



Renewable Energy Policy Review

Portugal

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PORTUGAL

1. General information

Population and geography

Portugal is a southern Europe country with an area of 91,905 km². The mainland is located on the south-west of the Iberian Peninsula surrounded by Spain on the north and east borders, and by the Atlantic Ocean on the south and west coast. Portuguese territory also includes the archipelagos of Azores, located 760 miles from Lisbon and 2110 miles from New York; and Madeira, 556 miles south-west of Lisbon.

Over the last decade the Portuguese population grew about 3.7%, from 9,866 million inhabitants in 1991 to 10,231 million in 2001. About 51.6% of the population is active and 3.9% is unemployed (September 2001), 12.5% work in agriculture and fishing, 35.4% in industry and 52.1% in services. Portugal is a parliamentary democracy member of the European Union since 1986. The constitution was published on 2nd April 1976 and became law on 25th April 1976. Portugal has 18 administrative regions on the mainland and 2 autonomous regions (Azores and Madeira). Each autonomous region has its own government and parliament, which report directly to the Portuguese government. There are 308 municipalities within these regions, with a local government elected each four years. Legislative power is held by Parliament which comprises a minimum of 180 and a maximum of 230 members chosen by proportional representation in national elections. Executive power is held by government. This comprises the Prime Minister, and members of his Cabinet, Secretaries of State and one or more assistant ministers.

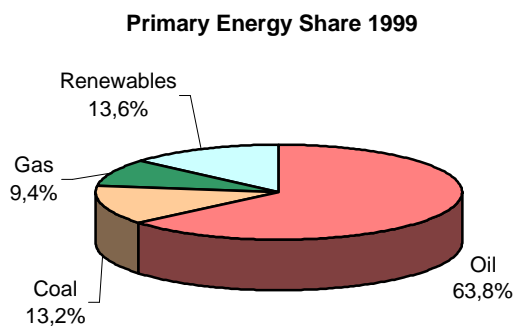
In 1998 and 1999, economic activity remained vigorous. This was particularly so in 1998 when GDP rose 4.0% essentially thanks to strong growth in fixed capital formation and exports. In 1999 the economy entered its 6th straight year of growth with GDP at 3.1%, slightly below that of the previous year but above the EU average. The economy was strong in 2000 growing at 3.3% and within the EU average. The pace slowed in 2001 and GDP is thought to have expanded by just 2%.

2. Renewable energy policy

Renewable energy country profile

| | | |
|------------------------------------|--------|-----------------|
| Population | 10.07 | Millions |
| Area | 92,391 | km ² |
| Total Primary Energy Supply | 25.4 | Mtoe |
| Electricity Production | 46.5 | TWh |
| Electricity Prod. by source | | |
| Fossil Fuel | 64.9 | % |
| Hydro | 30.9 | % |
| Nuclear | 0.00 | % |
| Other | 4.2 | % |

Source: CIA World Factbook 2001



Source: EUROSTAT

Domestic energy production in Portugal accounts for about 10% of total energy supplies. Currently oil, which is 100% imported, is the largest source of primary energy in Portugal representing 64% of primary energy consumption in 2002. Annual consumption of Natural gas was nearly non-existent prior to 1997 when the country consumed 4 billion cubic feet (Bcf). In 2001, consumption reached 90 Bcf. The increase in natural gas consumption can be attributed to the completion of the Maghreb-Europe pipeline in 1996, which connected the Iberian Peninsula to Algerian natural gas sources Portugal (with EU assistance) is making large investments in its natural gas infrastructure, having spent approximately 485 million euros between 1994 and 1999. Since 1999, the government has curtailed this spending somewhat, but there are still plans to expand the natural gas network from 3,761 miles in 1999 to 5,943 miles in 2010.

(EIA Country Analysis Briefs Portugal <http://www.eia.doe.gov/emeu/cabs/portugal.html>)

In the context of the EU's burden sharing arrangements, Portugal has committed itself to only allowing its average emissions of greenhouse gases to rise by 27 per cent between 2008 and 2012 compared with their 1990 levels. In spite of this target, energy-related CO2 emissions in 2000 were 50% higher than those in 1990. (IEA Portugal Standard Review 2002)

Renewable Energy Sources

Renewable energy country profile

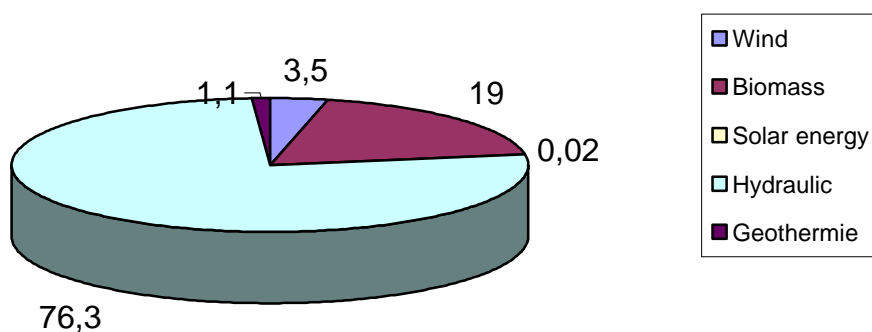
Renewable energy technology in 2003 in capacity

| | Portugal |
|------------------------------|-------------------|
| SPV (MWc) | |
| Grid connected | 0.4 |
| Off grid | 1.67 |
| Total | 2.07 |
| STH (square meter installed) | 211.963 m2 |
| Average surface for 1000 | 21.1 m2 |
| SHP (2001 figure) | 317 MW |
| Biogaz (Mtep) (2002 figure) | 2 |
| Wood (Mtep) (2002 figure) | 1.90 |
| Wind (MW) | 301 |

Source Eurobserv'ER 2003/Sun in Action 2/EWEA

The indicative target set for Portugal in Directive 2001/77/EC is that 39% of gross electricity production in 2010 should be generated from renewable sources – was based on the share of production from renewable sources in 1997, when hydraulic productivity was 22% above average. One important point to remember in this context is that the undertaking given by Portugal, in the form of the 39% target, was based on the assumption that work would continue on the plan for expansion of the electricity system, with the construction of new hydroelectricity plants with capacity of over 10 MW, and that other types of renewable capacity would increase at eight times the recent

Share of RES in the electricity production (%) 2003



It can be seen that, for all these technologies, in 2002 installed capacity grew by just 2.2 times the average rate for the previous five years (between the year of adoption of the Directive and the base year for setting the indicative targets). Only two of the technologies listed – wind power and cogeneration with biomass - made any significant contribution to this rate and only one of these (wind power) did so consistently. In other words, the target set in the Directive implies that, from now on, an average of 400 MW of extra capacity would have to be installed each year without counting construction of new hydroelectric plants with capacity of over 10 MW.

Renewable energy contributed 13.7% of Portugal's total energy supply and 34.6% of total electricity supply in 2001 compared to EU averages of 5,8% and 15.5% respectively. (IEA Renewables Information 2003) Final electricity consumption in Portugal in 2002 totaled 42 072 GWh. However, the figure for gross consumption rises to 48 006 GWh. This means that the share of electricity produced from RES, calculated from this indicator (which is the relevant figure for the purposes of compliance with Directive 2001/77/EC), was 32.5% in 2002. To meet the target set in the Directive, 18 722.3 GWh would have had to have been produced from renewable sources in 2002.

Another relevant indicator is the gross consumption trend in Portugal. Leaving aside 1998 (when EXPO 98 was held in Lisbon), the values observed for the year-on-year variation in consumption confirm a downward trend in growth in electricity consumption, which is the fruit of the steadily increasing awareness in Portuguese society of the need to take measures to make rational use of energy.

According to the "Report from the Forum for Renewable Energies in Portugal" the targets set for the installed capacity to be achieved by 2010 are as follows:

- Small hydro power 600 MW
- Wind energy 2,000 - 3,500 MW
- Solar Thermal 2,800,000 m²
- Solar Photovoltaic 50 MW
- Biomass 500 MW
- Geothermal 30 MW electricity and 30 MW thermal
- Wave energy 50 MW

Hydro

In 1996, hydro contributed 42.9% (14761 GWh) to electricity generation. Installed capacity rose from 2516 MW in 1980 to 4428 MW in 1996. Small hydro capacity has almost tripled from 121 MW in 1990 to 317 MW in 2001. At EU-15 level, about 3% of the EU-15 SHP capacity was installed in Portugal in 2001. Electricity generation from SHP increased almost four times between 1990 and 2001 from 261 GWh to 982 GWh. SHP represented about 7% of the hydropower generation and about 2% of the country's generation in 2001. About 31% of the electricity generated in Portugal came from hydropower in 2001. (source ESHA Report on Small Hydropower Statistics: General Overview of the last decade (1990-2001)) . Total hydro capacity is forecast to increase to 5489 MW by 2010.

Biomass

Recent figures issued by the Portuguese Directorate General for Energy (DGE), show that biomass combustion contributes to the national energy balance with almost 2300 ktep a year, standing out clearly the importance of biomass from forest, of waste and industrial residues. Concerning electricity, it is known that in 2001, 1600

GWh were produced from biomass, that is to say about 4% of the total electricity production of the country. In Portugal, the forest covers about 38% of the land (Directorate General for Forest - DGF, 2001), which corresponds in terms of area to 3,3 million hectares of standing forest and other wooded areas. In this sense, the forest sector, as generator of great amounts of residues assumes an important role respecting the use of biomass for energy.

The residual forest biomass can have two origins in relation to its production: the treatment of the wooden material and the transformation of that wooden material in the industry. The Biomass Centre for Energy, a non profit, private, scientific and technical association for technological support and development, has been trying to develop in a systematic way the improvement of the situation concerning forest residues, considering its knowledge as an indispensable instrument for the effective promotion of this energy resource.

In fact, part of this work developed in this sense, has allowed to promote the Project of Thermoelectric power plant using Forest Residues of (CTRF), located in the Centre Region. More recently, studies accomplished by CBE, have allowed private companies to request from the Directorate General for Energy, the construction of power Plants using forest Residues, animal manure and municipal solid waste located in the Centre Region of Portugal: Pombal - (33 MVA), Oliveira de Azeméis (12 MWe installed), Oleiros (7 MWe installed), Pedrógão Grande (5 MWe). In the island of S. Miguel of Azoren (12 MWe), as well as, the future forest residues power plant in the region of Basto (northern of Portugal). Biomass electricity production has increased rapidly over the last few years, up 39% since 1990, largely due to the incentives available for CHP partially fired by biomass. Biomass electricity generation is likely to increase in the short term, given the continuation of the present incentives, and with a 10 MW electricity plant using forest residues under construction.

Wind

Wind capacity has risen from 1 MW in 1990 to 301 MW at the end of 2003 Projects called Lomba da Seixa II - located close to the Northern cities of Braga, Vilareal and Porta- and Senhora da Vitoria -located close to Nazaré, north of Lisbon, have been announced. Each project will consist of eight GE 1.5-megawatt turbines. The new wind parks will be connected to the grid of the largest electricity utility in Portugal, Electricidade de Portugal (EDP), and they are expected to generate electricity from January 2004. The total installed capacity of the wind parks will be 24 MW, enough to meet the annual energy demands of 13,600 households.

Solar Thermal

The growth in the number of collectors sold peaked in 1985 at nearly 42.000m²/year, with more than 20 companies active in the sector. Since then, commercialisation of solar energy for hot water has steadily declined to 22.000m²/year in 1990 and to less than 5.000m²/year in 2002. In 1990 the number of companies active in the field was 5 manufacturers and about 50 companies listed as installers, engineering companies or importers, perhaps with only 10 of them dealing in solar energy. Today the number of manufacturers is even smaller, only one showing real signs of ambition and innovative technology. At the end of 2002, the total collector area in operation is estimated to be around 236.000m². The potential market for solar energy in Portugal is very large. First of all Portugal is a sunny country with differences in sunshine between regions not differing by more than 15% on an yearly average (Kh>0.6, on an yearly basis, almost all over the territory and Atlantic Islands). (source Sun in Action 2)

Solar PV

There's a new trend for photovoltaics in Portugal based in national investment subsidies and a legal framework for feed-in tariffs for the production of electricity from PV systems. The current buy-back rates for PV are ~0,30 EUR/kWh (systems over 5 kWp) and ~0,52 EUR/kWh (systems under 5 kWp), guaranteed for the lifetime of the plant, with automatic adjustments based on the inflation rate. Independent Power Producers must deliver all the generated power to the grid, the utility being obligated to buy the whole power. (source Portugal Photovoltaic technology status and prospects Pedro Sassetti Paes, Labeltec - EDP group, on IEA Photovoltaic Power Systems website, Annual Report, 2003)

However, there are few critical barriers still remain for the widespread of PV in the built environment: PV price, equipment and installer's certification, low voltage grid interconnection legislation, building codes for PV integration. The total installed PV capacity by the end of 2003 was about 2 MWp, of which 87 % are stand-alone applications and 13 % are grid-connected applications. The market continued to grow in 2003, mainly based on off-grid applications. (source Portugal Photovoltaic technology status and prospects Pedro Sassetti Paes, Labeltec - EDP group, on IEA Photovoltaic Power Systems website, Annual Report, 2003). The rate of growth of the total installed capacity between 2001 and 2002 was 30 %.The average annual growth in the period from 1995 to 2002 was 35 %. (source of the text in blue, IEA Photovoltaic Power Systems, National Status Report, Summary, 2002, Portugal)

RE Policy Outlook

The former E4 Programme (Energy Efficiency and Endogenous Energies) launched in 2001, established goals concerning the exploitation of renewable energy sources (RES) for power (and thermal) generation, which were consistent with the EU Directive on renewable electricity (2001/77/CE), under which Portugal has to aim to deliver 39 % (including large hydro) of its gross electricity consumption by 2010. The current energy policy framework is in line with the E4 Programme and, for some RES, the Portuguese government has set even more ambitious targets for 2010, namely:

- wind power: 3 750 MW (currently ~300 MW)
- photovoltaics: 150 MWp (currently ~2 MW).

The initiatives (legislation, incentive schemes) introduced in 2001/2002, aiming at stimulating the market (private investors), not only for RES electricity, but also for CHP, solar thermal use and building energy efficiency, are underway. These are namely:

- Decree-Law defining the conditions regulating the awarding and management of grid interconnection points for Independent Power Producers (IPP).
- Decree-Law establishing a range of favourable feed-in tariffs for RES electricity.
- Decree-Law regulating the delivery of electrical energy into the low-voltage grid (micro-generators, including PV).
- National programme for supporting wide diffusion of solar water heating.
- National programme on building energy efficiency.
- Adapting or broadening the scope of financial incentives for energy efficiency and use of endogenous energies in the framework of the POE/PRIME Programme (Operational Programme for Economical Development).

The most significant government initiative introduced in the framework of the E4 Programme and supported by the 2003 Cabinet Resolution, was the legislation promoting renewable electricity (higher feed-in tariffs, differentiated by technology).

The so-called “producer-consumer” law, aiming more at the residential and small industry markets, allows for micro-generators (micro-turbines, fuel cells, Stirling engines, etc., and also PV) to be connected to the low-voltage grid. Any individual or company may become an independent producer under this law, provided at least 50 % of the generated energy is self-consumed. Therefore, the utility is only obligated to buy half the generated power at a feed-in tariff depending on the technology. For PV, the buy-back rate is about 0,25 EUR/kWh, which, for small systems up to 5 kWp, is considerably lower than the IPP tariff, making this scheme considerably less attractive.

The technical regulation and licensing process already implemented under this legislation concern system ranging from 11 kW to 150 kW. For smaller systems, i.e., up to 16 Ampere per phase (3,68 kW single-phase or 11 kW 3-phase), a simplified process, in preparation, will likely be implemented. Financial incentives for renewables and energy efficiency applications are available under the POE/PRIME programme (2000-2006) – III EC Framework Programme. Grants are provided on the basis of energy and environmental value of the projects, typically ranging from 20 % to 40 % of the total eligible costs, with a maximum grant of 150 kEUR per application.

Indirect market development incentives for renewables are also available: reduction of VAT rate from 17 % to 12 % on renewable equipment, custom duties exemption and income tax reductions (up to 700 EUR for solar equipment).

The main changes relate to the simplification of the bureaucracy involved in obtaining licences and substantially more attractive tariffs for the acquisition of electricity from renewable sources by the national grid. Under the new law, 8.2€/kWh will be paid for the first 2,000 hours of wind energy production each year and 7.0€/kWh for the following 2,000 hours, with prices decreasing slightly after that. Average payment is expected to be about 8€/kWh, compared with 6€/kWh under the previous legislation. The new tariffs for mini-hydro production are 7€/kWh and 22.4€/kWh for wave energy. Solar will be paid at 28.4€/kWh for plants bigger than 5kW and 49.9€/kWh for smaller plants. These prices compare with an estimated average of 6.4€/kWh paid to Portugal's renewable energy producers in 2001.

The major source of investment support is the "Sistema de Incentivos a Utilizacao Racional de Energia - SIURE Energias Renovaveis". This is run by the Ministerio da Industria e Energia, and is supported by the European Union. It provides capital grants for different types of renewable installations. Additionally, energy efficiency investment is supported in the form of a subsidy. As regards achievement of the indicative target in Directive 2001/77/EC, although it is very early to draw conclusions, a high degree of convergence can be seen between the forecasts and the results achieved in 2002. Only two technologies installed less capacity than expected, namely biomass and, above all, wavepower, an emerging technology in which Portugal has been playing a leading role, given the extremely favourable conditions for developing it in this country. As expected, precipitation has an enormous effect on the results obtained from hydroelectricity production. For this reason, the HPI for the base year (1997) will be taken as the reference value. In Portugal rainfall is, beyond doubt, the climatic factor with the greatest impact on electricity production from RES. One important finding is the steady decline in gross electricity consumption in recent years. The strategy to control and reduce emissions of greenhouse gases mapped out in the 2001 version of the National Climate Change Plan (NCCP), which has been revised and is now open to public consultation, includes a large-scale contribution from the electricity production sector, especially in terms of the supply of electricity generated from RES. The objectives set for this sector necessarily match those in the Directive and, where appropriate, in the additional measures designed to comply with the Kyoto Protocol, which are even more ambitious than the Directive. Introduction of the guarantee of origin system is now in the final stages, with a body ready to issue guarantees of origin. The measures implementing Directive 2001/77/EC will put this on a more formal footing and will be followed in due course by the "Manual of Procedures" of the body issuing such guarantees. Assessment of the current legislative framework for the electricity sector confirmed that an adequate framework exists for the grid access issues covered by Article 7 of Directive 2001/77/EC, without prejudice to the possibility of making a few adjustments in the future, particularly with the expected increase in electricity supplies from windpower plants. (source First report on progress towards achieving the indicative targets for electricity production from renewable energy sources in Portugal, 2002)

The Ministry of Economy, through the Secretary of State for Economy, is the public authority that oversees the energy sector. The General-Directorate for Energy (DGE) is the entity responsible for the development, execution and evaluation of the energy policy. Concerning the local and regional competences, only the Regions of Madeira and Azores have specific local legislative powers. The municipalities have regulatory powers in land use, taxes for waste, water, forest maintenance, etc..., but they did not exercise all the regulatory powers they have, essentially through the National Plan for Energy Management in Municipalities, which lays great emphasis in RES.

Electricity

In 2003, electricity consumption was 46.5 TWh, compared to 23.5 TWh in 1990. This corresponds to an average growth rate of 5% per year. Coal stations accounted for 33.9% of total gross electricity generation in 2000, followed by hydro (26.1%), oil (19.4%), gas (16.5%) and combustible renewables and waste (3.6%). Since its introduction in 1997, the share of natural gas has expanded sharply, replacing oil in power generation. The share of oil dropped from 27.5% while the share of gas increased substantially from 5.2% and coal slightly increased from 31% between 1998 and 2000. (IEA Portugal Standard Review 2002 <http://library.iea.org/dbtw-wpd/textbase/nppdf/free/2002/SRPortugal02.pdf>)

Electricity production from renewables was 15 TWh, representing 35% of total gross generation in 2000. In September 2001, the EU adopted a new directive (2001/77/EC) to promote electricity production from renewables. Following the directive, Portugal adopted an indicative target to generate 39% of its electricity from renewables, including large-scale hydro, by 2010. (IEA Portugal Standard Review 2002 <http://library.iea.org/dbtw-wpd/textbase/nppdf/free/2002/SRPortugal02.pdf>)

The state has majority control over the electricity utility (EDP - Electricidade de Portugal) although the company has been partially privatised. Two major independent power producers are already operating, and a third is under study. Recently a company was created to have responsibility for the management of the electricity network all over the country (the REN - Rede Eléctrica Nacional). There is also a regulator entity, ERSE - Entidade Reguladora do Sector Eléctrico, created on March 1997, with responsibilities which include the regulation of prices.

In Portugal electricity produced from RES benefits from an incentive buy-back tariff and power purchase obligations. In 1999, Decree-law no. 168/99 introduced a full change to the feed-in tariffs applicable to the sale of electricity from renewables establishing the principles to account environmental benefits of power generation from renewable energy sources and creating an opportunity to implement green tariffs.

Under the conditions of the resultant legal diploma, power producers have the guarantee that the electricity produced will be bought by the public grid during the license period. The feed-in tariff is calculated as the sum of three parts related to,

- The avoided costs for the Public Power System due to the starting-up and operation of the power plant, including, (i) the avoided investment cost on new power plants and (ii) the transport, operation and maintenance, including fuel costs.
- The environmental benefits from the use of endogenous energy resources. This environmental part of the tariff is based on the unit valuation of the avoided CO₂ emissions of a reference plant: 370 g (CO₂)/kWh and 75 €/ton.

Besides subsidies to the investment costs, an important incentive for the electricity market comes from the legal framework for feed-in tariffs for electricity by renewable energy sources. In 1988, Decree-Law no. 189/88 of 27.05.88 came into force. This was the first law to guarantee the access to the grid for independent power producers using renewable energy sources and co-generation. In 1995, as part of the new legal framework of the National Electricity System and after the publication of an autonomous legislation regulating co-generation, Decree-Law no. 189/88 was adjusted to the new framework and Decree-Law no. 313/95 of 24.11.95 was approved. Nevertheless, in the late years, the energy sector, in general, and the electricity sector, in particular, have faced two important modifications: the development of a single internal energy market and the increasing pressure of global environmental challenges. The first one, is responsible for the adoption of EU Directives aiming to liberalise the energy sector operation. The second one, requires the integration of energy and environmental policies aiming to fulfil international commitments on the reduction of greenhouse gas emissions, to be reinforced. Therefore, the existing legal framework was revised by:

Decree-Law no. 168/99, which introduces a full change to the feed-in tariffs applicable to the sale of electricity from renewables and establishes the principles for accounting environmental benefits of power generation from renewable energy sources and creating an opportunity to implement green tariffs. Additionally, Decree-Law no. 168/99 reorganises the permission process for RES power plants - describes the general arrangements, lays down the principles and establishes the rights and duties of all parties involved. Last but not least, Decree-Law no. 168/99 modifies the mechanisms to define the interconnection points of power plants, in order to assure an increased transparency to the procedures and equity between promoters.

Several programmes and regulations envisage investment subsidies of between 30% and 60% of total investment costs to RES-E (MAPEPOE: Portaria nº 383/2002;198/2001;1219/2001, ENERGIA (Ministry of Economy) DN - 11-E/95 and SIURE (Incentives System for the Rational Use of Energy)). In some cases 50% of the subsidy is a refundable loan (3 to 4 years cadence). The other 50% is given as a non-refundable subsidy. Total investment costs must be larger than 50.000 € (at least for small hydro, wind and geothermal)(see the Admire-Rebus database for further details). (source Admire Rebus from deleted table)

New budget provisions allow purchasers of renewable energy equipment such as solar panels for residential use to benefit from a reduced VAT of 5%. Investment costs in renewable end-use technology are also deductible from the income tax with a limit to the deduction set at 50000 PTE in State Budget 2000. Beginning in October 1999, investors in equipment using solar energy are entitled to claim a depreciation rate of 25% (previously set at 7.14%). (IEA IEA Portugal Renewable Energy and Measures http://library.iea.org/dbtw-wpd/exec/dbtwpcgi.exe?TN=pamsdb&QF0=id&QI0=42&BU=http://library.iea.org/dbtw-wpd/textbase/pamsdb/re_webquery.htm&MR=10&RF=re%20Web%20display&RL=0&DF=re%20Web%20Display&DL=0&NP=3&AC=QBE_QUERY)

Climate Change

National commitments on climate change

The National Climate Change Plan (NCCP) is Portugal's national strategy to control and reduce emissions of greenhouse gases, in line with the commitments given by Portugal under the Kyoto Protocol and on burden-sharing within the EU. The 2001 NCCP, on which public consultations were held in December 2001, provided the starting point for mapping out this strategy, in the form of a package of measures and instruments fitting into a reference scenario, based on the following principles:

adoption of a positive, constructive national response to the commitments given by Portugal to reduce emissions of greenhouse gases, by promoting an integrated package of measures which safeguards and reinforces other environmental and sectoral objectives and the competitiveness of the Portuguese economy;

? application of the polluter/user pays principle;

? involvement of industry and stakeholders in the nation's efforts to reduce emissions of greenhouse gases.

According to the estimates of the results of the reference scenario, Portugal will have to endeavour to cut its emissions by the equivalent of between 13 and 16.5 t of CO₂ by 2012. The principal measures advocated in the NCCP for the electricity production sub-sector within the energy supply sector with a view to achieving the abovementioned objectives using RES are:

- ? Production of 39% of gross electricity consumption from RES in 2010;
- ? Investment in new (large-scale) hydroelectric plants plus upgrading, to add extra capacity totalling between 410 MW and 1250 MW;
- ? Investment in other power stations fuelled by RES, to add extra capacity totalling between 3440 MW and

3680 MW, most of it contributed by windpower (around 90% of capacity to be installed and 75% of the electricity production). Application of these measures offers the prospect of reducing emissions of greenhouse gases in the electricity production sector from between 23.1 t (high scenario) and 21.5 t (low scenario) to between 19.6 t and 18.5 t by 2010, i.e. a reduction equivalent to between 3.5 and 2.9 t of CO₂. Resolution No 63/2003, adopted by the Portuguese Council of Ministers on 28 April 2003, approving the guidelines for Portugal's national energy policy backed up the efforts to promote hydroelectricity and to provide incentives for use of renewable sources, with targets of installed capacity of 3750 MW of windpower, 5000 MW of large-scale hydroelectric potential and around 930 MW of capacity from other renewable resources by 2010. The same resolution also approved a series of measures in addition to the NCCP, notably the following action in the energy supply sector: (source First report on progress towards achieving the indicative targets for electricity production from renewable energy sources in Portugal, 2002)

The government is preparing a National Plan for Climate Change (PNAC). A working version of the plan was published in March 2002 and the government expects it to have been finalised during 2002. The working version quantifies the emissions reduction required to achieve the Kyoto target under the most probable socio-economic development and aims at opening public discussion on the measures and their implementation. It also defines some immediate measures and their potential for reducing emissions and their cost. One of the conclusions presented in this version is that Portugal will rely heavily on domestic measures to meet the emissions reduction target. The Plan is currently under public consultation and it has been criticised for not providing a detailed analysis of the emissions reduction potential, and the cost, of many prospective measures. The government plans to introduce sectoral emissions reduction targets, new measures and monitoring programmes in the final version of the Plan.

To reduce GHG emissions, Portugal has been relying on energy efficiency regulations in the industrial and household sectors, voluntary agreements with some industrial sectors, development of public transport and tax credits on photo-voltaic equipment. (source IEA Energy Efficiency Update 203 Portugal)

heating and cooling

Decree Law 189/88 of 1988 has provided for must-take obligations by the grid company REN (Rede Electrica Nacional) and favourable buy back tariffs set according to the price paid by end-use customers. Decree 186/95 of 1995 set minimum efficiency values and the minimum heat utilisation necessary for co-generators to qualify. The buy-back tariff for co-generators is as follows:

? The buy-back tariff for co-generators below 10 MW is calculated according to the price paid by end-use customers in the medium and high voltage tariff range. A minimum of 55% efficiency is required to qualify.

? For co-generators above 10 MW, the buy-back tariff is based on avoided costs calculated as the cost of building a new CCGT plant. Payments increase when the heat rate value and the availability of the plant increase.

? Co-generators pay for connection to the grid.

? Decree 538 of 1999 allows sales to affiliate companies as well as to companies buying heat. This regulation will be valid for ten years.

As a result of these measures and in particular of the buy-back tariff, co-generation capacity increased from about 600 MWe in 1990 to about 900 MWe in 1998. Generation amounted to about 5 TWh in 1998, including 3.1 TWh in auto-consumption. The standards defining the conditions for the exploitation of the co-generation plants and respective tariffs have recently been revised.

Transport

The RGCT is being implemented in the public and private transport enterprises where energy consumption is higher than 500 toe per year. The RGCT requires these companies to carry out energy auditing and to publish a plan for the rationalisation of their energy use every three years. The Directorate General for Energy (DGE) monitors the audit results and the plans when the companies apply for financial support.

Control of vehicle energy efficiency using new technologies and mandatory periodic inspections aimed at reducing the environmental impact of the transport sector have been implemented. The government announced in 1998 a three-year investment plan costing Esc 600 million aimed at the electrification of all international

railway lines and the development of a new high-speed link between Lisbon and Porto. The Directorate for Energy monitors the auditing and this triennial rationalisation plan. The use of natural gas in vehicles began in the public transport systems of Braga and Porto in 2000 and in Lisbon in 2001. The extra cost involved in purchasing buses that use natural gas is partially financed through the OPE Programme.

Research and Development

Public energy R&D is managed through the Institute for Industrial Engineering and Technology (INETI). Significant reorientation of support away from energy conservation and fossil fuels towards renewable R&D took place in 1993. Overall spending on renewable energy was increased by 44% in 1994 (to 2.1 M USD) while total energy R&D spending remained roughly the same. The main thrust of R&D was solar (mainly PV) accounting for over half the total renewable R&D. Biomass received the next largest share of funds (22%) with the remainder spent on small hydro, geothermal, wind and ocean energy. **(source to be updated and checked)**

| | | | TIME | 1980 | 1985 | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|----------|---|-----------------------------|--------|--------|--------|-------|-------|-------|-------|-------|------|
| COUNTRY | PRODUCT | FLOW | | | | | | | | | |
| Portugal | Million US\$ (2002 prices and exchange rates) | 4.1 Solar Heating & Cooling | 0.717 | 1,503 | 0.289 | 0.104 | 0.308 | 0.379 | 0.035 | 0.016 | |
| | | 4.2 Solar Photo-Electric | 0.157 | 0.325 | 0.342 | 0.033 | 0.019 | 0.004 | 0.045 | 0.015 | |
| | | 4.3 Solar Thermal-Electric | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.045 | |
| | | Total Solar | 0.875 | 1,829 | 0.632 | 0.136 | 0.328 | 0.383 | 0.079 | 0.076 | |
| | | 5. Wind | 0.429 | 0.475 | 0.120 | 0.005 | 0.037 | 0.000 | 0.007 | 0.010 | |
| | | 6. Ocean | 0.070 | 0.322 | 0.194 | 0.082 | 0.544 | 0.162 | 0.181 | 0.015 | |
| | | 7. Biomass | 0.184 | 1,503 | 0.764 | 0.053 | 0.115 | 0.173 | 0.088 | 0.126 | |
| | | 8. Geothermal | 0.157 | 0.081 | 0.113 | 0.027 | 0.308 | 0.063 | 0.031 | 0.025 | |
| | | 9.1 Large Hydro (>10 MW) | 0.000 | 0.000 | 0.000 | 0.235 | 0.000 | 0.000 | 0.000 | 0.000 | |
| | | 9.2 Small Hydro (<10 MW) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| | | Total Hydro | 0.000 | 0.000 | 0.000 | 0.235 | 0.000 | 0.000 | 0.000 | 0.000 | |
| | | TOTAL RENEWABLE ENERGY | 1,715 | 4,208 | 1,823 | 0.538 | 1,331 | 0.781 | 0.386 | 0.254 | |
| | | TOTAL OTHER TECH./RESEARCH | 0.140 | 3,163 | 1,973 | 0.018 | 0.217 | 0.177 | 0.018 | 0.042 | |
| | | TOTAL ENERGY R&D | 10,201 | 15,002 | 12,568 | 1,646 | 2,103 | 1,510 | 0.939 | 2,443 | |

(Source IEA 2003: National Budget RD&D in OECD Countries – Portugal 1980-2002, OECD, IEA)

RE Highlights

National Success Story

Portugal — Wind energy

Enernova is a subsidiary of Electricidade de Portugal (EDP) which was established to explore the wind energy potential in Portugal, and to develop the technology in the country. It was the main driving force behind implementation of wind energy schemes during the mid-1990s. A number of wind projects were established on Portuguese islands such as Madeira in the early part of the 1990s, but the first mainland wind scheme was built in 1996. This consisted of 17 600-kW machines, totalling 10.2 MW. A second project was built soon afterwards, with a total 10-MW electrical capacity, and further schemes have followed. The country does not have large areas with strong and predictable wind resources, but despite this a number of suitable sites have been identified through a detailed evaluation of wind resources and the subsequent development of a wind atlas of

Portugal. This, combined with the increasing availability of finance for wind developments and an improvement in tariffs paid to renewable electricity producers, has led to a surge in new projects recently. However, one of the limitations to the development of wind energy in Portugal is the quality of the grid infrastructure, which can result in complex and expensive connections.

Success factors:

• **Political: National energy programme established in support of renewable energy development**

The Portuguese Energy Programme was established in 1994 with the aim of reducing dependence on energy imports, providing reliable energy supply at a reasonable cost, encouraging energy efficiency and increasing the use of renewable energies. Regional energy plans have followed, promoting renewable energy and energy-efficiency initiatives.

• **Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market for renewable electricity producers**

Since 1988 independent producers using renewable energy sources or combined heat and power have had guaranteed access to the grid at regulated prices (Decree 189/88 on independent power production). This provided a guaranteed feed-in tariff for electricity generation from renewable energy for eight years. Despite this, few wind projects came forward until financial support and tariff levels for new renewable electricity were improved in 1995 when Decree 313/95 was introduced. Since 1999, a new feed-in law (Decree 168/99) has been implemented..

• **Financial: Generation incentives for independent power producers**

The Portuguese Energy Programme in 1994 introduced financial incentives for independent electricity producers. These differ depending on the nature of the project, its size and its geographical location. Grants were available of up to 60 % of eligible costs for demonstration projects, or up to 50 % for dissemination (commercialisation) projects. Zero-interest loans were also available for up to 40 % of project costs for commercial projects. After 1997, this loan level was raised to 60 % of project costs. The Programme was funded by the European Community (Structural Funds), the Portuguese government and private investors. More recently the government has provided finance towards grid connection costs. *Wind energy has been slow to develop, but is starting to show promise.*

1993: 11.0 GWh 1999: 123.0 GWh Increase 1993–99: 112.0 GWh, 1 018 %

• **Information, education and training: Regional evaluations of wind energy resources are available**

A great deal of work was carried out during the early 1990s to develop a wind atlas of Portugal. The Portuguese government makes information on subsidies for renewable energy projects and how to apply for them available to the public

Regional or Local Best Practice

Madeira – Green Hotel

With a view to promoting a new form of tourism and integrating environmental and energy issues in the economic development of the island, in April 2003 the regional agency of Madeira decided to embark on a project called "Green hotel". This consists of **the creation of a tourist complex that is 100% supplied by renewable energy sources**, through the application of the most advanced energy and environmental solutions.

The complex will be located on the east side of Madeira island, in the area of Caniçal, and will consist of a new hotel and a marina. The hotel will have 165 rooms and the marina will have capacity for 250 vessels. The marina will also incorporate marine reception services, a water sports centre, restaurants and shops. Construction is scheduled to start in early 2004.

The project is now ending its first six months, so it is still too early to assess the overall results. However, based on energy consumption of similar installations in Portugal, the reduction in energy needs appears to be between 35% and 40%

The Green Hotel project is co-financed within the 5th Framework Programme of the European Commission. In the near future, the project will again be submitted to another national programme, to support the investment in the wind turbine. The partners will provide the remaining costs of the project.

The project will be co-ordinated by AREAM Agência Regional da Energia e Ambiente da região Autónoma da Madeira, which assumes responsibility for the project management. The work plan is organised into work packages and each work package has a co-ordinator and a leader.

(source Campaign for Take-Off featured on the IDEA website)

5. Websites

| Name | Description | Website |
|---|--|---|
| Ministry of Economy | Oversees the energy sector | http://www.min-economia.pt/ |
| General Directorate for Energy | responsible for the development, execution and evaluation of the energy policy | http://www.dge.pt/ |
| The Energy Services Regulatory Authority– ERSE | responsible for the regulation of the natural gas and electricity sectors | http://www.erse.pt/erse_english/index.html |
| ADENE | Portuguese national energy agency | www.adene.pt |
| Europa website | EU Commission website | http://europa.eu.int |
| European Commission – Directorate General for Transport and Energy | | http://europa.eu.int/comm/energy/index_en.html |
| Managenergy | Information services for local and regional energy actors | www.managenergy.net |