recalculation system;
- a Methodological Development Program (PDM),
- a Quality Assurance and Control System (QA/QC), and
- a Documentation and Archiving System.

In accordance with the National Emissions Inventory 2013[68] (relative to 2011), GHG emissions, without land use and land use change and forestry[69] emissions (LULUCF), accounted for 70.0 Mt $CO_2$, an increase of

67 APA, IP, Rua da Murgueira, 9/9A, 2610-124 Amadora; Eduardo Santos, eduardo.santos@apambiente.pt.

68 Available in www.apambiente.pt (submitted on May 24th, 2013).

69 The sector of land use change and forestry is not taken into account since the compliance measurement of the Kyoto Protocol is different from the one carried out in the United Nations Framework Convention on Climate Change (UNFCCC).

14.8% relative to the 1990 level. Under the EU Burden Sharing Agreement, Portugal is bind to limit its emissions in the first commitment period to 27% compared to the 1990 level.

After the rapid growth during the 90s, national emissions slowed down in the early 2000s. In more recent years, especially after 2005, there was a decrease of national emissions. In 2011, national emissions were about 20.5% below the ones observed in 2005 (Figure 1).

This trend clearly shows that the evolution of the Portuguese economy was characterized by a strong growth associated to an increase in the demand for energy and mobility in the 90s and to a stabilization of the emissions in the early 2000s. The last one is mainly due to an increase of the integration of natural gas and a growth in the implementation of renewable energies, which supported a consistent reduction of national emissions since 2005. The latest emissions still reflect a stagnation in the Portuguese economy.

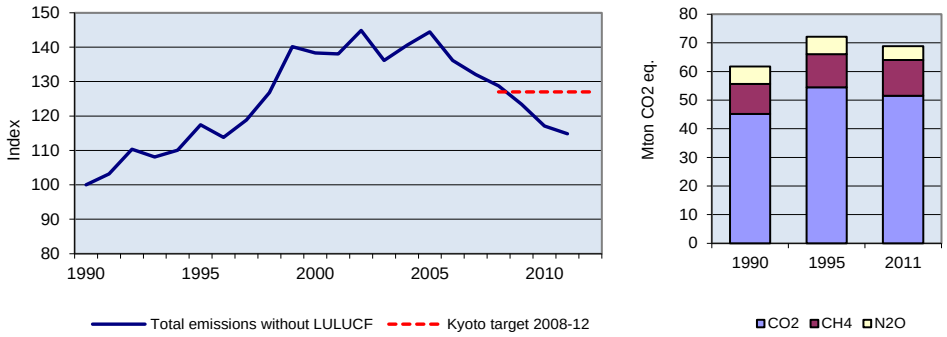



**Figure 1**
Evolution of the GHG national emissions (without LULUCF)
**Source**: APA, 2013

The energy sector, including transports, remains in 2011 as the main responsable for GHG emissions, accounting for 69.5% of the national total GHG emissions. The $CO_2$ is the leading GHG emitted at national level, which represented about 74% of the total emissions in 2011, reportable to the energy sector prominence and their fossil fuel dependency.

### A. Analysis by Gas

The GHG with the largest national emissions representation, about 74%, (Figure 2) is, in 2011, the $CO_2$ because of energy sector and fossil fuels related activities. Its growth compared to 1990 (14.1%) reflects an increase of the emissions in the energy sector. Compared to 1990, only $N_2O$ emissions have decreased (-19.2%) due to the reduction of emissions from agriculture. In turn, the increase in $CH_2$ emissions (21.3% compared to 1990) is mostly due to the growth of emissions in the waste sector (Figure 3).

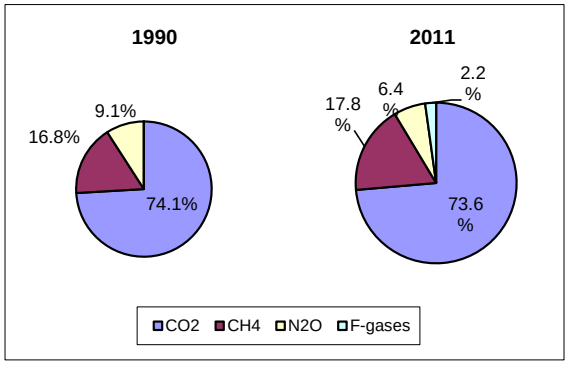



**Figure 2**
National emissions by gas, in 1990 and 2011
**Source**: APA, 2013

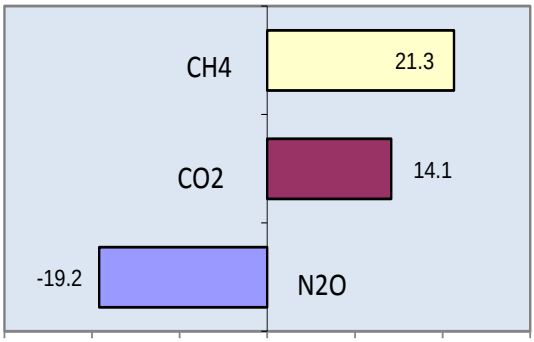



**Figure 3**
Evolution of national emissions by gas 1990 - 2011
**Source**: APA, 2013

$CO_2$ is mainly caused by the burning of fossil fuels in energy related activities (IPCC sector 1). Other non-energy production processes, such as cement production (category 2A), are also significant emissions amounts of $CO_2$.

The $CH_4$ is mainly produced through anaerobic decomposition of organic matter in biological systems, such as urban waste and livestock waste, wastewater treatment systems or enteric fermentation in animal. Other sources that are equally responsible for $CH_4$ emission include the burning of biomass, natural gas and oil distribution and the incomplete burning of fossil fuels.

$N_2O$ is associated to direct and indirect emissions from agricultural soils, mostly related to the use of synthetic fertilizers and manure from cattle, nitrogen fixing by leguminous crops and incorporation of agricultural residues in the soil. Other significant sources include the chemical industry (nitric acid production), wastewater treatment, burning of fossil fuels (mainly in the transport sector) and burning of biomass (forest fires, agricultural residues, biomass combustion in the residential sector and waste incineration).

Fluorinated gases reported under the context of CRF encompass hydrofluorocarbons (HFC) and sulphur hexafluoride ($SF_6$). HFC are the result of leaks in the production, operation and decommissioning of cooling and air conditioning equipments, foams, fire protection equipment and inhalators. $SF_6$ result from losses in electricity distribution systems, circuit breakers and metal-clad substations.

## B. Analysis of Key Drivers

The key drivers explaining the reduction in emissions since 2005 are, among others:

1. the "cruise speed" use of natural gas;
2. an unprecedented implementation of renewable energy;
3. the gradual implementation of biofuels in transport;
4. energy efficiency in sectors covered by the EU ETS;
5. the "green" car tax reform and, finally;
6. the present economic crisis (especially in the period 2009-12).

Meteorological parameters, such as precipitation, which have a high interannual variability, also have a significant influence on hydroelectric power production, thus influencing in a very significant manner the fluctuations in emissions. The higher values of the Index of Hydroelectric power production (IPH) correspond to the minimum emissions in public electricity and heat production categories, as in some case in 1996, 2003 or 2010. The reverse situation is also true, namely in 1992, 1999, 2002 or 2005 (Figure 4).

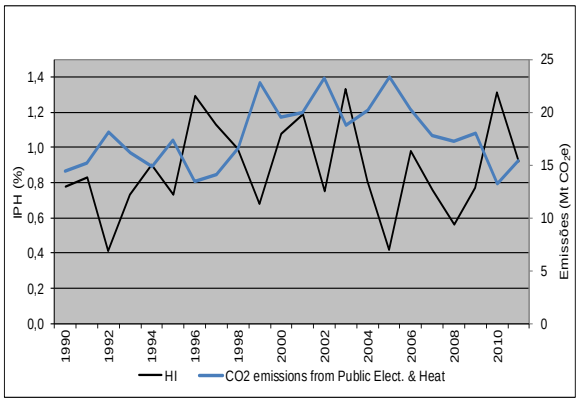
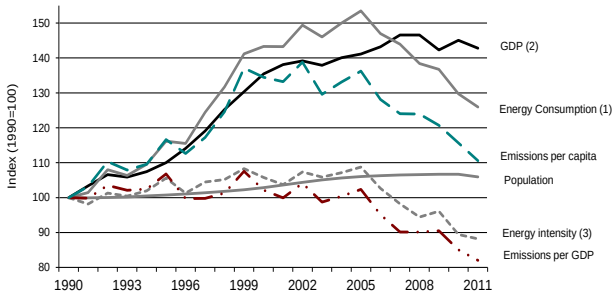



**Figure 4**

Index of Hydroelectric Production and emissions from Public Electricity and Heat Production

**Source**: APA, 2013

An analysis of the GHG emissions per unit of GDP shows that only in 2005 Portugal managed to decouple GHG emissions and the GDP, resulting from a "decarbonisation" of the economy, that is, a slight decrease in carbon emissions of the economy, trend that preceded the current economic crisis (Figure 5).




**Notes**:
(2) Primary Energy Consumption; (2) GDP at 2005 prices; (3) Energy Consumption per GDP.
Sources: INE, DGEG

**Figure 5**

GHG emissions per capita, per unit of GDP and energy consumption

**Source**: APA, 2013

There are many factors in the basis of this trend, among them: the growing implementation of less polluting energy sources such as natural gas, the introduction of more efficient combined cycle gas thermal electric plants, the increasing growth of energy from renewable energy sources (wind and water mainly) and energy and technology efficiency improvements. Efficiency improvements in the transport sector (car fleet renewal) and in the housing sector (buildings certification) may also explain these trends. Despite the significant reduction in carbon intensity of GDP, when compared to the rest of Europe, Portugal is above the European average.

### C. Analysis by Sector

In accordance with the Convention reporting guidelines, emission estimates are grouped into six sectors: Energy, Industrial Processes, Solvent Use, Agriculture, LULUCF, and Waste.

In 2011 the energy sector, including transport, was still responsible for the major GHG emissions, representing 69.5% of national emissions, and it has shown an increase since 1990 about 16.8% (Figure 7).

The transport sector, greatly dominated by road traffic, was one of the sectors that registered the highest growth in the period 1990-2011: 70.2% (Figure 6). However there has been, particularly since 2010, a reduction of emissions in this sector.

The sectors of waste, agriculture and industrial processes showed a similar weight (11.8%, 10.7% and 7.6%, respectively). However, the waste sector and the industrial processes sector have shown an upward trend since 1990 (38.1% and 10.1%, respectively), while the agriculture sector recorded a decrease in the emissions trend (-8.0%) (Figure 6).

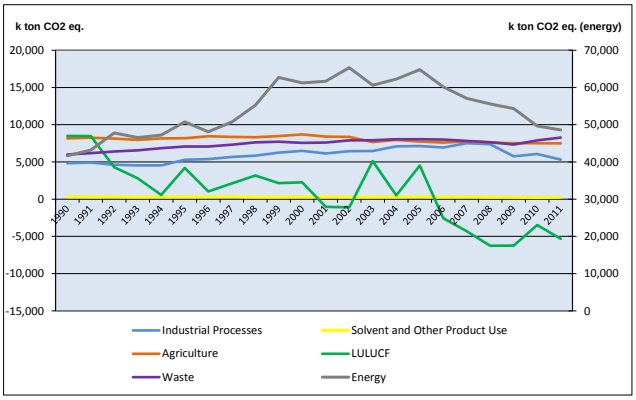



**Figure 6**
Evolution of sectoral emissions in Portugal (1990-2011)
**Source**: APA, IP, 2013

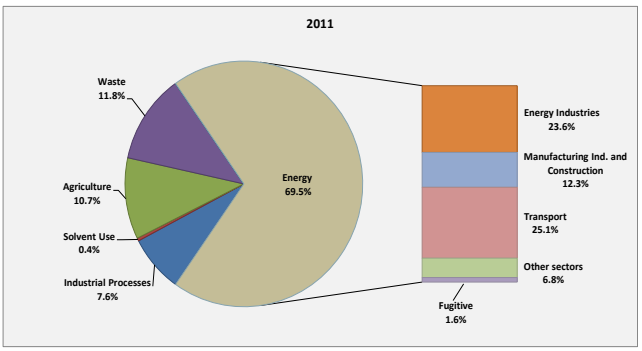



**Figure 7**
Distribution of na tional emissions by sector in 2011
**Source**: APA, IP, 2013

Estimates to LULUCF sector, which was considered a liquid sink of $CO_2$ in the whole period (1990-2010), suffered a substantial revision during the whole time period of 2010/11, to which corresponds a sequestration of 5,3 Mt $CO_2$ e. in 2011.The large fires that occurred in 2003 and 2005 are responsible for its increase and show a significant reduction in the sequestration capacity.

## II. Quantified economy-wide emission reduction target

Regarding the quantified economy-wide emission reduction target (QEWER), Portugal set the value of 127% as the national main goal.

Under the Portuguese QEWER definition, Portugal chose the year of 1995 as its base year for the emissions of fluorinated gases (hydrofluorocarbons-HFCs; perfluorocarbons-PFCs and sulphur hexafluoride-SF6), in harmony with Article 3, paragraph 8 of the Kyoto Protocol. For the other set of gases, the base year is 1990.

About the gases and sectores covered, the inventory submission includes estimates for the six greenhouses gases included in Annex A to the KP: carbon dioxide (CO2); methane (CH4); nitrous oxide (N2O); Hydrofluorocarbons (HFC); perfluorocarbons (PFC); sulfphur hexafluoride (SF6); as well as estimates for indirects GHGs, including carbon monoxide (NMVOC). Data are also reported for sulphur oxides (SOx).

Regading the Global Warning Potencial (GWP), Portugal applies the IPCC 1996 guidelines.

Concerning LULUCF, Portugal accounts for emissions and removals from each activity under Article 3, paragraphs 3 and 4 of the KP at the end of the commitment period, rather than annually. The elected activities were Forest Management (FM); Agriculture Management (AM) and Grassland Management (GM).

Finally the International Market-base Mechanisms issues and by the end of 2012, the FPC has budgeted around 124.8 M € (payments amount were around 96.9 M €), corresponding to about 11.8 Mt $CO_2$e. Following a risk analysis of the portfolio funds performed by CECAC fund portfolio, it is estimated that the investments made correspond to about 8.1 Mt $CO_2$e., of which 7.3 Mt $CO_2$e. concerns credits prior to 2012. By the end of 2013 the Carbon Fund had received in its account about 6.8 Mt $CO_2$e.

## III. Progress in achievement of quantified economy-wide emission reduction targets and relevante information

More detailed information can be found in chapter 3 and 4 of the Portuguese 6th National Communication (6CN).

### A. MITIGATION ACTIONS AND THEIR EFFECTS

Since 2001, Portugal has a Climate Change Strategy, a document framing the development of policies in this matter.

The achievement of national targets on climate change under the KP for 2008-2012 was based on the following key instruments:

i. **The National Program for Climate Change (PNAC)**, which includes a set of policies and measures of sectoral implementation to the reduction of GHG emissions;
ii. **The National Allocation Plan of Emissions Licenses (PNALE II)** for 2008-2012, which sets out the conditions to which facilities covered by the European trade of GHG emission licenses (EU ETS) are subject;
iii. **The Portuguese Carbon Fund (FPC)**, a Portuguese state financial instrument for acting on the carbon market to ensure compliance with national targets on climate change issues, making use of the flexibility mechanisms of the KP and supporting national projects to reduce emissions;

iv. **The National Strategy for Climate Change Adaptation** (ENAAC), structured under the following objective: information and knowledge; reduction of the vulnerability and increase of responsiveness; participation, awareness and promotion; international cooperation.

Public policies on climate change are now an integral part of a set of sectoral policies in Portugal. In fact, in areas such as energy and industry within the European Union Trade Emissions Licensing, "carbon dimension" is now part of the strategic and economic considerations of the companies concerned. In the agriculture and forestry sector there is a growing awareness of the important contribution to mitigate the emissions of greenhouse gases and to enhance its sink capacity. Even in areas with major challenges such as transport, some steps have already been given in terms of "decarbonization of the fleet of vehicle for instance in terms of natural gas in urban bus fleets or the electric vehicle program.

In this context, it is worth stressing the contribution of other policy instruments in the reduction of national emissions as is the case of the Energy Strategy, the National Action Plan for Energy Efficiency (PNAEE), the National Renewable Energy Program (PNAER), the Electric Mobility Program in Portugal, the Energy Efficiency Program in Public Administration - ECO.AP, among others .

In 2020, the European Union has established as Community target a reduction of 20% of greenhouse gases emissions regarding 1990. At European level, the sectors covered by the European Emission Trading System must have a reduction of 21% over 2005 and 10% in the other sectors compared to 2005.

The sharing of efforts among Member States was defined by EC Decision no. 406/2009 of 23rd April. In this context, Portugal should limit, between 2013 and 2020, the increase in greenhouse gas emissions from sectors which are not covered by the European Union Trade Emissions Licensing by +1% compared to 2005 (excluding LULUCF).

Target measures of 20% of renewable energy sources in final energy consumption and an increase of energy efficiency by 20% were some of the measures adopted, under the context of the Climate Change Package. In this context Portugal has a target of 31% of renewable energy sources in final energy consumption, of which 10% in transport. However, at a domestic level, more ambitious energy efficiency goals were established, including an overall reduction of primary energy consumption of 25% and a specific 30% target for the State.

In order to face the climate change challenges within commitments for the period after 2012, through Council of Ministers Resolution no. 93/2010, of 26$^{th}$ of November, the Government ordered the preparation of the following essential instruments:

i. National Low Carbon Road map (RNBC): The RNBC aims to determine a set of paths for cost-effective emissions reductions(for long - term targets concerning the national GHG emissions reduction) and its subsequent policy options, taking into account the national contribution to the EU target for 2050 (work completed in 2012);
ii. National Climate Change Program for the period of 2013-2020 (PNAC 2020): It should establish policies, measures and instruments with the aim of responding to the annual limitation of greenhouse gases emissions for sectors not covered by the European Union Trade Emissions Licensing; predict sectoral responsibilities, funding and monitoring and control mechanisms (ongoing work in 2013).

Portugal is fully committed to meeting climate change challenges, not only the presents targets but also looking towards 2020 and beyond.

Work on the new National Climate Change Program with a focus on 2020 and 2030 is ongoing and is expected to be concluded in the second quarter of 2014.

Due to the current macroeconomic environment (particularly, the reduction in energy consumption, the increase of energy supply and the funding constraints), Portugal redefined its priorities in terms of energy efficiency and renewable energy targets (Cabinet Resolution 20/2013, of 10th April), through the revision of National Energy Efficiency Action Plan (PNAEE) and National Renewable Energy Action Plan (PNAER).

The integration of these two Plans, PNAEE and PNAER, allows a concerted action for the accomplishment of the national and European energy objectives, minimizing the investment costs and increasing the national competitiveness.

Therefore, aiming to create synergies and facilitating the decision making, the Portuguese Government deliberated to review the PNAEE and the PNAER, taking into account the alignment of their objectives, in function of the primary energy and of the energy contribution impact for the greenhouse gases emissions reduction.

**B. ESTIMATES OF EMISSION REDUCTIONS AND REMOVALS AND THE USE OF UNITS FROM THE MARKET-BASED MECHANISMS AND LAND USE CHANGE AND FORESTRY ACTIVITIES**

The KP establishes that the European Union (EU), as a whole, is committed to reduce GHG emissions by 8% compared to the numbers registered in 1990. According to a commitment of shared responsibilities at Community level, it was established that Portugal could increase its emissions by 27% compared to 1990. However, it could not exceed, in the period 2008-2012, the 381.94 million tons of equivalents of CO2 (Mt CO2e), which represents an annual average of 76.39 Mt CO2e .

In terms of limiting GHG emissions, Portugal is currently on track to comply with the targets set for 2008-2012. In fact, the most recent data emissions confirm a downward trend since 2005, which indicates that Portugal has started a process of decoupling between economic growth and GHG emissions. In fact, national emissions for the year 2011 were approximately 14.8% higher than in 1990. However, this indicator corresponds to a decrease of 20.5% compared to 2005.

Without LULUCF, this analysis allows to estimate variance from the Kyoto target in +0.6 Mt $CO_2$e (surplus) with a range that varies from +3.7 Mt $CO_2$e, in a lower emissions scenario and -2,1 Mt $CO_2$e in a higher emissions scenario. According to the accounting of the LULUCF activities, the Kyoto target should be achieved in any of the studied scenarios: the variance is estimated at 20.7 Mt$CO_2$e (surplus of compliance) with an interval ranging from +52.7 Mt $CO_2$e in a lower emissions scenario and greater contribution of LULUCF activities and +6.0 Mt $CO_2$e, in a higher emissions scenario and smaller contribution of LULUCF activities.

The Portuguese Carbon Fund (FPC) has also a volume of 6.8 Mt $CO_2$e carbon credits to cover any future gap that may arise taking into account the uncertainty associated with the accounting of LULUCF activities.

## IV. Projections

More detailed information can be found in chapter 4 of the Portuguese 6th National Communication (6CN).

The following sections seek to describe, with the necessary detail, the behavior of the main sub-sectors of the energy and industrial processes, such as the installed capacity, the energy production sector and final energy consumption in buildings (residential and commercial), industry and transport.

In the context of TIMES_PT model, emissions that were not covered by this model, as for example fugitive emissions and fluorinated gases, were estimated based on the results obtained by the activity model, especially in the refining, distribution of petroleum products and natural gas sectors; and by the

refrigeration level used in the various sectors. The results were subsequently added to the energy sector ones.

The projections reported are those used in the elaboration of the National Low Carbon Roadmap (RNBC) in 2011. These provide information up to 2050 under different scenarios. Recently in 2013 an update on projection in the context of the National Programme on Climate Change 2020 (PNAC) were undertaken. This work is still ongoing and expected to be concluded in the second quarter of 2014. Nontheless some preliminary results of the updated reference scenario projections are presented in this chapter.

Regarding the projection methodology, the RNBC was built on a set of modeling exercises to the time horizon of 2050 which, on the other hand is supported by the evolution of macroeconomic scenarios in Portugal, results in coherent projections of relevant variables for each study .

The studies to support the RNBC elaboration were launched in 2010 by the Climate Change Commission's Executive Committee (CECAC), including a study directed to the energy sector, industrial processes and waste and another dedicated to the agriculture, forestry and land use sectors:

i. The RNBC 2050 - *National Low Carbon Roadmap* - modeling GHG - energy and waste , developed by E.VALUE - Environment and Economy Studies and Projects, SA, by CENSE - Center for Environmental and Sustainability Research;
ii. Modeling paths of carbon emissions for agriculture, forestry and land use in Portugal in the coming decades (2010-2050), to support the preparation of the RNBC developed by Agroges - Studies and Projects Society .

**Emissions projections to 2050 under the Low Carbon Roadmap**

The evolution of total emissions of GHG by 2020 is illustrated below comprising (figures 8 and 8a):

1. Total historical emissions 1990-2010;
2. Emissions from the energy sector (combustion and industrial processes) directly accounted by the TIMES_PT model;
3. Fugitive emissions from fuels;
4. Emissions arising from manufacturing and use of fluorinated gases;
5. Emissions from the agriculture sector;
6. Emissions from the waste sector (including wastewater).

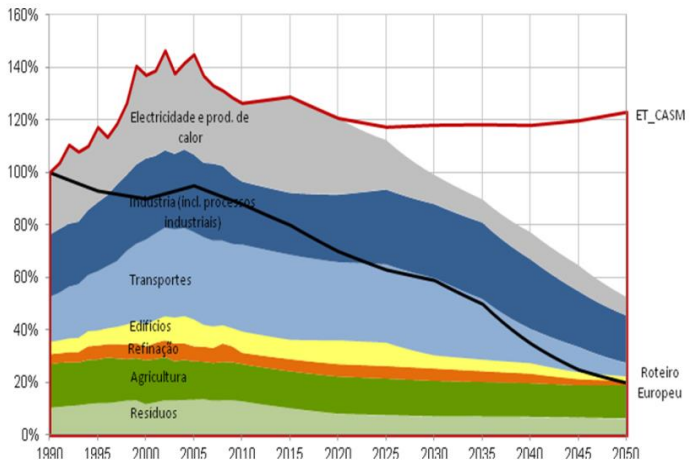



Figure 8

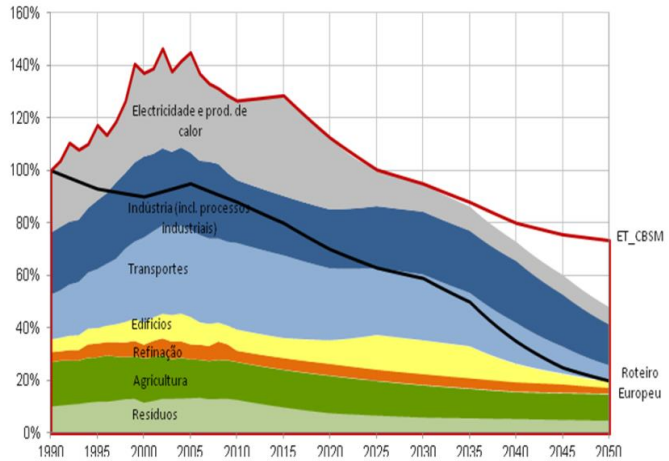



Figure 8a

The TIMES_PT is a technological model of linear optimization which results from the implementation of a generation of economy – energy – environment optimized models, with a TIMES[70] technology base, in Portugal and there is no changes to report.

## V. Provisions of financial, technological and capacity-building support to developing country Parties

More detailed information can be found in chapter 6 of the Portuguese 6th National Communication (6CN).

**FINANCE**

In Portugal, the ODA for environment has a limited significance comparing to the total values. This is justified by the predetermined strategic priorities (Education, Health, Security and Justice), which emphasize the sustainable development and the figh against to poverty as the main goals to achieve.

Regarding the ODA related to Climate Change, the mitigation strategy has been representing between 51% (rate recorded in 2007) and 93% (rate recorded in 2012) of the total environment ODA. This scenario is confirmed by the table 1, which data emphasize the last three years (more than 80%) as the highest rates of the statis .

**Table 1**

Climate change related ODA

| | | ***Significant objective*** | ***Principal objective*** | **APD Bilateral TOTAL - Mitigação** |
|---|---|---|---|---|
| **2011** | **€** | 2,068,687 | 15,414,281 | 17,482,968 |
| | **%** | 12% | 88% | 100% |
| **2012** | **€** | 444,791 | 14,475,621 | 14,920,412 |
| | **%** | 3% | 97% | 100% |

| | | ***Significant objective*** | ***Principal objective*** | **APD Bilateral TOTAL - Adaptação** |
|---|---|---|---|---|
| **2011** | **€** | 1,085,255 | 140,731 | 1,225,986 |
| | **%** | 89% | 11% | 100.00% |
| **2012** | **€** | 213,955 | 29,085 | 243,040 |
| | **%** | 88% | 12% | 100.00% |

**Source**: Camões, P.I./DPC

[70] TIMES is an acronym for *The Integrated Markal-EFOM System.* Both Markal - *Market Allocation* and EFOM - *Energy Flow Optimization Model* are based technology energy models developed by the IEA in the 80s and 70s, respectively. This model was developed by ETSAP (*Energy Technology Systems Analysis Program*) of the International Energy Agency.

These rates registered between 2010 and 2012 are due primarily to the financing of renewable energy projects under the Line of Credit for Cabo Verde and two ongoing projects in Mozambique which were funded under the Portuguese Fast Start Implementation Initiative (Fast Start).

In general, Portugal has been paying particular attention to Climate Change, especially its integration in terms of Development Cooperation, thus seeking to follow through international guidelines.

Our country has been following the negotiations on adaptation under the UNFCCC and, at EU and OECD level, in the latter two cases, in particular with regard to the integration of adaptation to Climate ChangeC in Development Cooperation policy. In order to comply with the recommendations of the OECD and in line with what is advocated in the examination of the Development Cooperation policy in 2010, a number of initiatives were carried out, namely:

a) Translation into Portuguese of the OECD Guide on "integrating adaptation to climate change in Development Cooperation ";
b) Camões´s in-house awareness actions on integrating Climate Change in Development Cooperation;
c) Professional training on Climate Change adaptation and Development Cooperation, attended by technicians of public administration related to the area of PtC;
d) In 2011, was held in Lisbon the 4th Lusophone Meeting on Environment and Development, in which particular attention was paid to Climate Change integration in Development Cooperation, attended by representatives of the Ministries of Foreign Affairs, External Affairs and Environment from the PALOP and East Timor;
e) Actions to raise awareness on integrating Climate Change, in particular on adaptation, in the development policies among Portuguese teachers who participate in education programs (professional training) with Angola and Guiné-Bissau;
f) Strengthening the implementation of the OECD marker for adaptation, which aims at the classification of ODA;
g) Creation of a working group responsible for the adequacy of forms, drafting new rules for submitting projects and new analysis criteria, aiming to integrate Climate Change adaptation in Development Cooperation.

Regarding other initiatives in disaster's risk reduction (DRR), a new eligible area was added. The "Resilience/ Disaster Risk Reduction " area belongs to the Support Mechanism of the Development Cooperation Project for Portuguese NGDO, a joint initiative between Calouste Gulbenkian Foundation, EDP Foundation, Luso-American Development Foundation, Portugal Foundation-Africa (promoting Foundations), with the support of Camões, IP, Cooperation and Language Institute. This initiative is intended to support financially the NGDO in the development of applications for several international funding, a matter which requires preparation, knowledge and financial resources.

Under the Fast Start initiative, in 2010-12, Portugal undertook towards the European Council (held on 10-11 December 2009) a commitment of 36 M€ in order to support developing countries on measures on Climate Change, focusing on strategies to reduce emissions, increase resilience and adaptation to the impacts of Climate Change and capacity building. This national contribution was integrated into the EU Financial Envelope, European mechanism that pursuit the same goals, whose amount to 7.2 billion€ for the 2010-12 time period. This financial contribution should be considered as an instrument of Development Cooperation policy, with special focus on partner countries of PtC and focused on actions related to Climate Change and actions that integrate Climate Change issues. Accordingly to that, the PALOP and East Timor are the main targets for the national cooperation in this thematic area.

In order to operationalize its commitment, several technical and political contacts were made, at different levels. These contacts led to the Memoranda of Understanding (MoUs) established between Portugal and preference-receiving countries (please see Table 2). These MoUs serve as a framework for the submission and approval of projects under the Fast Start.

**Table 2**

MoU between Portugal and preferential countries in terms of cooperation, 2010-2012

| Country | Financial Envelope | Signature Date |
|---|---|---|
| Moçambique | 9 M€ | March 2010 |
| Angola | 9 M€ | November 2010 |
| Timor Leste | 1,5 M€ | December 2010 (Cancun COP) |
| Guiné-Bissau | 1,5 M€ | February 2011 |
| São Tomé e Príncipe | 1,5 M€ | March 2012 |
| Cabo Verde | 1,5 M€ | June 2012 |

Given the increase interest and impact of the Environment and Climate Change issues whithin the Portuguese cooperation efforts, an inter-ministerial task force was established following the Copenhagen Conference, which were composed by the representatives of the Ministry of Foreign Affairs and the Environment to coordinate this file.

In the purpose of regulating the implementation of the fast start commitment of Portugal, the application rules as well as the responsibility for its implementation through the establishment of a working group (WG-Fast Start) were established by Cabinet order no. 15295/2010, of 11th October.

Apart from the seven projects supported by Camões, IP, that were integrated within Fast start (a total of 800,000 euros), in 2011 the Portuguese Government, through the Carbon Fund (FPC), signed a contract for two projects in Mozambique, namely:

a) "Atlas of the renewables energies in Mozambique" envisaging the characterization of Mozambique renewable resources (solar, wind, hydroelectric, geothermal, biomass/ MSW, waves) and;
b) "Installation of photovoltaic systems in 50 villages" envisaging the installation of photovoltaic systems for the electrification of 50 villages in Mozambique.

In March 2013, Portugal concluded the approval process of five new fast start projects, namely:

a) "Capacity Building for the Low Carbon Resilient Development Strategies";
b) "National Energy Plan for Forest Biomass for Angola";
c) "Integrating Adaptation to Climate Change into Development planning";
d) "Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique";
e) "National Support Plan for Urban Sanitation regarding Emission Reduction and Adaptation to Climate Change".

Note that the project "Development and implementation of a system for monitoring agro-forest vegetation" (SiMoFlor, with a budget of about 940,000€), also submitted and then analyzed with positive technical assessment, was not approved. its support was suspended until the constitutional order is resumed and there is a re-engagement with the Guinean authorities democratically elected. For the same reasons, the participation of Guiné-Bissau in the project "Capacity Building for the Low Carbon Resilient Development Strategies" was also suspended until approved budget revised accordingly (decrease of 350,000 €).

In this context it should be noted that under the Fast Start bilateral cooperation the following amounts are budgeted (table 3) up to 2015:

a) 24 million euros in MoUs;
b) Some 14,3 million euros in projects with Ministerial approval;
c) 10,9 million euros in contracts in progress/ completed;
d) 1,9 million euros in a project to be contractualized in a near future with the promoters.

**Table 3**

Total amount approved and distribution by major measures and by country

| | |
|---|---|
| **Total amount approved** | **14,259,547.09 €** |
| Mitigation | 11,199,562.66 € |
| Adaptation | 2,115,155.02 € |
| Capacity building | 944,829.41 € |
| **Total** | **14,259,547.09 €** |
| **Bilateral cooperation** | **14,250,207.09 €** |
| Angola | 1,973,683.51 € |
| Cabo Verde | 566,545.11 €. |
| Mozambique | 10,402,780.36 € |
| Guiné-Bissau | 635,181.00 € |
| São Tomé e Príncipe | 672,017.11 € |
| Timor Leste | - € |
| **Multilateral cooperation** | **- €** |
| **Others** | **9,340.00 €** |
| **Total** | **14,259,547.09 €** |

Until December 2012, payments were made amounting to 5.7 M€ (disbursement of about 69% of the total amount committed by contract). Furthermore, under the Fast Start initiative, there are still some projects in the pipeline.

In addition to the amount recorded for the purposes of undertaking fast start, it should be noted that, through the co-financing of some projects, it was possible to mobilize an additional amount of funding for these countries of 1.6 M€ (public and private financing).

Note also that the funds allocated by the FPC under the Fast Start initiative are counted as ODA but are addicional for they are earmarked in its own budget (FPC) to cooperation projects in the area of Climate Change. Therefore, this is not a question of a diversion of funds that could be channeled to another type of cooperative actions for Climate Change theme. Further amounts related to fast start, will be allocated in the following years not only dued to phased disbursements related to implementation of approved projects but also due to late approval of other projects in the pipeline.

With regard to the values of multilateral ODA intended to Climate Change, since 2010 these have been reduced. A justification to this lies in the fact of Portugal does not have formally established any commitment regarding a potential national contribution to the 5th replenishment of the Global Environment Fund.

**TECHNOLOGY DEVELOPMENT AND TRANSFER**

In the field of technology transfer and considering the definition written in the Convention text, particularly item c, paragraph 1 and paragraph 5 of Article 4, in most cases the programs, projects and activities (PPA) developed by the Portuguese cooperation under the context of ODA involve technology transfer, practices and processes appropriate to each area of the PPA as well as the necessary Knowledge to implement these technologies.

Notwithstanding what was already said, it becomes difficult to specify a case since the policy of statistical report of the OECD/ DAC currently does not foresee a marker for the transfer of technology that allows the qualification of the PPA in this perspective or to specifically identify the technology or technologies transferred in each case. This omission at a reference statistical report level, does not mean that in the review and approval process the identified technologies are not taken into account, and their assessment is not part of the criteria .

However, the Portuguese cooperation in the context of combating climate change has increased significantly since the creation (in 2005) of the Network of Climate Change Offices of CPLP countries (RELAC) seeking to develop actions in the area of training and developing cooperation activities particularly with its partner countries, including PALOPs (African Portuguese speaking countries) and East Timor. In this context, the Portuguese Ministry of Environment started promoting some activities and projects, some of which focused on the know – how transfer, processes and technology for these countries, in different sectors, in line with the Strategic Vision for Portuguese Cooperation. More and more, Portugal wants to continue the cooperation focused on the energy sector and particularly on renewables. Here are two specific examples in the area of technology transfer that correspond to two projects conducted in Mozambique in recent years.

| | | | |
|---|---|---|---|
| **Project / Program**: Supply and Installation of Photovoltaic systems for the electrification of 50 villages in Mozambique | | | |
| **Objective**: aims to promote the use of renewable energies on solving specific problems of energetic nature, such as to provide clean water to education and health sectors of energy, education and rural health centers, establishing itself as a capacity building model for implementing projects of a Clean Development Mechanism. | | | |
| **Country:** Mozambique | **Sector:** Energy | **Total funding:** 3.85M€ | **Implementation years:** 2011-2013 (extension foreseen) |
| **Description:**<br>The project is to provide 50 remote villages, covering all provinces of Mozambique, with solar PV systems in schools and health centers and associated housing (teachers and nurses) that will allow basic access to electricity in a way to allow not only illumination but also refrigerators for vaccines and water pumping systems, thus given access to health and education to the population that does not have these resources. The project also provides training for local technicians to maintain the systems. | | | |
| **Factors that lead to the success of the project** : Education and the provision of basic health services to rural Mozambican population are two important vectors of PARPA - Action Plan for the Reduction of Absolute Poverty in Mozambique . Through the electrification of schools and rural hospitals several goals of great importance can be achieved, namely:<br>– Duplicate the training capacity of schools by enabling schools to be open at night , the most suitable for adult training period, which during the day are devoted to agricultural activities and grazing;<br>– Allow hospitals to have means for storage of drugs and vaccines (Refrigerators and the possibility of better care at night.<br>By enabling the electrification of staff and physician´ homes, this action also has a great impact in creating better housing conditions for the technical staff , which translates in an increase of the ability to attract personnel. | | | |
| **Transferred Technology: solar photovoltaic** | | | |
| **Impact on GHG emissions**: The project does not foresee an Emission monitoring system; | | | |

| | | | |
|---|---|---|---|
| **Project / Program:** Atlas of the Renewable Energies of Mozambique | | | |
| **Purpose:** Mapping and assessment of renewable resources in Mozambique: Wind, Solar, Water Resources, Geothermal, Biomass / MSW, Waves | | | |
| **Country:** Mozambique | **Sector:** Energy | **Total funding:** 3.699.218,45 € | **Implementation Years:** 2011-2013 |
| **Description:**<br>Based on the objectives identified in the "New and Renewable Energy Development Policy", identification, location, characterization and evaluation of the potential of renewable resources have become a priority in Mozambique. To achieve this goal, this project conducted a mapping of the following potential sources of renewable energy: Solar, wind, water , hydro, geothermal, biomass/ MSW and wave energy. This mapping is intended to be a basis for consultation and work for all renewable energy projects that will be developed in Mozambique. | | | |
| **Factors that lead to success of the project**: Create conditions and promote the development of projects that will maximize the use of existing and available natural resources in Mozambique. | | | |
| **Technology transfer:** The identification and characterization of renewable potential in order to create the foundation for the development of decentralized renewable energy projects, enabling a progressive electrification of the whole country and the creation of small local networks that will gradually be expanded and linked to other local networks and subsequently interconnected to the transmission system. | | | |
| **Impact on GHG emissions:** The project does not foresee an Emission monitoring system; | | | |

Portugal has also been involved in the translation of various technical documents related to climate change - the Manual for "Integrating Adaptation to Climate Change in Development Cooperation" was recently translated. This manual provides ways to identify approaches in order to integrate adaptation into national development policies, at a sectoral and project level, both in the urban and rural context.
Currently Portugal has, some in the analysis phase others in the initial implementation phase, more projects with its partner countries that fall in promoting technologies transfer, practices and processes in different sectors.

When it comes to development cooperation, including with the PALOPs and TL whether in the bilateral context or in the Community of Portuguese Language Countries (CPLP), Portugal has paid special attention to capacity building at institutional level. This is true both for PPAs that are exclusively dedicated to this matter and to the inclusion of a capacity building component in different PPAs, trying to adapt them to change demand, to State institutions, to strengths and weaknesses of existing national systems in the recipient countries in a way to produce capabilities of autonomous problem solving.

The PPAs supported by the Portuguese cooperation usually have a strong technical assistance component with strong focus on the development of national capacities. Portugal tries to pay special attention to the efficiency and aid principles embodied in the Declaration of Paris and developed in Accra and Busan, especially: leadership and control by beneficiaries so they can strategically earmark their resources; enhance existing capabilities as a starting point, avoiding the creation of parallel structures and systematically using to national systems for aid implementation; technical driven cooperation for the demand of partners.

Regarding cooperation projects on climate change, Portugal tries to lead beneficiaries to lead and control systematically using national systems for aid implementation. In this context, there are some project that should be highlight, in particular the projects developed in Mozambique with FUNAE ("50 Villages " and "Atlas of the renewable energy") and MICOA ("Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique") and the development of projects with more than one country promoter, as in the case of "Capacity Building for the Low Carbon Resilient Development Strategies " and "Integrating Adaptation to Climate Change into Development" projects involving Cape Verde, Mozambique and São Tomé e Príncipe.

**CAPACITY-BUILDING**

Regarding the capacity-building, Portugal support several programmes or projects in this time period, investment described in table4.

**Table 4**

Provision of capacity-building support

| Programme or project title | Recipient country/ region | Targeted area | Description of programme or project |
|---|---|---|---|
| Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique | Mozambique (Moz) | Adaptation | Increase resilience to the adverse impacts of Climate Change in 9 villages in Mozambique through implementation of adaptation measures and catalysing local activities. |
| Integrating Adaptation to Climate Change into Development planning | Cape Verde (CP), Moz, Sao Tome and Principe (STP) | Adaptation | Contribute to reducing vulnerability to the impacts of Climate Change in Cape Verde, Mozambique and Sao Tome and Principe, creating capabilities to integrate the response to Climate Change vulnerability in the process of designing policies and projects; |
| | | | Enhance the skills for the design of policies and projects that are resilient to the impacts of Climate Change and simultaneously consistent with the Sustainability Development Goals, particularly poverty reduction and environmental sustainability. |
| Installation of photovoltaic systems in 50 villages | Mozambique | Mitigation | The project is to provide 50 remote villages, covering all provinces of Mozambique, with solar PV systems in schools and health centers and associated housing (teachers and nurses) that will allow basic access to electricity in a way to allow not only illumination but also refrigerators for vaccines and water pumping systems, thus given access to health and education to the population that does not have these resources. The project also provides training for local technicians to maintain the systems. |
| Capacity Building for the Low Carbon Resilient Development Strategies | CP, Moz, STP | Mitigation | Develop the necessary skills to elaborate, implement and Measure, Report and Verify Low Emissions Development Strategies Resilient to a Changing Climate and coherent with the the National Development Plans and, broadly, the Millennium Development Goals. |
| Atlas of the renewables energies in Mozambique | Mozambique | Mitigation | Based on the objectives identified in the "New and Renewable Energy Development Policy", identification, location, characterization and evaluation of the potential of renewable resources have become a priority in Mozambique. To achieve this goal, this project conducted a mapping of the following potential sources of renewable energy: Solar, wind, water, hydro, geothermal, biomass/ MSW and wave energy. This mapping is intended to be a basis for consultation and work for all renewable energy projects that will be developed in Mozambique. |
| Several initiatives | PALOP | Multiple Areas | Translation into Portuguese of the OECD Guide on "integrating adaptation to climate change in Development Cooperation"; |
| | | | In 2011, was held in Lisbon the 4th Lusophone Meeting on Environment and Development, in which particular attention was paid to Climate Change integration in Development Cooperation, attended by representatives of the Ministries of Foreign Affair; |
| | | | Actions to raise awareness on integrating Climate Change, in particular adaptation to the development policies among Portuguese teachers who participate in education programs (teacher training) with Angola and Guiné-Bissau; |
| | | | Regarding other initiatives in the disaster risk reduction area, a new eligible area was added. The "Resilience/ Risk Reduction Disaster " area belongs to the Support Mechanism to the Development Cooperation Project for Portuguese NGDO, a joint initiative between Calouste Gulbenkian Foundation, EDP Foundation, Luso - American Development Foundation, Portugal Foundation - Africa (promoting Foundations), with the support of Camões, IP, Cooperation and Language Institute. This initiative is intended to support financially NGDOs in developing applications for various international funding, a matter which requires preparation, knowledge and financial resources. |

| | | | |
|---|---|---|---|
| Support Plan for Urban Drainage from the perspective of Emission Reduction and Adaptation to Climate Change | Mozambique | Mitigation and adaptation | The Project "Support Plan for Urban Drainage from the perspective of Emission Reduction and Adaptation to Climate Change" aims to contribute to the development of policies and strategies for development of urban sanitation, particularly regarding mitigation of GHG emissions concerns, adaptation of infrastructure to changes climate and training of institutions as well as the development and transfer of knowledge to the relevant sector institutions in Mozambique in the field of sustainable development of the urban sanitation sector vis a vis the impacts of Climate Change. |

# ANNEX II – Common Table Format (1st Biennial Report)

**Table 1**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | | |
| 1. Energy | 40,609,21 | 42,179.95 | 46,732.79 | 45,405.79 | 46,039.08 | 49,543.85 | 46,825.61 | 49,440.50 | 53,896.25 | 61,279.03 | 60,037.48 | 60,164.86 |
| *A. Fuel Combustion (Sectoral Approach)* | 40,333,54 | 41,901.50 | 46,440.85 | 45,100.58 | 45,472.20 | 48,804.55 | 46,151.00 | 48,630.43 | 53,110.10 | 60,507.97 | 59,337.81 | 59,308.83 |
| 1. Energy Industries | 16,260.71 | 16,881.78 | 19,947.15 | 18,008.93 | 17,189.57 | 19,808.31 | 15,851.88 | 16,574.00 | 19,190.37 | 25,263.01 | 21,490.46 | 21,962.12 |
| 2. Manufacturing Industries and Construction | 9,759.04 | 9,872.65 | 10,303.29 | 10,322.51 | 10,643.27 | 10,854.38 | 11,106.01 | 12,081.61 | 11,977.89 | 12,064.00 | 12,646.58 | 11,493.33 |
| 3. Transport | 10,139.78 | 10,738.74 | 11,638.80 | 12,066.07 | 12,677.87 | 13,322.41 | 13,982.13 | 14,769.03 | 16,540.99 | 17,388.01 | 19,157.18 | 19,461.51 |
| 4. Other Sectors | 4,070.32 | 4,295.72 | 4,466.01 | 4,624.62 | 4,876.92 | 4,738.14 | 5,106.85 | 5,105.74 | 5,296.54 | 5,713.18 | 5,948.86 | 6,297.14 |
| 5. Other | 103.69 | 112.61 | 85.60 | 78.46 | 84.57 | 81.30 | 104.14 | 100.05 | 104.30 | 79.77 | 94.73 | 94.73 |
| *B. Fugitive Emissions from Fuels* | 275.67 | 278.45 | 291.94 | 305.21 | 566.89 | 739.31 | 674.60 | 810.06 | 786.15 | 771.06 | 699.67 | 856.03 |
| 1. Solid Fuels | 8.65 | 8.37 | 7.80 | 7.25 | 5.41 | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO |
| 2. Oil and Natural Gas | 267.02 | 270.08 | 284.14 | 297.96 | 561.48 | 739.31 | 674.60 | 810.06 | 786.15 | 771.06 | 699.67 | 856.03 |
| 2. Industrial Processes | 4,296.59 | 4,407.56 | 4,128.00 | 4,152.41 | 4,201.82 | 4,721.30 | 4,794.00 | 5,013.02 | 5,076.66 | 5,459.61 | 5,571.85 | 5,158.45 |
| *A. Mineral Products* | 3,493.38 | 3,627.01 | 3,523.50 | 3,602.99 | 3,738.14 | 3,949.09 | 3,878.63 | 4,098.54 | 4,119.45 | 4,433.00 | 4,460.68 | 4,325.07 |
| *B. Chemical Industry* | 632.69 | 629.52 | 397.21 | 348.33 | 254.10 | 559.28 | 699.51 | 689.37 | 743.01 | 799.54 | 873.01 | 734.07 |
| *C. Metal Production* | 170.08 | 150.60 | 206,88 | 200.70 | 209.20 | 212.57 | 215.51 | 224.78 | 213.88 | 226.77 | 237.87 | 99.03 |
| *D. Other Production* | 0.44 | 0.42 | 0.41 | 0.39 | 0.38 | 0.36 | 0.35 | 0.33 | 0.32 | 0.30 | 0.29 | 0.27 |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 3. Solvent and Other Product Use | 231.04 | 234.70 | 221.00 | 206.12 | 212.53 | 207.78 | 224.48 | 233.17 | 241.36 | 240.55 | 244.46 | 247.71 |
| 4. Agriculture | | | | | | | | | | | | |
| *A. Enteric Fermentation* | | | | | | | | | | | | |
| *B. Manure Management* | | | | | | | | | | | | |
| *C. Rice Cultivation* | | | | | | | | | | | | |
| *D. Agricultural Soils* | | | | | | | | | | | | |
| *E. Prescribed Burning of Savannas* | | | | | | | | | | | | |
| *F. Field Burning of Agricultural Residues* | | | | | | | | | | | | |
| *G. Other* | | | | | | | | | | | | |
| 5. Land Use, Land-Use Change and Forestry | 7,731.25 | 7,620.21 | 3,752.68 | 2,350.28 | 188.35 | 3,590.85 | 624.45 | 1,785.02 | 2,699.91 | 1,793.36 | 1,777.54 | -1,438.71 |
| *A. Forest Land* | -619.38 | -162.55 | -3,806.94 | -4,764.35 | -6,353.58 | -5,494.92 | -7,777.72 | -6,540.47 | -5,696.32 | -5,871.49 | -5,312.37 | -8,267.92 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *B. Cropland* | 5,835.14 | 5,405.45 | 4,975.76 | 4,546.07 | 4,143.50 | 5,041,48 | 4,781.26 | 4,521.05 | 4,260.83 | 4,199.37 | 4,142.02 | 4,080.14 |
| *C. Grassland* | 3,814.29 | 3,859.12 | 3,904.00 | 3,948.88 | 3,994.84 | 3,427,66 | 3,431.60 | 3,435.54 | 3,439.47 | 3,236.49 | 3,033.53 | 2,830.25 |
| *D. Wetlands* | 0.65 | 0.64 | 0.64 | 0.64 | 0.63 | 112,16 | 141.18 | 170.19 | 199.20 | 228.21 | 257.22 | 286.23 |
| *E. Settlements* | 31.32 | 38.50 | 40.62 | 42.79 | 44.99 | 450,54 | 555.04 | 659.59 | 764.18 | 868.81 | 973.50 | 1,078.23 |
| *F. Other Land* | 574.36 | 259.62 | -55.27 | -370.15 | -685.01 | 863,04 | 622.33 | 381.64 | 140.95 | -99.71 | -,340.36 | -580.99 |
| *G. Other* | -1,905.13 | -1,780.57 | -1,306.13 | -1,053.59 | -957.03 | -809,12 | -1,129.24 | -842.50 | -408.41 | -768.32 | -976.00 | -864.66 |
| 6. Waste | 12.52 | 12.57 | 12.62 | 12.67 | 12.72 | 12,78 | 14.01 | 15.91 | 12.73 | 11.63 | 9.43 | 2.91 |
| *A. Solid Waste Disposal on Land* | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *B. Waste-water Handling* | | | | | | | | | | | | |
| *C. Waste Incineration* | 12.52 | 12.57 | 12.62 | 12.67 | 12.72 | 12,78 | 14.01 | 15.91 | 12.73 | 11.63 | 9.43 | 2.91 |
| *D. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| Total $CO_2$ emissions including net $CO_2$ from LULUCF | 52,880.61 | 54,455.00 | 54,847.09 | 52,127.28 | 50,654.51 | 58,076,55 | 52,482.56 | 56,487.63 | 61,926.92 | 68,784.17 | 67,640.76 | 64,135.21 |
| Total $CO_2$ emissions excluding net $CO_2$ from LULUCF | 45,149.36 | 46,834.79 | 51,094.41 | 49,777.00 | 50,466.15 | 54,485,70 | 51,858.11 | 54,702.61 | 59,227.01 | 66,990.82 | 65,863.22 | 65,573.92 |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 2,847,05 | 2,908.24 | 2,993.95 | 2,693.64 | 2,597.90 | 2,717,63 | 2,763.28 | 2,784.36 | 2,887.83 | 3,419.03 | 3,627.56 | 3,076.25 |
| Aviation | 1,461,08 | 1,533.12 | 1,622.02 | 1,536.85 | 1,545.38 | 1,610,05 | 1,594.81 | 1,645.34 | 1,740.43 | 1,919.66 | 1,977.23 | 1,926.93 |
| Marine | 1,385,97 | 1,375.11 | 1,371.93 | 1,156.79 | 1,052.52 | 1,107,58 | 1,168.46 | 1,139.02 | 1,147.40 | 1,499.36 | 1,650.34 | 1,149.32 |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | 10,673,94 | 10,645.94 | 10,594.43 | 10,383.47 | 10,181.55 | 10,297,46 | 10,373.94 | 10,503.25 | 10,341.66 | 10,647.85 | 10,959.01 | 10,621.28 |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | (%) |
| 1. Energy | 63,715.10 | 58,956.03 | 60,871.86 | 63,360.66 | 59,043.63 | 55,972.89 | 54,203.64 | 52,820.61 | 48,248.00 | 47,609.98 | 17.24 |
| *A. Fuel Combustion (Sectoral Approach)* | 62,865.22 | 58,034.84 | 59,979.95 | 62,354.34 | 58,084.53 | 55,031.27 | 53,215.57 | 51,807.65 | 47,229.11 | 46,622.20 | 15.59 |
| 1. Energy Industries | 25,370.75 | 20,872.02 | 22,332.63 | 25,330.66 | 22,382.79 | 19,743.12 | 19,172.36 | 19,345.27 | 14,421.99 | 16,385.06 | 0.76 |
| 2. Manufacturing Industries and Construction | 10,948.65 | 10,531.15 | 10,810.87 | 10,555.23 | 10,344.99 | 10,473.31 | 9,878.71 | 8,487.43 | 9,137.66 | 8,476.75 | -13.14 |
| 3. Transport | 19,958.50 | 19,849.89 | 19,809.36 | 19,586.09 | 19,636.09 | 19,241.62 | 18,956.77 | 18,933.04 | 18,711.58 | 17,350.73 | 71.12 |
| 4. Other Sectors | 6,520.82 | 6,728.78 | 6,986.76 | 6,809.80 | 5,645.32 | 5,500.59 | 5,122.79 | 4,956.64 | 4,872.35 | 4,332.76 | 6.45 |
| 5. Other | 66.50 | 53.00 | 40.33 | 72.56 | 75.34 | 72.62 | 84.93 | 85.28 | 85.52 | 76.90 | -25.84 |
| B. Fugitive Emissions from Fuels | 849.88 | 921.18 | 891.91 | 1,006.32 | 959.10 | 941.62 | 988.07 | 1,012.95 | 1,018.89 | 987.77 | 258.32 |
| 1. Solid Fuels | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | -100.00 |
| 2. Oil and Natural Gas | 849.88 | 921.18 | 891.91 | 1,006.32 | 959.10 | 941.62 | 988.07 | 1,012.95 | 1,018.89 | 987.77 | 269.92 |
| 2. Industrial Processes | 5,367.45 | 5,242.18 | 5,692.28 | 5,665.41 | 5,369.98 | 5,768.76 | 5,544.04 | 4,018.16 | 4,171.24 | 3,684.38 | -14.25 |
| *A. Mineral Products* | 4,595.67 | 4,282.61 | 4,698.89 | 4,753.85 | 4,660.96 | 4,883.56 | 4,757.49 | 3,861.86 | 3,999.67 | 3,503.39 | 0.29 |
| *B. Chemical Industry* | 698.50 | 878.55 | 880.63 | 789.11 | 572.74 | 759.16 | 683.86 | 91.44 | 107.65 | 109.05 | -82.76 |
| *C. Metal Production* | 73.02 | 80.77 | 112.40 | 122.06 | 135.88 | 125.73 | 102.39 | 64.58 | 63.68 | 71.70 | -57.85 |
| *D. Other Production* | 0.27 | 0.25 | 0.36 | 0.39 | 0.40 | 0.32 | 0.30 | 0.27 | 0.25 | 0.24 | -44.13 |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| 3. Solvent and Other Product Use | 246.22 | 235.36 | 229,25 | 222.23 | 225.21 | 223.62 | 212.04 | 195.34 | 203.18 | 218.34 | -5.49 |
| 4. Agriculture | | | . | | | | | | | | |
| *A. Enteric Fermentation* | | | | | | | | | | | |
| *B. Manure Management* | | | | | | | | | | | |
| *C. Rice Cultivation* | | | | | | | | | | | |
| *D. Agricultural Soils* | | | | | | | | | | | |
| *E. Prescribed Burning of Savannas* | | | | | | | | | | | |
| *F. Field Burning of Agricultural Residues* | | | | | | | | | | | |
| *G. Other* | | | | | | | | | | | |
| 5. Land Use, Land-Use Change and Forestry | -1,538.96 | 4,032.34 | 69.28 | 3,632.92 | -2,942.65 | -4,578.54 | -6,532.23 | -6,586.42 | -3,999.20 | -5,725.53 | -174.06 |
| *A. Forest Land* | -7,852.16 | -1,694.93 | -5,511.93 | -769.04 | -6,469.03 | -7,605.00 | -8,828.65 | -8,803.04 | -6,058.73 | -7,707.15 | 1,144.33 |
| *B. Cropland* | 4,018.28 | 3,956.42 | 3,894.22 | 3,545.87 | 3,408.82 | 3,273.73 | 3,137.95 | 3,242.21 | 3,339.32 | 3,443.18 | -40.99 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. Grassland* | 2,626.96 | 2,423.67 | 2,220.37 | 2,054.73 | 1,832.40 | 1,610.,07 | 1,292.95 | 1,233.05 | 1,160.38 | 1,081.22 | -71.65 |
| *D. Wetlands* | 315.24 | 344.25 | 373.26 | 328.24 | 340.66 | 353.09 | 365.52 | 377.95 | 390.38 | 402.81 | 62,051.20 |
| *E. Settlements* | 1,183.02 | 1,287.85 | 1,392.73 | 1,372.47 | 1,445.86 | 1,510.40 | 1,581.31 | 1,652.22 | 1,723.14 | 1,792.10 | 5,622.43 |
| *F. Other Land* | -821.60 | -1,062.19 | -1,302.77 | -2,069.17 | -2,597.85 | -3,126.47 | -3,655.09 | -3,868.84 | -4,082.58 | -4,296.34 | -848.02 |
| *G. Other* | -1,008.70 | -1,222.72 | -996.61 | -830.18 | -903.53 | -594.36 | -426.22 | -419.97 | -471.11 | -441.35 | -76.83 |
| 6. Waste | 2.62 | 7.56 | 14.09 | 16.89 | 16.45 | 13.94 | 24.71 | 15.74 | 18.14 | 13.83 | 10.48 |
| *A. Solid Waste Disposal on Land* | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00 |
| *B. Waste-water Handling* | | | | | | | | | | | |
| *C. Waste Incineration* | 2.62 | 7.56 | 14.09 | 16.89 | 16.45 | 13.94 | 24.71 | 15.74 | 18.14 | 13.83 | 10.48 |
| *D. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00 |
| | | | | | | | | | | | |
| Total $CO_2$ emissions including net $CO_2$ from LULUCF | 67,792.43 | 68,473.47 | 66,876.75 | 72,898.10 | 61,712.62 | 57,400.68 | 53,452.21 | 50,463.43 | 48,641.36 | 45,801.00 | -13.39 |
| Total $CO_2$ emissions excluding net $CO_2$ from LULUCF | 69,331.39 | 64,441.12 | 66,807.47 | 69,265.18 | 64,655.27 | 61,979.21 | 59,984.44 | 57,049.85 | 52,640.56 | 51,526.54 | 14.12 |
| | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | |
| International Bunkers | 3,048.69 | 3,515.58 | 3,922.75 | 3,788.63 | 4,058.97 | 4,277.38 | 4,557.01 | 4,147.45 | 4,222.25 | 4,641.63 | 63.03 |
| Aviation | 1,831.63 | 2,012.46 | 2,167.71 | 2,251.04 | 2,381.67 | 2,513.45 | 2,602.49 | 2,366.54 | 2,604.05 | 2,709.16 | 85.42 |
| Marine | 1,217.06 | 1,503.12 | 1,755.04 | 1,537.59 | 1,677.30 | 1,763.94 | 1,954.52 | 1,780.90 | 1,618.20 | 1,932.47 | 39.43 |
| Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0..00 |
| $CO_2$ Emissions from Biomass | 10,485.34 | 10,235.93 | 10,589.71 | 10,479.17 | 10,791.22 | 10,963.96 | 10,831.67 | 11,162.23 | 11,940.76 | 12,125.73 | 13.60 |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | | |
| 1. Energy | 27.20 | 26.65 | 26.59 | 25.99 | 25.23 | 23.23 | 22.88 | 24.69 | 27.43 | 29.45 | 28.25 | 42.19 |
| *A. Fuel Combustion (Sectoral Approach)* | 22.23 | 21.84 | 21.82 | 21.33 | 20.99 | 21.03 | 20.94 | 20.53 | 20.12 | 19.72 | 19.10 | 18.25 |
| 1. Energy Industries | 0.21 | 0.21 | 0.24 | 0.22 | 0.23 | 0.25 | 0.21 | 0.22 | 0.25 | 0.30 | 0.30 | 0.31 |
| 2. Manufacturing Industries and Construction | 1.30 | 1.34 | 1.42 | 1.41 | 1.37 | 1.47 | 1.46 | 1.61 | 1.60 | 1.68 | 1.64 | 1.61 |
| 3. Transport | 4.12 | 4.41 | 4.79 | 4.67 | 4.51 | 4.42 | 4.33 | 4.16 | 4.15 | 4.00 | 3.83 | 3.37 |
| 4. Other Sectors | 16.59 | 15.87 | 15.36 | 15.03 | 14.89 | 14.88 | 14.94 | 14.54 | 14.13 | 13.73 | 13.33 | 12.96 |
| 5. Other | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B. Fugitive Emissions from Fuels | 4.97 | 4.81 | 4.78 | 4.66 | 4.24 | 2.20 | 1.94 | 4.15 | 7.32 | 9.73 | 9.15 | 23.95 |
| 1. Solid Fuels | 3.14 | 3.04 | 2.84 | 2.64 | 1.97 | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO |
| 2. Oil and Natural Gas | 1.83 | 1.76 | 1.94 | 2.02 | 2.27 | 2.20 | 1.94 | 4.15 | 7.32 | 9.73 | 9.15 | 23.95 |
| 2. Industrial Processes | 0.91 | 0.89 | 1.03 | 1.04 | 1.08 | 1.12 | 1.15 | 1.25 | 1.34 | 1.40 | 1.47 | 1.46 |
| *A. Mineral Products* | 0.27 | 0.33 | 0.36 | 0.36 | 0.40 | 0.43 | 0.45 | 0.49 | 0.50 | 0.53 | 0.56 | 0.62 |
| *B. Chemical Industry* | 0.40 | 0.34 | 0.37 | 0.38 | 0.38 | 0.39 | 0.38 | 0.41 | 0.48 | 0.47 | 0.48 | 0.48 |
| *C. Metal Production* | 0.25 | 0.22 | 0.30 | 0.30 | 0.30 | 0.31 | 0.32 | 0.35 | 0.35 | 0.39 | 0.44 | 0.37 |
| *D. Other Production* | | | | | | | | | | | | |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 3. Solvent and Other Product Use | | | | | | | | | | | | |
| 4. Agriculture | 197.68 | 202.23 | 198.04 | 190.95 | 200.43 | 205.54 | 207.71 | 204.62 | 208.90 | 213.33 | 213.33 | 208.91 |
| *A. Enteric Fermentation* | 129.01 | 131.06 | 130.76 | 125.87 | 132.02 | 138.43 | 140.24 | 137.18 | 141.63 | 146.00 | 147.79 | 145.12 |
| *B. Manure Management* | 56.42 | 59.00 | 59.30 | 59.80 | 59.42 | 58.90 | 57.01 | 56.88 | 57.25 | 57.89 | 56.61 | 54.49 |
| *C. Rice Cultivation* | 10.80 | 10.68 | 6.74 | 4.21 | 7.68 | 6.94 | 9.03 | 9.11 | 8.63 | 8.08 | 7.62 | 7.96 |
| *D. Agricultural Soils* | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO |
| *E. Prescribed Burning of Savannas* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *F. Field Burning of Agricultural Residues* | 1.45 | 1.49 | 1.24 | 1.06 | 1.32 | 1.27 | 1.43 | 1.44 | 1.40 | 1.36 | 1.32 | 1.33 |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 5. Land Use, Land-Use Change and Forestry | 10.52 | 15.80 | 5.18 | 3.38 | 2.27 | 11.84 | 4.53 | 1.62 | 8.40 | 4.38 | 9.01 | 5.88 |
| *A. Forest Land* | 9.94 | 15.04 | 4.95 | 3.18 | 1.96 | 11.18 | 4.19 | 1.50 | 7.78 | 4.09 | 8.37 | 5.61 |
| *B. Cropland* | 0.57 | 0.74 | 0.23 | 0.19 | 0.29 | 0.63 | 0.33 | 0.11 | 0.60 | 0.27 | 0.61 | 0.26 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. Grassland* | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 | 0.01 | 0.03 | 0.01 | 0.03 | 0.01 |
| *D. Wetlands* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *E. Settlements* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *F. Other Land* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *G. Other* | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO |
| 6. Waste | 262.80 | 271.67 | 281.49 | 288.80 | 301.82 | 311.64 | 312.02 | 322.96 | 336.36 | 340.43 | 333.76 | 336.62 |
| *A. Solid Waste Disposal on Land* | 144.41 | 151.05 | 157.87 | 164.87 | 172.17 | 179.68 | 187.70 | 196.41 | 206.99 | 217.74 | 224.89 | 230.79 |
| *B. Waste-water Handling* | 118.39 | 120.61 | 123.61 | 123.92 | 129.66 | 131.96 | 124.32 | 126.55 | 129.38 | 122.68 | 108.86 | 105.83 |
| *C. Waste Incineration* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *D. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| Total $CH_4$ emissions including $CH_4$ from LULUCF | 499.11 | 517.24 | 512.33 | 510.15 | 530.84 | 553.37 | 548.29 | 555.15 | 582.44 | 588.98 | 585.82 | 595.07 |
| Total $CH_4$ emissions excluding $CH_4$ from LULUCF | 488.59 | 501.43 | 507.15 | 506.77 | 528.57 | 541.53 | 543.76 | 553.52 | 574.03 | 584.61 | 576.81 | 589.18 |
| | | | | | | | | | | | | |
| *Memo Items:* | | | | | | | | | | | | |
| *International Bunkers* | *0.15* | *0.15* | *0.15* | *0.14* | *0.14* | *0.15* | *0.14* | *0.14* | *0.16* | *0.17* | *0.12* | *0.11* |
| Aviation | 0.12 | 0.13 | 0.13 | 0.12 | 0.12 | 0.13 | 0.12 | 0.12 | 0.14 | 0.15 | 0.10 | 0.09 |
| Marine | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| $CO_2$ Emissions from Biomass | | | | | | | | | | | | |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | % |
| 1. Energy | 45.98 | 49.87 | 36.49 | 35.89 | 22.82 | 23.76 | 35.51 | 44.07 | 40.60 | 20.81 | -23.49 |
| *A. Fuel Combustion (Sectoral Approach)* | 17.89 | 17.10 | 16.63 | 16.00 | 15.24 | 14.61 | 13.85 | 13.40 | 12.75 | 13.04 | -41.34 |
| 1. Energy Industries | 0.34 | 0.31 | 0.35 | 0.38 | 0.37 | 0.34 | 0.37 | 0.39 | 0.37 | 0.39 | 90.31 |
| 2. Manufacturing Industries and Construction | 1.67 | 1.63 | 1.74 | 1.74 | 1.70 | 1.71 | 1.62 | 1.67 | 1.58 | 1.61 | 23.27 |
| 3. Transport | 3.32 | 3.00 | 2.77 | 2.53 | 2.30 | 2.11 | 1.84 | 1.76 | 1.62 | 1.42 | -65.63 |
| 4. Other Sectors | 12.56 | 12.15 | 11.76 | 11.35 | 10.86 | 10.44 | 10.01 | 9.59 | 9.17 | 9.62 | -41.99 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -93.42 |
| *B. Fugitive Emissions from Fuels* | 28.09 | 32.77 | 19.87 | 19.89 | 7.58 | 9.15 | 21.66 | 30.67 | 27.85 | 7.78 | 56.33 |
| 1. Solid Fuels | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | -100.00 |
| 2. Oil and Natural Gas | 28.09 | 32.77 | 19.87 | 19.89 | 7.58 | 9.15 | 21.66 | 30.67 | 27.85 | 7.78 | 324.88 |
| 2. Industrial Processes | 1.44 | 1.50 | 1.64 | 1.69 | 1.75 | 1.83 | 1.92 | 1.74 | 1.78 | 1.92 | 110.41 |
| *A. Mineral Products* | 0.62 | 0.61 | 0.64 | 0.67 | 0.69 | 0.75 | 0.76 | 0.78 | 0.79 | 0.80 | 191.66 |
| *B. Chemical Industry* | 0.48 | 0.51 | 0.52 | 0.52 | 0.50 | 0.48 | 0.50 | 0.44 | 0.50 | 0.50 | 26.18 |
| *C. Metal Production* | 0.34 | 0.37 | 0.47 | 0.50 | 0.56 | 0.60 | 0.65 | 0.52 | 0.50 | 0.63 | 156.13 |
| *D. Other Production* | | | | | | | | | | | |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0,00 |
| 3. Solvent and Other Product Use | | | | | | | | | | | |
| 4. Agriculture | 206.10 | 201.90 | 209.55 | 209.60 | 210,71 | 207,79 | 207,76 | 204,42 | 204,72 | 204,94 | 3,68 |
| *A. Enteric Fermentation* | 142.08 | 138.38 | 142.22 | 143.67 | 142,99 | 140,85 | 141,32 | 137,07 | 134,97 | 132,58 | 2,77 |
| *B. Manure Management* | 51.89 | 49.91 | 49.81 | 49.68 | 50,32 | 50,50 | 50,74 | 50,79 | 50,36 | 49,74 | -11,85 |
| *C. Rice Cultivation* | 10.89 | 12.44 | 16.52 | 15.38 | 16,48 | 15,41 | 14,67 | 15,49 | 18,44 | 21,73 | 101,24 |
| *D. Agricultural Soils* | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | 0,00 |
| *E. Prescribed Burning of Savannas* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0,00 |
| *F. Field Burning of Agricultural Residues* | 1.23 | 1.17 | 0.99 | 0.88 | 0,92 | 1,04 | 1,03 | 1,07 | 0,95 | 0,89 | -38,45 |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0,00 |
| 5. Land Use, Land-Use Change and Forestry | 7.94 | 33.09 | 7.43 | 25.23 | 5,14 | 1,60 | 0,88 | 3,77 | 9,26 | 4,37 | -58,50 |
| *A. Forest Land* | 7.60 | 30.61 | 6.27 | 24.81 | 4,74 | 1,37 | 0,74 | 3,46 | 8,74 | 4,08 | -58,96 |
| *B. Cropland* | 0.32 | 2.34 | 1.09 | 0.39 | 0,37 | 0,21 | 0,13 | 0,29 | 0,49 | 0,27 | -52,47 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *C. Grassland* | 0.02 | 0.14 | 0.07 | 0.03 | 0.02 | 0.01 | 0.01 | 0.02 | 0.03 | 0.02 | 23.63 |
| *D. Wetlands* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *E. Settlements* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *F. Other Land* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *G. Other* | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | IE,NO | 0.00 |
| 6. Waste | 348.82 | 349.09 | 354.20 | 354.92 | 353.06 | 343.54 | 335.26 | 322.50 | 347.39 | 365.02 | 38.89 |
| *A. Solid Waste Disposal on Land* | 235.51 | 228.04 | 227.44 | 222.71 | 224.37 | 226.48 | 229.78 | 223.78 | 237.68 | 243.89 | 68.89 |
| *B. Waste-water Handling* | 113.30 | 121.04 | 126.74 | 132.19 | 128.67 | 117.05 | 105.46 | 98.71 | 109.69 | 121.11 | 2.29 |
| *C. Waste Incineration* | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 788.87 |
| *D. Other* | NO | NO | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00 |
| | | | | | | | | | | | |
| Total $CH_4$ emissions including $CH_4$ from LULUCF | 610.27 | 635.45 | 609.30 | 627.33 | 593.47 | 578.53 | 581.33 | 576.51 | 603.75 | 597.06 | 19.62 |
| Total $CH_4$ emissions excluding $CH_4$ from LULUCF | 602.33 | 602.36 | 601.87 | 602.10 | 588.33 | 576.93 | 580.45 | 572.74 | 594.49 | 592.70 | 21.31 |
| | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | |
| International Bunkers | 0.11 | 0.12 | 0.11 | 0.10 | 0.10 | 0.10 | 0.11 | 0.10 | 0.10 | 0.11 | -28.37 |
| Aviation | 0.09 | 0.09 | 0.08 | 0.07 | 0.07 | 0.07 | 0.08 | 0.07 | 0.08 | 0.07 | -40.69 |
| Marine | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 39.72 |
| Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| $CO_2$ Emissions from Biomass | | | | | | | | | | | |

**Table 1(cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kt | | | | | | | | | | | |
| 1. Energy | 1.47 | 1.51 | 1.58 | 1.87 | 2.13 | 2.37 | 2.62 | 2.53 | 2.44 | 2.63 | 1.98 | 1.99 |
| *A. Fuel Combustion (Sectoral Approach)* | 1.46 | 1.50 | 1.57 | 1.86 | 2.12 | 2.36 | 2.62 | 2.52 | 2.43 | 2.62 | 1.98 | 1.98 |
| 1. Energy Industries | 0.20 | 0.20 | 0.23 | 0.22 | 0.22 | 0.25 | 0.21 | 0.22 | 0.25 | 0.40 | 0.40 | 0.40 |
| 2. Manufacturing Industries and Construction | 0.22 | 0.22 | 0.23 | 0.23 | 0.23 | 0.24 | 0.24 | 0.26 | 0.26 | 0.27 | 0.28 | 0.27 |
| 3. Transport | 0.27 | 0.29 | 0.31 | 0.60 | 0.85 | 1.07 | 1.30 | 1.31 | 1.37 | 1.39 | 0.72 | 0.71 |
| 4. Other Sectors | 0.77 | 0.79 | 0.79 | 0.81 | 0.82 | 0.80 | 0.86 | 0.73 | 0.55 | 0.55 | 0.58 | 0.60 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *B. Fugitive Emissions from Fuels* | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1. Solid Fuels | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2. Oil and Natural Gas | 0-01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 2. Industrial Processes | 1.67 | 1.55 | 1.53 | 1.20 | 0.99 | 1.50 | 1.54 | 1.60 | 1.80 | 1.67 | 1.82 | 1.68 |
| *A. Mineral Products* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *B. Chemical Industry* | 1.67 | 1.55 | 1.53 | 1.20 | 0.99 | 1.50 | 1.54 | 1.60 | 1.80 | 1.67 | 1.82 | 1.68 |
| *C. Metal Production* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *D. Other Production* | | | | | | | | | | | | |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 3. Solvent and Other Product Use | 0.32 | 0.26 | 0.33 | 0.25 | 0.33 | 0.33 | 0.35 | 0.39 | 0.16 | 0.16 | 0.17 | 0.17 |
| 4. Agriculture | 12.93 | 12.95 | 12.82 | 12.75 | 12.78 | 12.47 | 13.19 | 13.08 | 12.71 | 12.91 | 13.59 | 13.01 |
| *A. Enteric Fermentation* | | | | | | | | | | | | |
| *B. Manure Management* | 1.70 | 1.68 | 1.65 | 1.61 | 1.58 | 1.55 | 1.52 | 1.48 | 1.48 | 1.53 | 1.53 | 1.47 |
| *C. Rice Cultivation* | | | | | | | | | | | | |
| *D. Agricultural Soils* | 11.16 | 11.20 | 11.11 | 11.08 | 11.13 | 10.85 | 11.60 | 11.53 | 11.16 | 11.31 | 11.99 | 11.47 |
| *E. Prescribed Burning of Savannas* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *F. Field Burning of Agricultural Residues* | 0.07 | 0.07 | 0.06 | 0.06 | 0.07 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 | 0.06 |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 5. Land Use, Land-Use Change and Forestry | 1.75 | 1.69 | 1.40 | 1.23 | 1.10 | 1.18 | 1.01 | 0.91 | 0.95 | 0.89 | 0.95 | 0.90 |
| *A. Forest Land* | 0.14 | 0.21 | 0.07 | 0.04 | 0.03 | 0.15 | 0.06 | 0.02 | 0.11 | 0.06 | 0.12 | 0.08 |
| *B. Cropland* | 1.62 | 1.48 | 1.33 | 1.19 | 1.08 | 1.02 | 0.96 | 0.89 | 0.84 | 0.83 | 0.83 | 0.83 |
| *C. Grassland* | 0.00 | 0.00 | 0.00 | 000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *D. Wetlands* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *E. Settlements* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *F. Other Land* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *G. Other* | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO |
| 6. Waste | 1.49 | 1.53 | 1.56 | 1.58 | 1.63 | 1.64 | 1.61 | 1.68 | 1.75 | 1.78 | 1.79 | 1.73 |
| *A. Solid Waste Disposal on Land* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| *B. Waste-water Handling* | 1.49 | 1.53 | 1.56 | 1.58 | 1.63 | 1.63 | 1.61 | 1.67 | 1.75 | 1.77 | 1.78 | 1.72 |
| *C. Waste Incineration* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *D. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| Total $N_2O$ emissions including $N_2O$ from LULUCF | 19.63 | 19.49 | 19.22 | 18.89 | 18.96 | 19.48 | 20.32 | 20.20 | 19.80 | 20.04 | 20.30 | 19.48 |
| Total $N_2O$ emissions excluding $N_2O$ from LULUCF | 17.88 | 17.80 | 17.82 | 17.65 | 17.85 | 18.30 | 19.31 | 19.29 | 18.85 | 19.15 | 19.35 | 18.57 |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 0.08 | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.09 | 0.10 | 0.08 |
| Aviation | 0.04 | 0.04 | 0.05 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.05 |
| Marine | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 |
| Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| $CO_2$ Emissions from Biomass | | | | | | | | | | | | |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | % |
| 1. Energy | 2.09 | 1.98 | 2.01 | 2.14 | 2.08 | 2.03 | 1.98 | 1.87 | 1.83 | 1.82 | 23.98 |
| *A. Fuel Combustion (Sectoral Approach)* | 2.08 | 1.97 | 2.00 | 2.13 | 2.07 | 2.02 | 1.97 | 1.86 | 1.82 | 1.81 | 24.11 |
| 1. Energy Industries | 0.45 | 0.41 | 0.44 | 0.48 | 0.45 | 0.41 | 0.42 | 045 | 0.39 | 0.43 | 116.02 |
| 2. Manufacturing Industries and Construction | 0.27 | 0.28 | 0.29 | 0.29 | 0.30 | 0.31 | 0.30 | 0.28 | 0.31 | 0.31 | 42.50 |
| 3. Transport | 0.74 | 0.74 | 0.74 | 0.71 | 0.71 | 0.69 | 0.67 | 0.59 | 0.59 | 0.55 | 105.71 |
| 4. Other Sectors | 0.62 | 0.54 | 0.53 | 0.64 | 0.61 | 0.60 | 0.57 | 0.54 | 0.53 | 0.52 | -32.41 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -20.99 |
| *B. Fugitive Emissions from Fuels* | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | -0.51 |
| *1. Solid Fuels* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *2. Oil and Natural Gas* | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | -0.51 |
| 2. Industrial Processes | 1.69 | 1.77 | 1.96 | 1.81 | 1.77 | 1.85 | 1.68 | 0.94 | 0.96 | 0.21 | -87.49 |
| *A. Mineral Products* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *B. Chemical Industry* | 1.69 | 1.77 | 1.96 | 1.81 | 1.77 | 1.85 | 1.68 | 0.94 | 0.96 | 0.21 | -87.49 |
| *C. Metal Production* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *D. Other Production* | | | | | | | | | | | |
| *E. Production of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *F. Consumption of Halocarbons and $SF_6$* | | | | | | | | | | | |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| 3. Solvent and Other Product Use | 0.14 | 0.17 | 0.27 | 0.32 | 0.19 | 0.25 | 0.17 | 0.24 | 0.07 | 0.16 | -50.96 |
| 4. Agriculture | 12.99 | 11.09 | 11.50 | 10.78 | 10.24 | 10.95 | 10.50 | 10.39 | 10.38 | 10.33 | -20.14 |
| *A. Enteric Fermentation* | | | | | | | | | | | |
| *B. Manure Management* | 1.40 | 1.29 | 1.23 | 1.18 | 1.12 | 1.06 | 1.01 | 0.99 | 0.96 | 0.96 | -43.67 |
| *C. Rice Cultivation* | | | | | | | | | | | |
| *D. Agricultural Soils* | 11.53 | 9.73 | 10.21 | 9.54 | 9.06 | 9.84 | 9.43 | 9.34 | 9.37 | 9.32 | -16.50 |
| *E. Prescribed Burning of Savannas* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| *F. Field Burning of Agricultural Residues* | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | -30.65 |
| *G. Other* | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| 5. Land Use, Land-Use Change and Forestry | 0.93 | 1.27 | 0.91 | 1.16 | 0.88 | 0.83 | 0.82 | 0.91 | 1.03 | 1.01 | -42.26 |
| A. Forest Land | 0.10 | 0.42 | 0.09 | 0.34 | 0.07 | 0.02 | 0.01 | 0.05 | 0.12 | 0.06 | -58.96 |
| B. Cropland | 0.82 | 0.85 | 0.83 | 0.82 | 0.81 | 0.81 | 0.81 | 0.86 | 0.91 | 0.96 | -40.86 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C. Grassland | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23.63 |
| D. Wetlands | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| E. Settlements | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| F. Other Land | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| G. Other | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | IE,NA, NE,NO | 0.00 |
| 6. Waste | 1.81 | 1.85 | 1.92 | 1.91 | 1.89 | 1.96 | 1.88 | 1.78 | 1.92 | 1.94 | 29.78 |
| A. Solid Waste Disposal on Land | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| B. Waste-water Handling | 1.80 | 1.84 | 1.89 | 1.88 | 1.85 | 1.93 | 1.84 | 1.75 | 1.87 | 1.91 | 27.94 |
| C. Waste Incineration | 0.00 | 0.00 | 0.02 | 0.03 | 0.03 | 0.02 | 0.04 | 0.03 | 0.04 | 0.03 | 788.87 |
| D. Other | NO | NO | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| 7. Other (as specified in the summary table in CRF) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00 |
| | | | | | | | | | | | |
| Total $N_2O$ emissions including $N_2O$ from LULUCF | 19.64 | 18.12 | 18.57 | 18.11 | 17.04 | 17.85 | 17.02 | 16.13 | 16.19 | 15.46 | -21.25 |
| Total $N_2O$ emissions excluding $N_2O$ from LULUCF | 18.71 | 16.85 | 17.66 | 16.95 | 16.16 | 17.03 | 16.20 | 15.22 | 15.16 | 14.45 | -19.19 |
| | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | |
| International Bunkers | 0.08 | 0.10 | 0.11 | 0.10 | 0.11 | 0.12 | 0.12 | 0.11 | 0.12 | 0.13 | 64.15 |
| Aviation | 0.05 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 85.42 |
| Marine | 0.03 | 0.04 | 0.05 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 39.72 |
| Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| $CO_2$ Emissions from Biomass | | | | | | | | | | | |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | | |
| Emissions of HFCsc - (kt $CO_2$ eq) | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | 66.27 | 88.30 | 122.87 | 166.10 | 223.54 | 319.04 | 410.86 |
| HFC-23 | NE,NO | NE,NO | NE,NO | NE,NO | NE,NO | NO | NO | NO | NO | 0.00 | 0,00 | 0.00 |
| HFC-32 | NE | NE | NE | NE | NE | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 |
| HFC-41 | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| HFC-43-10mee | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| HFC-125 | NE | NE | NE | NE | NE | NO | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.03 |
| HFC-134 | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| HFC-134a | NE | NE | NE | NE | NE | 0.05 | 0.06 | 0.08 | 0.11 | 0.14 | 0.17 | 0.21 |
| HFC-152a | NE | NE | NE | NE | NE | 0.01 | 0.01 | 0.02 | 0.04 | 0.06 | 0.09 | 0.12 |
| HFC-143 | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| HFC-143a | NE | NE | NE | NE | NE | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| HFC-227ea | NE | NE | NE | NE | NE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| HFC-236fa | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| HFC-245ca | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| Unspecified mix of listed HFCsd - (kt $CO_2$ eq) | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| | | | | | | | | | | | | |
| Emissions of PFCsc - (kt $CO_2$ eq) | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NO | NA,NO | 0.01 | 0.03 | 0.06 | 0.03 | 0.06 |
| $CF_4$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| $C_2F_6$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| C 3F8 | NE | NE | NE | NE | NE | NO | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $C_4F_{10}$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| c-$C_4F_8$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| $C_5F_{12}$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| $C_6F_{14}$ | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| Unspecified mix of listed PFCs(4) - (Gg $CO_2$ eq) | NE | NE | NE | NE | NE | NO | NO | NO | NO | NO | NO | NO |
| | | | | | | | | | | | | |
| Emissions of $SF_6$(3) - (Gg $CO_2$ eq) | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | 6.83 | 7.05 | 8.64 | 9.19 | 10.04 | 9.70 | 11.24 |
| $SF_6$ | NA,NE | NA,NE | NA,NE | NA,NE | NA,NE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | | | | | | | | | | % |
| Emissions of HFCsc - (kt $CO_2$ eq) | 524.98 | 644.86 | 734.13 | 848.05 | 961.94 | 1,100.48 | 1,248.56 | 1,378.86 | 1,515.03 | 1,491.49 | 100.00 |
| HFC-23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| HFC-32 | 0.03 | 0.03 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 100.00 |
| HFC-41 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| HFC-43-10mee | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| HFC-125 | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 | 0.11 | 100.00 |
| HFC-134 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| HFC-134a | 0.26 | 0.31 | 0.35 | 0.42 | 0.48 | 0.55 | 0.62 | 0.69 | 0.77 | 0.76 | 100.00 |
| HFC-152a | 0.14 | 0.28 | 0.30 | 0.30 | 0.30 | 0.30 | 0.29 | 0.28 | 0.29 | 0.28 | 100.00 |
| HFC-143 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| HFC-143a | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 100.00 |
| HFC-227ea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| HFC-236fa | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| HFC-245ca | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| Unspecified mix of listed HFCsd - (kt $CO_2$ eq) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| | | | | | | | | | | | |
| Emissions of PFCsc - (kt $CO_2$ eq) | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.00 | 100.00 |
| $CF_4$ | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| $C_2F_6$ | NO | NO | NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | NO | NO | 0.00 |
| C 3F8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| $C_4F_{10}$ | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| c-$C_4F_8$ | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| $C_5F_{12}$ | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| $C_6F_{14}$ | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| Unspecified mix of listed PFCs(4) - (Gg $CO_2$ eq) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | 0.00 |
| | | | | | | | | | | | |
| Emissions of $SF_6$(3) - (Gg $CO_2$ eq) | 10.00 | 16.33 | 25.69 | 25.70 | 26.24 | 36.97 | 35.63 | 40.89 | 43.57 | 42.89 | 100.00 |
| $SF_6$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |

**Table 1 (cont.)**

| GREENHOUSE GAS EMISSIONS | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt $CO_2$ eq | | | | | | | | | | | |
| $CO_2$ emissions including net $CO_2$ from LULUCF | 52,880.61 | 54,455.00 | 54,847.09 | 52,127.28 | 50,654.51 | 58,076.55 | 52,482.56 | 56,487.63 | 61,926.92 | 68,784.17 | 67,640.76 | 64,135.21 |
| $CO_2$ emissions excluding net $CO_2$ from LULUCF | 45,149.36 | 46,834.79 | 51,094.41 | 49,777.00 | 50,466.15 | 54,485.70 | 51,858.11 | 54,702.61 | 59,227.01 | 66,990.82 | 65,863.22 | 65,573.92 |
| $CH_4$ emissions including $CH_4$ from LULUCF | 10,481.38 | 10,861.96 | 10,758.98 | 10,713.24 | 11,147.54 | 11,620.74 | 11,514.16 | 11,658.09 | 12,231.17 | 12,368.62 | 12,302.17 | 12,496.37 |
| $CH_4$ emissions excluding $CH_4$ from LULUCF | 10,260.49 | 10,530.11 | 10,650.16 | 10,642.17 | 11,099.94 | 11,372.17 | 11418.95 | 11,624.02 | 12,054.69 | 12,276.73 | 12,113.03 | 12,372.81 |
| $N_2O$ emissions including $N_2O$ from LULUCF | 6,086.58 | 6,041.48 | 5,957.78 | 5,854.98 | 5,877.16 | 6,037.58 | 6,299.67 | 6,263.15 | 6,138.01 | 6,211.97 | 6,292.40 | 6,037.91 |
| $N_2O$ emissions excluding $N_2O$ from LULUCF | 5,542.54 | 5,518.77 | 5,524.20 | 5,472.93 | 5,534.66 | 5,673.08 | 5,985.08 | 5,979.76 | 5,844.50 | 5,936.59 | 5,998.24 | 5,758.02 |
| HFCs | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | 66.27 | 88.30 | 122.87 | 166.10 | 223.54 | 319.04 | 410.86 |
| PFCs | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NO | NA,NO | 0.01 | 0.03 | 0.06 | 0.03 | 0.06 |
| $SF_6$ | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | NA,NE,NO | 6.83 | 7.05 | 8.64 | 9.19 | 10.04 | 9.70 | 11.24 |
| Total (including LULUCF) | 69,448.57 | 71,358.44 | 71,563.85 | 68,695.51 | 67,679.20 | 75,807.97 | 70,391.73 | 74,540.39 | 80,471.42 | 87,598.40 | 86,564.11 | 83,091.66 |
| Total (excluding LULUCF) | 60,952.39 | 62,883.66 | 67,268.76 | 65,892.09 | 67,100.76 | 71,604.05 | 69,357.49 | 72,437.90 | 77,301.51 | 85,437.77 | 84,303.27 | 84,126.91 |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | Base year[a] | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt $CO_2$ eq | | | | | | | | | | | |
| 1. Energy | 41,634.94 | 43,207,99 | 47,779.95 | 46,531.01 | 47,227.86 | 50,766.38 | 48,119.57 | 50,742.91 | 55,227.71 | 62,713.12 | 61,245.85 | 61,668.32 |
| 2. Industrial Processes | 4,833.70 | 4,907,69 | 4,623.31 | 4,546.76 | 4,532.10 | 5,281.95 | 5,390.83 | 5,668.17 | 5,838.58 | 6,240.81 | 6,494.44 | 6,132.42 |
| 3. Solvent and Other Product Use | 329.62 | 313,75 | 324.23 | 284.24 | 313.28 | 310.08 | 331.43 | 355.00 | 289.41 | 290.77 | 297.78 | 299.48 |
| 4. Agriculture | 8,159.50 | 8,261,21 | 8,132.85 | 7,962.36 | 8,169.97 | 8,180.97 | 8,449.53 | 8,353.22 | 8,325.51 | 8,481.23 | 8,693.36 | 8,419.20 |
| 5. Land Use, Land-Use Change and Forestry[b] | 8,496.18 | 8,474,77 | 4,295.09 | 2,803.42 | 578.44 | 4,203.92 | 1,034.25 | 2,102.49 | 3,169.90 | 2,160.62 | 2,260.84 | -1,035.25 |
| 6. Waste | 5,994.63 | 6,193,03 | 6,408.42 | 6,567.72 | 6,857.56 | 7,064.67 | 7,066.13 | 7,318.60 | 7,620.31 | 7,711.84 | 7,571.83 | 7,607.49 |
| 7. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total (including LULUCF) | 69,448.57 | 71,358,44 | 71,563.85 | 68,695.51 | 67,679.20 | 75,807.97 | 70,391.73 | 74,540.39 | 80,471.42 | 87,598.40 | 86,564.11 | 83,091.66 |

**Table 1 (cont.)**

| GREENHOUSE GAS EMISSIONS | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt $CO_2$ eq | | | | | | | | | | (%) |
| $CO_2$ emissions including net $CO_2$ from LULUCF | 67,792.43 | 68,473.47 | 66,876.75 | 72,898.10 | 61,712.62 | 57,400.68 | 53,452.21 | 50,463.43 | 48,641.36 | 45,801.00 | -13.39 |
| $CO_2$ emissions excluding net $CO_2$ from LULUCF | 69,331.39 | 64,441.12 | 66,807.47 | 69,265.18 | 64,655.27 | 61,979.21 | 59,984.44 | 57,049.85 | 52,640.56 | 51,526.54 | 14.12 |
| $CH_4$ emissions including $CH_4$ from LULUCF | 12,815.63 | 13,344.35 | 12,795.25 | 13,173.93 | 12,462.91 | 12,149.05 | 12,207.95 | 12,106.75 | 12,678.76 | 12,538.28 | 19.62 |
| $CH_4$ emissions excluding $CH_4$ from LULUCF | 12,648.94 | 12,649.53 | 12,639.29 | 12,644.17 | 12,354.99 | 12,115.52 | 12,189.53 | 12,027.54 | 12,484.31 | 12,446.61 | 21.31 |
| $N_2O$ emissions including $N_2O$ from LULUCF | 6,088.87 | 5,617.25 | 5,757.37 | 5,612.84 | 5,281.64 | 5,534.74 | 5,276.31 | 4,999.19 | 5,018.45 | 4,793.03 | -21.25 |
| $N_2O$ emissions excluding $N_2O$ from LULUCF | 5,801.18 | 5,223.33 | 5,473.78 | 5,254.08 | 5,009.22 | 5,278.13 | 5,023.48 | 4,718.55 | 4,698.95 | 4,478.92 | -19.19 |
| HFCs | 524.98 | 644.86 | 734.13 | 848.05 | 961.94 | 1,100.48 | 1,248.56 | 1,378.86 | 1,515.03 | 1,491.49 | 100.00 |
| PFCs | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.00 | 100.00 |
| $SF_6$ | 10.00 | 16.33 | 25.69 | 25.70 | 26.24 | 36.97 | 35.63 | 40.89 | 43.57 | 42.89 | 100.00 |
| Total (including LULUCF) | 87,231.96 | 88,096.31 | 86,189.24 | 92,558.67 | 80,445.39 | 76,221.95 | 72,220.71 | 68,989.13 | 67,897.16 | 64,666.69 | -6.89 |
| Total (excluding LULUCF) | 88,316.54 | 82,975.22 | 85,680.41 | 88,037.23 | 83,007.70 | 80,510.35 | 78,481.69 | 75,215.70 | 71,382.42 | 69,986.45 | 14.82 |

**Table 1 (cont.)**

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Change from base to latest reported year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt $CO_2$ eq | | | | | | | | | | (%) |
| 1. Energy | 65,328.15 | 60,616.80 | 62,262.71 | 64,777.92 | 60,166.33 | 57,100.03 | 55,563.27 | 54,324.47 | 49,667.35 | 48,610.50 | 16.75 |
| 2. Industrial Processes | 6,456.22 | 6,482.12 | 7,094.09 | 7,135.38 | 6,943.34 | 7,516.81 | 7,390.58 | 5,767.05 | 6,064.82 | 5,323.95 | 10.14 |
| 3. Solvent and Other Product Use | 289.31 | 287.91 | 313.14 | 319.95 | 284.10 | 300.48 | 263.85 | 269,93 | 225.76 | 266.69 | -19.09 |
| 4. Agriculture | 8,354.79 | 7,676.87 | 7,963.96 | 7,742.76 | 7,598.76 | 7,758.40 | 7,617.09 | 7,513.15 | 7,517.39 | 7,504.88 | -8.02 |
| 5. Land Use, Land-Use Change and Forestry[b] | -1,084.58 | 5,121.09 | 508.83 | 4,521.43 | -2,562.31 | -4,288.39 | -6,260.98 | -6,226.57 | -3,485.26 | -5,319.75 | -162.61 |
| 6. Waste | 7,888.07 | 7,911.52 | 8,046.51 | 8,061.23 | 8,015.17 | 7,834.63 | 7,646.89 | 7,341.10 | 7,907.10 | 8,280.43 | 38.13 |
| 7. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00 |
| Total (including LULUCF) | 87,231.96 | 88,096.31 | 86,189.24 | 92,558.67 | 80,445.39 | 76,221.95 | 72,220.71 | 68,989.13 | 67,897.16 | 64,666.69 | -6.89 |

**Table 2**

Description of quantified economy-wide emission reduction target

| **Emission reduction target: base year and target** | | |
|---|---|---|
| | | Comments |
| Base year/ base period | 1990 | |
| Emission reductions target (% of base year/base period) | 20.00 | Legally binding target trajectories for the period 2013-2020 are enshrined in both the EU-ETS Directive (Directive 2003/87/EC and respective amendments) and the Effort Sharing Decision (Decision No 406/2009/EC). These legally binding trajectories not only result in a 20% GHG reduction in 2020 compared to 1990 but also define the EU's annual target pathway to reduce EU GHG emissions from 2013 to 2020. The Effort Sharing Decision sets annual national emission targets for all Member States for the period 2013-2020 for those sectors not covered by the EU emissions trading system (ETS), expressed as percentage changes from 2005 levels. Portugal's effort sharing target is +1% compared to 2005 by 2020. In March 2013, the Commission formally adopted the national annual limits throughout the period for each Member State. By 2020, the national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels. The emission reduction to be achieved from the sectors covered by the EU ETS will be 21% below 2005 emission levels. |
| Emission reductions target (% of 1990) | | |
| Period for reaching target | BY-2020 | |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Gases covered** | | | | |
|---|---|---|---|---|
| Gases covered | Covered | Base Year | GWP reference source | Comments |
| $CO_2$ | Yes | 1990 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| $CH_4$ | Yes | 1990 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| $N_2O$ | Yes | 1990 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| HFCs | Yes | 1995 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| PFCs | Yes | 1995 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| $SF_6$ | Yes | 1995 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| $NF_3$ | Yes | 1995 | 2nd AR | Current reporting is done using 2nd AR. As of 2015, Portugal will use 4th AR as adopted in UNFCCC reporting guidelines for national GHG inventories of Annex I Parties and as adopted under the EU Monitoring Mechanism Regulation. |
| Other Specify | | | | |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Sectors covered** | | |
|---|---|---|
| Sectors covered | Covered | Comments |
| Energy | Yes | |
| Transport[f] | Yes | |
| Industrial processes[g] | Yes | |
| Agriculture | Yes | |
| LULUCF | Yes | |
| Waste | Yes | |
| Other Specify | | |
| Aviation | Yes | Aviation in the scope of the EU-ETS: CO2 emissions from all flights falling within the aviation activities listed in Annex I of the EU ETS Directive which depart from an aerodrome situated in the territory of a Member State and those which arrive in such an aerodrome from a third country, excluding small commercial emitters. |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Role of LULUCF sector** | | |
|---|---|---|
| | | Comments |
| LULUCF in base year level and target | Excluded | |
| Contribution of LULUCF is calculated using | | |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Market-based mechanisms under the Convention** | | |
|---|---|---|
| | | Comments |
| Possible scale of contributions of market-based mechanisms under the Convention (estimated kt $CO_2$ eq) | | |
| CERs | | The exact number of units that can be used during the period 2013-2020 can only be determined following the availability of final data concerning the use of these units during the period 2008-2012 and relevant greenhouse gas emissions data. The use of these units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of CERs. |
| ERUs | | The exact number of units that can be used during the period 2013-2020 can only be determined following the availability of final data concerning the use of these units during the period 2008-2012 and relevant greenhouse gas emissions data. The use of these units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of ERUs. |
| AAUs[i] | | AAUs for the period 2013-2020 have not yet been determined. Portugal expects to achieve its share of the EU's 20% target for the period 2013-2020 with the implementation of the ETS Directive and the ESD Decision in the non-ETS sectors which do not allow the use of AAUs from non-EU Parties. |
| Carry-over units[j] | | The exact number of carry-over units for the EU and its Member States from the first commitment period that can be used for compliance during the period 2013-2020 can only be determined after the true-up period of the first commitment period. In the second commitment period the use of such units in the PPSR account depend on the extent by which emissions during the second commitment period exceed the assigned amount for that commitment period, which can only be determined at the end of the second commitment period. At CMP.9 the EU made a declaration when adopting the Doha amendment of the Kyoto Protocol that the European Union legislation on Climate-Energy Package for the implementation of its emission reduction objectives for the period 2013-2020 does not allow the use of surplus AAUs carried over from the first commitment period to meet these objectives. |
| Other mechanism units under the Convention (specify)[k] | | |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Other market-based mechanisms** | | |
|---|---|---|
| | | Comments |
| Possible scale of contributions of other market-based mechanisms (estimated kt $CO_2$ eq) | | |

**Table 2 (cont.)**

Description of quantified economy-wide emission reduction target

| **Any other information** | |
|---|---|
| | |
| Any other information | In December 2009, the European Council reiterated the conditional offer of the EU to move to a 30% reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities. |

**Table 3**

Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

| **Name of mitigation action** | **Included in with measures GHG projection scenario** | **Sectors affected** | **GHGs affected** | **Objctive and/or activity affected** | **Type of instrument** | **Status of implementation** | **Brief description** | **Start year of implementation** | **Implementing entity or entities** | **Mitigation impact** | | **Comment** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Estimate of mitigation impact (not cumulative) | 2020 | |
| MRe1. "E4, ERES" Programme (replaced by MA2007e1) | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Reduction of GHG emissions from electricity production through the increase in generation from renewable energy sources (meeting a 39% target of gross electricity consumption by 2010 with RES). | Economic | Implemented | | 2007 | MEID | kt $CO_2$ eq | 893,00 | |
| MRe2 – (New) Expansion Plan of the electricity production system (replaced by MA2007e2) | No | Energy | $CO_2$, $CH_4$ | Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010). | Regulatory | Planned | | 2007 | MEID | kt $CO_2$ eq | | |
| MRe3. Energy Efficiency in Buildings | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Increase energy efficiency in buildings by about 40% through the adoption of new regulation(s) on acclimatisation and thermal behaviour of buildings, in substitution of present regulations. | Regulatory | Implemented | | | MEID | kt $CO_2$ eq | 331,00 | |
| MRe4. Solar Hot Water for Portugal Programme (AQSpP) | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Promotion of domestic water heating by solar energy. Initial target of 1 million m2 of solar panels installed by 2010 (around 150 000 m2 per year) altered to sustaining in 2005 and 2006 the growth rate of past few years. An installation rate of 100 000 m2/year is considered for the following years (2007-2020), with the entry into force in 2006 of new legislation. | Economic | Implemented | | | MEID | kt $CO_2$ eq | 312,00 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MRe5. IPPC Directive (Integrated Prevention and Pollution Control) | No | | $CH_4$, $CO_2$ | The IPPC Directive was transposed to internal legislation by Decree-Law 194/2000, of 21 August. | Regulatory | Implemented | | | MAOT | kt $CO_2$ eq | | |
| MAe1. Energy efficiency improvement in the electricity generation sector | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Reduction of the rate of loss in the energy transport and distribution network to 8.6% by 2010. | Regulatory | Implemented | | | MEID | kt $CO_2$ eq | 103,00 | |
| MAe3. Improvement in energy efficiency from the electricity demand-side | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Reduction of electricity consumption by about 1000 GWh by 2010. | Regulatory | Implemented | | | MEID | kt $CO_2$ eq | 340,00 | |
| MAe4. Promotion of electricity produced from renewable energy sources | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Increase installed capacity of units of electricity generation from RES to yield up to 5100 MW of wind power. | Economic | Implemented | | | MEID | kt $CO_2$ eq | | |
| MAe5. Introduction of natural gas in the Autonomous Region of Madeira | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Substitution of the most polluting fuels and diversification of energy sources in the Autonomous Region of Madeira. | Regulatory | Planned | | | RG - ARM[71] | kt $CO_2$ eq | | |
| MAr1. Realignment of the tax burden on diesel fuel for heating (residential sub-sector) | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Tax harmonization between diesel fuel for heating and for transport by 2014. | Other (Fiscal) | Implemented | | | MEID | kt $CO_2$ eq | 53,00 | |
| MAs1 Realignment of the tax burden on diesel fuel for heating (services sub-sector) | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Tax harmonization between diesel fuel or heating and for transport by 2014. | Other (Fiscal) | Implemented | | | MEID | kt $CO_2$ eq | 323,00 | |
| MAi1. Increase in tax on industrial fuels | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Changing the fuel tax (ISP) on industrial fuels, so as to create an incentive structure for GHG emissions reduction. | Other (Fiscal) | Implemented | | | MEID | kt $CO_2$ eq | 93,00 | |
| MAi2. Review of the Regulation on the Management of Energy Consumption (RGCE) | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Defining of a new RGCE that promotes energy efficiency in the industrial sector through voluntary agreements. | Other (Regulatory) | Implemented | | | MEID | kt $CO_2$ eq | 54,00 | |
| MAi3. Incentives to the substitution of fuel oil cogeneration by natural gas generation | No | Energy | $CH_4$, $CO_2$, $N_2O$ | Reduction or phasing-out of the tariff for cogeneration using fuel oil. | Economic | Implemented | | | MEID | kt $CO_2$ eq | 196,00 | |

[71] Regional Government of the Autonomous Region of Madeira.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2007e1 – replacing MRe1 | No | Energy | $CO_2$ | Renewable energy: increase to 45% the goal of electricity generation in 2010 by renewable sources (previously of 39%). | Economic | Planned | | | MEID | kt $CO_2$ eq | | |
| MA2007e2 – replacing MRe2 | No | Energy | $CO_2$ | Operational start of new natural gas combined cycle power plants (NGCCP) (2160 MW in 2006 will now be 5360 MW in 2010) 70<br>MA2007e2/scenario<br>1 – use rate of an average 37% in the 2008-2012 period for all (existing and new) NGCCP plants.<br>MA2007e 2/scenario<br>2 - use rate of an average 40% in 2008-2012 period for all (existing and new) NGCCP plants. | Regulatory | Planned | | | MEID | kt $CO_2$ eq | | |
| MA2007e3 – (new) | No | Energy | $CO_2$ | Co-combustion of biomass: 5% to 10% substitution of the coal in Sines and Pego thermic power plants by biomass or Waste Derived Fuel.<br>MA2007e3/scenario 5%<br>MA2007e3/scenario 10% | Regulatory | Planned | | | | kt $CO_2$ eq | | |
| MRt1. Auto-Oil Program: Monitoring of the Agreement with Atomobile Manufacturers Associations | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Reduction of the carbon intensity of light passenger vehicles transport, with increasingly restrictive consumption (and CO2 emissions) standards, to reach the 120 g CO2e/km target by 2010. | Voluntary Agreement | Implemented | | | MFAP; MAI | kt $CO_2$ eq | | |
| MRt2. Expansion of the Lisbon Metro (ML)-extension of the Blue Line; extension of the Yellow Line; Red Line | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, through the expansion of the Lisbon Metro network. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MRt3. Construction of the Metro Sul do Tejo | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, by the construction of a new light metro network. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MRt4. Construction of the Oporto Metro (MP) | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of modal transfer, and consequent reduction in carbon intensity of the entire transport sector, through the construction of the Oporto Metro network. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MRt5. Construction of th Metro Ligeiro do Mondego (MLM) | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of modal transfer, and consequent reduction in carbon intensity of the global transport activity through the construction of a light metro network. | Economic | Planned | | | MOPTC | kt $CO_2$ eq | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MRt6. Improve services provided by CP (reduction in travel time) between LisbonOporto; LisbonCastelo Branco; Lisbon-Algarve | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of modal transfer, and consequent reduction in carbon intensity of the global transport activity through supply changes (reduction in travel time) between LisbonOporto; Lisbon-Castelo Branco and Lisbon-Algarve, and consequent increase in the competitiveness of the railway system. | Economic | Planned | | | MOPTC | kt $CO_2$ eq | | |
| MRt7. Enlargement of the fleet of vehicles powered by natural gas of CARRIS and of the STCP | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Reduction of carbon intensity of heavy passenger vehicle transport, through the enlargement of the fleet of public vehicles powered by natural gas (of CARRIS and of the STCP), and the substitution of dieselpowered vehicles. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MRt8. Incentive Programme for the dismantling of End-of-Life Vehicles | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of the renovation of the car stock, in order to reduce carbon intensity of light passenger vehicles, through the provision of monetary incentives for the substitution of end-oflife vehicles. 4200 vehicles over 10 years old are expected to be decommissioned annually from 2005. | Economic | Implemented | | | MAI | kt $CO_2$ eq | | |
| MRt9. Reduction of interurban motorway speeds | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotion of the reduction of speeds and consequent reduction of the carbon intensity of road transport by lowering the average motorway speed by about 6 km/h, comparatively to year 2000 in the frame of an accident prevention programme. | Other (Information) | Implemented | | | MAI | kt $CO_2$ eq | | |
| MRt10. Biofuels Directive (Replaced by MA2007t1) | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Reduction in the consumption of fuels responsible for the emission of GHG through the promotion of the use of biofuels in the transport subsector (2%-2005; 5.75%-2010). | Other (Economic) | Adopted | | | MEID | kt $CO_2$ eq | | |
| MAt1. Reduction of Taxis´ service days | No | Transport | $CO_2$, $CH_4$, $N_2O$ | Reducing the number of service days to a maximum of 6 days per week. | | Planned | | | MOPTC | kt $CO_2$ eq | | |
| MAt2. Enlargement of the fleet of taxi vehicles powered by natural gas | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Promotes the shift to natural gas in 200 vehicles. | Economic | Planned | | | MOPTC | kt $CO_2$ eq | | |
| MAt3. Review of the current tax regime on private vehicles | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Energy efficiency improvements of the car stock through the revision of the present taxation regime on private vehicles, so that CO2 emissions are factored in the calculation of the tax (representing at least 60% of the total value of the tax from 2008). | Other (Fiscal) | Implemented | | | MFAP | kt $CO_2$ eq | | |
| MAt4. Metropolitan Authority of Lisbon Transports | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Modal transfer of 5% (pkm/pkm) by 2010. | Other (Regulatory) | Planned | | | MOPTC | kt $CO_2$ eq | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAt5. Metropolitan Authority of Oporto Transports | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Modal transfer of 5% (pkm/pkm) by 2010. | Other (Economic) | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MAt6. Incentive Programme for the dismantling of End-of-Life Vehicles (further objectives) | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Extra 500 vehicles decommissioned annually relative to the 4200 considered in measure MRt8. | Economic | Implemented | | | MAI | kt $CO_2$ eq | | |
| MAt7. Regulation on Energy Management in the Transport Sector | No | Transport | $CH_4$, $CO_2$, $N_2O$ | 5% reduction of the consumption factor of freight transport. | Regulatory | Planned | | | MOPTC | kt $CO_2$ eq | | |
| MAt8. Railway connection to Aveiro Sea Port | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Transfer of 1553 kt of freight to maritime transport, yearly, from 2007. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MAt9. Motorways of the Sea | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Transfer of 20% of international road freight traffic to maritime transport. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MAt10. Logistical Platforms | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Development of the National Logistics System. | Economic | Planned | | | MOPTC | kt $CO_2$ eq | | |
| MAt11. Restructuring of supply of CP (national railway) service | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Renovation of trains and changes at the supply level (schedules and frequency of services, new connections/services, etc.) so as to capture 261x106 tkm of the road transport mode. | Economic | Implemented | | | MOPTC | kt $CO_2$ eq | | |
| MA2007t1 replacing MRt10. Biofuels Directive | No | Transport | $CH_4$, $CO_2$, $N_2O$ | Biofuels Directive – increase of the 5.75% goal to 10% in 2010 regarding biofuels incorporation tax in the road fuels. | Economic | Adopted | | | MEID | kt $CO_2$ eq | | |
| MRg1. IPPC Directive (Integrated Prevention and Pollution Control) | No | | | Implementation of the IPPC Directive. | Regulatory | Implemented | | | | kt $CO_2$ eq | | |
| MAg1. Evaluation and promotion of carbon sequestration in agricultural soil | No | Agriculture | $CO_2$ | Adoption of cropland management and grazing land management activities, under the Art. 3(4) of the Kyoto Protocol. | Economic | Implemented | | | MADRP | kt $CO_2$ eq | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAg2. Treatment and energy recovery of livestock waste | No | Agriculture | $CH_4$, $N_2O$ | Reduction in methane emissions resulting from manure management through the conversion of medium and large manure management systems (headcount over 1000) to anaerobic biodigestors with energy recovery 945 000 heads associated to the Liz, Oeste, Algarve, Setubal e Rio Maior systems. | Economic | Planned | | | MADRP, MAOT | kt $CO_2$ eq | | |
| MRf1. Programme for the Sustainable Development of Portuguese Forests (in the context of IIIFSP) | No | Forestry/ LULUCF | $CO_2$ | Promote the sustained increase in forested area, through financial support and incentives to new tree plantations. | Economic | Implemented | | | MADRP | kt $CO_2$ eq | | |
| MAf1. Promotion of carbon sink capacity of forests | No | Forestry/ LULUCF | $CO_2$ | Increase in the carbon sink capacity of Portuguese forests, through the improvement of forestry management<br>(forest stands in place on the 1st of January 1990). | Economic | Adopted | | | MADRP | kt $CO_2$ eq | | |
| MRr1. Directive on Packaging and Packaging Waste | No | Waste management/ waste | $CH_4$, $CO_2$, $N_2O$ | Decree-Law 366-A/97, of 20 December, transposed the EC Directives that manage the flow of packaging and related waste (Directive 94/62/CE of the European Parliament and Council, of 20 December, altered by Directive 2004/12/CE of the European Parliament and Council, of 11 February) imposing recovery and recycling objectives for packaging waste. The following targets, to be met by the 31st December 2011, were defined:<br>- recovery: of at least 60% of waste<br>- Recycling:<br>Overall: 55-80%<br>Glass: 60%<br>Paper: 60%<br>Metals: 50%<br>Plastics: 22,5%<br>Wood: 15% | Economic | Implemented | | | MAOT | kt $CO_2$ eq | | |
| MRr2. Landfill Directive | No | Waste management/ waste | $CH_4$ | Decree-Law n.º 183/2009, of 10 August, which replaced the DecreeLaw 152/2002, of 23 May, transposed Directive 1999/31/CE of the Council, of 26 April, on the disposal of waste to landfills, establishes the need to define a national strategy to reduce biodegradable municipal waste (BMW) destined to landfills. Maximum percentage of BMW disposed in landfills in relation to the BMW production in 1995 (targets):<br>2006 (75%)<br>2013 (50%)<br>2020 (35%) | Economic | Implemented | | | MAOT | kt $CO_2$ eq | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MRr3. IPPC Directive (Integrated Prevention and Pollution Control) | No | Waste management/ waste | $CH_4$, $CO_2$ | The IPPC Directive was transposed to internal legislation by DecreeLaw 194/2000, of 21 August. Waste Management (Category 5) includes a set of activities of Annex I of DL 194/2000. Improvement of environmental performance of facilities covered with regard to: discharges to the atmosphere, water and soil; waste production; use of raw materials, energy efficiency, noise, risk prevention and management, among others (Time Horizon: 2007-2010) | Regulatory | Implemented | | | MAOT | kt $CO_2$ eq | | |

**Table 4**

Report on progress

| | Unit | Base Year | 2010 | 2011 | 2012 | Comment |
|---|---|---|---|---|---|---|
| Total (without LULUCF) | kt $CO_2$ eq | 60,952.39 | 71,382.42 | 69,986.45 | | |
| Contribution from LULUCF [c] | kt $CO_2$ eq | | -9,990.28 | -9,990.28 | -9,990.28 | Average projected accounting of activites under Article 3.3 and 3.4. |
| Market-based mechanisms under the Convention | number of units | | | | | Final CP1 compliance actions will take place when reviewed inventory data will be available for the complete period, in the "true-up" period in 2015. As a result, data on the final use of flexible mechanisms and sinks is not available for the 1st BR |
| | kt $CO_2$ eq | | | | | |
| Other market-based mechanisms | number of units | | | | | |
| | kt $CO_2$ eq | | | | | |

**Table 4(b)**

Reporting on progress

| | Quantity of units | kt $CO_2$ eq | Comments |
|---|---|---|---|
| 2011 | | | |
| Kyoto Protocol Units [d] | | | |
| AAUs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| ERUs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| CERs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| tCERs | | | |
| lCERs | | | |
| Units from market-based mechanisms under the Convention [d, e] | | | |
| Units from other market-based mechanisms [d, e] | | | |
| Total | | | |
| 2012 | | | |
| Kyoto Protocol Units [d] | | | |
| AAUs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| ERUs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| CERs | | | Data on the final use of KP units will be reported when final CP1 compliance is undertaken in the "true-up" period in 2015. |
| tCERs | | | |
| lCERs | | | |
| Units from market-based mechanisms under the Convention [d, e] | | | |
| Units from other market-based mechanisms [d, e] | | | |
| Total | | | |

**Table 5**

Summary of key variables and assumptions used in the projections analysis

| Key underlying assumptions | Unit | Historical | | | | | | Projected | | | | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1990 | 1995 | 2000 | 2005 | 2010 | 2011 | 2015 | 2020 | 2025 | 2030 | |
| GDP growth rate | % | | 1.90 | 4.20 | 0.80 | 0.60 | | -1.00 | 1.80 | 3.00 | 3.00 | |
| Population | thousands | 9,877,000.00 | 10,043,000.00 | 10,257,000.00 | 10,503,000.00 | 10,573,000.00 | | 10,565,692.48 | 10,565,712.90 | 10,579,363.46 | 10,677,172.25 | |
| Population growth | % | | 3.85 | 6.34 | 3.28 | 7.05 | | 6.83 | 6.97 | 7.11 | 8.10 | |
| International coal price | USD / boe | 1.32 | 1.17 | 1.14 | 2.14 | 2.51 | | 2.60 | 2.69 | 2.74 | 2.77 | Unit used: € 2000/ GJ. |
| International oil price | USD / boe | 2.92 | 2.38 | 5.34 | 8.51 | 8.28 | | 9.79 | 11.57 | 12.10 | 12.41 | Unit used: € 2000/ GJ. |
| International gas price | USD / boe | | | 5.54 | 6.50 | 4.31 | | 5.15 | 6.16 | 6.77 | 7.39 | Unit used: € 2000/ GJ. |
| Number of households | thousands | | 45,033.29 | 50,071.00 | 54,738.49 | 57,425.04 | | | | | | |

**Table 6**

Information on updated greenhouse gas projections

| GHG emissions projections | Unit | GHG emissions and removals | | | | | | | GHG emission projections (Scenarios) With measures | | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Base year (1990) | 1990 | 1995 | 2000 | 2005 | 2010 | 2011 | 2020 | 2030 | |
| Sector | | | | | | | | | | | |
| Energy | kt $CO_2$ eq | 41,634.94 | 41,634.94 | 50,766.38 | 61,245.85 | 64,777.92 | 49,667.35 | 45,801.00 | 40,191.08 | 35,834.65 | Emission projections from the work of PNAC2020. |
| Transport | kt $CO_2$ eq | 10,139.78 | 10,139.78 | 13,322.41 | 19,157.18 | 19,586.09 | 18,936.13 | 17,350.73 | 16,680.51 | 15,741.48 | Emission projections from the work of PNAC2020. |
| Industry/industrial processes | kt $CO_2$ eq | 4,833.70 | 4,833.70 | 5,281.95 | 6,494.44 | 7,135.38 | 6,064.81 | 5,323.95 | 3,583.49 | 4,211.94 | Emission projections from the work of PNAC2020. |
| Agriculture | kt $CO_2$ eq | 8,159.50 | 8,159.50 | 8,180.97 | 8,693.36 | 7,742.78 | 7,517.39 | 7,504.88 | 7,077.53 | 6,707.59 | Emission projections from the work of PNAC2020. |
| Forestry/LULUCF | kt $CO_2$ eq | 8,496.18 | 8,496.18 | 4,203.92 | 2,260.84 | 4,521.43 | -3,485.26 | -5,319.75 | -3,506.22 | -2,803.13 | Emission projections from the work of RNBC2050. |
| Waste management/waste | kt $CO_2$ eq | 5,994.63 | 5,994.63 | 7,064.67 | 7,571.83 | 8,061.23 | 7,907.10 | 8,280.43 | 6,637.78 | 5,891.26 | Emission projections from the work of PNAC2020. |
| Other Sectors | | | | | | | | | | | |
| Aviation | kt $CO_2$ eq | 1,476.53 | 1,476.53 | 1,626.92 | 1,996.63 | 2,272.35 | 2,268.51 | 2,734.50 | | | |
| Gases | | | | | | | | | | | |
| $CO_2$ emissions including net $CO_2$ from LULUCF | kt $CO_2$ eq | 52,880.61 | 52,880.61 | 58,076.55 | 67,640.76 | 72,898.10 | 48,641.36 | 45,801.00 | | | |
| $CO_2$ emissions excluding net $CO_2$ from LULUCF | kt $CO_2$ eq | 45,149.36 | 45,149.36 | 54,485.70 | 65,863.22 | 69,265.18 | 52,640.56 | 51,526.54 | 57,489.88 | 52,645.44 | Emission projections from the work of PNAC2020. |
| $CH_4$ emissions including $CH_4$ from LULUCF | kt $CO_2$ eq | 10,481.38 | 10,481.38 | 11,620.74 | 12,302.17 | 13,173.93 | 12,678.76 | 12,538.28 | | | |
| $CH_4$ emissions excluding $CH_4$ from LULUCF | kt $CO_2$ eq | 10,260.49 | 10,260.49 | 11,372.17 | 12,113.03 | 12,644.17 | 602.74 | 12,446.61 | 10,504.41 | 9,273.90 | Emission projections from the work of PNAC2020. |
| $N_2O$ emissions including $N_2O$ from LULUCF | kt $CO_2$ eq | 6,086.58 | 6,086.58 | 6,037.58 | 6,292.40 | | 5,018.45 | 4,793.03 | | | |
| $N_2O$ emissions excluding $N_2O$ from LULUCF | kt $CO_2$ eq | 5,542.54 | 5,542.54 | 5,673.08 | 5,998.24 | 5,254.08 | 4,698.95 | 4,478.92 | 4,491.27 | 4,521.39 | Emission projections from the work of PNAC2020. |
| HFCs | kt $CO_2$ eq | | | 66.27 | 319.04 | 848.05 | 1,515.03 | 1,491.49 | 2,471.51 | 549.73 | Emission projections from the work of PNAC2020. |
| PFCs | kt $CO_2$ eq | | | | 0.03 | 0.05 | | | | | |
| $SF_6$ | kt $CO_2$ eq | | | 6.83 | 9.70 | 257.00 | 43.57 | 42.89 | 117.49 | 234.12 | Emission projections from the work of PNAC2020. |
| Other gases | | | | | | | | | | | |

**Table 7(a)**

Provision of public financial support: contribution through multilateral channels

| Donor funding | Total Amount | | | | Status | Funding source | Financial instrument | Type of support | Sector | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| | Core/general | | Climate-specific | | | | | | | |
| | Domestic Currency | USD | Domestic Currency | USD | | | | | | |
| 2011 | | | | | | | | | | |
| Total contributions through multilateral channels | | | | | | | | | | |
| Multilateral climate change funds [g] | | | | | | | | | | |
| 1. Global Environment Facility | | | | | | | | | | |
| 2. Least Developed Countries Fund | | | | | | | | | | |
| 3. Special Climate Change Fund | | | | | | | | | | |
| 4. Adaptation Fund | | | | | | | | | | |
| 5. Green Climate Fund | | | | | | | | | | |
| 6. UNFCCC Trust Fund for Supplementary Activities | | | | 54,499.00 | Provided | | | | | |
| 7. Other multilateral climate change funds | | | | | | | | | | |
| Multilateral financial institutions, including regional development banks | | | | | | | | | | |
| 1. World Bank | | 20,958,472.00 | | | Provided | | | | | |
| 2. International Finance Corporation | | | | | | | | | | |
| 3. African Development Bank | | 2,033,660.00 | | | Provided | | | | | |
| 4. Asian Development Bank | | 6,627,940.00 | | | Provided | | | | | |
| 5. European Bank for Reconstruction and Development | | | | | | | | | | |
| 6. Inter-American Development Bank | | 552,489,00 | | | Provided | | | | | |
| 7. Other | | | | | | | | | | |
| Specialized United Nations bodies | | | | | | | | | | |
| 1. United Nations Development Programme | | | | | | | | | | |
| 2. United Nations Environment Programme | | | | | | | | | | |
| 3. Other | | | | | | | | | | |
| 2012 | | | | | | | | | | |
| Total contributions through multilateral channels | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Multilateral climate change funds [g] | | | | | | | | | | |
| 1. Global Environment Facility | | | | | | | | | | |
| 2. Least Developed Countries Fund | | | | | | | | | | |
| 3. Special Climate Change Fund | | | | | | | | | | |
| 4. Adaptation Fund | | | | | | | | | | |
| 5. Green Climate Fund | | | | | | | | | | |
| 6. UNFCCC Trust Fund for Supplementary Activities | | | | 96,865.00 | Provided | | | | | |
| 7. Other multilateral climate change funds | | | | | | | | | | |
| Multilateral financial institutions, including regional development banks | | | | | | | | | | |
| 1. World Bank | | 1,735,219.00 | | | Provided | | | | | |
| 2. International Finance Corporation | | | | | | | | | | |
| 3. African Development Bank | | 2,387,743.00 | | | Provided | | | | | |
| 4. Asian Development Bank | | 6,105,398.00 | | | Provided | | | | | |
| 5. European Bank for Reconstruction and Development | | | | | | | | | | |
| 6. Inter-American Development Bank | | 824,382.00 | | | Provided | | | | | |
| 7. Other | | | | | | | | | | |
| Specialized United Nations bodies | | | | | | | | | | |
| 1. United Nations Development Programme | | | | | | | | | | |
| 2. United Nations Environment Programme | | | | | | | | | | |
| 3. Other | | | | | | | | | | |

**Table 7(b)**

Provision of public financial support: contribution through bilateral, regional and other channels

| Donor funding | Total Amount | | Status | Funding source | Financial instrument | Type of support | Sector | Additional Information | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | Climate-specific | | | | | | | | |
| | Domestic Currency | Euros (€) | | | | | | | |
| **2011** | | | | | | | | | |
| Total contributions through bilateral, regional and other channels | | | | | | | | | |
| Guinea-Bissau / | | 145,938.00 | Provided | | | Mitigation | Energy | | |
| Angola / | | 19,880.00 | Provided | | | Mitigation | Energy | | |
| Cape Verde / | | 11,419,677.00 | Provided | | | Mitigation | Energy | | |
| Mozambique / | | 3,666,648.00 | Provided | | | Mitigation | Energy | | |
| Sao Tome and Principe / | | 56,804.00 | Provided | | | Mitigation | Energy | | |
| Cape Verde / | | 2,674.00 | Provided | | | Adaptation | Not applicable | | |
| Guinea-Bissau / | | 138,057.00 | Provided | | | Adaptation | Not applicable | | |
| Cuba / | | 55,922.00 | Provided | | | Mitigation | Energy | | |
| El Salvador / | | 49,412.00 | Provided | | | Mitigation | Capacity-building | | |
| El Salvador / | | 49,412.00 | Provided | | | Adaptation | Other Vulnerability Assessments | | |
| **2012** | | | | | | | | | |
| Total contributions through bilateral, regional and other channels | | | | | | | | | |
| Guinea-Bissau / | | 83,327 | Provided | | | Mitigation | Energy | | |
| Mozambique / | | 17,192 | Provided | | | Mitigation | Foresty | | |
| Cape Verde / | | 13,178,586 | Provided | | | Mitigation | Energy | | |
| Mozambique / | | 1,109,766 | Provided | | | Mitigation | Energy | | |
| Sao Tome and Principe / | | 16,286 | Provided | | | Mitigation | Energy | | |
| Mozambique / | | 47,659 | Provided | | | Adaptation | Other Vulnerability Assessments | | |
| El Salvador / | | 12,353 | Provided | | | Adaptation | Other Vulnerability Assessments | | |

**Table 8**

Provision of technology development and transfer support

| Measures and activities related to technology transfer | Recipient country and/or region | Targeted area | Sector | Source of the funding for technology transfer | Activities undertaken by | Status | Additional information | Comments |
|---|---|---|---|---|---|---|---|---|
| Provide 50 remote villages in all provinces with solar PV systems in schools and health centers and associated accommodation that will allow basic access to electricity to allow not only lighting but also refrigerators for vaccines and water pumping systems, allowing access to health and education of populations without these resources. Installation of two solar systems heat water in two health centers pilot for future replication. | Mozambique | Adaptation | Energy | Public | Public | Implemented | An extension of the contract is foreseen for 2014 to conclude the work in the remaining villages. | FUNAE (Energy Fund of Mozambique). |
| Mapping and assessment of the renewable resources of Mozambique: wind, solar, hydro, geothermal, biomass and waves. | Mozambique | Adaptation | Energy | Public | Public | Implemented | FUNAE (Energy Fund of Mozambique). | Concluded. Waiting for the final report. |

**Table 9**

Provision of capacity-building support

| Programme or project title | Recipient country/ region | Targeted area | Description of programme or project | Comments |
|---|---|---|---|---|
| Implementation of Pilot Projects Local Adaptation Program of Action in Mozambique | Mozambique | Adaptation | Increase resilience to the adverse impacts of climate change in 9 villages in Mozambique through implementation of adaptation measures and catalysing local activities. | |
| Integrating Adaptation to Climate Change into Development planning | Cape Verde, Mozambique, Sao Tome and Principe | Adaptation | Contribute to reducing vulnerability to the impacts of climate change in Cape Verde, Mozambique and Sao Tome and Principe, creating capabilities to integrate the response to climate change vulnerability in the process of designing policies and projects - Enhance the skills for the design of policies and projects that are resilient to the impacts of climate change and simultaneously consistent with the Sustainability Development Goals, particularly poverty reduction and environmental sustainability. | |
| Installation of photovoltaic systems in 50 villages | Mozambique | Mitigation | The project is to provide 50 remote villages, covering all provinces of Mozambique, with solar PV systems in schools and health centers and associated housing (teachers and nurses) that will allow basic access to electricity in a way to allow not only illumination but also refrigerators for vaccines and water pumping systems, thus given access to health and education to the population that does not have these resources. The project also provides training for local technicians to maintain the systems. | |
| Capacity Building for the Low Carbon Resilient Development Strategies | Cape Verde, Mozambique, Sao Tome and Principe | Mitigation | Develop the necessary skills to elaborate, implement and Measure, Report and Verify (MRV) Low Emissions Development Strategies (LEDS) Resilient to a Changing Climate and coherent with the the National Development Plans and, broadly, the Millennium Development Goals (MDG) | |
| Atlas of the renewables energies in Mozambique | Mozambique | Mitigation | Based on the objectives identified in the " New and Renewable Energy Development Policy", identification, location, characterization and evaluation of the potential of renewable resources have become a priority in Mozambique. To achieve this goal, this project conducted a mapping of the following potential sources of renewable energy: Solar, wind, water , hydro, geothermal, biomass / MSW and wave energy. This mapping is intended to be a basis for consultation and work for all renewable energy projects that will be developed in Mozambique. | |

| | | | | |
|---|---|---|---|---|
| Several initiatives | Africa | Multiple Areas | | (for Portuguese Speaking African Countries)<br><br>- Translation into Portuguese of the OECD Guide on "integrating adaptation to climate change in development cooperation";<br><br>- In 2011, was held in Lisbon the 4th Lusophone Meeting on Environment and Development, in which particular attention was paid to climate change integration in development cooperation, attended by representatives of the Ministries of Foreign Affair<br><br>- Actions to raise awareness on integrating climate change, in particular adaptation to the development policies among Portuguese teachers who participate in education programs (teacher training) with Angola and Guiné-Bissau;<br><br>- Regarding other initiatives in the disaster risk reduction area, a new eligible area was added. The "Resilience/ Risk Reduction Disaster " area belongs to the Support Mechanism to the Development Cooperation Project for Portuguese NGDO, a joint initiative between Calouste Gulbenkian Foundation, EDP Foundation, Luso - American Development Foundation, Portugal Foundation - Africa (promoting Foundations), with the support of Camões, IP, Cooperation and Language Institute. This initiative is intended to support financially NGDOs in developing applications for various international funding, a matter which requires preparation, knowledge and financial resources. |
| Support Plan for Urban Drainage from the perspective of Emission Reduction and Adaptation to Climate Change | Mozambique | Mitigation and adaptation | The Project "Support Plan for Urban Drainage from the perspective of Emission Reduction and Adaptation to Climate Change" aims to contribute to the development of policies and strategies for development of urban sanitation, particularly regarding mitigation of GHG emissions concerns, adaptation of infrastructure to changes climate and training of institutions as well as the development and transfer of knowledge to the relevant sector institutions in Mozambique in the field of sustainable development of the urban sanitation sector *vis a vis* the impacts of climate change. | |

# ANNEX III-1

Targets by specific waste stream

| Specific waste stream | Targets | | | | | |
|---|---|---|---|---|---|---|
| | **Term** | **Collection** | **Reuse and preparation for reuse** | **Regeneration** | **Recycling** | **Recovery** |
| **Packaging Waste** | 31/12/ 2005 | Not applying | Not applying | Not applying | 25% | 55% |
| | 31/12/ 2011 | Not applying | Not applying | Not applying | **55%** (percentage that should correspond to the material recycling, with minimum sectoral targets: 60% of paper/pulp packaging and glass; 50% of metals; 22,5% of plastics; 15% of wood). | 60% |
| **Used Oils** | 31/12/ 2004 [1 2] | 70% of used oils and generated annually | Not applying | Not applying | 50% of the collected used oils | Recovery of all used oils collected but not subject to recycling. |
| | 31/12/ 2006 [1] | 85% of used oils and generated annually. | Not applying | Regeneration of all oils collected, provided they comply with technical specifications for operation, a minimum of 25% regeneration of the total collected must be ensured. | 50% of the collected used oils that have not being subject to regeneration. | Recovery of all used oils collected but not subject to recycling. |
| | 31/12/ 2011 [2] | 85% of the used oils and generated annually. | Not applying | Regeneration of all oils collected, provided they comply with technical specifications for operation, a maximum of 50% regeneration of the total collected must be ensured | 75% of the collected used oils. | Recovery of all used oils collected but not subject to recycling. |
| **Used Tires [3]** | January 2007 | 95% of the tires placed on the market | Retreading of used tires in a minimum proportion of 30% of the total year | Not applying | 65% of the collected used tires that have not been retreaded | Recovery of all used tires collected but not subject to recycling. |
| **Waste of Electrical and Electronic Equipment** | 31/12/ 2006 | 4 kg/per capita /year | Not applying | Not applying | 75% of the average weight per appliance (Categories 1, 10); 65% of the average weight per appliance (categories 3, 4); 50% (and 80% for gas discharge lamps) of the average weight per appliance (Categories: 2, 5, 6, 7, 9). | 80% of the average weight per appliance (Categories 1, 10); 75%of the average weight per appliance (categories 3, 4); 70% of the average weight per appliance (Categories: 2, 5, 6, 7, 9). |
| **of batteries and accumu** | 31/12/ 2011 | 25% of batteries and accumulators | Not applying | Not applying | Not applying | Not applying |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 31/12/ 2015 | 45% of batteries and accumulators | Not applying | Not applying | Not applying | Not applying |
| | 26/09/ 2011 | Not applying | Not applying | Not applying | 65% (in mass) of batteries and lead-acid accumulators, including recycling of the highest technically feasible, possible lead content, avoiding at the same time excessive costs; 75% (in mass) of batteries and nickel-cadmium accumulators, including the recycling of the highest, technically feasible, possible level of cadmium, avoiding at the same time excessive costs; 50% (in mass) of other waste batteries and accumulators. | Not applying |
| **End-of-life vehicles** | 1/01/ 2006 | Not applying | Not applying | Not applying | Reuse and recycling of all ELV (minimum 80% average weight per vehicle and year). | Reuse and recovery of all ELV (minimum 85% average weight per vehicle and year). |
| | 01/01/ 2015 | Not applying | Not applying | Not applying | Reuse and recycling of all ELV (minimum 85% average weight per vehicle and year). | Reuse and recovery of all ELV (minimum 95% average weight per vehicle and year). |
| **Notes** | 1) To assess targets, the ones taken into account were those of the permit of the managing entity of used oils, whilst national 2006 targets have been repealed by Decree-Law No. 73/2011 of June 17th.<br>(2) Targets set in the specific Diploma of used oils, with some amendments done by Decree-Law No. 73/2011 of June 17th.<br>Although there are some targets in the domestic legislation, the ones taken onto account to assess were those of the used tires because the new license of the management entity, on-going, already contemplates the new settings of the Waste Framework Directive. | | | | | |

# ANNEX III-2

| List of approved projects under the *fast start* initiative | | | | | | |
|---|---|---|---|---|---|---|
| **Country** | **Project** | **Promoter/ Implementor** | **Objective** | **Approved Budget (€)** | **Estimated time** | **Comments** |
| **Mozambique (RM)** | Installation of Photovoltaic Systems in 50 Villages | FUNAE/ Selfenergy | Provide schools, health centers and associated housing, in a total of 50 remote villages in all provinces, with solar photovoltaic systems; thus allowing basic access to electricity, enabling lighting and storage in refrigerators, vaccines and water pumping systems, facilitating access to education and health of populations without resources. Installation of two solar water heat systems in two pilot health centers for future replication. | 3,850,000.00 | 34 months | **Approved** funding: CECAC meeting of 07/12/2010, approved and SEA SENEC. Contract**:** FPC and ex-IPAD/FUNAE signed on 31/03/2011. Funding source: FPC. FUNAE`s contribution: 1,186,914.80 € . **Ongoing** (transferred 2 tranches corresponding to approximately EUR 2 million - 52% of the total). |
| | Atlas of Renewable Energy | FUNAE/ Gesto | Mapping and assessment of renewable resources in Mozambique: wind, solar, hydro, geothermal, biomass and waves. | 3,699,218.45 | 24 months | **Approved** funding: CECAC meeting of 07/12/2010, approved and SEA SENEC (January-2011). Contract: FPC and ex-IPAD/FUNAE signed on 31/03/2011. Funding source: FPC. FUNAE contribution: 739,843.69 €. **Ongoing** (transferred funds in the order of € 3.1 million - 85% of the total). The beneficiary must submit quarterly progress reports. |
| **Angola (RA)** | Pilot Diagnosis for Supply and Energy Access through Solar Equipment in Malanje | *Sun Aid* – Association for Solar Energy Development | Identify the economic, financial and social viability of implementing a pilot project to facilitate access to a set of final beneficiaries in the municipality of Cacuso (Malanje Province) regarding equipment, power generation, water purification and cooking ovens for kitchen base. | 19,880.00 | 10 months | Approved **funding**: ex-IPAD (May-2011). Co-financed project: 57% (€ 26,000.00) by the Calouste Gulbenkian Foundation and Emirates Foundation. Contract: ex-IPAD/SUNAID. Funding source: ex-IPAD. |
| **Guiné-Bissau (GB)** | Community Program to Access Renewable Energy | ENGO Tese | Ensure sustainable access to electricity using renewable energy sources from the semi-rural central Bambadinca. | 535,181.00 | 42 months | Project approved under the EU Easy Energy for ACP. EC co-financing: € 1,605,543.00 (75%). Approved co-financing ex-IPAD: equivalent to 25% of the total. |

| List of approved projects under the *fast start* initiative | | | | | | |
|---|---|---|---|---|---|---|
| **Country** | **Project** | **Promoter / Implementor** | **Objective** | **Approved Budget (€)** | **Estimated time** | **Comments** |
| **PALOP and Timor Leste** | VI Congress on Planning and Management of Coastline Areas / I Intensive Course on Risk Analysis in Coastal Systems | APRH | Transfer of technical and scientific knowledge among institutions with responsibilities in the management of coastal areas, especially the Portuguese-speaking world. The proposed intervention will enhance the exchange of experiences of the shoreline management, identify key challenges for the next decade and discuss new overcoming approaches. | 4,500.00 | 4 to 8 of April | **Approved.** Funding source: FPC. |
| **PALOP and TL** | OECD`s Guide on "Integrating Climate Change Adaptation into Development Cooperation". | Ex-CECAC/ex-IPAD | | 4,840.00 | — | Support to the version, in Portuguese, published by the OECD, **conclued**. Funding source: FPC and ex-IPAD. |
| **Cabo Verde (CV)** | Participation in the UNFCCC negotiations | Ex-CECAC | Participation by developing countries in UNFCCC meetings in 2010 | 15,500.00 | | Support in 2010. Funding source FPC. |
| **GB** | *Support to the local Communities of Mamelamu in water sector, improvement of the local communities` access to water* | Ex-IPAD/VIDA | *Support to the local Communities of Mamelamu in water sector, improvement of the local communities` access to water* | 100,000.00 | | Support in 2010 and 2011. Funding source ex-IPAD. |
| **S. Tomé e Príncipe (STP)** | Solar panels in schools | Ex-IPAD/TESE | | 120,972.00 | | Support in 2010-12. Funding source ex-IPAD. |

| List of approved projects under the *fast start* initiative | | | | | | |
|---|---|---|---|---|---|---|
| **Country** | **Project** | **Promoter / Implementor** | **Objective** | **Approved Budget (€)** | **Estimated time** | **Comments** |
| **CV, STP, RM** | Capacity Building to the Low Carbon Resilient Development Strategies | CV (INMG); RM (MICOA/DC); STP (MOPRN/DGA) Caos – Borboletas e Sustentabilidade, Lda (CAOS). | Equip the countries involved with the skills needed to design, implement, measure, report and verify a development strategy low in GHG emissions adapted to Climate Change (CC) impacts. | 1,082,284.33 | 23 months | **Approved.** Funding source: FPC. |
| **RA** | National Energy Plan for Forest Biomass for Angola | Ministry of the Environment Angola Climate Change Iberfer | Design and implementation in Angola, of a national energy plan (PN) for forest biomass. In a decentralized strategy of electricity production, this PN will be able to identify the location of production centers depending on local consumption, national energy net availability, existence of forest resources and pre - sizing of production centers according to the population`s dispersion and quantification of the surrounding forest resources. | 1,953,803.51 | 9 months | **Approved.** Funding source: FPC. |
| **CV, RM, STP** | Integrating Climate Change Adaptation to Development (ICCAD) | Cabo Verde (INMG) RM (MICOA/DC) STP (MOPRN/INM) CAOS | Contribute to reducing vulnerability to CC impacts in CV, MOZ, STP. Capacity building to integrate response to the vulnerability to CC and create policies and resilient strategies to CC impacts. | 570,851.00 | 22 months | **Approved.** Funding source: FPC. |
| **RM** | Implementation of Pilot Projects of Local Adaptation Plan of Action in Mozambique (IPPLAPA) | DNPA/MICOA CAOS | Increase resilience to CC impacts in 9 Mozambican locations through the implementation of adaptation measures, allowing greater resilience from communities and building a path to a green economy by dynamizing the local activities. | 910,872.00 | 24 months | **Approved.** Funding source :FPC. |

| List of approved projects under the *fast start* initiative | | | | | | |
|---|---|---|---|---|---|---|
| **Country** | **Project** | **Promoter / Implementor** | **Objective** | **Approved Budget (€)** | **Estimated time** | **Comments** |
| **RM** | National Urban Sanitation Plan to Emissions Reduction and Climate Change Adaptation (NUSP-CC) | Infrastructures Administration of Water and Sanitation (AIAS) VISAQUA – Infrastructures Management and Environmental Services S.A. | Contribute to the development of policies and strategies for development of the urban sanitation (US), with concern for the mitigation of GHG emissions, adaptation of the infrastructure to climate change ( CC ) and capacity building of the institutions. Development and transfer know-how to the relevant sector institutions in Mozambique, regarding US sustainable development and adaptation to CC impacts. ( Project targeted to urban areas , cities of Maputo , Matola , Beira , Dondo , Nampula , Pemba and Quelimane ) . | 1,391,644.80 | 18 months | **Approved.** Funding source FPC. |

# Annex III-3

**table 5.2**

References on Portuguese projects or on Portuguese information mentioned in INFOBASE, CIRCLE2

CIRCLE2 Climate Adaptation INFOBASE

Last update: 2014/01/23

| Title | Acronym | Type | Country | Duration |
|---|---|---|---|---|
| Remote sensing of phytoplankton variability patterns off South-Western Iberia: a sentinel for climate change? | PHYTOCLIMA | National | Portugal (Coord.) | 2011-2014 |
| Assessing the importance of rear edge populations for biodiversity conservation in Southern Iberian Peninsula: a multi-species comparison under a scenario of climate change using amphibians as a model | | National | Portugal (Coord.) | 2010-2013 |
| Predicting the effect of global warming on stream ecosystems | | National | Portugal (Coord.) | 2008-2011 |
| Drought quantification and evolution on Iberian Peninsula: past, present and future | QSECA | National | Portugal (Coord.) | 2013-2015 |
| Climate change inferences from tree rings in the Mediterranean area: a database for Portugal | | National | Portugal (Coord.) | 2005-2008 |
| Impacts of climate change on European rocky intertidal ecosystems: coupling ecological, physiological and genetic approaches | HINT | National | Portugal (Coord.) | 2010-2013 |
| The potential of the dog cockle, Glycymeris glycymeris (bivalvia), as an annually resolved, multi-proxy, multi-centennial paleoenvironmental proxy archive for changes in the upwelling system off Portugal | GLYCY | National | Portugal (Coord.) | 2012-2015 |
| Short-term climate change mitigation strategies for Mediterranean vineyards | ClimVineSafe | National | Portugal (Coord.) | 2011-2014 |
| Assessment of genetic and genomic resources of Cork Oak: the basis towards a prospective management | | National | Portugal (Coord.) | 2010-2013 |
| Adapting the EPAL urban water cycle to climate change scenarios | AdaptaClimaEPAL | National | Portugal (Coord.) | 2010-2013 |
| Responses of phytoplankton communities from the Subtropical North Atlantic Gyre to increasing CO2 concentrations and consequent carbonate chemistry changes in the ocean - Azores | ROPICO2 | National | Portugal (Coord.) | 2011-2014 |
| Global climate change and pollution: a synergy designed for disaster? | | National | Portugal (Coord.) | 2010-2013 |
| Participatory design of adaptive groundwater management strategies and instruments in Mediterranean coastal water scarce areas as a response to climate change | AQUIMED | CIRCLE-2 | France (Coord.), Morocco | 2008-2010 |
| Atmospheric aerosol in Cape Verde region: seasonal evaluation of composition, sources and transport | CV-Dust | National | Portugal (Coord.) | 2010-2013 |
| Past, Present and Future Health Impacts of Extreme Events in Portugal | ImpactE | National | Portugal (Coord.) | 2006-2009 |
| Climate change over the Western Mediterranean and Atlantic Islands: a dendroclimatic and genetic survey of the genus Juniperus | MEDIATIC | National | Portugal (Coord.) | 2010-2013 |
| History, chance and selection during local adaptation: a genome-wide analysis | | National | Portugal (Coord.) | 2013-2015 |
| Physiological and gene expression profiles for early selection of Eucalyptus globulus in a climate change context | Ecophysiolyptus | National | Portugal (Coord.) | 2011-2014 |
| Estuarine Dynamics and Plume Propagation in the Portuguese Coast - Impacts of Climate Change | DyEPlume | National | Portugal (Coord.) | 2010-2013 |
| Physiological stress of intertidal fucoids related to their biogeography: implications under new climate scenarios | PHYSIOGRAPHY | National | Portugal (Coord.) | 2010-2013 |
| Mediterranean climate control on tree-ring growth dynamics: towards a mechanistic model and its applications in dendroclimatology | ONE RING | National | Portugal (Coord.) | 2011-2013 |
| Responses of Daphnia magna exposed to chemical pulses and mixtures throughout generations | REpulse | National | Portugal (Coord.) | 2012-2015 |
| Effects of pollution on estuarine zooplankton-zooplanktivorous fish ecological interactions in relation | | | Portugal | |

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| to climate changes | SIGNAL | National | (Coord.) | 2011-2014 |
| Climate changes in the Iberian Upwelling Ecosystem: a regional retrospective and scenario study approach | CLIBECO | National | Portugal (Coord.) | 2006-2009 |
| Climate Change Modelling on Ria de Aveiro Littoral - Adaptation Strategy for Coastal and Fluvial Flooding | ADAPTARia | National | Portugal (Coord.) | 2010-2013 |
| Strategic Plan for Adaptation to Climate Change in Cascais Municipality | SIAM-CASCAIS | National | Portugal (Coord.) | 2009-2010 |
| Application of GRID-computing in a coastal morphodynamics nowcast-forecast system | G-Cast | National | Portugal (Coord.) | 2007-2010 |
| Phenotypic plasticity of maritime pine to climate change | | National | Portugal (Coord.) | 2010-2013 |
| Holocene Environmental Change in the Maritime Antarctic. Interactions between permafrost and the lacustrine environment | HOLOANTAR | National | Portugal (Coord.) | 2012-2015 |
| The politics of climate change: discourses and representations | | National | Portugal (Coord.) | 2005-2008 |
| Simulation of the effect of different forest management strategies and climate change on wood/cork and carbon sequestration for the most important species of Portuguese forest | CarbWoodCork | National | Portugal (Coord.) | 2005-2008 |
| Rapid changes in interglacial surface and deep-water properties in the North Atlantic:temperature, nutrient and density variability derived from trace element analysis | INTER-TRACE | National | Portugal (Coord.) | 2008-2011 |
| Climate change & fish communities of Mediterranean-type streams. Potencial impact on the bio-integrity and implications on the ecological status assessment | | National | Portugal (Coord.) | 2010-2013 |
| Atlantic ocean-wide changes in sea surface temperature and trends on Cory's shearwater Calonectris diomedea foraging success, migration and population dynamics | | National | Portugal (Coord.) | 2008-2011 |
| Aerosol composition in Southwestern Iberia: properties and sources | | National | Portugal (Coord.) | 2011-2013 |
| Sex at the edge: How temperature influences sexual selection | | National | Portugal (Coord.) | 2011-2014 |
| Climate change of precipitation extreme episodes in the Iberian Peninsula and its forcing mechanisms | CLIPE | National | Portugal (Coord.) | 2011-2014 |
| Latitudinal variation on the biology of estuarine key-species as a tool to predict climate change effects | | National | Portugal (Coord.) | 2005-2008 |
| Long Term Variability of the Canary Current Upwelling System | LongUp | National | Portugal (Coord.) | 2010-2013 |
| Climate Change & Tourism in Portugal: Potential Impacts & Adaptation Measures | CLITOP | National | Portugal (Coord.) | 2005-2007 |
| Vulnerability of cork oak woodlands to climate change: a modelling approach | | National | Portugal (Coord.) | 2005-2008 |
| Flood Forecast and Alert System in Coastal and Port Areas | HIDRALERTA | National | Portugal (Coord.) | 2012-2015 |
| Assessing gene flow and contact zone dynamics in desert lizards under climate change scenarios | DESERTFLOW | National | Portugal (Coord.) | 2013-2015 |
| Climate change: an additional threat to aquatic systems under intensive pressure from agricultural diffuse pollution | VITAQUA | National | Portugal (Coord.) | 2011-2014 |
| Long term monitoring in the Ria de Aveiro: towards a deeper understanding of ecological, environmental and economic processes | LTER-RAVE | National | Portugal (Coord.) | 2011-2014 |
| Predator-prey interactions in the Antarctic Ocean during the International Polar Year | POLAR | National | Portugal (Coord.) | 2007-2010 |
| Impact of climate change on groundwater in a semi-arid region of Portugal | | National | Portugal (Coord.) | 2008-2011 |
| Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources (17th-19h century) | Klimhist | National | Portugal (Coord.) | 2012-2015 |
| Climatic / environmental factors affecting the population dynamics of Lymnaea truncatula and | | | Portugal | |

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| Peri-urban areas facing sustainability challenges:scenario development in the Metropolitan Area of Lisbon | PERIURBAN | National | Portugal (Coord.) | 2012-2015 |
| Effects of climate change on the early ontogeny of small pelagic fish off the Portuguese upwelling system | | National | Portugal (Coord.) | 2013-2015 |
| Effects of climate change on olive crop, yield and economics | FUTUROLIVE | National | Portugal (Coord.) | 2010-2013 |
| Evaluation of climate changes impacts on irrigated systems and definition of adaptation measures | | National | Portugal (Coord.) | 2011-2014 |
| Managing Flood Risk in Urban areas in a global change context | FRURB | National | Portugal (Coord.) | 2012-2015 |
| Climate changes from isotopic records during the Holocene in South-western Iberia | CIRCO | National | Portugal (Coord.) | 2008-2011 |
| Temperature, precipitation regime and soil conditions in Southwestern Iberian Peninsula under a warmer climate - Insights from the past | | National | Portugal (Coord.) | 2010-2013 |
| Impact of biodiversity evenness changes in the ecosystem functioning of estuaries | BIOCHANGED | National | Portugal (Coord.) | 2011-2014 |
| Assessing the Mid-Century Climate transition: contributing to an ensemble of global and regional decadal simulations | AMIC | National | Portugal (Coord.) | 2010-2012 |
| Past climate reconstructions and future climate change scenarios in Portugal using a dendroclimatological approach | | National | Portugal (Coord.) | 2010-2012 |
| Reducing uncertainties in species range shift predictions under climate change | Range Shift | National | Portugal (Coord.) | 2010-2013 |
| Genetic determination and evolution of seasonal phenotype variation of coat-colour in boreal species | CRYPSIS | National | Portugal (Coord.) | 2011-2014 |
| CLImate Changes and Potencial Impact on Soil FUNctional Ecology | CLIMAFUN | National | Portugal (Coord.) | 2010-2013 |
| Impact of climatic changes on toxicity of pollutants | | National | Portugal (Coord.) | 2013-2015 |
| Responses to Anthropogenic Perturbations: climatic and nutrient effects on rock pool assemblages | RAP | National | Portugal (Coord.) | 2011-2014 |
| Modelling floods in estuaries. From the hazard to the critical management | MOLINES | National | Portugal (Coord.) | 2013-2015 |
| Mid-Latitude North Atlantic Extreme Storms Variability: Diagnosis, Modelling Dynamical Processes and Related Impacts on Iberia | STORMEx | National | Portugal (Coord.) | 2012-2015 |
| Extant or extinct tipping points - climate changes drive genetic diversity and dynamics of range edge populations as evolutionary hotspots | | National | Portugal (Coord.) | 2013-2016 |
| Modeling Ecosystem Structure and Functional Diversity as early-warning indicators of Desertification and Land-degradation - from regional to local level | DesertWarning | National | Portugal (Coord.) | 2010-2013 |
| Modelling scenarios for aquifer exploitation in coastal areas: effects on biodiversity of lagoons and respective stream systems as groundwater-dependent ecosystems | GroundScene | National | Portugal (Coord.) | 2010-2013 |
| Estuarine Valley Evolution During The Eustatic Sea-Level Rise - Assessement of Climate Change Impacts Through The Confrontation of Paleoenvironmental Data With Two Types Of Models | EVEDUS | National | Portugal (Coord.) | 2008-2011 |
| Direct and indirect impacts of climate change on soil erosion and land degradation in Mediterranean watersheds | ERLAND | National | Portugal (Coord.) | 2010-2013 |
| Permafrost and Climate Change in the Maritime Antarctic | PERMANTAR-2 | National | Portugal (Coord.) | 2010-2012 |
| Past Analogs for Future Climate: tomorrow's predictions from North Pacific Ocean Pleistocene/Pliocene reconstructions | | National | Portugal (Coord.) | 2011-2014 |
| Paleoenvironmental Evolution of the Nazaré coastal plain since the Lateglacial | PaleoNaz | National | Portugal (Coord.) | 2007-2010 |

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| Impact of climatic and anthopic variations on the Northern continental shelf, Gulf of Cadiz | IMCA | National | Portugal (Coord.) | 2005-2008 |
| Predicting the synergistic impact of ocean acidification, warming and expanding hypoxia in coastal marine biota | SYNERG | National | Portugal (Coord.) | 2010-2013 |
| Permafrost and Climate Change in the Maritime Antarctic | PERMANTAR | National | Portugal (Coord.) | 2008-2010 |
| Consequences of past and present climatic changes on biodiversity patterns of peat-rich environments: from genes to communities | CLIMATEGENE | National | Portugal (Coord.) | 2011-2014 |
| How will climate changes influence the viability of amphibian populations already stressed with anthropogenic contamination | AMPHIBIA | National | Portugal (Coord.) | 2010-2011 |
| Studying the impact of the climate change in the Portuguese coastal waters - the Aveiro costal ecosystem | SIMCLAVE | National | Portugal (Coord.) | 2006-2008 |
| Model and proxy evaluation: are the reconstructed and projected climate changes real? | | National | Portugal (Coord.) | 2013-2014 |
| Soil Function-Biodiversity relationship And regional variation | FUBIA | National | Portugal (Coord.) | 2010-2013 |
| Droughts Risk Management: Identification, Monitoring, Characterisation, Prediction and Mitigation | | National | Portugal (Coord.) | 2007-2010 |
| Karstic caves of Central Portugal as palaeoenvironmental archives. Speleogenesis and present-day dynamics | CAVE | National | Portugal (Coord.) | 2012-2015 |
| Strategic Plan for Adaptation to Climate Change in Sintra Municipality | SIAM-SINTRA | National | Portugal (Coord.) | 2007-2009 |
| Climate change and Mediterranean ecosystems - the effect of precipitation variability on the understory of cork oak woodlands | | National | Portugal (Coord.) | 2009-2011 |
| Urban flood risk and pollutant relocation as a result of global change | | National | Portugal (Coord.) | 2005-2008 |
| Climate Change in Portugal. Scenarios, Impacts and Adaptation Measures (SIAM I and II) | SIAM | National | Portugal (Coord.) | 1999-2006 |
| Impact of climate variability on zooplankton community structure and function in estuarine ecosystems | COMPARE | National | Portugal (Coord.) | 2012-2015 |
| Changing Climate, Changing Coasts, Changing Communities - glocal erosions, risk conceptions and sustainable solutions in Portugal | CHANGE | National | Portugal (Coord.) | 2010-2013 |
| Biogeochemical Processes induced by Climate and Anthropogenic Circulation Changes: The Case Study of Ria de Aveiro (Portugal) | BioChangeR | National | Portugal (Coord.) | 2012-2015 |
| Dependence of coastal ecosystems on river run-off: today & tomorrow. | BioPlume | National | Portugal (Coord.) | 2013-2015 |
| Space-Time Evaluation of the Risks of Climate Changes Based on an Aridity Index | BioAridRisk | National | Portugal (Coord.) | 2005-2007 |
| Whole-system metabolism and CO2 fluxes in a coastal lagoon dominated by saltmarsh and seagrass meadows | | National | Portugal (Coord.) | 2010-2013 |
| Evolution of North Atlantic Climate; the role of Blocking and Storm-tracks in the Past, Present and Future climate of Southern Europe | ENAC | National | Portugal (Coord.) | 2010-2012 |
| Assessing and managing the impact of climate change on coastal groundwater resources and dependent ecosystems | CLIMWAT | CIRCLE-2 | Portugal (Coord.), Morocco | 2008-2011 |
| Scales of adaptation along environmental gradients in keystone intertidal organisms under different gene flow scenarios | | National | Portugal (Coord.) | 2012-2015 |
| Reconstruction of the past climate in Portugal from borehole temperatures | BOREHCLIM | National | Portugal (Coord.) | 2008-2011 |
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| Integration of proxy data from the North Atlantic for modelling climatic events | MONA | National | Portugal (Coord.) | 2010-2013 |
| Effects of Carbon Dioxide increase on Salt Marshes | ECOSAM | National | Portugal (Coord.) | 2010-2012 |
| MINHO, MONDEGO, AND MIRA ESTUARIES observatory: Long term vaRiation of ECOLOGICAL sTAtus as a response to naturaL and human induced changes. implications for management and restoration | 3M_RECITAL | National | Portugal (Coord.) | 2011-2014 |
| Coastal Dune Forests under Scenarios of Groundwater Limitation: from Tropics to Mediterranean | GWTropiMed | National | Portugal (Coord.) | 2012-2015 |
| Shooting at a moving target. Scenarios of agricultural land use of the alqueva irrigation project in a changing environment.Climate change, crop options and water needs | ALQUEVA XXII | National | Portugal (Coord.) | 2005-2008 |
| Recent evolution of Portuguese W coast estuaries: high resolution studies from marshes geological record. | WesTLog | National | Portugal (Coord.) | 2010-2012 |
| Immediate soil management strategy for recovery after forest fires | RECOVER | National | Portugal (Coord.) | 2007-2010 |
| Linking habitat heterogeneity with physiology and metapopulation structure to forecast effects of climate change on continental scales | Coastal4cast | National | Portugal (Coord.) | 2012-2015 |
| Present and Future Coastal Climate in Portugal and its Impacts on the Coastal Biological Communities | PORTCOAST | National | Portugal (Coord.) | 2005-2008 |
| Permafrost and Climate Change in the Antarctic Peninsula | PERMANTAR-3 | National | Portugal (Coord.) | 2013-2015 |
| The integrated impacts of marine acidification, temperature and precipitation changes on bivalve coastal biodiversity and fisheries: how to adapt? | ACIDBIV | CIRCLE-2 | Portugal (Coord.), Tunisia | 2008-2011 |
| REgional clouds and WateR balance In a changing climaTE | REWRITE | National | Portugal (Coord.) | 2009-2011 |
| The southwest Iberian record of land vegetation and climate during the Quaternary | | National | Portugal (Coord.) | 2010-2013 |
| Trace gas emissions from Portuguese irrigated rice fields in contrasting soils, by the influence of crop management, climate and increase concentration of CO2 in the atmosphere | | National | Portugal (Coord.) | 2010-2013 |
| Escape the heat: upwelling as current refugia from climate change | | National | Portugal (Coord.) | 2013-2014 |
| Making edges meet: genetic signatures of climate-driven range shifts | | National | Portugal (Coord.) | 2010-2012 |
| Long-term socio-ecological research and monitoring in a Mediterranean cultural landscape | LTER Montado | National | Portugal (Coord.) | 2011-2014 |
| A proteomic study on the combined effects of pCO2 and temperature on different life stages of the marine fish Sparus aurata. | | National | Portugal (Coord.) | 2012-2015 |
| Morphodynamic feedback of estuarine margins to climate change | MorFeed | National | Portugal (Coord.) | 2010-2013 |
| Construction of a Desertification Susceptibility Index for the Left Margin of Guadiana | CIDmeg | National | Portugal (Coord.) | 2005-2007 |
| Biodiversity, function, source-sink balance and services of fish communities in estuaries: modelling patterns and relationships, and predicting responses in view of natural and anthropogenic induced changes | FISHBIODIVERSITY | National | Portugal (Coord.) | 2012-2014 |
| Climate change in Viticulture: Scenarios, Impacts and Adaptation Measures | SIAMVITI | National | Portugal (Coord.) | 2010-2013 |
| Vulnerability Mapping to Malaria Vector from Earth Observation Data: Anopheles atroparvus density mapping under climate scenarios for Southern Portugal | MALVEO | National | Portugal (Coord.) | 2008-2010 |
| Integrated Water Management in Coastal Drainage Basins: challenges and adaptation strategies within the framework of climate change | WATERKNOW | CIRCLE-2 | Italy (Coord.), Morocco | 2008-2011 |

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| Water, aquatic ecosystems and human activity. An integrated and participatory framework to define innovative prospective strategies for water resources management in south Portugal | PROWATERMAN | National | Portugal (Coord.) | 2010-2012 |
| Use of traditional knowledge to attain water sustainable management under different climate change scenarios | TRADWATER | National | Portugal (Coord.) | 2005-2008 |
| The combined impacts of invasion and climate change on coastal ecosystem functioning | CleF | National | Portugal (Coord.) | 2011-2014 |
| Prediction of salinisation effects on coastal freshwater and soil ecosystems due to climate changes | SALTFREE | National | Portugal (Coord.) | 2011-2014 |
| Mediterranean woody species of montados: surviving the drought | | National | Portugal (Coord.) | 2005-2008 |
| Floods and Flood Risk Maps in Climate Change Scenarios | CIRAC | National | Portugal (Coord.) | 2010-2013 |
| Environmental Determinants Of The Changing Dynamics Of European Tick-Borne Disease Systems | | National | Portugal (Coord.) | 2008-2011 |
| Development of a Methodology to Integrate CC effects in Water Resources Management on a Portuguese River Basin | | National | Portugal (Coord.) | 2011-2013 |