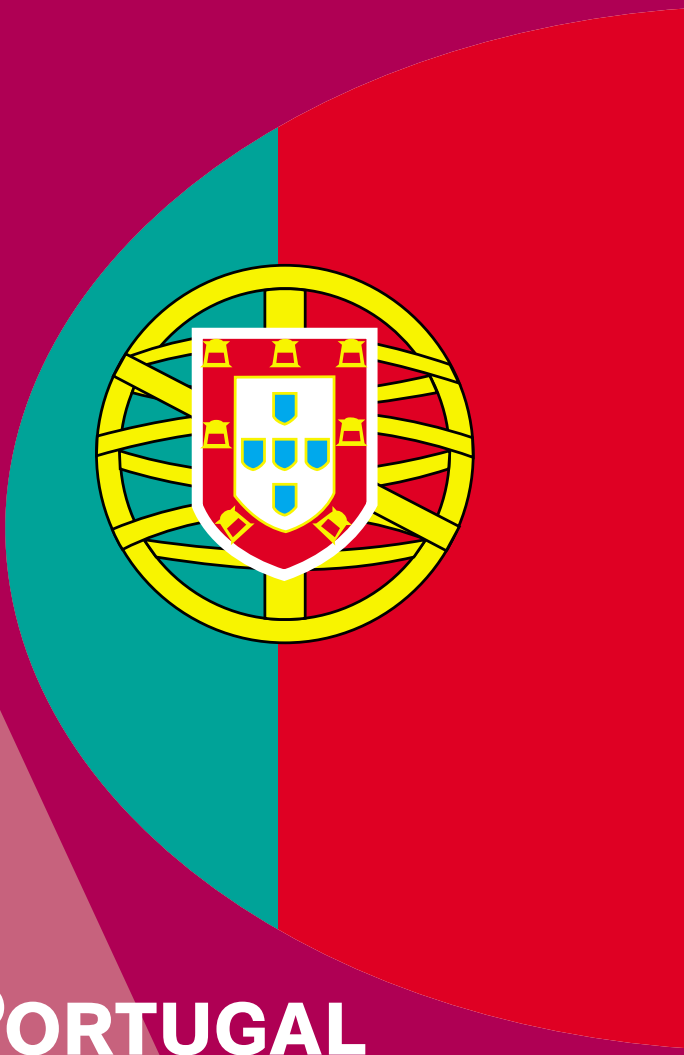
INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

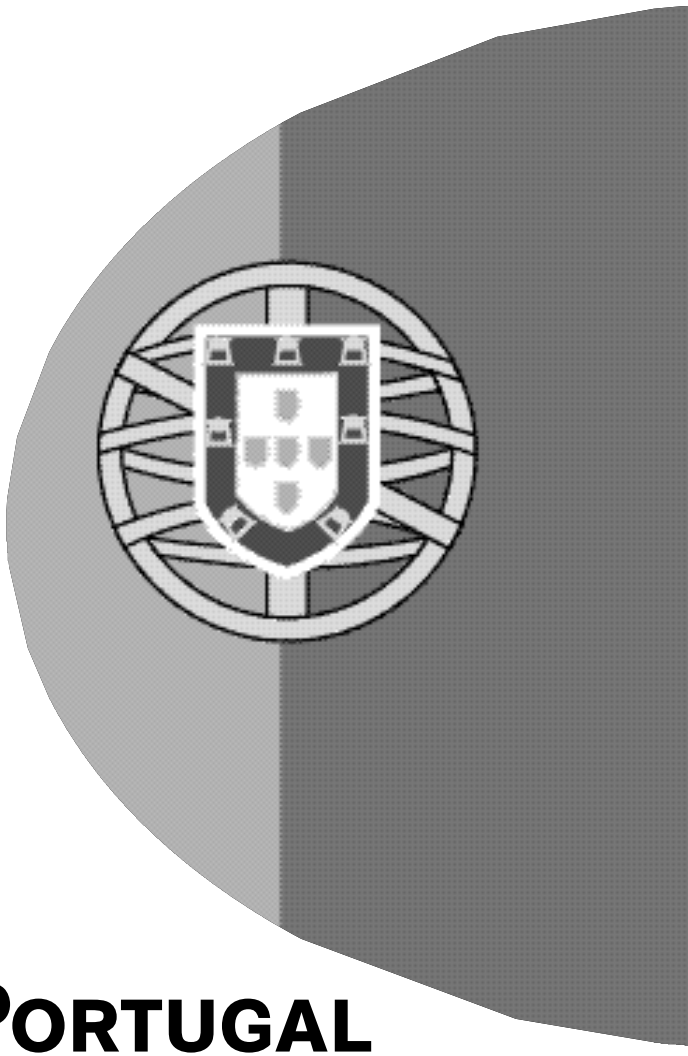


PORTUGAL 2000 REVIEW

OECD

INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries



PORTUGAL 2000 REVIEW

INTERNATIONAL ENERGY AGENCY
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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-four* of the OECD's twenty-nine Member countries. The basic aims of the IEA are:

- To maintain and improve systems for coping with oil supply disruptions;
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- To operate a permanent information system on the international oil market;
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- To assist in the integration of environmental and energy policies.

** IEA Member countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

ORGANISATION FOR
ECONOMIC CO-OPERATION
AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- To achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- To contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- To contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and the Republic of Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

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INTRODUCTION

An IEA team visited Portugal in September 1999 to review the country's energy policies. This report was drafted on the basis of information received during and prior to the visit, including the Portuguese Government's official response to the IEA's annual policy questionnaire and views expressed by various parties during the visit.

The team greatly appreciated the co-operation and the openness demonstrated by the participants during this policy review process.

Members of the team were:

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Pierre-Marie Cussaguet managed the review and drafted the report,in consultation with the team. Monica Petit prepared the figures.

The team held discussions with representatives from the following organisations:

- Ministry of Economy, General Department of Energy (DGE)
- Ministry of the Environment
- Ministry of Social Equipment
- Programa Energia
- Associação Nacional de Conservação da Natureza
- Grupo de Estudos de Ordenamento do Territorio e Ambiente (GEOTA)
- Petróleos e Gás de Portugal (GALP)
- Petrogal
- Associação das Empresas Petoliferas (APETRO)
- Gás de Portugal (GDP)
- Lisbogás
- Portgás
- Lusitâniagás
- Setgás
- Entidade Reguladora do Sector Eléctrico (ERSE)
- Electricidade de Portugal (EDP)
- Associação Portuguesa de Cogeneração (COGEN)
- Turbogás
- Associação Portuguesa de Grandes Consumidores de Energia Eléctrica (APIGEE)
- Confederação da Indústria Portuguesa (CIP)
- Associação Portuguesa de Energias Renováveis (APREN)
- Instituto Nacional de Engenharia e Tecnologia Industrial (INETI)

2

SUMMARY AND RECOMMENDATIONS

SUMMARY

Energy consumption in Portugal is expected to continue growing with GDP. Portugal has a low energy production and is increasingly dependent on imported energy. Portuguese energy policy has aimed at liberalising energy markets,ensuring security of energy supply, improving energy efficiency and mitigating environmental problems. Consistent with these objectives, Portugal has increased its effort to diversify energy sources, in particular through the introduction of natural gas, and to improve energy efficiency with the support of the European Union's "Community Support Framework".

Since the last review, the government has taken measures to prepare an environment for competition in the electricity sector and has continued to liberalise the oil sector in line with the IEA's Shared Goals. In addition, Portugal's energy companies have been restructured and the government has begun their privatisation.

The government has started to privatise Electricidade de Portugal (EDP) and Petrogal,which have dominant positions in the electricity and oil sectors. In 1999, Gás de Portugal (GDP), which retained a monopoly position in imports and transport through its subsidiary Transgás and a dominant position in distribution, remained fully owned by the state. In April 1999,the government set up a holding company called Petróleos e Gás de Portugal,SGPS,S.A. (GALP),including GDP and Petrogal, the national oil company. GALP is responsible for the operation and management of the Portuguese oil and gas industries. The aim is to gradually privatise GALP and create an enterprise large enough to compete in the Iberian market.

An important policy objective is to avoid abuse by these companies of their dominant position in their respective markets. In this regard,the development of effective competition in the Iberian electricity and gas sectors has become essential.

Portugal has taken a cautious approach towards liberalisation in the electricity sector. The electricity law of 1995 divided the electricity market into a competitive segment and a centralised (non-competitive) segment. In 1995, an independent electricity regulator, the Entidade Reguladora do Sector Eléctrico (ERSE), was established with extensive powers and in 1999,the electricity law was adapted to the EU directive on electricity. However, in 1999, the competitive segment of the electricity market was not functioning adequately. Therefore,further measures are needed to implement effective competition.

The successful introduction of natural gas has been a key factor in the diversification of Portugal's energy sources and mitigation of environmental

problems. Gas was first used in electricity generation, allowing electricity to be supplied at a competitive price. Gas consumption has expanded rapidly since 1997: the construction of pipelines and the conversion of facilities to adapt to natural gas have been supported by funds from the 1994 Energy Programme granted by the EU and the Portuguese state. Security of gas supply remains an important issue,since Portugal will continue to depend mainly on a single gas supplier.

Because Portugal is an emergent gas market, European legislation permits the introduction of competition to be delayed for ten years after the beginning of gas supplies. Therefore, the government obtained a derogation from the EU directive which will allow Portugal to delay the introduction of competition in the gas market until 2008. In January 1999, the government and the major energy consumers agreed to establish a regulator for the gas market. A clear schedule for the implementation of competition and an early decision on its modalities would allow suppliers and consumers to prepare for the liberalised gas market.

In the early 1990s, the Portuguese oil sector experienced major changes. Oil consumption was growing quickly and the government introduced competition in a short time frame in parallel with the partial privatisation of Petrogal. Price ceilings, set by the government to protect consumers from abuses, have been progressively removed but have been maintained on gasoline and automotive diesel. Since competition has now developed for these two products,there is no economic rationale to maintain price ceilings.

Improving energy efficiency has been an important policy objective in order to reduce the sharp growth of energy demand,lower the increase in greenhouse gas (GHG) emissions and help Portuguese industries to be competitive. However, energy-related CO_2 emissions have increased rapidly and are expected to continue growing sharply. To achieve the Kyoto target of limiting the increase to 27% between 1990 and 2008-2010,further efforts may be needed.

All of Portugal's own energy production is from renewable energy. The government has promoted renewable sources through funding from the 1994 Energy Programme and a premium on electricity purchases from renewable sources. The government does not favour any specific fuel and grants subsidies only to economically viable projects. As the number of projects is increasing, the government should select the most cost-efficient ones and promote cost reductions.

Public funding for energy R&D decreased substantially between 1990 and 1997. It increased in 1998 and 1999 but was still one of the smallest budgets of IEA countries with regard to GDP. The government rightly plans to reform public R&D to improve its efficiency. In its reform,the government needs to sharpen the focus of public research in energy, to assess the results of R&D programmes and to strengthen co-operation with industry in order to achieve better market deployment of new technologies.

RECOMMENDATIONS

The Portuguese Government should:

Energy Policy and Market Trends

☐ Take further measures to stimulate competition in the energy sector.

☐ Continue to work for the development of effective,competitive Iberian natural gas and electricity sectors.

☐ Establish clear arm's-length relations between the state and companies with state ownership.

☐ Reform the tax system to better internalise external costs of using energy.

☐ Enhance co-ordination of energy policy measures between the different ministries and appropriate organisations to take better account of energy in other policies and increase efficiency.

Energy Efficiency and Environment Policy

☐ Release, as soon as practicable, its report evaluating GHG emission trends so that a comprehensive assessment can be made of how much Portugal must reduce its emissions to meet its climate change commitments under the Kyoto Protocol.

☐ Revive its efforts to develop and implement a comprehensive climate change mitigation plan in order to start getting current GHG levels on track to meeting Kyoto commitments.

☐ Set up new programmes for energy efficiency in the different sectors,taking into account the results of the assessments of the previous programmes to focus on the most cost-effective measures. Ensure that these programmes are effectively funded.

☐ Increase information to energy consumers on energy efficiency measures. Focus on measures to improve energy efficiency in small industries, such as providing information and expertise.

☐ Carefully assess the results of the energy audits in industry to improve the effectiveness of energy efficiency measures in this sector.

☐ Continue to increase investment in railways and to develop modern public transport in the major towns.

☐ Ensure maximum compliance with EU directives on labelling. Ensure that the Regulation on the Energy Systems for Air Conditioning of Buildings is periodically revised to adapt to new technologies. Contribute to the elaboration of EU regulations on labelling and efficiency standards for cooling appliances.

☐ Ensure that building codes are periodically revised to take into account technical improvements. Ensure that these codes are effectively implemented and that their implementation is effectively monitored at local level.

Oil

☐ Continue to take active steps to enhance competition in the oil sector.

☐ Remove remaining price ceilings on oil products as soon as possible.

Natural Gas

☐ Continue to favour diversity of gas supplies.

☐ Ensure that regulations providing for security of gas supply, in particular gas storage requirements, will be adapted to the future competitive gas market.

☐ Phase out subsidies for gas infrastructure when the gas market is mature to allow gas to compete on a level playing field with the other fuels.

☐ Set a clear schedule for the introduction of competition in the gas market and take an early decision on its modalities so that suppliers and consumers have a firm basis to adapt to the new market.

☐ Ensure effective unbundling between gas import facilities, transmission, distribution,supply and non-gas activities to create a level playing field.

☐ Introduce regulated third party access to prevent any discrimination between users of gas infrastructure.

☐ Set up an independent regulator in charge of preparing for and ensuring fair competition,e.g.setting tariffs and dealing with consumers'complaints.

Electricity

☐ Give public support to competition in the electricity sector through the Expansion Plans prepared by the General Department of Energy, in particular by encouraging the competitive part of the independent system to develop.

☐ Consider replacing power purchase agreements between generators in the Public Electricity System and Rede Eléctrica Nacional by a more competitive system to better pass on efficiency gains to end users.

☐ Ensure that generators in the electricity sector benefit from the same purchase conditions for natural gas. Joint ventures in electricity generation involving EDP and GDP should not reinforce EDP's dominant position in the electricity market.

☐ Clearly determine the available capacity for international electricity trading and the terms and conditions for the use of interconnections.

☐ Encourage the development of tariffs for transmission and in particular cross-border tariffs allowing for effective trade and competition. Take measures to clarify the rules for handling of possible bottlenecks and reinforcement of the grid when new generation/consumption or trading requires it.

☐ Take into account the importance of small and medium enterprises in Portugal's economy, allowing them to form consortia in order to qualify as eligible consumers.

☐ Relax the limitations on the distributors for buying electricity in the Independent Electricity System.

☐ Remove the limitations on co-generators wanting to sell electricity directly to consumers.

☐ Safeguard the independence of the regulator and ensure that the resolution of disputes between consumers and suppliers is under its control.

☐ Encourage the regulator to ensure the effective independence of both the System Operator and the Market Operator to avoid discrimination between the users of the grid.

☐ Encourage the regulator to set cost-reflective prices for end users to ensure that there are no cross-subsidies in favour of eligible consumers.

Renewable Energy Sources

☐ Ensure that the promotion of renewable sources, including through a new Energy Programme, encourages a decrease in their costs, e.g. by introducing competition among them.

☐ Continue to seek the most cost-effective ways to promote renewable sources, including biomass and in the domestic sector.

Energy Technology, Research and Development

☐ Develop a national energy R&D strategy that is coherent with Portuguese energy policy and that encourages private companies to undertake R&D.

☐ Encourage public research institutes,and in particular the Instituto Nacional de Engenharia e Tecnologia Industrial, to sharpen the focus of public research, to assess the results of R&D programmes and to strengthen co-operation with industry to better secure market deployment of new technologies.

☐ Continue to ensure effective participation in international energy R&D programmes focusing on those which are of major national interest.

3

ENERGY POLICY AND MARKET TRENDS

BACKGROUND

Portugal's total area is 91,900 km^2, including the Autonomous Regions of the Azores and Madeira archipelagos (Figure 1). Continental Portugal is divided into five administrative regions (North,Centre, Lisbon and Tagus Valley, Alentejo and Algarve) and 18 districts. In 1998, the population of Portugal was ten million and population density was 109 inhabitants per km^2. The Lisbon and Porto areas account for one-third of the inhabitants and around 50% of Portugal's GDP. Eighty per cent of industry and service employment is located in the coastal area between Setúbal and Braga. Twenty per cent of Portugal's citizens live in communities of less than 200 inhabitants.

Portugal entered the European Union in 1986. GDP growth slowed down in 1991 and 1992 and decreased in 1993. GDP increased by an average annual rate of more than 3% between 1993 and 1998.

In 1998,GDP was $105.4 billion,a 3.7% increase over 1997[1]. GDP per capita was $10,600, 47% of the EU average of $22,300. GDP calculated in purchasing power parity (PPP) was $152 billion and GDP (PPP) per capita was also much higher than GDP per capita: $15,300 compared with $21,300 for the EU average.

In 1997, the government issued a Stability and Growth Pact for the period 1999-2002. GDP growth is expected to amount to 3.3% per year during this period. The pact aims at reducing the state budget deficit from 2.3% of GDP in 1998 to 0.8% in 2002. Portugal has undertaken a privatisation policy which makes it one of the largest privatisers in the OECD. Portugal's privatisation programme aims at "strengthening competitiveness, broadening and deepening capital markets, reducing public debt and maximising proceeds from privatisation"[2]. In 1998,state receipts from privatisations were estimated to be around $4.3 billion. Estimated receipts from privatisations in 1999 amount to 4% of GDP.

ENERGY POLICY OBJECTIVES

Portugal's energy policy objectives are as follows:

- To reduce dependence on imported energy and to develop domestic energy sources.
- To reduce dependence on oil and to diversify energy sources and suppliers.

1. Escudos (PTE) 1,000 = € 4.99; in 1998 on average,PTE 1,000 = US$ 5.57.
2. *OECD Economic Surveys, Portugal*, 1998.

Figure 1
Map of Portugal

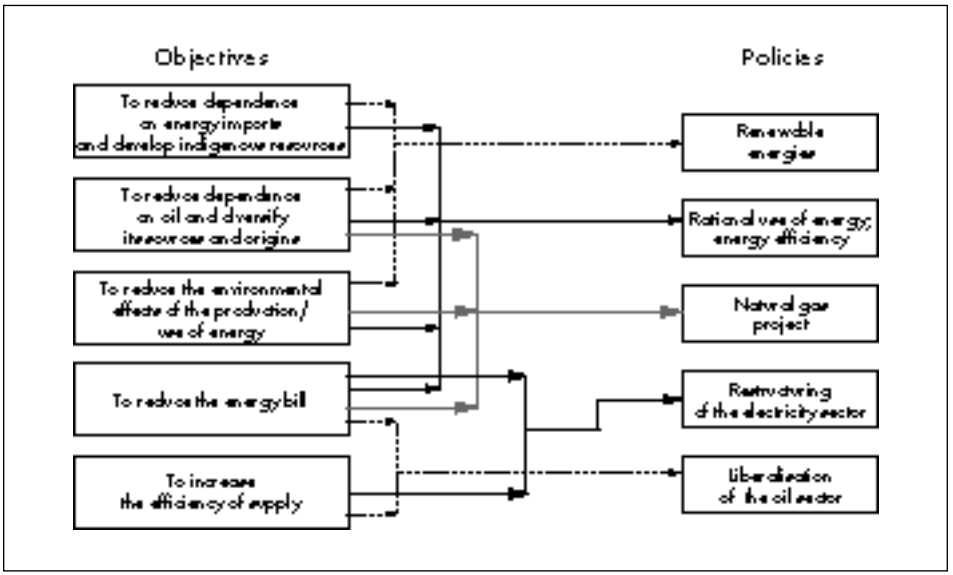
- To reduce the environmental impact of the production and use of energy.

- To reduce the energy bill.

- To increase efficiency of energy supply and conservation.

These objectives lead to five energy policy measures as indicated in Figure 2: promotion of renewable sources, promotion of energy efficiency, introduction of natural gas, restructuring of the electricity sector and liberalisation of the oil sector. Measures implemented and achievements in these sectors are discussed in detail in the relevant chapters.

Figure 2
Portugal's Energy Objectives and Policy



Source: General Department of Energy.

The 1994 Energy Programme provides for specific financing measures to achieve three objectives included in the above-mentioned goals for the period 1994-1999. The programme provides funding:

- To introduce natural gas in Portugal's energy supply.

- To increase the use of renewable sources.

- To promote energy efficiency and conservation.

The measures to reach these objectives have been financed mainly through the SIURE programme (Incentive System for the Rational Use of Energy). Between 1994 and

1999, total public funding was about PTE 140 billion (ECU 704 million), of which 44% came from EU FEDER funding (Table1). Public funding for the introduction of natural gas accounted for 69% of the total, promotion of renewable sources for 22.6%, energy savings for 7.5% and technical assistance[3] for less than 1%. The Portuguese Government plans to continue the programmes, giving more emphasis to energy savings and progressively reducing funding for the introduction of natural gas (for detailed information on these programmes, see Chapters 4, 6 and 8).

Table 1
Funds Granted for the Energy Programme, 1994-1999
(PTE and ECU millions)

	*European Union**		*Portuguese Public***		*Total Public*		*Private Sector*	
	ECU	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*
1994	3.55	706.3	3.54	703.5	7.09	1,409.8	9.43	1,874.9
1995	22.21	4,309.9	30.21	5,863.2	52.42	10,173.1	21.87	4,244.4
1996	43.95	8,531.3	60.70	11,783.2	104.66	20,314.5	39.44	7,654.9
1997	61.76	12,284.1	79.88	15,888.2	141.64	28,172.3	51.64	8,408.7
1998	79.67	15,969.5	99.63	19,974.8	179.29	35,944.3	62.21	10,271.9
1999	97.05	14,957	122.29	29,017.6	219.34	43,974.6	61.22	12,471.8
Total	**308.18**	**61,258.1**	**396.26**	**78,730.6**	**704.44**	**139,988.7**	**245.81**	**12,273.9**

* FEDER.

** State and public enterprises.

Source: Ministry of Economy.

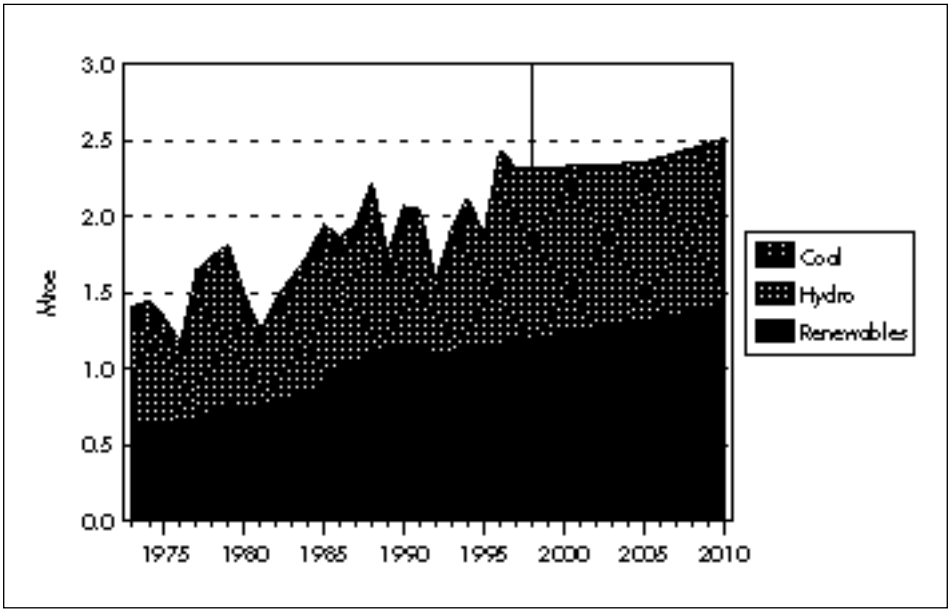
ENERGY TRENDS

Energy Production

In 1998,energy production in Portugal was 2.3 Mtoe (Figure 3), i.e. less than 11% of total supply[4]. All domestic energy production is from renewable sources[5]. Hydro is the most important renewable source,but hydro availability varies widely (see Chapters 7 and 8).

3. The technical assistance programme aims mainly at funding administrative costs,e.g.management of the programmes,preliminary studies,information to the administration,advertising campaigns and assessment.
4. In addition, Portugal produces some yellow cake.
5. Portugal had two coal mines which stopped activity because of to their non-competitive cost of production. The Sao Pedro Da Cova mine closed down in 1994 and the other one,situated in the Pejao region,in 1995.

Figure 3
Energy Production by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Energy Supply

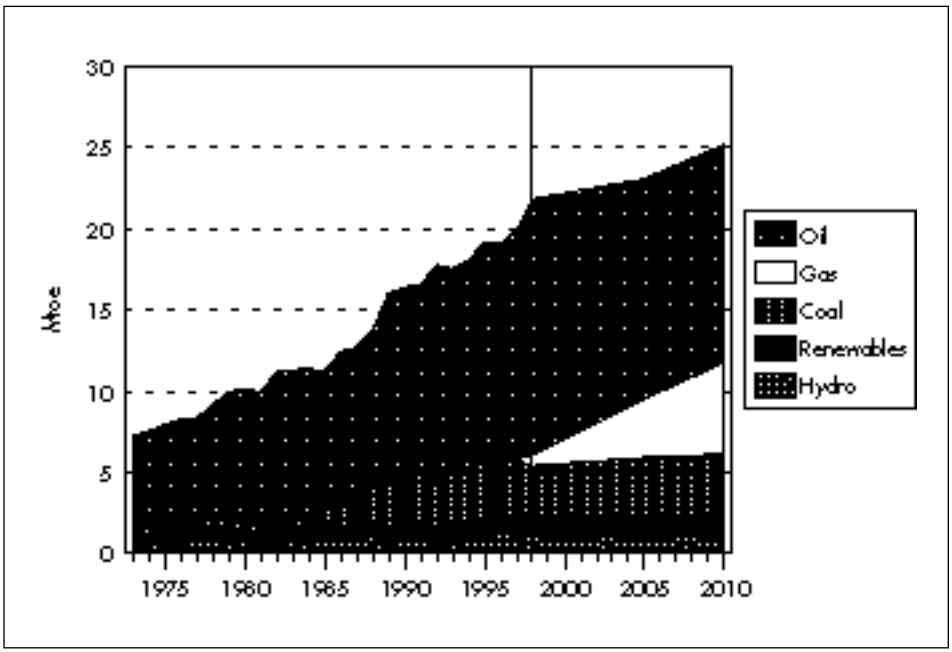
In 1998,total energy supply was 21.9 Mtoe, a 8.4% increase over 1997 (Figure 4). Between 1973 and 1998, energy supply increased at an annual rate of 4.5%, thanks to the country's strong growth and rapid development. In spite of this growth, in 1998 Portugal had the lowest energy supply per capita of the EU. In 1998, it amounted to just above 2 toe, in comparison with an EU average of around 3.8 toe.

Oil has been the dominant fuel although its share in total supply was slightly reduced from 75.4% in 1973 to 72% in 1998. This share is due to extensive use of oil in power generation and the increase in end-use energy consumption owing to the economic development of the country.

Coal supply increased rapidly between the mid-1980s and the mid-1990s,after the commissioning of the 1,200 MW Sines and the 615 MW Pego power plants[6], to diversify from heavy fuel oil (see following box and Chapter 7). Coal supply reached 3.1 Mtoe in 1998 (14.2% of total supply). Gas supply and imports started at the end of 1997 and amounted to 0.7 Mtoe in 1998.

6. A small amount of coal is also used in the cement, iron and steel and non-metallic minerals industries.

Figure 4
Energy Supply by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Energy Imports

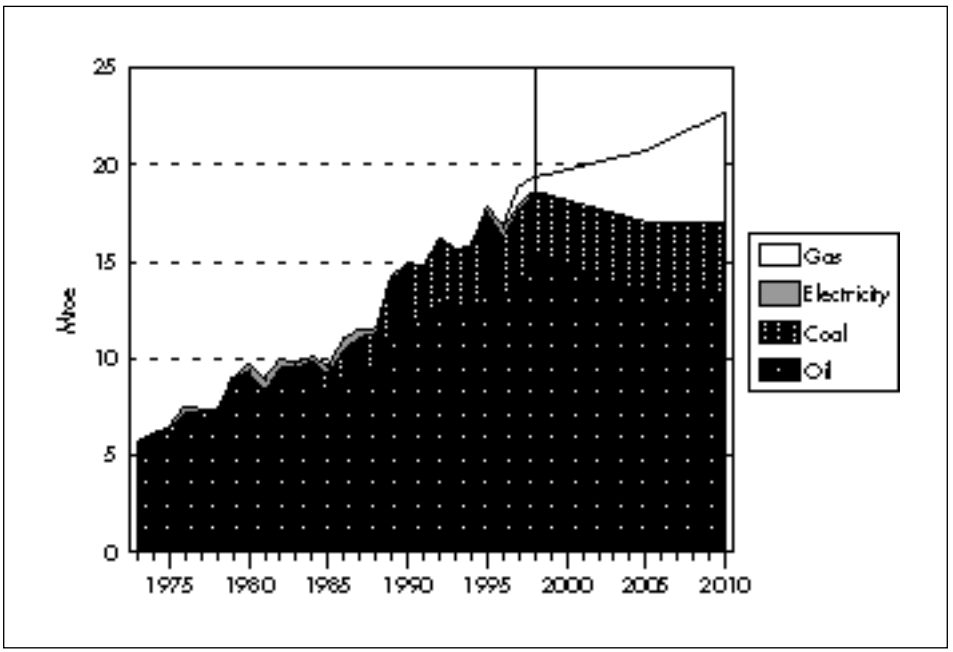
Portugal's dependence on imported fuels is large and increasing. Total net imports of energy amounted to 19.3 Mtoe in 1998,i.e. 88.5% of total energy supply. This compares with 90.2% in 1990 and 79% in 1973. In 1973,oil accounted for nearly all energy imports. Since then, energy imports have diversified. Oil is still the major imported fuel with a share of 80% of total net imports (Figure 5), followed by coal (16.2%) and natural gas (3.6%).

Coal Import Infrastructure

In 1998, Portugal had a coal import capacity of around 6.5 million tonnes at its two terminals at Lisbon and Sines. Expansion works at Sines were completed in 1998. Coal downloaded at Sines is used for the Sines and Pego power plants (Chapter 7).

Coking coal is imported mostly from the United States and Canada. Steam coal is imported mostly from Poland,the United States and Colombia.

Figure 5
Net Energy Imports, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Energy End-use

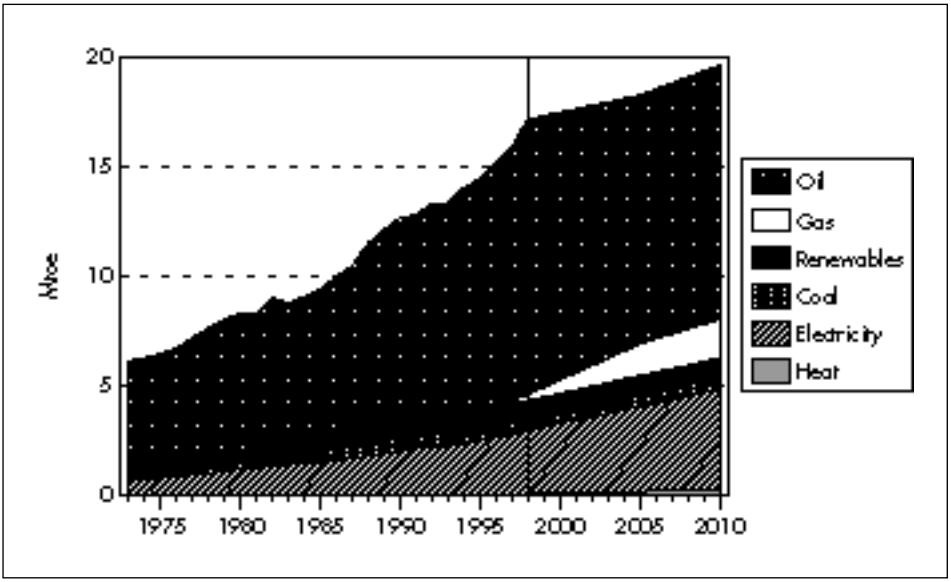
Total final consumption of energy (TFC) was 17.2 Mtoe in 1998. Between 1973 and 1998,TFC increased at an annual rate of 4.2% (Figure 6). Final consumption of oil in 1998 was 12.5 Mtoe,which was 72.9% of final energy consumption and a slight decrease from the rate of 75% in 1973. Electricity consumption increased at the fastest pace. It multiplied more than fourfold between 1973 and 1998, reaching 33.8 TWh in 1998.

Industry is the largest final consumer of energy in Portugal (Figures 7 and 8). In 1998, energy consumption in industry was 7.5 Mtoe, i.e. 43.9% of TFC. In this sector, energy consumption decreased at the beginning of the 1990s in pace with the reduction in industrial production. Consumption has, however, increased since 1994. In 1998, oil consumption accounted for 5.1 Mtoe (67.3% of energy consumption in this sector). Electricity consumption increased rapidly, reaching a share of 16.6% in 1998.

Transport is the fastest growing sector. Energy consumption for transport more than doubled since the mid-1980s, increasing regularly at an average annual rate of more than 6%. In 1998, oil consumption in the transport sector was 5.8 Mtoe, i.e. 46.3% of total final consumption of oil[7]. Recent development of road infrastructure, rapid

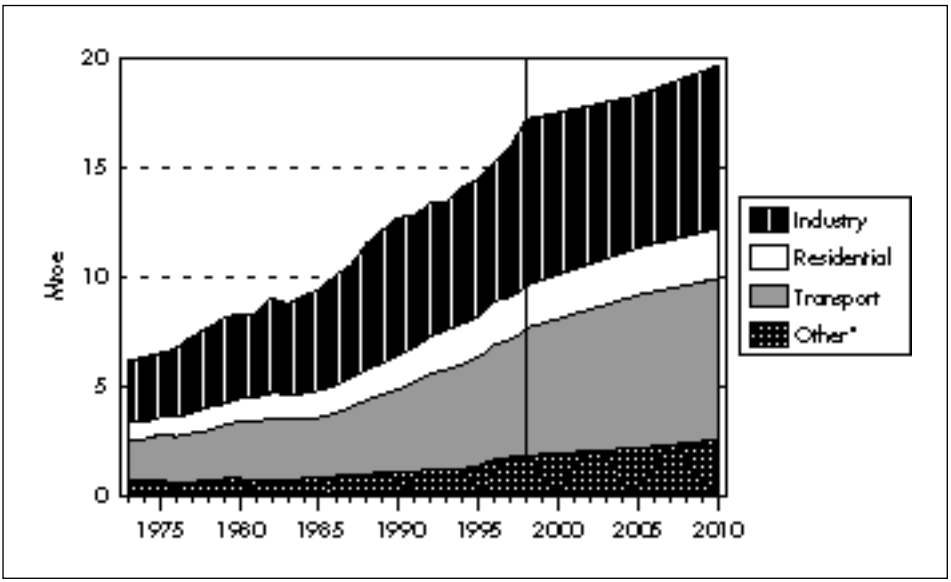
7. This figure does not include diesel use for transport in industry and in the service sector.

Figure 6
Total Final Consumption by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

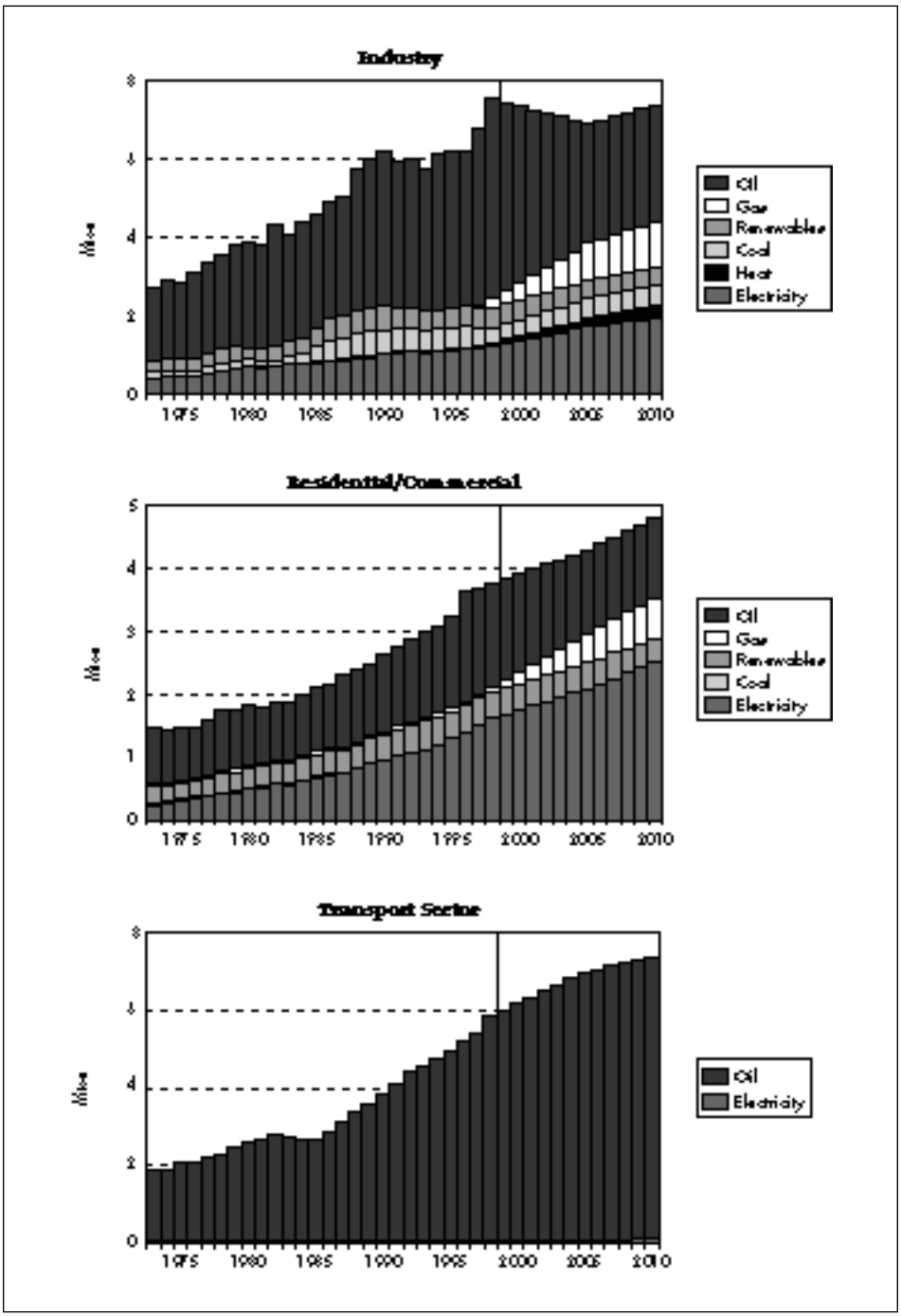
Figure 7
Total Final Consumption by Sector, 1973-2010



* Includes commercial,public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Figure 8

Total Final Consumption by Sector and by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

growth in private car ownership and road transport and development of air traffic are the main reasons for this strong growth:

- According to the Ministry of Social Equipment, in charge of transport, the number of private cars increased from 1.5 million in 1990 to 2.5 million in 1998[8]. However, car ownership per inhabitant (25/100) was still lower than the EU average. Growth in the motorisation rate is expected to decrease from 3.4% in 1995 to less than 2.5% in 2010.

- The number of light and heavy trucks also nearly doubled between 1990 and 1998. The number of light vehicles increased from 473,000 to 945,000 and the number of heavy vehicles increased from 110,000 to 127,000.

- According to the Ministry of Social Equipment,in 1995 rail freight was 1.5 billion tonne-kms and road freight was 17 billion tonne-kms. In 1995, passenger transport by rail was 6 billion passenger-kms, by bus 10.7 and by car 56.3. Freight and passenger transport by road and by rail are expected to continue to develop at a rapid rate (Table 2).

Table 2
Trends in Public and Private Transport, 1990-2010

	1990	*1995*	*2000*	*2005*	*2010*
Transport of Passengers (billion passenger-kms)					
Cars	36.6	56.3	70.2	84.9	98.8
Buses	13.3	10.7	9.7	10.2	12.4
Rail*	7.3	6.0	5.6	6.3	8.2
Total	**57.2**	**73.1**	**85.5**	**101.4**	**119.3**
Freight Transport (billion tonne-kms)					
Road	13.5	16.9	21.8	26.5	30.1
Rail	1.2	1.5	1.9	2.5	3.0

* Includes trains,subway and trams.

Source: Ministry of Social Equipment.

In 1998, energy consumption was 2 Mtoe in the residential sector and 1.8 Mtoe in the commercial sector (commercial, agriculture and public services). Energy consumption in the residential sector has increased at the slowest pace. Because of Portugal's mild

8. The ministry estimates that in 1998 there were 2.1 million private cars. It adds to this number around half of the 900,000 light vehicles which are used as private cars.

climate, little energy is used for space heating; electricity consumption has, however, grown rapidly with the increased use of domestic appliances. In the commercial sector, energy use has increased at the same average rate as in industry.

Forecasts

The Ministry of Economy's central scenario for future energy consumption, production and trade (called "competitive scenario") is based on the assumption of substantial economic growth in Europe and in Portugal. The Ministry of Economy expects energy supply to increase 1.8% per year between 2005 and 2010. Diversification of fuel supply will continue with the increased use of natural gas, whose share in total supply will amount to 22.7% in 2010, up from 3.2% in 1998. The increase in electricity consumption will slow down slightly to 3.8% per year between 1998 and 2010.

The increase in energy consumption is expected to slow down in the industry sector. In the commercial sector, energy consumption would continue to increase at the same rate, in line with the expected growing importance of services in Portugal's economy. Improvements in comfort levels,increased use of domestic appliances and increased space heating and cooling would maintain the growth in energy use in the residential sector. The increase in energy consumption in the transport sector is expected to slow down after 2005, when Portugal's situation would be comparable to that of other EU countries.

Domestic energy production is expected to continue to be based on renewable sources. Although some new hydro power plants are planned, electricity generation from hydro is not expected to increase significantly. Non-hydro renewable sources, mostly biomass and wind energy, are expected to increase by more than 17% to 1.4 Mtoe between 1998 and 2010, mostly from biomass and wind energy.

Dependence on energy imports is expected to remain at a high level, above 90%. However, because of the energy diversification policy, oil's share in total energy imports is planned to decrease from 80% in 1998 to 59% in 2010. The share of natural gas in imports is expected to be more than 25% in 2010, compared with 3.6% in 1998.

ENERGY TAXATION

VAT differs according to the fuel. Heating oil,diesel and electricity were previously subject to a reduced VAT of 5% compared to the normal rate of 17%. In 1996, VAT on heating oil and automotive diesel was raised to 12%. In 1997, VAT for these two products was raised to 17% except for automotive diesel for agricultural purposes, which remained at 12%. A reduced VAT of 5% on natural gas was also introduced.

VAT on automotive diesel is fully reimbursed for heavy passenger vehicles, public transport, and machines and tractors used in agriculture. For other commercial purposes,50% is reimbursed.

Until January 1994, excise taxes on oil products fluctuated to balance the variations in their pre-tax prices for end-use consumers. In 1994, excise taxes were set at a fixed amount and pre-tax price fluctuations were passed on to consumers. This reform was undertaken at the same time as a change in price setting for oil products (see Chapter 5).

Every year since 1997, the Parliament has voted for a range of revenue (maximum and minimum) from the excise tax. The government has used this range to offset pre-tax price variations of gasoline and automotive diesel (Table 3). Excise taxes increased in 1998. They decreased in 1999 to maintain prices at the same level in order to curb inflation.

No light fuel oil is used in industry. Industries use "thin fuel oil",i.e.a mix of middle distillates and heavy fuel oil. The tax is the same as for heavy fuel and the blending is supervised by the customs officials.

Table 3
Prices and Taxes on Automotive Diesel and Unleaded Gasoline, 1994-1999
(PTE per litre)

	*Automotive Diesel**				*Premium Unleaded***			
	Excise	*VAT*	*Total Taxes*	*Total Price*	*Excise*	*VAT*	*Total Taxes*	*Price Total*
1994	58.5	4.9	63.4	103.5	85.2	20.8	106.0	150.7
1995	61.7	5.0	66.7	104.6	86.7	22.3	109.0	153.8
1996	60.3	9.3	69.6	112.2	89.9	23.0	112.9	158.2
1997	52.8	16.7	69.5	115.0	90.5	23.7	114.2	162.9
1998	55.8	16.4	72.1	112.7	94.6	23.6	118.2	162.4
1Q99	57.7	16.0	73.7	110.0	98.4	23.4	121.8	161.0
2Q99	54.8	16.0	70.8	110.0	95.0	23.4	118.4	161.0
3Q99	50.4	16.0	66.4	113.0	77.0	23.4	100.5	161.0

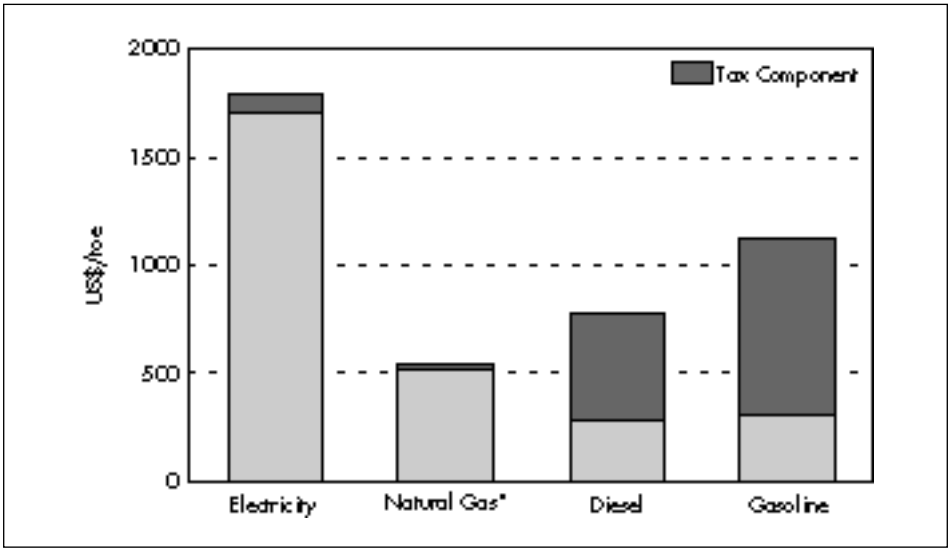
* Non-commercial use.

** Unleaded 95 RON.

Source: *Energy Prices and Taxes*, IEA/OECD, Paris,1999.

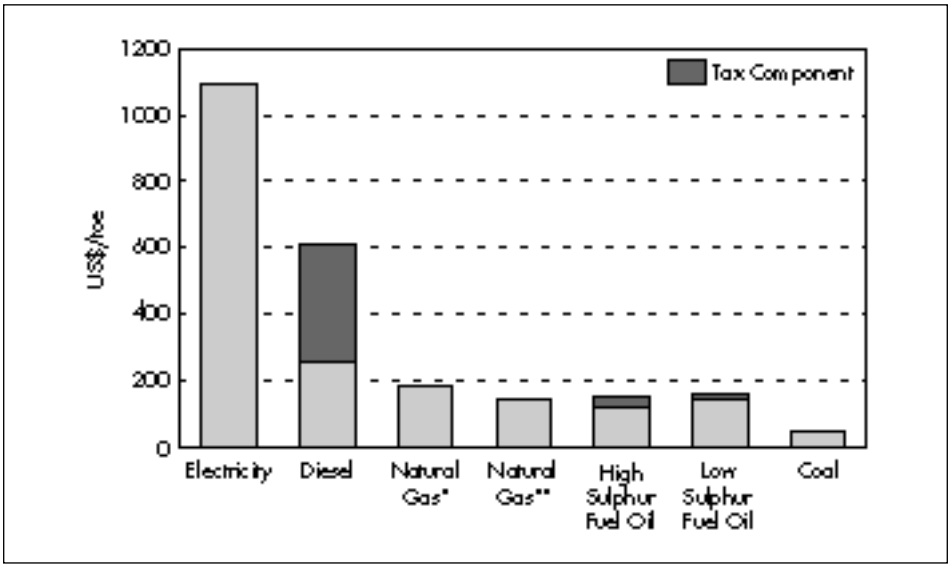
Excise tax on unleaded gasoline is higher than that on automotive diesel (Table 3, Figures 9 and 10). However, annual taxes on diesel cars are twice that on gasoline cars. Excise taxes on low sulphur fuel oil (LSFO) are half the level of that on high sulphur fuel oil (HSFO). There are no excise taxes on electricity, liquefied petroleum gas (LPG),coal and natural gas.

Figure 9
Fuel Prices and Taxes in the Household Sector, 1998



* First quarter 1999.
Sources: *Energy Prices and Taxes*, IEA/OECD Paris,1999; Gás de Portugal.

Figure 10
Fuel Prices and Taxes in the Industry Sector, 1998



* Indicative price for small industry, first quarter 1999.
** Indicative price for large industry, first quarter 1999.
Sources: *Energy Prices and Taxes*, IEA/OECD Paris,1999; Gás de Portugal.

In the second quarter 1999,taxes on unleaded gasoline (95 RON) were in the higher range of OECD countries (Figure 11) and taxes on automotive diesel were lower than the average (Figure 12).

In industry, HSFO accounts for around 70% of heavy fuel oil consumption. Excise taxes on HSFO are about average within the EU (Figure 13).

INDUSTRY STRUCTURE

Electricidade de Portugal (EDP) has a dominant position in the electricity sector, as does Petrogal in the oil sector. In 1999, Gás de Portugal (GDP) and Transgás retained a monopoly position in imports and transport and a dominant position in distribution in the gas sector. Before the creation of GALP (see below), there was cross-shareholding between Petrogal, Gás de Portugal and Transgás (see Figure 14 and the relevant chapters for more detailed information).

The government has partially privatised EDP and Petrogal. At the end of 1999, the state retained shares of 55% in Petrogal and 50.8% in EDP. On 22 April 1999, Decree Law No. 137-A/99 created the holding company "Petróleos e Gás de Portugal, SGPS, S.A. (GALP). This holding company is responsible for the operation and management of the Portuguese oil and gas industries. The aim of the government is to create an enterprise large enough to compete in the Iberian market.

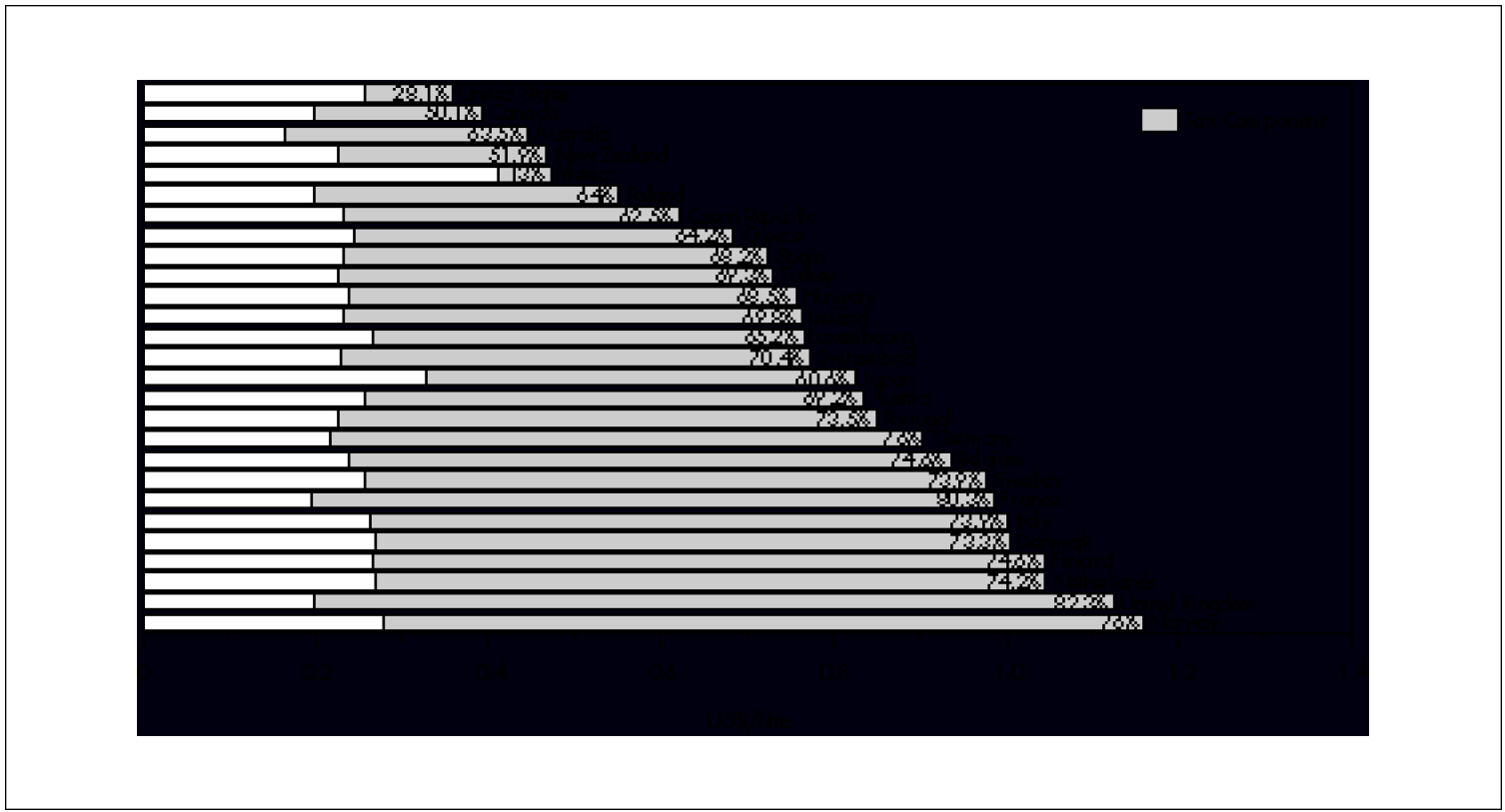
Decree-Law No. 261-A/99 of 7 July 1999 provided for an increase in GALP's capital which will be reserved for Petrogal and Gas de Portugal. The state retained a share of 60.56% of the new company; the Caixa Geral de Depósitos (CGD, a public bank) held 2.75%; Petrocontrol (a group of Portuguese banks and industries) held 33.34%; EDP held 3.27% and gas distribution companies 0.08%[9]. In January 2000, ENI, the Italian oil and gas group, acquired 33.3% of GALP, i.e. 11% from the Portuguese state and 22.3% from Petrocontrol. Petrocontrol sold its remaining 11% shares to Electricidade de Portugal, and Iberdrola, a Spanish utility, bought 4% of GALP from the state. The Caixa Geral de Depósitos increased its share in GALP to 13.5%. The state plans to privatise its remaining stake in GALP and possibly keep golden shares (Figure 15)

ENERGY ADMINISTRATION STRUCTURE

The General Department of Energy (DGE) within the Ministry of Economy is in charge of energy issues. Its main responsibilities include:

9. Portgás,0.04% and Setgás,0.04%.

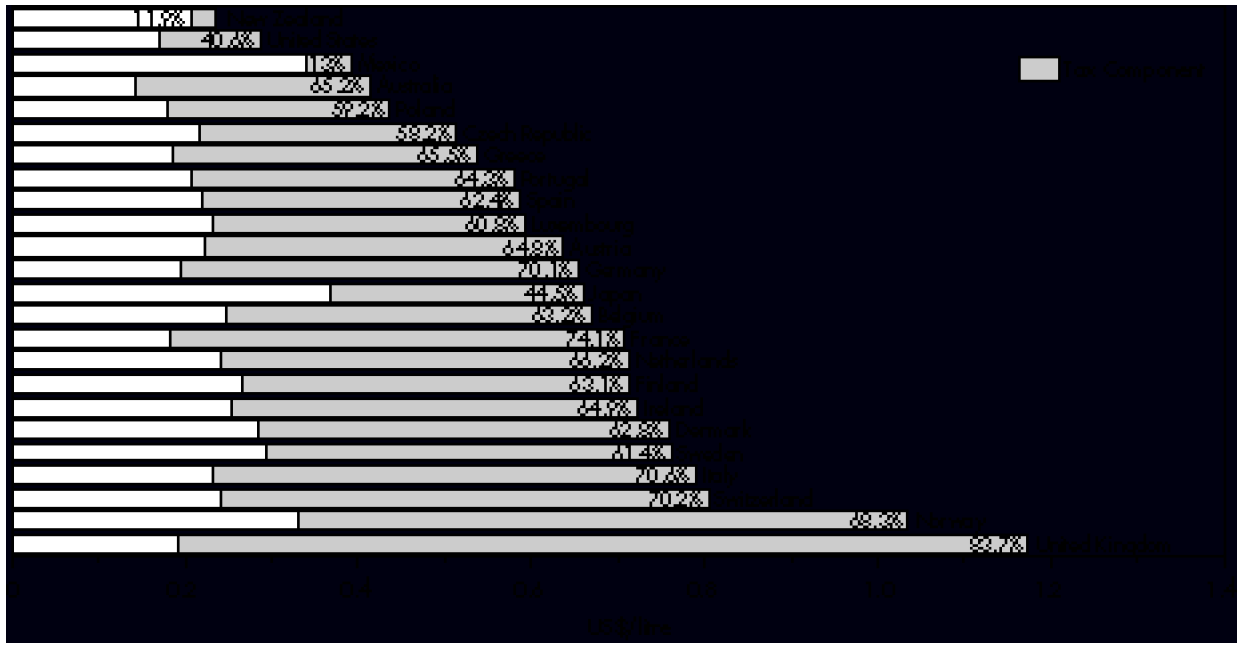
Figure 11
OECD Unleaded Gasoline Prices and Taxes, Second Quarter 1999



Note: First quarter 1999 for Japan.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

Figure 12

OECD Automotive Diesel Prices and Taxes, Second Quarter 1999

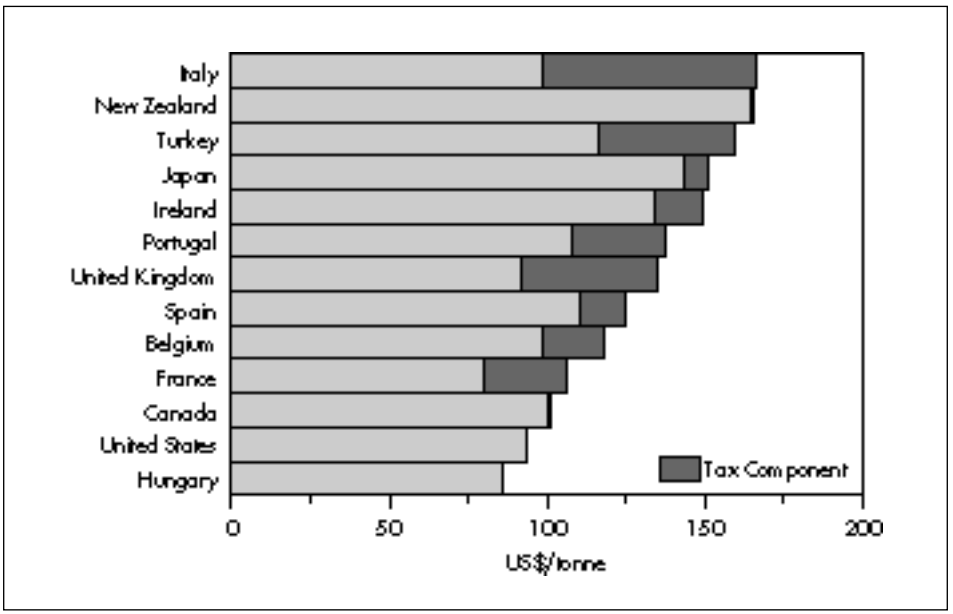


Note: Data not available for Canada, Hungary and Turkey. First quarter 1999 for Australia and Japan.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

- Proposing legislation to regulate the energy sector and supervising its implementation.

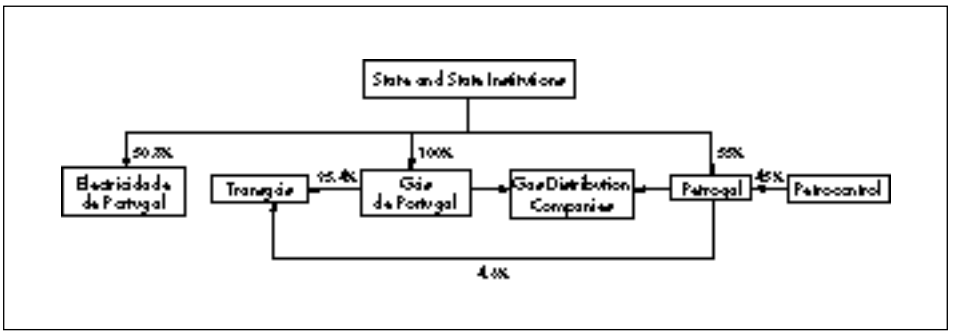
- Granting licences and authorisations to energy-based plants and infrastructure and establishing their technical standards.

Figure 13
OECD High Sulphur Fuel Oil Prices and Taxes, Second Quarter 1999



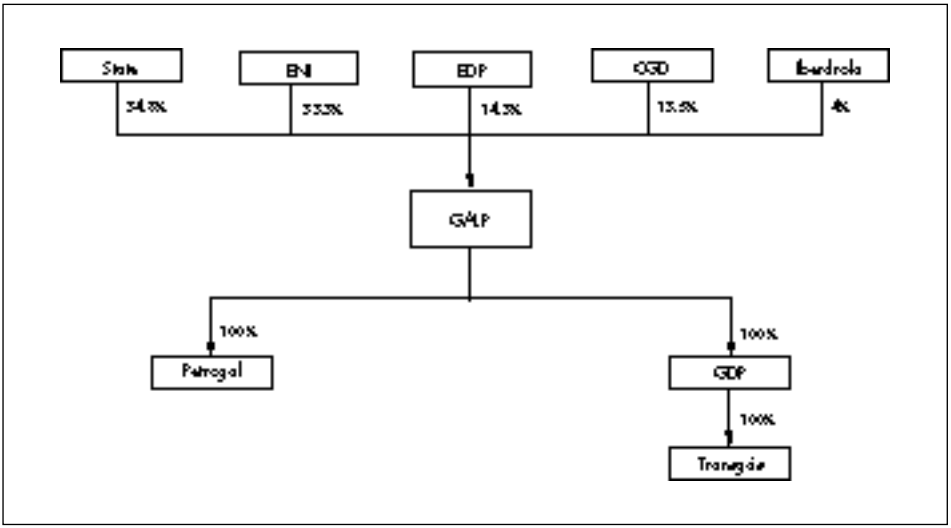
Note: Data not available for Australia, Austria, Denmark, Finland, Germany, Greece, Luxembourg, Netherlands,Norway, Sweden and Switzerland.
Source: *Energy Prices and Taxes*, IEA/OECD Paris,1999.

Figure 14
Main Shareholdings in the Portuguese Energy Sector, 1999



Sources: Country submission,annual reports.

Figure 15
GALP's Shareholding Structure, 2000



Source: Country submission.

- Developing and implementing energy-related programmes (e.g. energy efficiency programmes).
- Encouraging the dissemination of information on energy policy and energy statistics.
- Carrying out studies on energy issues for the government.

Regulation of the electricity sector is shared by the Ministry of Economy and the Regulator, the Entidade Reguladora do Sector Eléctrico (ERSE)[10]. The Ministry of the Environment has general responsibility for greenhouse gas (GHG) emission policy. The Ministry of Social Equipment is in charge of transport.

CRITIQUE

Portugal has been experiencing strong growth in GDP and in energy consumption and both are expected to continue. As Portugal's domestic energy production is modest and will not grow at the same pace as future energy needs,dependence on energy imports is expected to grow further.

In this context, Portugal's energy policy, which aims at liberalising energy markets and ensuring security of energy supply, mitigating the environmental problems due

10. For detailed information see Chapter 7.

to the increase in energy consumption and improving energy efficiency to reduce external dependence, is well adapted to the needs of the country. Since its accession to the EU, Portugal has benefited from the "Community Support Framework", which has helped finance the 1994 Energy Programme to promote natural gas, renewable energy and energy efficiency.

In implementing its energy policy, the government has undertaken a large number of measures in line with the IEA's Shared Goals. Thus,since the last in-depth review, major progress has been achieved in Portugal's energy policies:

- The Portuguese Government has been successful in rapidly introducing natural gas in the market, which will contribute significantly to the diversification of energy supplies.

- Efforts have also been made to prepare an environment for competition in the electricity sector. Since the early 1990s, measures have also been taken to liberalise the oil sector rapidly.

- The government has made continuous efforts to increase energy efficiency and to promote renewable sources in a cost-effective way, which mitigates the increases in CO_2 emissions.

In line with the IEA's Shared Goals, the Portuguese Government rightly recognises the benefits of competitive energy markets for the efficiency of energy supply, which results in lower prices for end-use customers. The government should therefore continue its policy of introducing competition in the energy sector.

The government has also restructured the industries in the energy sector. It has started to privatise Petrogal and EDP and has created GALP, a holding company including GDP and Petrogal,which will be able to compete in the Iberian market.

EDP and Petrogal have a dominant position in their markets and GDP and Transgás enjoy a monopoly. The government created GALP, which has a very large share in the Portuguese oil and gas sectors. Therefore,it should be ensured that this merger does not lead to abuses of dominant position and does not impede the effective functioning of energy markets. To avoid these problems, several measures should accompany this merger:

- As Portugal's energy market is small,the government should continue to work for the development of an effective, competitive Iberian market in the natural gas and electricity sectors whereby foreign companies can develop activities in Portugal and Portuguese companies can develop abroad.

- The government should also establish a clear distinction between the state and the companies with state ownership so that energy industries compete on a level playing field. In this context, Portugal's privatisation policy is a right move towards clarifying the relations between the state and energy companies.

- The new regulatory framework should ensure that there are no entry barriers for competitors and that the regulators have enough power to track down any anti-competitive practices and take appropriate measures.

- A legal unbundling of GALP's activities would better ensure the development of effective competition.

In 1994, the government rightly reformed the excise tax system, allowing price fluctuations to be passed on fully to end users, thus reflecting the evolution in supply and demand and eliminating distortions in interfuel competition. In addition, the tax differential between high sulphur and low sulphur heavy fuel oil better internalises the external costs of using these fuels. However, since 1997,the government has used taxation on gasoline and automotive diesel to offset price variations.

Good internalisation of the external costs of using energy leads to undistorted energy prices. Therefore,in its tax policy, the government should consider better internalisation of these external costs, in particular for gasoline and automotive diesel,so that end users pay the full cost of using energy.

The government is implementing numerous reforms in the energy sector. These reforms involve a large number of ministries, public institutions, associations and enterprises dealing with energy issues. To increase efficiency in decision-making and implementing policy and to take better account of energy in other policies,co-ordination between ministries as well as the sharing of information within and outside the administration should be enhanced.

RECOMMENDATIONS

The Portuguese Government should:

☐ Take further measures to stimulate competition in the energy sector.

☐ Continue to work for the development of effective,competitive Iberian natural gas and electricity sectors.

☐ Establish clear arm's-length relations between the state and companies with state ownership.

☐ Reform the tax system to better internalise external costs of using energy.

☐ Enhance co-ordination of energy policy measures between the different ministries and appropriate organisations to take better account of energy in other policies and increase efficiency.

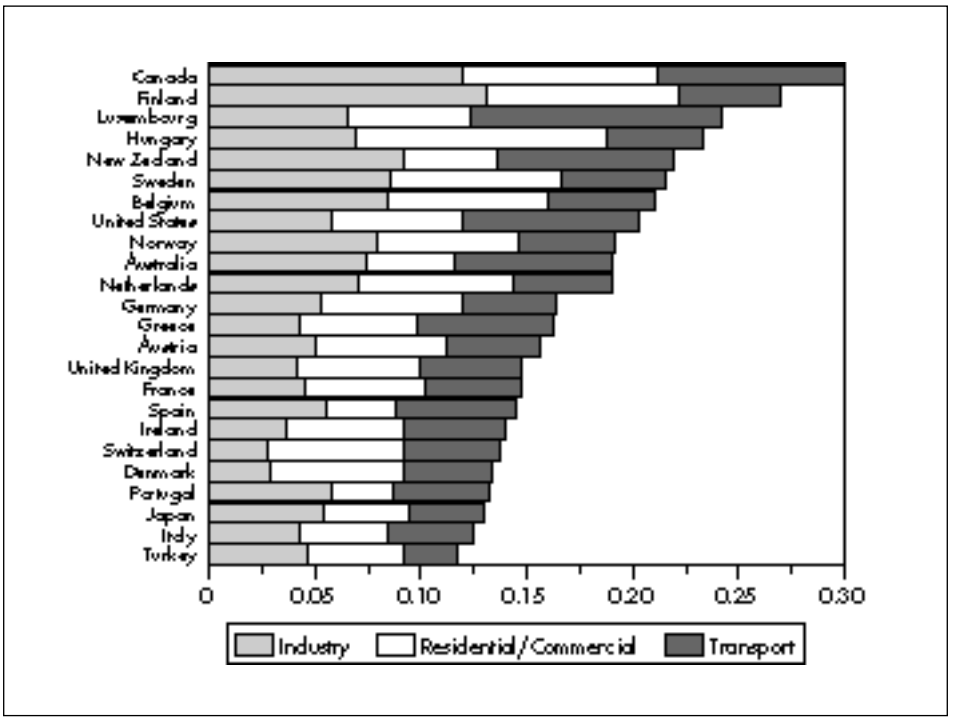
4

ENERGY EFFICIENCY AND ENVIRONMENT POLICY

TRENDS IN ENERGY INTENSITY

In 1998, Portuguese energy intensity, calculated as Total Primary Energy Supply (TPES) per GDP in purchasing power parity (PPP), was the fourth lowest of IEA countries (Figure 16). This was mainly due to the energy intensity in the residential/commercial sector, which was the lowest of all IEA countries.

Figure 16
Energy Intensity in IEA Countries by Sector in PPP, 1998
(Toe per thousand US$ at 1990 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and *National Accounts of OECD Countries*, OECD Paris,1999.

Energy intensity increased at an annual average of 1.7% between 1973 and 1990 (Figure 17) but slowed down to 1.2% per year between 1990 and 1998. Since 1985, the increase in energy intensity accelerated in the transport sector, reaching the IEA

Europe average at the end of the 1990s. Energy intensity increased in the residential/commercial sector between 1990 and 1996. It stabilised in the industry sector in the mid-1990s at a higher level than the IEA Europe average (Figure 18).

Electricity intensity increased at a fast rate until 1986. Since 1988,the increase has slowed down to 1.7% annually. In spite of this growth,electricity intensity is still at a lower level than the IEA Europe average (Figure 19).

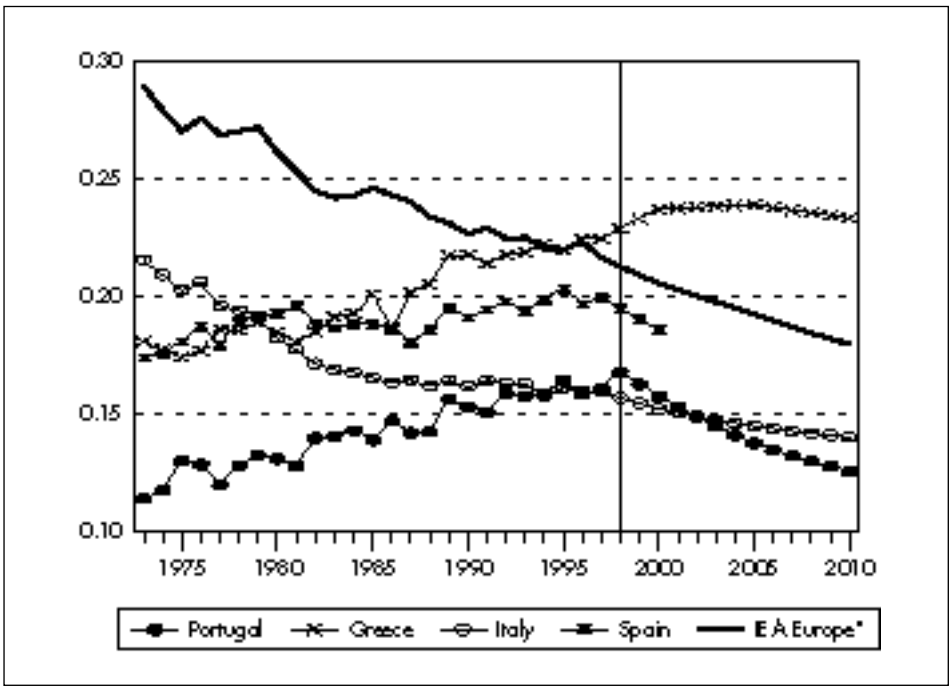
Figures 20 to 22 illustrate the evolution of consumption in energy-related service sectors (transport excluding electricity, electricity and stationary fossil fuel uses) and GDP calculated in PPP. Figures 20 and 21 indicate a close correlation between the growth in transport,in electricity and GDP as for IEA countries as a whole. This is also the case for stationary fossil fuel use,contrary to the IEA average (Figure 22).

According to the statistics on energy consumption elaborated by the Ministry of Economy, energy intensity is expected to decrease rapidly in every sector. This is a change in comparison with the past trend,particularly for the transport sector. Growth in electricity intensity is expected to slow down in accordance with the past trend.

Figure 17

Energy Intensity in Portugal and in Other Selected IEA Countries, 1973-2010

(Toe per thousand US$ at 1990 prices and purchasing power parities)



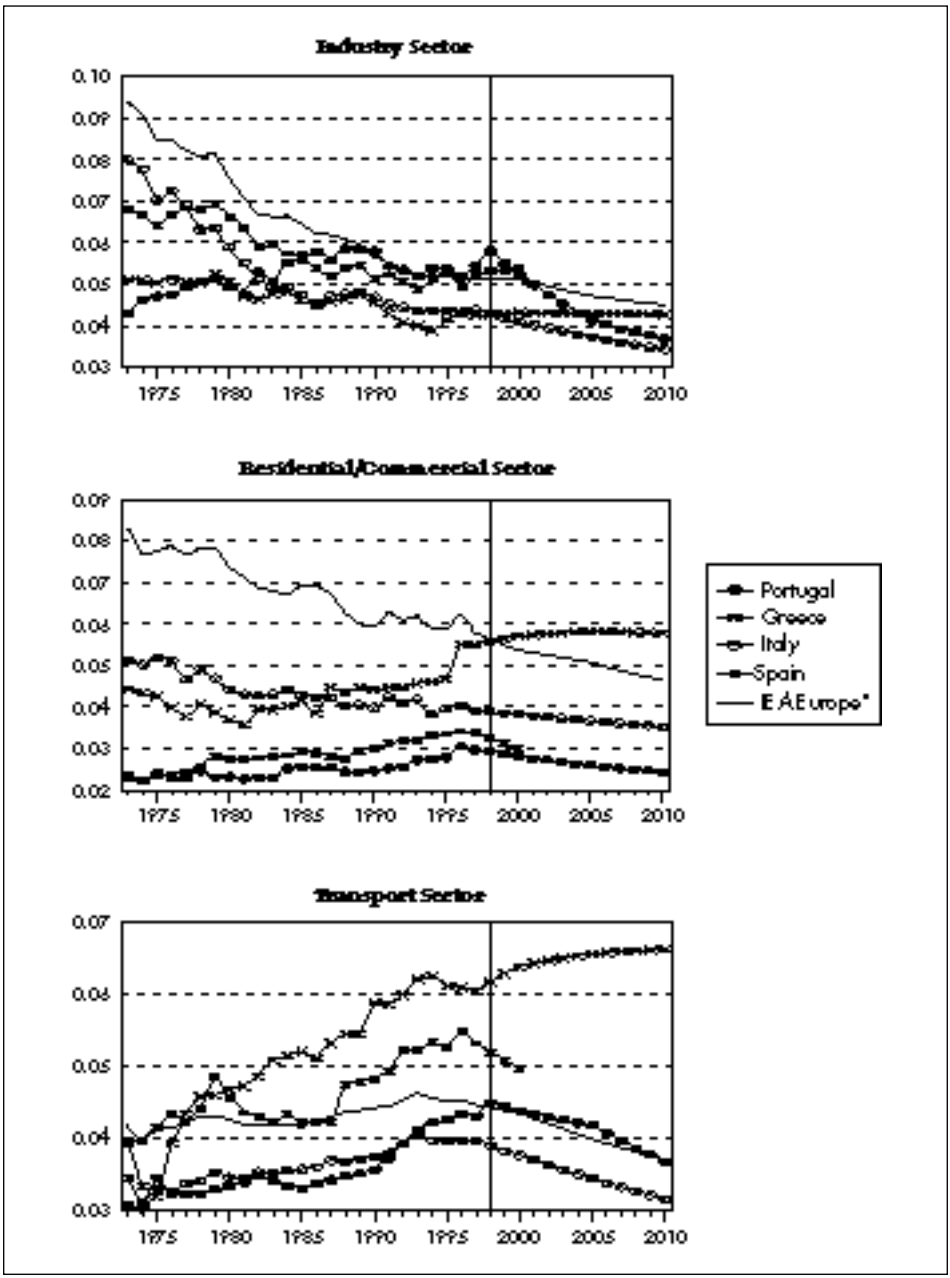
* Excluding Spain and Norway from 2001-2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris,1999; and country submissions.

Figure 18

Energy Intensity by Sector in Portugal and in Other Selected IEA Countries, 1973-2010

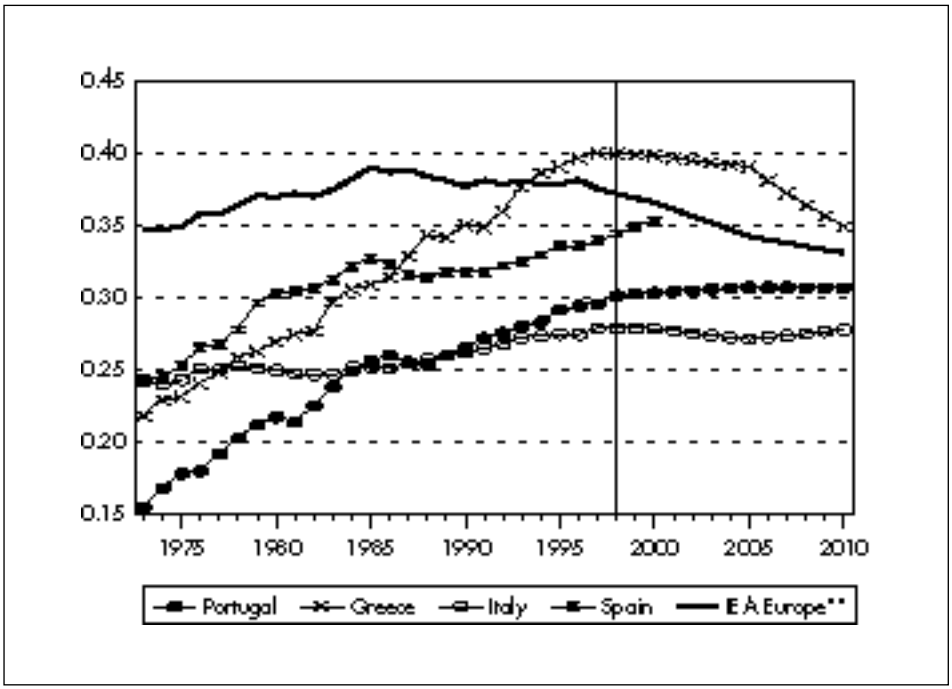
(Toe per thousand US$ at 1990 prices and purchasing power parities)



* Excluding Spain and Norway from 2001 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris,1999; and country submissions.

Figure 19
Electricity Intensity* in Portugal and in Other Selected IEA Countries, 1973-2010



* Calculated as production plus net imports divided by GDP and measured in kWh per dollar of GDP at 1990 prices and purchasing power parities.

** Excluding Norway and Spain from 2001 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris,1999; and country submissions.

ENERGY EFFICIENCY

General Policy

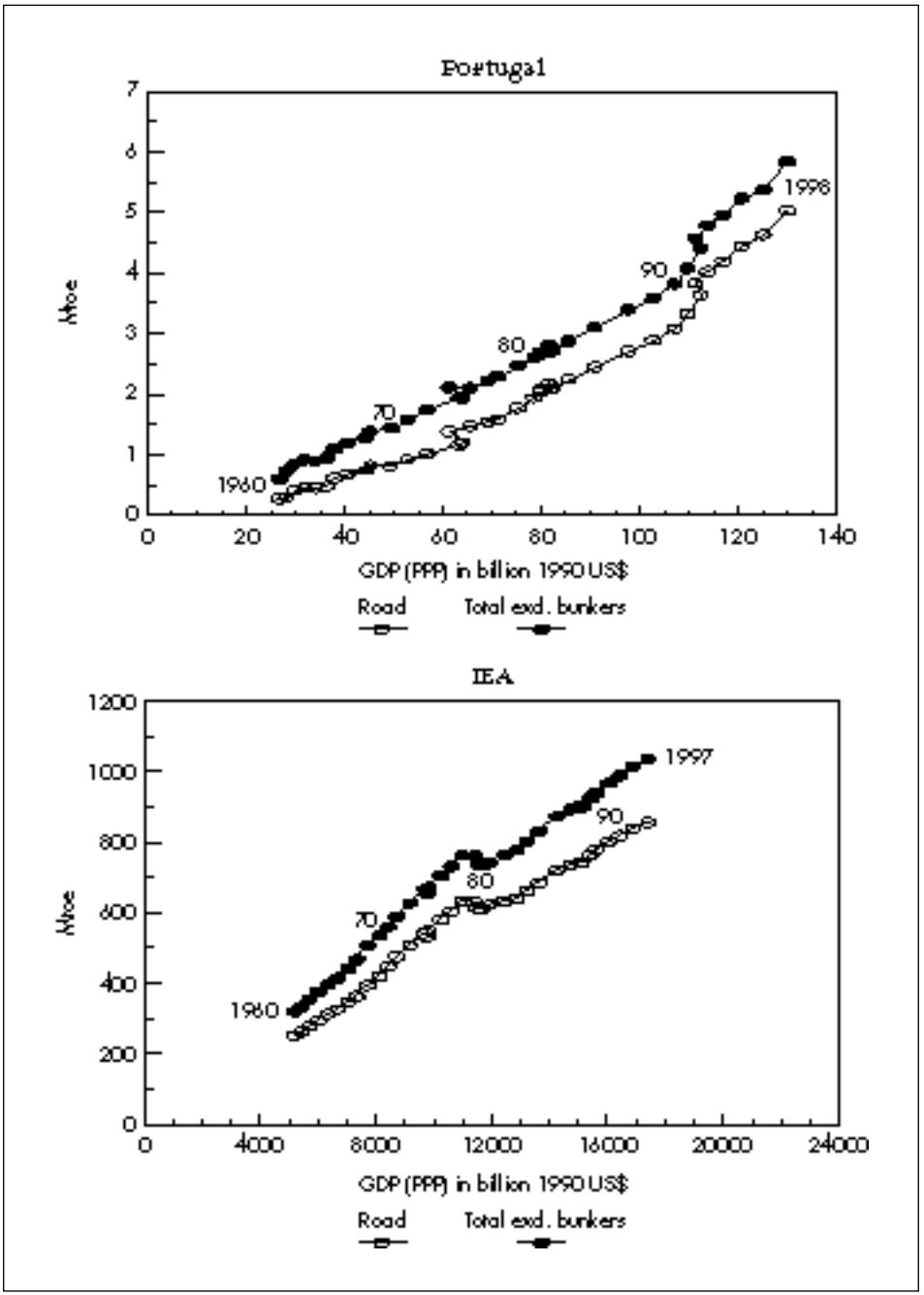
The promotion of energy efficiency is one of the goals of the 1994 Energy Programme (see Chapter 3). Energy efficiency programmes are financed through SIURE (Incentive System for the Rational Use of Energy)[11]. SIURE was established in 1988 and was included in the 1994 Energy Programme.

SIURE provides grants for energy audits in the commercial and transportation sectors,energy research and feasibility studies,and investments in energy efficiency. It excludes the household sector. Around 60% of funding for energy efficiency has

11. SIURE is the national system of assistance for energy projects including energy efficiency. (For the promotion of natural gas and renewable energy, see Chapters 6 and 8.)

Figure 20

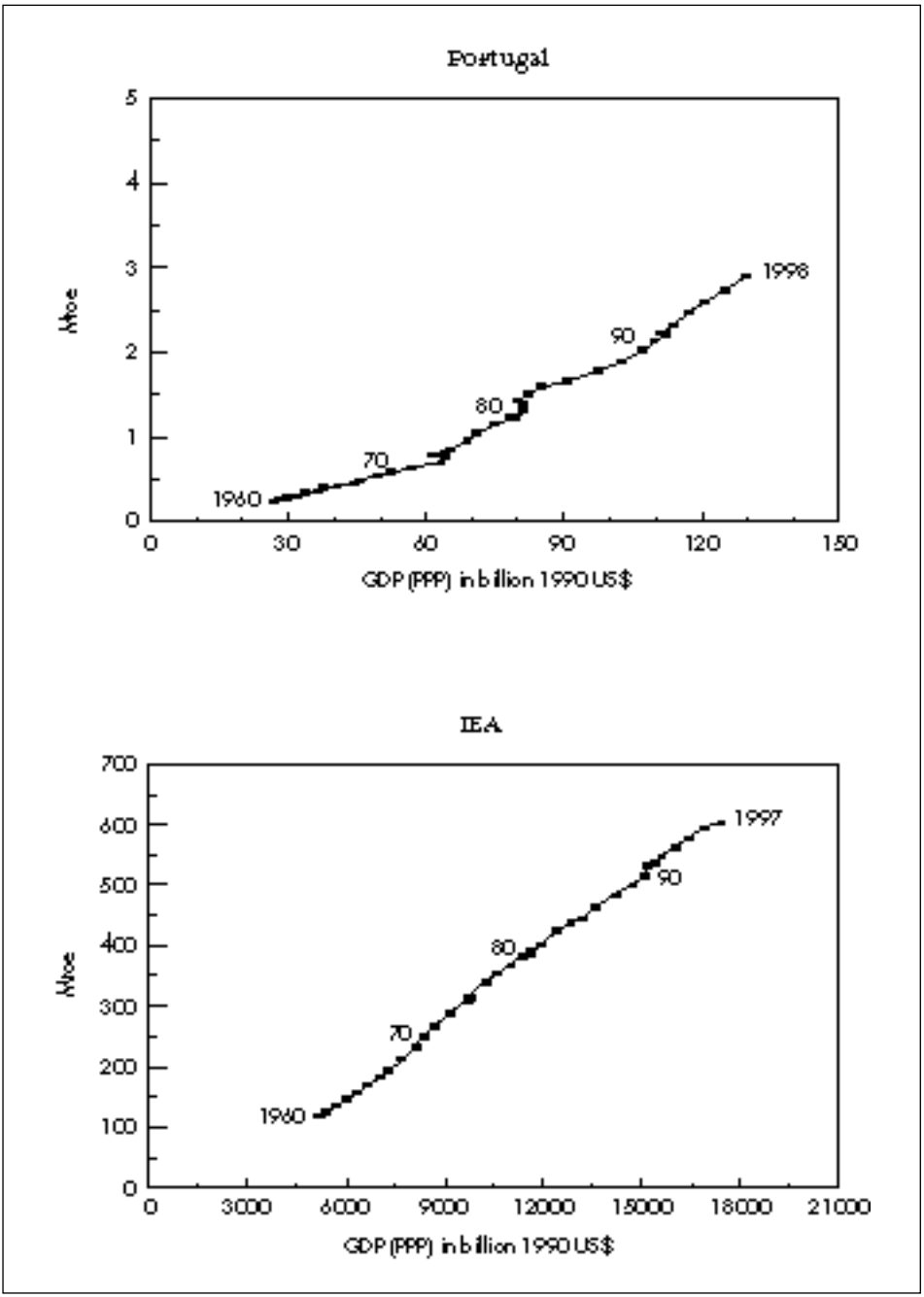
Energy Consumption in the Transport Sector, Excluding Electricity, and GDP (PPP) in Portugal and IEA Countries, 1960-1998



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1999.

Figure 21

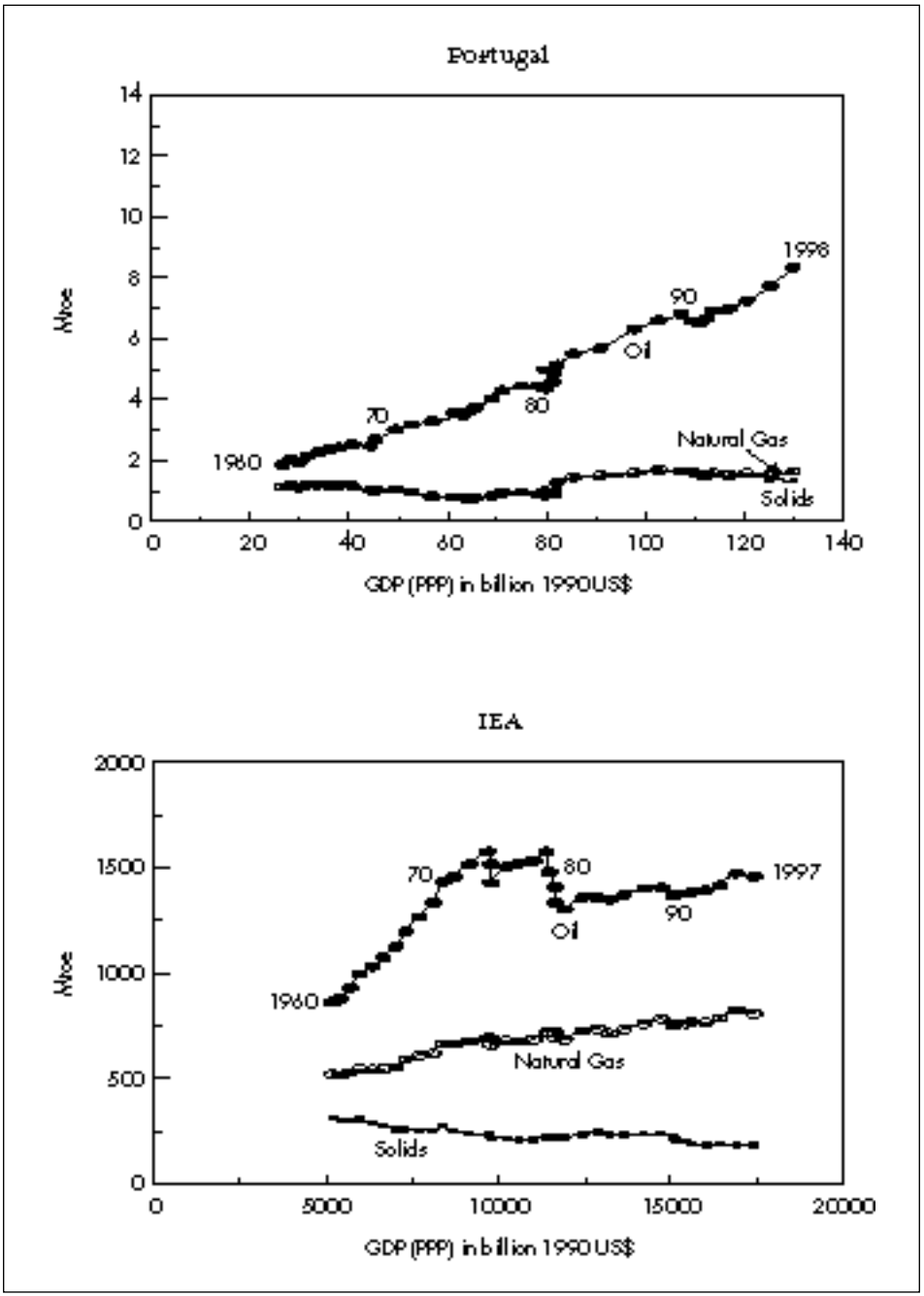
Electricity Consumption and GDP (PPP) in Portugal and IEA Countries, 1960-1998



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and *National Accounts of OECD Countries*, OECD Paris,1999.

Figure 22

Stationary Fossil Fuel Use and GDP (PPP) in Portugal and IEA Countries, 1960-1998



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and *National Accounts of OECD Countries*, OECD Paris,1999.

been dedicated to co-generation projects (see Chapter 7 for detailed information). From 1994 to 1999, the amount of public funding awarded to energy efficiency projects was more than PTE 10 billion, i.e. around ECU 53 million (Table 4). The government contributed 25% of total public funding and FEDER contributed 75%. State and EU funding have been increasing over the years. Private funding for these projects amounted to more than PTE 48 billion.

Table 4
Public and Private Funding for Energy Efficiency, 1994-1999
(ECU and PTE million)

	*European Union**		*Portuguese Public***		*Total Public*		*Private Sector*	
	ECU	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*
1994	1.00	201.3	0.34	67.1	1.35	268.4	9.43	1,874.9
1995	3.71	720.7	1.24	240.2	4.95	961	21.87	4,244.4
1996	6.30	1,223.8	2.10	407.9	8.41	1,631.8	39.44	7,654.9
1997	7.89	1,568.8	2.63	522.9	10.52	2,091.8	51.64	10,271.9
1998	9.33	1,870.6	3.11	623.7	12.44	2,494.4	62.21	12,471.8
1999	11.48	2,301.1	3.83	767.4	15.31	3,068.5	61.22	12,273.9
Total	**39.73**	**7,886.3**	**13.25**	**2,629.2**	**52.97**	**10,515.9**	**245.81**	**48,791.8**

* FEDER funds.

** State and public enterprises.

Source: Ministry of Economy.

Energy efficiency programmes are evaluated when the funds are granted by the General Department for Energy (DGE),during the programme and afterwards by the DGE and INETI (the research institute - see Chapter 9) on the basis of energy and CO_2 emissions saved.

In designing energy efficiency policies in 1994, the government decided to give greater emphasis to municipalities. For this reason, the government, through the DGE, has designed an action plan,Plano de Acção nos Municipios (PAM), to foster the creation of local energy entities and the implementation of energy policy measures at the local level, using financial support available under the Energy Programme.

The Centro para a Conservação de Energia (CCE) is a private institute owned by public bodies and Portuguese energy companies and staffed by about 40 persons. Its main tasks are to prepare studies on energy efficiency, to carry out energy audits, to prepare studies on standards for electrical appliances and to disseminate information.

Industry

The Management Regulations for Energy Consumption (RGCE) were established under Decree-Law No. 58/82 of February 1982. This regulation establishes goals for energy-intensive companies to progressively reduce their specific energy consumption. In addition, the regulations require companies to audit their energy use twice a decade, to prepare and carry out annual plans for rationalising their energy consumption and to meet their energy savings goals. The regulations oblige the companies to verify the results of the energy savings measures. Industries must comply with these regulations in order to be eligible for funding from the PEDIP programme (see below).

All energy-consuming facilities meeting one or more of the following conditions are covered:

- Industry having an energy consumption of more than 1,000 toe in the last 12 months.
- Industry having equipment with a total nominal power rating of more than 0.3 toe per hour.
- Industry having at least one item of equipment with nominal energy consumption of more than 0.3 toe per hour.

From the beginning of the RGCE to December 1998,493 energy audit reports were submitted to the DGE. The potential of energy savings calculated in those industrial plants that fulfil the requirements represents 113 ktoe,which corresponds to about 3% of their energy consumption.

During 1998,60 energy audit reports for energy efficiency performed in industrial plants were submitted to the DGE. At the beginning of 1999,41 of these audits had been evaluated by the DGE,corresponding to savings of 33 ktoe.

The measures undertaken by industry were mainly improvements in energy management systems, co-generation projects, thermal insulation, heat recovery systems and installation of more efficient equipment. The main industrial sectors covered by RGCE are food and drinks, textiles, wood and cork, pulp and paper, chemistry and cement,ceramics and glass[12].

Information for small and medium enterprises is provided mainly through seminars, conferences and a Web site.

Transport

Until 1998, SIURE funds allocated for energy diversification and energy savings in transport amounted to PTE 5.2 million. Funds were mostly granted for information systems to improve the mobility of transportation of captive fleets.

12. The energy industry is not included.

In 1998,the government announced a three-year investment plan of PTE600 million aiming at the electrification of all international railway lines and the development of a new high-speed link between Lisbon and Porto. Public investment in transport has increased in the Lisbon metropolitan area,which accounts for roughly 20% of the Portuguese population. The underground system doubled its length in 1999, with improved links to the railway and bus networks. In Porto, a metropolitan railway system is scheduled to start operating by 2001.

Residential

Regulations on the Characteristics of the Thermal Behaviour of Buildings (RCCTE) were published in Decree-Law No. 40/90 of 1990 and came into force in January 1991. These regulations aim at improving thermal comfort in buildings and quantifying the needs of buildings in terms of energy and consumption. A revision of this regulation is already in preparation to strengthen the energy standards. The government is also preparing specific legislation for a voluntary classification of new buildings according to their energy performance. A study was begun in 1999 to define the type of certification to be attributed to buildings and to establish standards for tests and methodologies to assess energy efficiency in buildings.

The government has decided that public buildings should have an energy audit in the design phase. Funds from the National Energy Programme are granted for the construction and retrofitting of non-residential buildings on the condition that their energy efficiency is 30% higher than required by Laws 40/90 and 118/98.

The Regulation on the Energy Systems for Air Conditioning of Buildings (RSECE) was set by Decree-Law No. 118/98 of 1998. This regulation establishes the rules to be used in calculating the size of energy systems for air conditioning in order to achieve higher energy efficiency ratios.

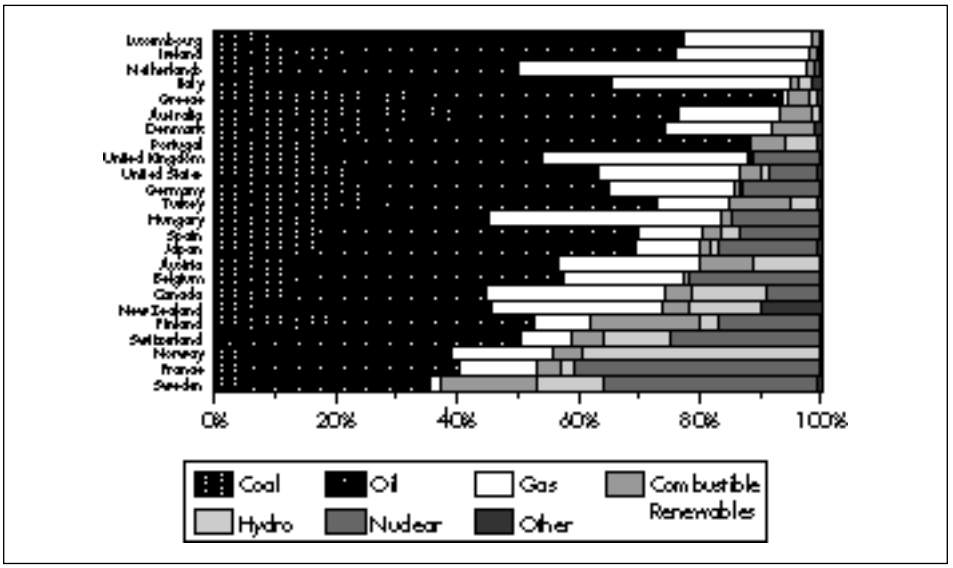
Efficiency labelling has been implemented for refrigerators (1994), washing machines (1996), washer-dryers (1996),dryers (1997) and dishwashers (1999). The EU directive on energy efficiency standards for refrigerators and freezers was adopted in 1994. Since 1996, a Decree on "Minimum Efficiency for Heating Boilers", which sets minimum efficiency requirements for hot water boilers, has been in force.

ENVIRONMENT POLICY

Trends in CO_2 Emissions

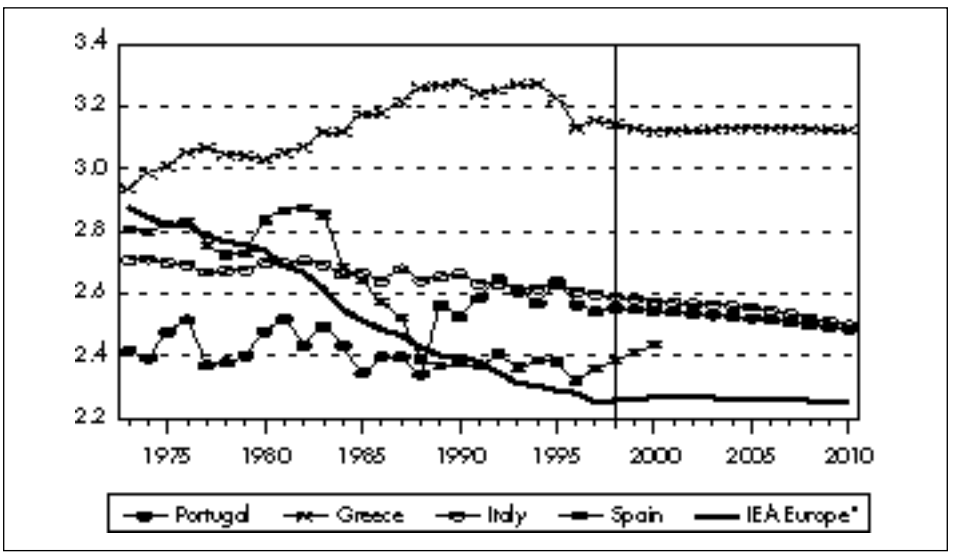
Portugal's energy mix includes a large proportion of fossil fuels in energy supply (Figure 23). The carbon content of Portugal's energy supply increased rapidly at the end of the 1980s, mostly because of the commissioning of the Sines coal-fired power plant, and then stabilised (Figure 24), while the carbon content decreased overall in IEA Europe to a lower level than in Portugal.

Figure 23
Total Primary Energy Supply in IEA Countries, 1997
(%)



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999.

Figure 24
Energy-related CO_2 Emissions per TPES in Portugal and Other Selected IEA Countries, 1973-2010
(tonnes of CO_2)



* Excluding Spain and Norway from 2001-2010.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submissions.

In 1998, oil was the major emitter of CO_2, followed by coal (Figure 25). Consumption of both has increased in the past two decades. The transport sector is the major contributor to the country's CO_2 emissions from energy, followed by the electricity sector.

Energy-related CO_2 emissions per GDP increased until the beginning of the 1990s and then stabilised at a lower level than the IEA average (Figure 26).

The end result, according to IEA statistics, is that Portugal's energy-related CO_2 emissions were 55.8 Mt in 1998, 34.5% above 1990 levels.

According to IEA calculations based on energy supply forecasts by the Ministry of Economy, energy-related emissions are expected to increase 51% between 1990 and 2010, reaching 62.6 Mt in 2010[13]. Energy-related CO_2 emissions per TPES as well as CO_2 emissions per GDP are expected to decline with the increased use of natural gas.

Portugal's 1994 Energy Plan had forecast a 30 to 40% growth in energy-related CO_2 emissions between 1990 and 2000. These forecasts took into account the measures included in the national plan and in particular those to improve energy efficiency and to introduce natural gas. In Portugal's second report to the FCCC (1997), CO_2 emissions were forecast to increase 69% between 1990 and 2010, reaching 74.9 Mt in 2010. Energy-related CO_2 emissions would increase 68% to 62.5 Mt.

Portugal has undertaken a study to improve the estimates of GHG emissions since 1990. The report is expected to be available in mid-2000.

Greenhouse Gas Emissions Policy

Portugal ratified the UN Framework Convention on Climate Change on 21 December 1993 and submitted its first national report to the UN FCCC on January 1995. Portugal's second national communication, entitled "Segundo relatório de Portugal", was released in November 1997.

Under the terms of a European Union allocation agreement, Portugal may fulfil its Kyoto commitments by limiting its increase of greenhouse gas emissions to 27% above 1990 levels over the period 2008-2010. The EU's overall commitment is a reduction of 8% below 1990 levels over the same period. A plan including measures to reach the Kyoto target is under preparation.

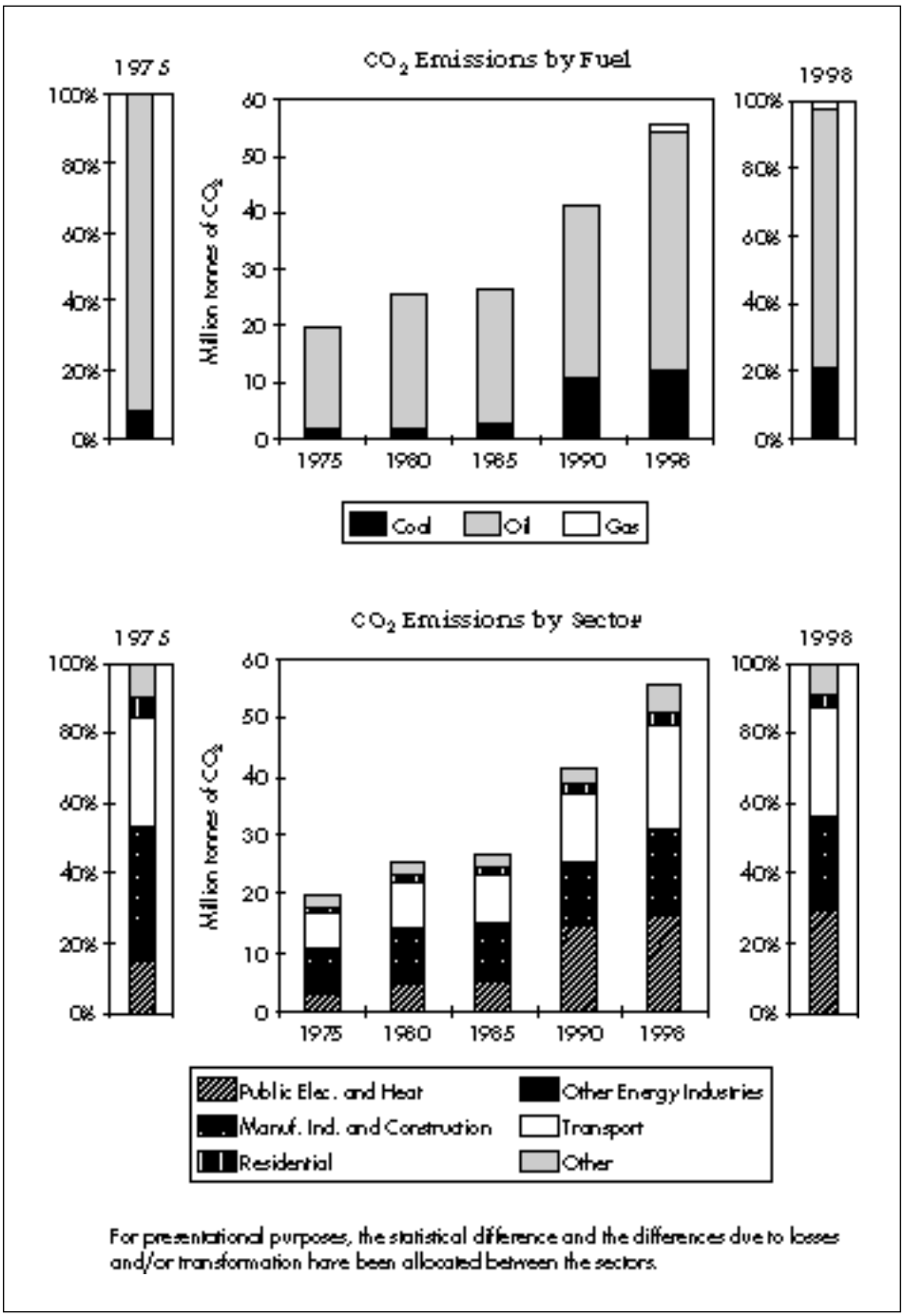
Other Pollutant Emissions

The "Programa Nacional de Redução de Emissões" of 1996 set global annual ceilings for large combustion plants (Table 5). SO_2 emissions are required to decrease from

13. When including emissions from bunkers, the increase between 1990 and 2010 would be 54%, reaching 66.9 Mt.

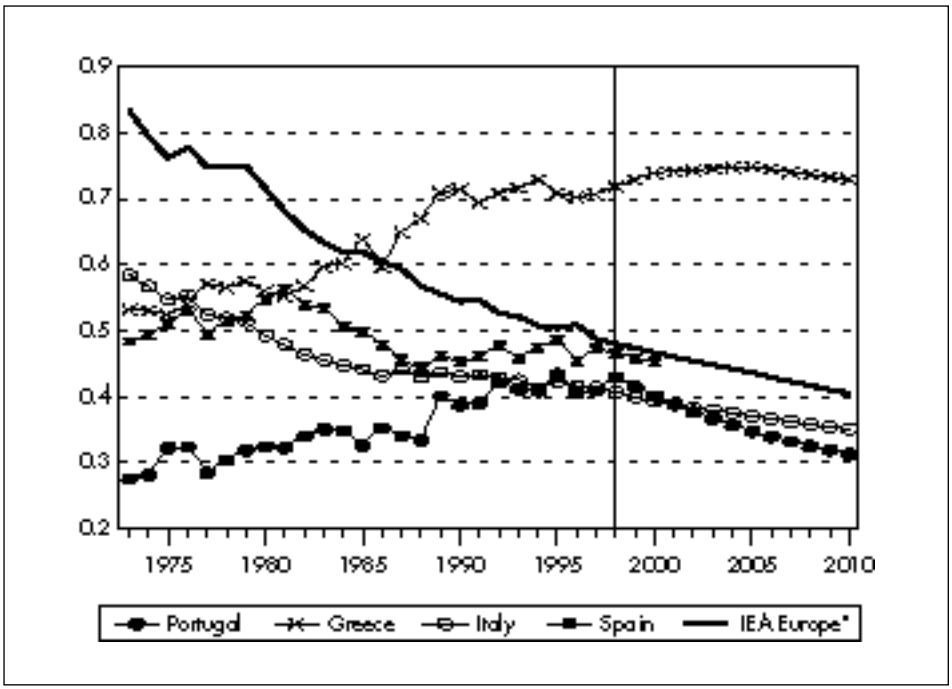
Figure 25

Energy-related CO_2 Emissions by Fuel and by Sector, 1975-1998



Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris,1999.

Figure 26
Energy-related CO_2 Emissions per GDP (PPP) in Portugal and in Other Selected IEA Countries, 1973-2010
(kilogrammes CO_2 /US$ using 1990 prices and purchasing power parities)



* Excluding Spain and Norway from 2001-2010.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris,1999; and country submissions.

232 kt in 1993 to 204 kt in 2003. Industries have to maintain their 1996 level of NO_x emissions in 1998.

Urban ozone levels are monitored. Legislation has been passed to increase the number of urban polluters being monitored and to allow municipalities to take measures to reduce pollution in co-ordination with the Ministry of the Environment. This legislation is expected to be enforced in 2000. Mandatory periodic inspections of cars aim to reduce the environmental impact of private transport.

Sales of leaded gasoline ceased in June 1999. The EU Commission granted a one-year derogation for the new sulphur content standard in diesel (until 2001) and a two-year derogation (until 2002) for gasoline.

The PEDIP II programme (Strategic Programme for the Development of Portuguese Industry) ran from 1994 to the end of 1999 and succeeded the previous PEDIP (1988 to 1992). The latter was initiated in the context of Portugal's accession to the European Union and received EU funding to modernise Portugal's industry and

Table 5
SO_2 and NO_x Emissions Limitation Requirements by Sector
(1,000 tonnes)

	1996		*1998*		*2000*	*2003*
	SO_2	*NO_x*	*SO_2*	*NO_x*	*SO_2*	*SO_2*
Electricity	218.0	54.5	219.0	54.5	190.0	165.0
Refining	30.5	4.3	30.5	4.3	26.0	22.0
Paper and Pulp	10.0	3.6	10.0	3.6	9.5	9.0
Petrochemical	7.2	0.9	7.2	0.9	6.2	6.2
Iron and Steel	2.3	0.4	2.3	0.4	2.3	1.8
Total	**268.0**	**63.7**	**269.0**	**63.7**	**234.0**	**204.0**

Source: Ministry of the Environment.

improve its environmental performance. PEDIP was complemented by the following programmes targeting different sectors:

- Energy audits and studies on more efficient use of energy, and advertising campaigns.

- Measures to demonstrate the technical viability of the implementation of the monitoring and targeting system of PEDIP.

- Energy managers' training to improve skills in energy management of human resources.

PEDIP was divided into several sub-programmes. The SINDEPEDIP programme was designed to fund productivity investments in industries and investments related to protection of the environment. Grants and zero-interest loans funded the following schemes:

- Finance studies and audits to support industrial management strategies, particularly in the areas of environmental protection and energy management.

- Support for integrated investment projects in various functional areas of a company. These projects may include environmental investments encouraging the use of cleaner production technologies, as well as investments in energy rationalisation.

- Support for the purchase of equipment and the implementation of suitable technologies to protect the environment and improve working conditions.

- Support for demonstration activities in areas having an effect on the competitiveness of companies, such as the rational use of energy and protection of the environment.

To be eligible for SINDEPEDIP loans and grants, enterprises need to comply with Decree Law 58/82[14]. Enterprises that received the funds had to report every six months on progress made, particularly on the evolution of specific energy consumption.

At the beginning of 2000, there were discussions about the follow-up to the 1994 Energy Programme and PEDIP. Only continuing projects are to be funded. The government plans to increase funding for energy efficiency in the new Energy Programme.

CRITIQUE

Energy consumption in Portugal has been increasing more rapidly than economic growth,leading to a rapid increase in energy intensity. However, growth in energy intensity has slowed down since the beginning of the 1990s. The government expects energy intensity to start falling soon,a change from the past trend. Further efforts in energy efficiency policy would help meet this objective.

Because of the high carbon content of energy, energy efficiency measures can have a significant impact on reducing CO_2 emissions from energy. The introduction of natural gas and the partial substitution of natural gas for oil products are also expected to slow the growth in CO_2 emissions. Nevertheless, energy-related CO_2 emissions are still expected to increase quickly and new measures would help Portugal meet its challenging greenhouse gas emission limitation obligations. In this context, the government rightly decided to prepare a report evaluating GHG trends and to issue a plan for reducing GHG emissions.

The 1994 Energy Programme and the PEDIP programme formally ended at the end of 1999, and it should be ensured that enough funding is available for the new programmes. In designing new programmes, the government should continue to carefully assess the cost-effectiveness of measures already taken in order to improve the cost-effectiveness of the new projects.

Because energy efficiency policy is relatively recent, it is necessary to strengthen information provided to the public about these measures and their benefits. In industry, information should be targeted at small businesses, for example through industry associations. In addition, information and expertise on available energy efficient technologies could be provided at the local level. This could be achieved *inter alia* by energy service companies,which provide advice to businesses on the most cost-effective ways to save energy. As a first step, this service could be undertaken by "intermediary" service companies (such as installation businesses). In the service sector, a programme to save energy in hotels has been successfully

14. Some other PEDIP programmes have environmental aspects. In these cases,compliance with these regulations is also required.

undertaken on a voluntary basis. The government should further propagate this information and investigate if that success could be replicated by other businesses in the commercial sector.

The government should give special attention to the audits being undertaken on industries' specific energy consumption when assessing the effectiveness of the RGCE projects. This would allow the government to better determine which further actions could be undertaken to help industries achieve greater progress in energy efficiency and to better inform them about possible improvements in energy efficiency. The government could facilitate industry's energy management by designing systems for information exchange and benchmarking, especially in the context of Voluntary Agreements[15].

Fuel use in transport has increased quickly, in pace with the development of road and air transport. In recent years, major investments have been made to modernise road infrastructure, thus facilitating private transport. Therefore, it is important that the government increase investments in railway lines to provide better balance in favour of public transport. In particular, it is important that investments in public transport in the largest towns be enhanced to help mitigate urban air pollution in addition to saving energy. The following are additional measures that would also facilitate energy policy decision-making and contribute to curbing energy consumption in transport:

- Further co-ordination between the Ministry of Social Equipment, in charge of transport,and the Ministry of Economy, in charge of energy.

- Improvement in statistics on the use of public and private transport and on the stock of vehicles to help take cost-effective decisions.

- The implementation of incentives such as appropriate automotive taxes to promote the penetration of vehicles using more efficient technologies and alternative fuels.

Electricity consumption is increasing quickly with the growth in household revenue and the development of the service sector. Electricity consumption for cooling is surging and it is expected that in the near future, consumption will be higher in summer than in winter. Specific attention should therefore be given to cooling appliances. The government should ensure and inform the public that the Regulation on the Energy Systems for Air Conditioning of Buildings (RSECE) will be periodically revised to adapt to new technologies. The government should also contribute to the elaboration of EU regulations on labelling and efficiency standards for these appliances. The government has rightly implemented the EU directives on efficiency standards and labelling of appliances. It should investigate compliance with the directives on labelling, and take appropriate measures in case of low compliance.

15. The term voluntary agreements is used to describe a wide range of industry actions including: industrial covenants,negotiated agreements,self-regulation,codes of conduct and eco-contracts. For more information see *Energy Efficiency Initiative*, IEA/OECD Paris,1997.

Further improvements in energy efficiency in buildings could be achieved with the following measures:

- Building codes in the residential and commercial sector should continue to tighten, as technical improvements become available. These codes need to be effectively implemented and their implementation effectively controlled at local level.

- Most residential buildings were built before the introduction of codes. It is thus important to encourage energy efficiency investments when buildings are retrofitted, for instance through tax rebates.

RECOMMENDATIONS

The Portuguese Government should:

- ☐ Release,as soon as practicable,its report evaluating GHG emission trends so that a comprehensive assessment can be made of how much Portugal must reduce its emissions to meet its climate change commitments under the Kyoto Protocol.

- ☐ Revive its efforts to develop and implement a comprehensive climate change mitigation plan in order to start getting current GHG levels on track to meeting Kyoto commitments.

- ☐ Set up new programmes for energy efficiency in the different sectors, taking into account the results of the assessments of the previous programmes to focus on the most cost-effective measures. Ensure that these programmes are effectively funded.

- ☐ Increase information to energy consumers on energy efficiency measures. Focus on measures to improve energy efficiency in small industries, such as providing information and expertise.

- ☐ Carefully assess the results of the energy audits in industry to improve the effectiveness of energy efficiency measures in this sector.

- ☐ Continue to increase investment in railways and to develop modern public transport in the major towns.

- ☐ Ensure maximum compliance with EU directives on labelling. Ensure that the Regulation on the Energy Systems for Air Conditioning of Buildings is periodically revised to adapt to new technologies. Contribute to the elaboration of EU regulations on labelling and efficiency standards for cooling appliances.

- ☐ Ensure that building codes are periodically revised to take into account technical improvements. Ensure that these codes are effectively implemented and that their implementation is effectively monitored at local level.

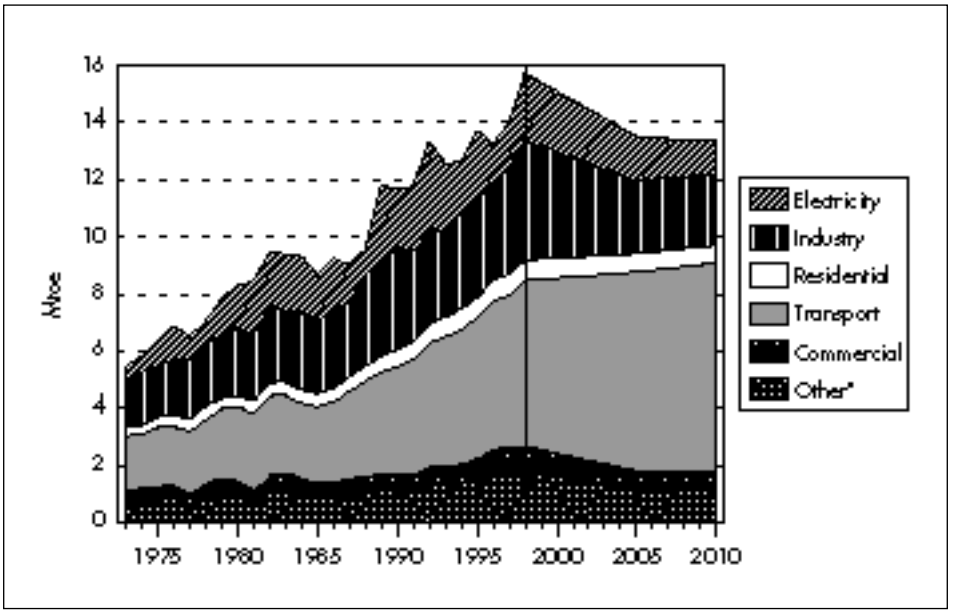
5

OIL

SUPPLY AND CONSUMPTION

Portugal produces no crude oil. Growth in total oil use of 4.3% per year since 1973 (Figure 27) has contributed to increased dependence on imported oil. Oil supply accounted for 15.7 Mtoe in 1998,i.e.72% of Total Primary Energy Supply, although this share has been decreasing since the mid-1980s.

Figure 27
Oil Use by Sector, 1973-2010



* Includes own use in the transformation sector and distribution losses.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Oil is used in electricity generation both as base load power and to compensate for periods of low hydro availability (see Chapter 7). Between 1990 and 1998, an annual average of 2.1 Mtoe of oil was used for electricity generation, with a minimum of 1.3 Mtoe in 1996 and a maximum of 3 Mtoe in 1992. In 1998, oil accounted for more than 27% of electricity generation. Low sulphur fuel oil is used in power generation only in exceptional cases such as dry periods when oil-fired power plants are running at their maximum capacity. For the rest of the time,only high sulphur fuel oil is used.

The largest increase in oil use has been in the transport sector, where it reached 5.8 Mtoe in 1998,i.e.46.3% of oil final consumption. This is mainly due to the rapid

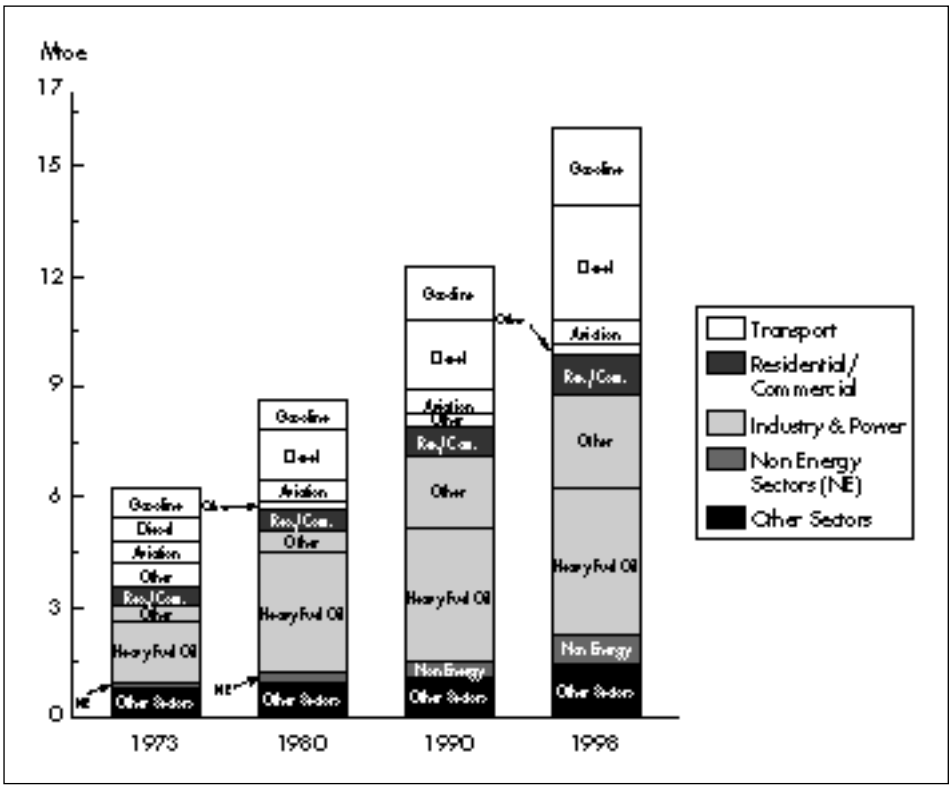
increase in air transport, in car and truck traffic and to the development of road infrastructure (see Chapter 3).

Oil consumption in industry was 5.1 Mtoe (a 4.2% increase per year between 1973 and 1998) and accounted for 40.5% of oil final consumption. Oil use in the residential/ commercial sector increased 2.6% per year between 1973 and 1998, reaching 1.6 Mtoe in 1998,i.e.13.1% of oil final consumption. In 1998,oil had the largest share in both sectors.

Figure 28 indicates the following trends for the main oil products:

- Gasoline consumption in road transport increased 48% between 1990 and 1998 to 2.2 Mtoe and automotive diesel consumption increased 58% to 3.1 Mtoe[16]. In 1998, the share of unleaded gasoline in total gasoline consumption was 54%. However, according to the government,some drivers use leaded gasoline while

Figure 28
Oil Products Consumption, 1973-1998



Source: *Energy Balances of OECD Countries,* IEA/OECD Paris,1999.

16. This figure does not include diesel use for transport in industry and in the service sector.

they could use unleaded. Only 15 to 20% of the car fleet can use only leaded gasoline. In June 1999, the government abolished the sale of leaded gasoline, which was replaced by unleaded gasoline with a special additive.

- Heavy fuel oil (HFO) is the main fuel consumed in the industry sector. In 1998, 69% of HFO consumption in industry was high sulphur heavy fuel oil. When industries need heavy fuel oil with low viscosity, they use a mix of middle distillates and heavy fuel oil (called "thin fuel oil"), which is included under HFO in IEA's statistics. In 1998, consumption of HFO and thin fuel oil in industry was 3.9 Mtoe.

- Because of the mild climate,little energy is used for heating purposes. Buildings are heated with electricity and liquefied petroleum gas (LPG). In 1998, LPG consumption was 0.8 Mtoe in the residential/commercial sector and 0.4 Mtoe in industry. LPG use in road transport is very slight. No use of electricity for cars is recorded.

- Owing to the use of LPG and "thin fuel oil"in industry and LPG in the residential/commercial sector, no light fuel oil is consumed in Portugal.

FOREIGN TRADE

The share of the Middle East in crude oil imports (52% of the total in 1998) has been increasing at the expense of Africa (Table 6). In 1998,Saudi Arabia was the largest supplier, with a share of 20.4%, followed by Iran (18.3%).

Table 6
Oil Trade, 1995-1998
(Mt)

	1995	*1996*	*1997*	*1998*
Crude Oil Imports	**12.9**	**11.4**	**12.7**	**13.3**
Middle East	5.3	4.4	4.5	7.0
Africa	5.3	5.3	4.2	2.6
Other	2.3	1.7	4.0	3.7
Oil Products Imports	**4.3**	**3.6**	**3.2**	**4.1**
HFO	1.9	1.2	0.8	1.5
LPG	0.6	0.8	0.8	0.7
Other*	1.8	1.6	1.6	1.9
Oil Products Exports	**3.7**	**2.4**	**2.1**	**1.9**
Gasoline	0.9	0.7	0.9	0.8
Other	2.8	1.7	1.2	1.1

* Mostly petroleum coke and naphtha.
Source: *Oil Information*, IEA 1999.

Portugal is a net importer of oil products. Heavy fuel oil accounts for the largest share of imported products,mostly from Spain and the United Kingdom, followed by LPG, mostly from the United Kingdom. Oil products exports are decreasing. Gasoline is the main fuel exported,mostly to the United States.

FORECASTS

According to Ministry of Economy forecasts, natural gas is expected to substitute progressively for oil in electricity generation, in industry and in the residential/ commercial sector. Total oil use is therefore expected to be 13.4 Mtoe in 2010 despite a continued rapid increase in oil use in the transport sector, where it is expected to account for 54.7% of total oil use in 2010.

Oil's share in total energy use is expected to be reduced to 53% by 2010 and net oil imports,which amounted to 80% of total net energy imports in 1998,are expected to decrease to 59% in 2010.

INDUSTRY STRUCTURE

Petrogal

In 1999, the Portuguese oil sector was dominated by Petrogal (Petróleos de Portugal S.A.). The government started to privatise the national oil company in 1992 with the sale of a 25% stake to Petrocontrol, a consortium comprised in 1999 of Finpetro (a group of Portuguese industries and banks), 98.8%, and M. Bullosa (a private shareholder),1.2%. In June 1995, Petrocontrol increased its share in Petrogal to 45%, thus reducing the share of the state to 55%. In June 1997, the government reached an agreement with Saudi Aramco for the acquisition by the Saudi national oil company of 27.5% of Petrogal. However, in September 1997, Saudi Aramco decided to pull out of the deal.

On 22 April 1999, Decree Law No. 137-A/99 created the holding company "Petróleos e Gás de Portugal, SPGS, S.A. (GALP – see Chapter 3). This holding company groups the shares of the state in Petrogal, Gás de Portugal and Transgás. GALP is responsible for the operation and management of the Portuguese oil and gas industries. When created, GALP was 60.56% owned by the state, 33.34% by Petrocontrol,3.27% by EDP, 2.75% by the Caixa Geral de Depósitos (CGD),0.04% by Portgás and 0.04% by Setgás. In January 2000, ENI, the Italian oil and gas group, acquired 33.3% of GALP, i.e. 11% from the Portuguese state and 22.3% from Petrocontrol. Petrocontrol sold its remaining 11% shares to Electricidade de Portugal and Iberdrola, a Spanish utility, bought 4% of GALP from the state. The CGD increased its share in GALP to 13.5%.

In 1999, Petrogal directly and together with its associates operated its own downstream sector in Portugal (refining and distribution) and in Spain (distribution) and held more than 40 companies, the major ones being involved in marine

transport, marketing, pipelines and storage activities. Petrogal also owned 4.6% of Transgás, the gas transport company, and several stakes in gas distribution companies (see Chapter 6). Upstream activities are concentrated in Angola. Recent operational and financial results are shown in Table 7.

Table 7
Petrogal's Financial and Operational Results, 1996-1998
(PTE billion)

	1996	*1997*	*1998*
Turnover	922.6	918.4	882.4
Net Profits	6.6	18.4	32.5
Number of Employees*	4 607	3 928	4 036

* 31 December.
Source: Petrogal Annual Reports.

Refining, Transport and Storage

Petrogal owns the only two Portuguese refineries (Figure 29):

- The Sines refinery has a capacity of 10.5 Mt per year. A fluid catalytic cracker, a visbreaker and an alkylation unit were commissioned in 1994. A new gasoil/diesel desulphurisation unit was completed in March 1997.

- The Porto refinery has a capacity of 4.7 Mt per year. It comprises a hydro-skimming fuels facility, a lubes plant and an aromatics production facility. A new gasoil/diesel desulphurisation unit was completed at the end of 1997.

- Petrogal's refinery in Lisbon was closed in 1993 and its storage facilities were closed in 1997.

The utilisation rate of refineries, which in 1998 amounted to 90%, is increasing as a result of the rapid growth in domestic consumption of refined products. In addition, domestic production of heavy fuel oil is decreasing, while that of lighter products (gasoline and middle distillates) is rising.

In 1998, after the completion of a study on requirements to adapt the refining system, Petrogal decided to invest PTE 60 to 90 billion over four years. The aim is to comply with the new quality specifications for oil products, in particular concerning the sulphur content of gasoline and diesel[17], to adapt the supply of oil products to the evolution of future demand (mainly to the reduction in heavy fuel

17. The EU Commission granted a one-year derogation from the new sulphur content standard for diesel (until 2001) and a two-year derogation (until 2002) for gasoline.

Figure 29
Map of the Portuguese Oil Sector Facilities

Source: Petrogal.

oil consumption) and to continue to invest in energy efficiency improvements at the Sines refinery.

An oil products pipeline completed in 1997 supplies the Lisbon area with products from the Sines refinery. It is owned by CLC (Companhia Logística de Combustíveis),which in 1999 included Petrogal,65%,BP/Mobil,20%,and Shell,15%.

In 1999,total primary storage capacity was estimated to be 5.7 million cubic metres. Petrogal owns most of the storage facilities. The company negotiates with third parties for the use of its facilities. Some storage facilities, such as at airports, are jointly owned with other companies. Independent storage and terminal facilities have been built on the left bank of the Tejo River near Lisbon.

Distribution

Petrogal was still the major oil products distributor in 1998. Its market share in oil products distribution (with the exception of heavy fuel oil for electricity generation) had been around 75% in the 1980s. Its share decreased to 53.4% in 1995 and 49.7% in 1998. Table 8 shows Petrogal's market share by products in 1995 and 1998. Petrogal's share in LPG, gasoline,diesel, jet fuel and high sulphur heavy fuel oil distribution is on a decreasing trend. Its share in low sulphur heavy fuel oil, marine bunkers and bitumens has increased.

Table 8
Petrogal's Share in Oil Products Distribution, 1995 and 1998
(%)

	1995	*1998*
LPG	48.4	43.7
Gasoline	48.2	44.9
Diesel	48.1	42.5
Jet Fuel	53.3	50.7
Light Fuel Oil*	30.0	25.0
Lubricants	24.2	25.9
Low Sulphur Heavy Fuel Oil (Industry)	78.2	82.6
High Sulphur Heavy Fuel Oil (Industry)	68.5	60.6
Marine Bunkers	74.8	78.1
Bitumens	30.3	40.4
Average	53.4	49.7

* Thin fuel oil for industry (see above).
Source: Petrogal.

In 1998, there were more than 50 oil products distributors in Portugal, but nine alone (Petrogal, Shell, BP, Mobil, Repsol, Cepsa/Elf, Total, Elf[18] and Agip) accounted for more than 98% of total sales.

The regional delegations of the Ministry of Economy grant licences for the opening and operation of service stations. Petrogal owned around 45% of the 2,500 service stations under the brand of GALP. Around two-thirds of service stations are owned by integrated companies which set the selling price. At the end of the 1990s,the number of service stations increased annually by about 15,a much slower rate than at the beginning of the 1990s.

Petrogal's refineries supply approximately 85% of the oil products consumed in Portugal. In 1998, around 4.6 Mt of Petrogal's oil products were sold to other distributors,and the remainder (around 2 Mt) was exported. Petrogal supplies the whole domestic gasoline market: there are no imports of gasoline recorded in Portugal. Petrogal's competitors were the main importers of oil products.

PRICE SETTING

The government abolished the quotas granted to companies for oil products imports and distribution in 1991. Since then, imports have been free,according to EC rules, and subject only to customs declaration and stockholding obligations (see below).

In addition, the government replaced a system of administered prices for oil products with a system of price ceilings which have been progressively lifted[19]. In 1999, price ceilings remained on unleaded gasoline (RON 95) and automotive diesel,including for agricultural use (see box).

Formula for the price ceiling for gasoline RON 95 and automotive diesel

- The weighted average pre-tax price of each fuel in the European Community is converted into national currencies. Up to 1996,the formula included a two-week rolling average in the EU. As of 1996,the rolling average was extended to four weeks.
- Domestic excise taxes are added to the prices.
- An additional margin of PTE 2 per litre is added (PTE 2.5 per litre for diesel used in agriculture).
- The VAT is added to this amount.

18. Total and Elf decided to merge in 1999.
19. Prices of oil products were previously set by the administration. Prices for some fuels were set to compensate for underpricing of other fuels. This cross-subsidisation was undertaken by the Supply Fund,which reported to the Ministry of Finance. Although the Supply Fund was abolished in 1993, this price system had already been abolished in January 1991.

As a result of EU rules on fiscal harmonisation, the Portuguese excise tax changed in 1994. In the previous system, excise taxes varied to compensate for the variations in the pre-tax prices of products. When pre-tax prices increased, the excise tax was reduced and vice versa. Since 1994, excise taxes have been a fixed amount, set by law. However, since 1997, the government has used excise taxes on oil products to reduce pre-tax price variations for gasoline and automotive diesel (see Chapter 3).

EMERGENCY STOCKS AND EMERGENCY RESPONSE MEASURES

Emergency Response Policy

There are no government or agency-owned emergency stocks in Portugal. Instead, the obligation to hold emergency stocks is imposed on oil companies by Law 77/91, which stipulates the following minimum product requirements: 120 days of imports for gasoline,gasoil, kerosene and fuel oils and 90 days for jet fuel and fuel oil for power generation. The same legislation gives the government the power to order the use of reserves in a crisis.

The most recent legislative acts empowering the government to fulfil its IEA obligations are: Law-Decree 77/91, Law-Decree 153/91, and the Council of Ministers Resolution 29/92. These laws define stockholding obligations, the conditions for drawdown of emergency stocks and the structure of the Portuguese National Emergency Sharing Organisation (NESO, see below).

The International Energy Programme (IEP) Agreement was ratified by Parliament and fully integrated into the Portuguese legal system through Law 6/81. IEA Governing Board decisions adopted under the Agreement provisions are equally binding, as are the CERM (Co-ordinated Emergency Response Measures) decision and the 22nd February 1995 decision of the Governing Board. Flexible response and reliance on market mechanisms,which are emphasised in the above-mentioned Governing Board decisions, are reflected in general principles for oil crisis management contained in the NESO Manual.

Since there is no domestic oil production and since participation in foreign oil production is currently very limited,any oil supply disruption would translate into a domestic supply deficit.

For a number of years, Portugal has not maintained the full level of emergency oil stocks to which it is committed. The closure of storage facilities at the Lisbon refinery in mid-1994 resulted in a shortage of oil storage capacity. The Portuguese Government has been strongly encouraged to improve the situation, and several new storage facilities are currently under construction. Moreover a new law that should be adopted before this summer would allow the utilisation of agency stockholding and the storage of emergency stocks abroad consistent with the recent EU stock directive.

Emergency Organisation

The Portuguese NESO, named Organização para Emergência Energética (OEE), was created by Council of Ministers Resolution 29/92 through reorganisation of previously existing structures. OEE comprises:

- Direcção Geral de Energia (DGE, General Department of Energy), the department in the Ministry of Economy mainly responsible for energy policy preparation and implementation.
- Comissão de Planeamento Energético de Emergência (CPEE, Energy Emergencies Planning Board), a small body representing all sectors of the energy industry, which is in charge of emergency planning and preparation.
- Conselho Nacional de Emergência Energética (CNEE, National Council for Energy Emergency),a council of energy operators and consumers which may be called upon by the Director General for Energy in the event of a crisis. It is a consultative body without any executive powers.

In an emergency, OEE will assume the role and functional structure of NESO. It will be staffed with DGE officials who are familiar with the specific needs of their area of responsibility, and supported by CPEE in planning activities. This will guarantee efficient operation of the crisis management structure. OEE participates through CPEE in Conselho Nacional de Planeamento Civil de Emergência (CNPCE), which is headed by the Minister of Defence. CNPCE comprises administration, army representatives, and the chairmen of all sectoral emergency organisations. OEE may be activated at the discretion of the government, or according to international obligations (i.e. the IEP Agreement and European Union directives for oil emergencies).

Allocation Procedures

In a crisis, oil companies would be encouraged by the Administration to participate in the international reallocation of oil in order to comply with the provisions of the IEP.

CRITIQUE

In the early 1990s, the Portuguese oil sector experienced major changes: oil consumption was growing rapidly and the government introduced competition over a short time frame in parallel with the partial privatisation of Petrogal. Existing price ceilings were progressively lifted on some oil products, but have been maintained on gasoline and automotive diesel. Petrogal started to lose market shares and the number of its competitors increased. However, the opening of competition and Petrogal's partial privatisation helped the company to strengthen its commercial performance and improve its competitiveness.

The Portuguese oil sector will continue to experience important changes. Oil use is expected to decrease. The introduction of natural gas will reduce heavy fuel oil and

LPG consumption, but gasoline and automotive diesel consumption are expected to continue increasing. This will oblige the refining company to continue to restructure its product mix in a context of increasing competition. An efficient refining industry is important for Portugal's oil supply. Petrogal has undertaken an investment programme to meet quality standard requirements and the government should ensure that there are no unnecessary impediments to these downstream investments.

The government should continue to ensure that competition works effectively in the oil market and continue to protect consumers against unjustified price rises. Jurisdictional authorities should be encouraged to ensure that there is no abuse of dominant position. There should be no barriers to entry for Petrogal's competitors and, in particular, no unnecessary impediment to the opening of service stations. Drawing on other countries' experience, the government could consider issuing regulations allowing for the use of unused oil storage facilities.

Production from Petrogal's refineries should continue to compete with imported products on a level playing field. There should be no unnecessary impediment to the use of import facilities and Petrogal should be free of political interference in its corporate strategy, investment decisions and daily management. After Petrogal's merger into GALP, legal unbundling of its different activities, and particularly of oil and gas activities, would allow oil companies to compete more fairly (see Chapter 3).

Price ceilings set by the government were aimed at protecting consumers from possible abuses by distributors and at controlling the final prices to consumers. The government rightly abolished these price ceilings progressively as competition developed in most product markets but maintained them on gasoline and automotive diesel. Petrogal's share in gasoline and automotive diesel has also decreased and, in 1998, was lower than its share of some other products where price ceilings were removed. Imports of gasoline and automotive diesel are unrestricted. Thus,there is no economic rationale for maintaining price ceilings on these two products.

The removal of such ceilings would also give companies more freedom in setting market-based prices. Companies may be impeded from increasing prices above a ceiling when distribution costs would dictate higher prices,such as in remote areas. In the current situation, companies are not inclined to decrease prices in areas where distribution costs are low, such as in coastal areas.

RECOMMENDATIONS

The Portuguese Government should:

- ☐ Continue to take active steps to enhance competition in the oil sector.
- ☐ Remove remaining price ceilings on oil products as soon as possible.

6

NATURAL GAS

IMPORTS AND SUPPLY

Portugal is not a gas producer. It initiated natural gas imports from Algeria through the Europe-Maghreb pipeline (Figure 30) in February 1997 after the completion of the main lines. The Portuguese connection from Badajoz in Spain to Campo Maior and Leiria in Portugal was completed in 1996 and the southern connection from Leiria to Lisbon and Setúbal in 1997. The northern connection from Leiria to Tuy in Spain was completed in 1998.

Natural gas supply was 0.7 Mtoe (0.8 bcm) in 1998 (Figure 31),most of which was used in the newly built Tapada do Outeiro Combined Cycle Gas Turbine (CCGT[20]). The second largest consumer was industry, mainly the ceramic and glass industries, with 0.2 bcm. The residential/commercial sector consumed 0.1 bcm. According to the company Gás de Portugal (see below), in 1999, total gas supply and gas transported to supply the Spanish region of Galicia amounted to 2.1 bcm. The CCGT Tapada consumed 1.04 bcm, large industries consumed 0.46 bcm and distribution companies distributed 0.22 bcm.

Before the import of natural gas,a town gas system was developed in Lisbon with approximately 230,000 customers and town gas accounted for about 2% of energy consumption in the residential sector. The town gas system is being converted to natural gas and by the end of 1999,approximately 90,000 customers were supplied with natural gas. The aim is to complete the conversion in 2001.

INDUSTRY OWNERSHIP AND ORGANISATION

Gás de Portugal (GDP) is the major gas company in Portugal. GDP was fully state-owned before the government created the company GALP, which includes the oil company Petrogal and GDP, in 1999 (see below).

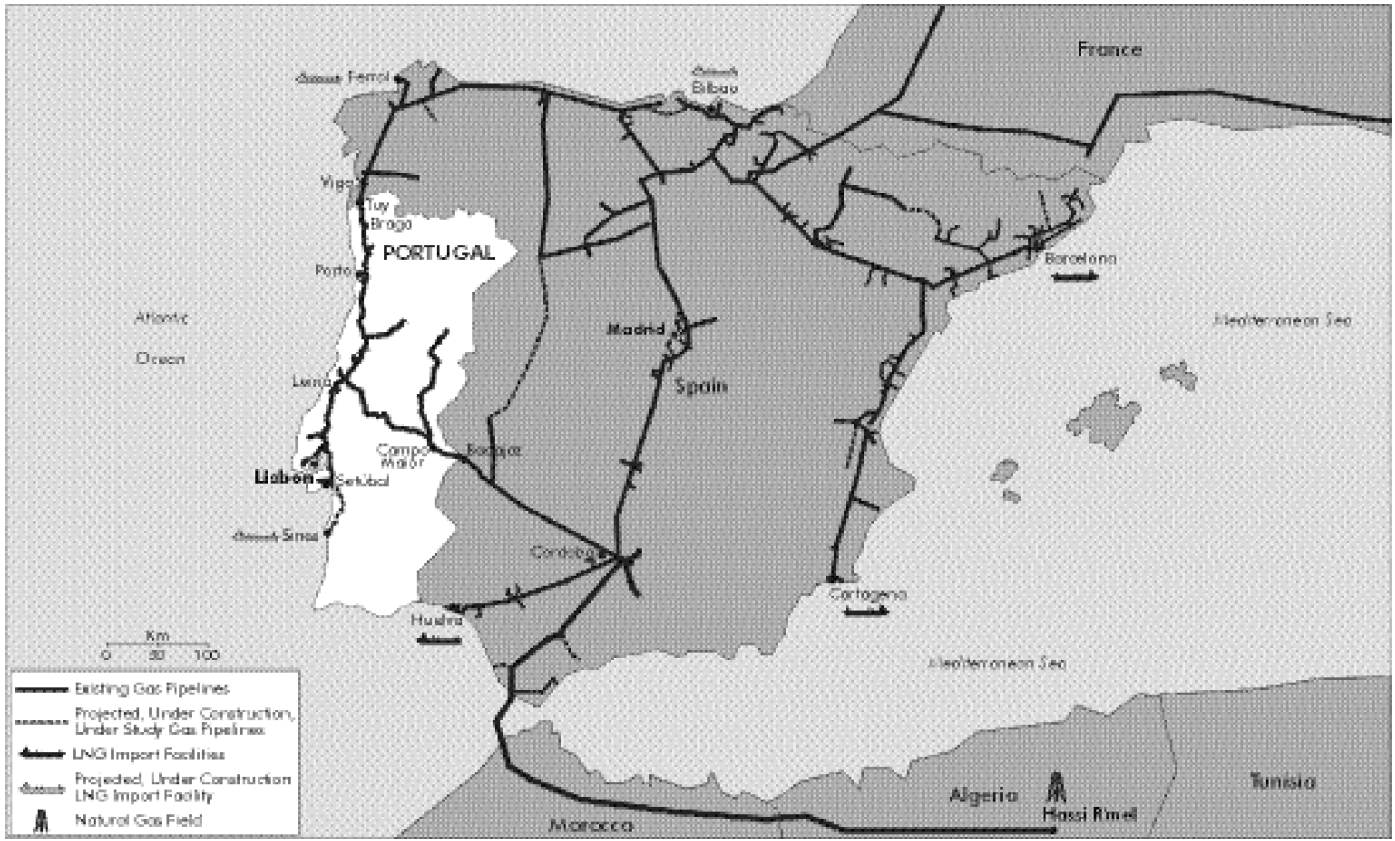
Transport

At the beginning of 2000, Transgás, the company in charge of gas imports, transport and sales to large consumers and distributors, was 95.4% owned by GDP and 4.6% by Petrogás,a subsidiary of Petrogal (Figure 32)[21]. Transgás had a 27.4% stake in the

20. In 1997 and 1998, two of the three groups of the 990 MW plant were commissioned (see Chapter 7).
21. Petrogal bought its share from Caixa Geral de Depósitos (CGD) in 1997. In 1998, 11% of CGD's shareholding in Transgás was transferred to GDP; in return, CGD acquired an equivalent stake in GDP.

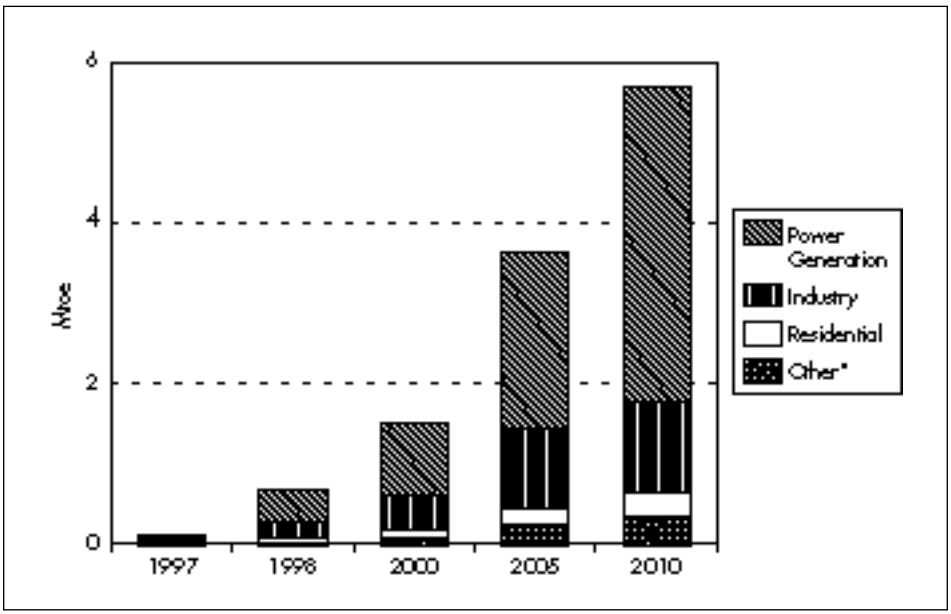
Figure 30

Map of the Iberian Natural Gas Grid



Source: Gás de Portugal.

Figure 31
Natural Gas Use by Sector, 1997-2010



* Includes commercial,public service and agricultural sectors.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999.

Europe-Maghreb Pipeline Company and other shares in companies running gas pipelines connected to Portugal.

Distribution

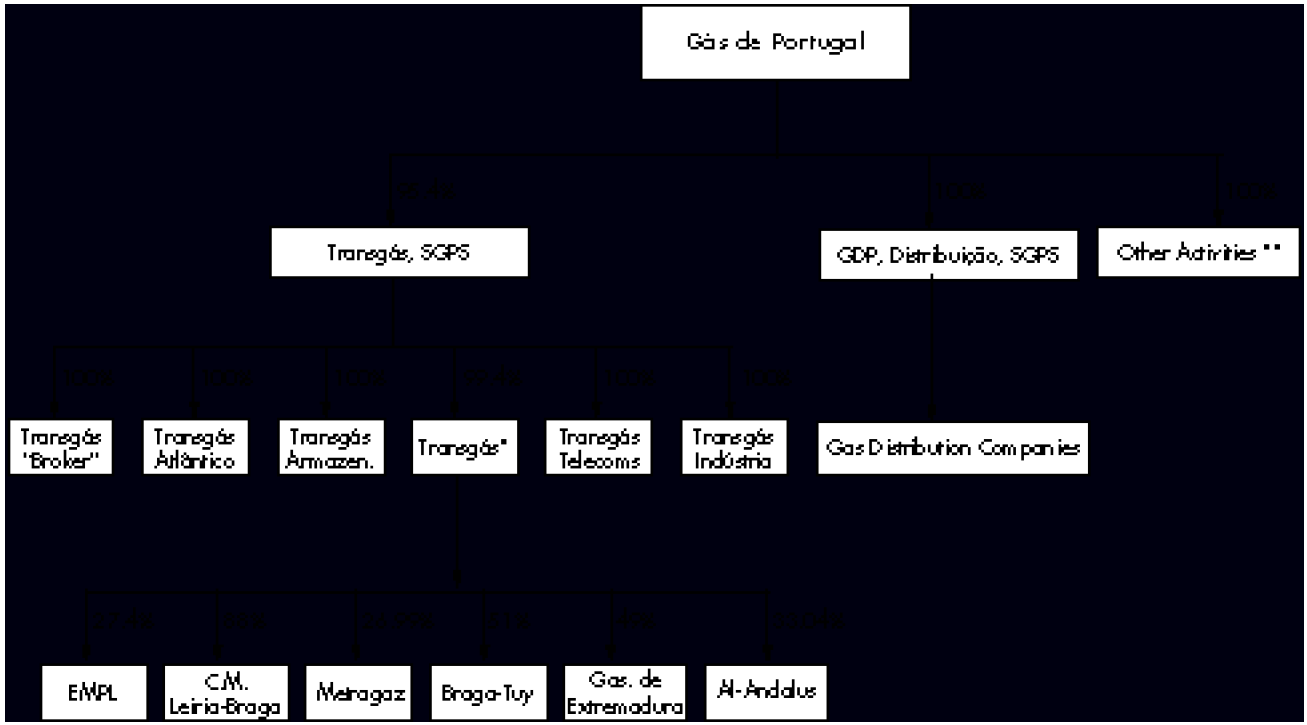
At the beginning of 2000, GDP owned the largest stakes in all the Portuguese distribution companies. Petrogal,through its fully owned subsidiary Petrogás, was the second largest owner (Figure 33)[22]:

- Lisboagás,which was fully owned by GDP, it is the largest Portuguese distributor. In 1998,it supplied 245,000 customers in Lisbon and its surroundings; Lisboagás sales amounted to 11.9% of Portuguese gas supply.

- Portgás was owned 26.4% by GDP, 20.3% by Petrogás, 25% by NQF, 12.7% by Elio and 12.7% by Gaz de France, with the remainder owned by small shareholders. Portgás is in charge of distribution in the northwest of the country and had 30,000 clients in 1998; it distributed 0.9% of Portuguese gas supply.

22. GDP and Petrogás shares will merge.

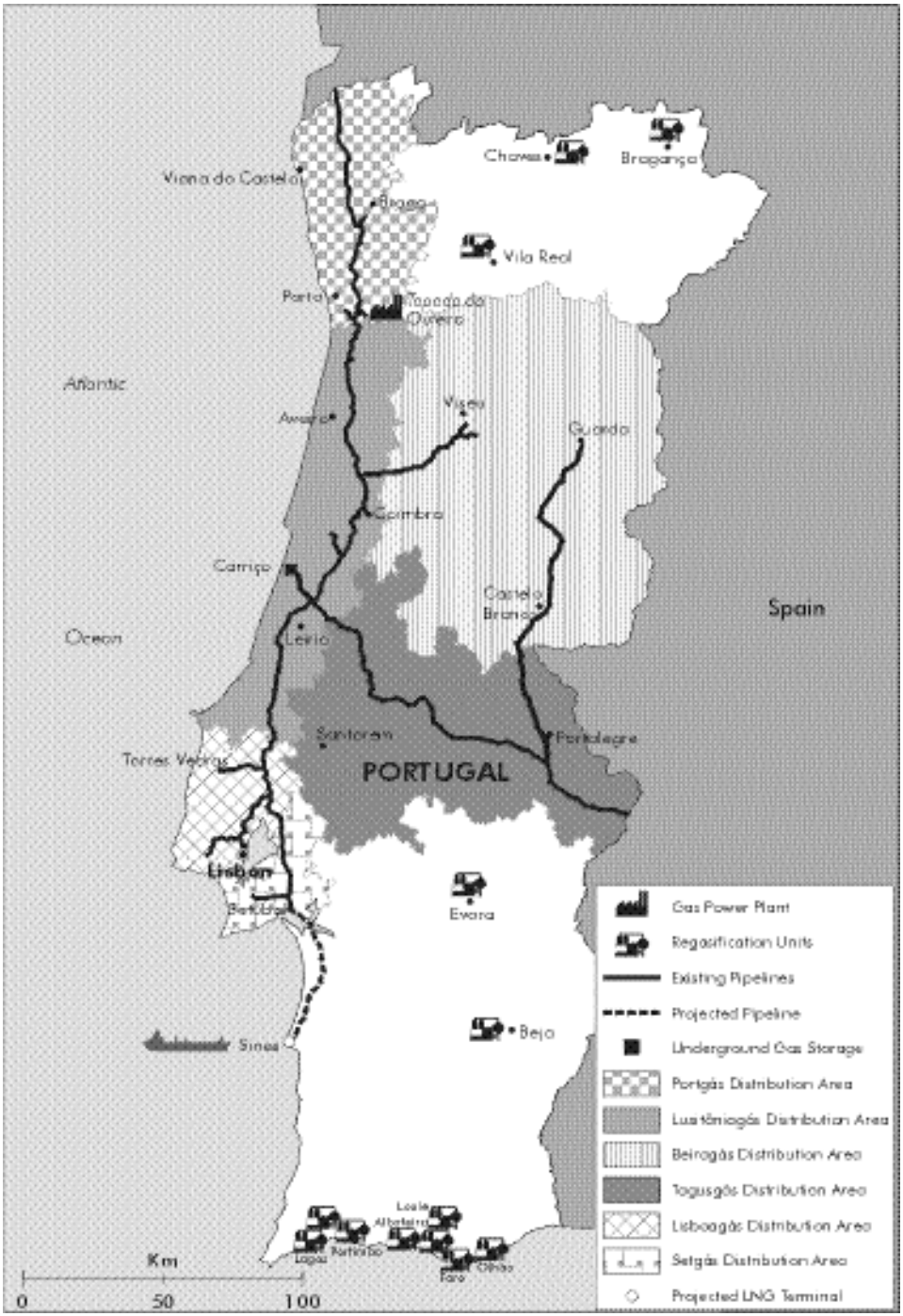
Figure 32
Portuguese Gas Industry Shareholding, End 1999



* Shares in gas pipeline companies.
** Telecom, real estate, industry, other.
Source: GDP.

Figure 33

Map of the Gas Facilities and Distribution Areas in Portugal



Source: GDP.

- Lusitâniagás was owned 48.8% by GDP, 35.3% by Petrogás and 10% by Italgás (the major Italian gas company), with the remainder owned by small shareholders. Lusitâniagás is in charge of the centre west of the country. It had 17,000 clients in 1998 and distributed 2.7% of Portuguese gas supply.

- Setgás was owned 33% by GDP, 12% by Petrogás, 33% by Enagás (the Spanish gas distribution company) and 22% by Italgás. Setgás distributes gas on the southern bank of the river Tejo and on the peninsula of Setúbal. In 1998,it had 15,000 customers and distributed 0.4% of Portuguese gas supply.

- Tagusgás was owned 20.5% by GDP, 20% by Petrogás, 20% by Constructora do Lena,SA,10% by António Gomes Vieira & Filhos,Lda,10% by Faiart Gásriba,with the remainder owned by small shareholders. Tagusgás is situated in the Tagus valley and started distributing gas in 1999.

- Beiragás was owned 65% by GDP and 20% by Grupo Visabeira, with the remainder owned by small investors. Beiragás is situated in the eastern part of Portugal.

Tagusgás and Beiragás are the most recent distribution companies. They were created in 1997 and 1998, respectively. The northwest and the south of the country are not covered by the grid. In these regions, 13 regasification units are being installed in 2000 to distribute gas in remote areas. LNG will be transported by truck and will be stored in specially built cryogenic plants.

Structural Reform

On 22 April 1999, Decree Law No. 137-A/99 created "Petróleos e Gás de Portugal, SGPS,S.A. (GALP),a company merging Petrogal and GDP. This holding company is responsible for the operation and management of the Portuguese oil and gas industries. When created, GALP was owned 60.56% by the state, 33.34% by Petrocontrol,3.27% by EDP, 2.75% by CGD, 0.04% by Portgás and 0.04% by Setgás. In January 2000,ENI,the Italian oil and gas group,acquired 33.3% of GALP, i.e.11% from the Portuguese state and 22.3% from Petrocontrol. Petrocontrol sold its remaining 11% shares to Electricidade de Portugal. Iberdrola, a Spanish utility, bought 4% of GALP from the state. The Caixa Geral de Depósitos increased its share in GALP to 13.5% (see Chapter 3 and Figure 15).

GDP reorganised its activities to prepare for the merger. It undertook a legal unbundling of its activities and sold most of its shares in Empresa de Telecomunicaçoes Globais, S.A. (OPTEP) to EDP in order to concentrate on its core activities. GDP created a new subsidiary, GDP Energia, which is in charge of managing investments in new CCGTs, independant power producers and co-generation plants.

Transgás' newly created subsidiary,Transgás Indústria,is in charge of selling natural gas and associated services to large clients. At the end of 1999, Transgás Indústria had around 130 clients (including electricity generators) representing more than 86% of total gas supply.

REGULATORY FRAMEWORK AND GAS PRICING

Regulatory Framework

Natural gas supply is regulated by four main decree laws:

- Decree Law 374/89 establishes the basic rules of gas supply and the public service regime,such as the obligation to supply gas.
- Decree Law 274-C/93 establishes the rules governing the exclusive service public concessions (see box).
- Decree Laws 33/91 and 333/91 deal with imports, transmission, supply and distribution of natural gas.

Concession Agreements

The activities of Transgás and the six distribution companies are regulated by 35-year concession contracts awarded by the state. These contracts establish:

- Concession areas for distribution companies.
- Investment targets for network expansion.
- Rules to operate the network and the storage facilities.
- Basic principles governing tariffs for end users.
- Rules for relations with clients.
- Rules for the capital structure of the companies.
- Profitability caps for transmission.
- Indemnities in case of non-compliance with take-or-pay contracts.

Transgás owns the high-pressure network. The company has an exclusive 35-year concession contract to import natural gas,to store and operate the network,as well as to import, store and regasify LNG. In addition, the concession contract gives Transgás the exclusive right to supply directly customers using more than 2 million cubic metres per year (including electricity utilities) and distributors. In 1999, Transgás imported gas from Algeria under a long-term take-or-pay contract with the price linked to a basket of eight crude oils. The price is reviewed every three months.

Natural gas sold by Transgás to distribution companies is covered by 25-year contracts. The price is set according to a cost-plus calculation which includes a rate

of return on investments of 11% for Transgás. The calculation has a variable component (commodity charge) and a fixed component (demand charge):

- The variable component comprises the acquisition costs to Sonatrach, the royalities to the Moroccan Government, the transmission costs, the losses and self-consumption in compression units.

- The fixed component is set according to the maximum daily load.

Distribution companies are granted exclusive concession contracts for the ownership of the distribution grid, its operation and maintenance and the distribution of natural gas in their areas. As part of the contract, distribution companies have an obligation to supply gas in their area. These concession contracts have a duration of 35 years. At the end of the concession contract, ownership of the distribution grid reverts to the state.

End Users' Tariffs

Tariffs for end users are set on a netback basis since gas prices need to be competitive with prices for oil products. There is no excise tax on natural gas, which has a reduced VAT of 5% (see Chapter 3).

Prices for large industries, which are indexed on the price of heavy fuel oil, are reviewed on a monthly basis. Transgás sells natural gas to large industries at a price comparable to that of low sulphur heavy fuel oil,which makes it very competitive with propane. High sulphur fuel oil,the main fuel consumed in large industries,is less expensive than natural gas (Figure 34). Prices decrease when volume increases and there are rebates for interruptible consumers.

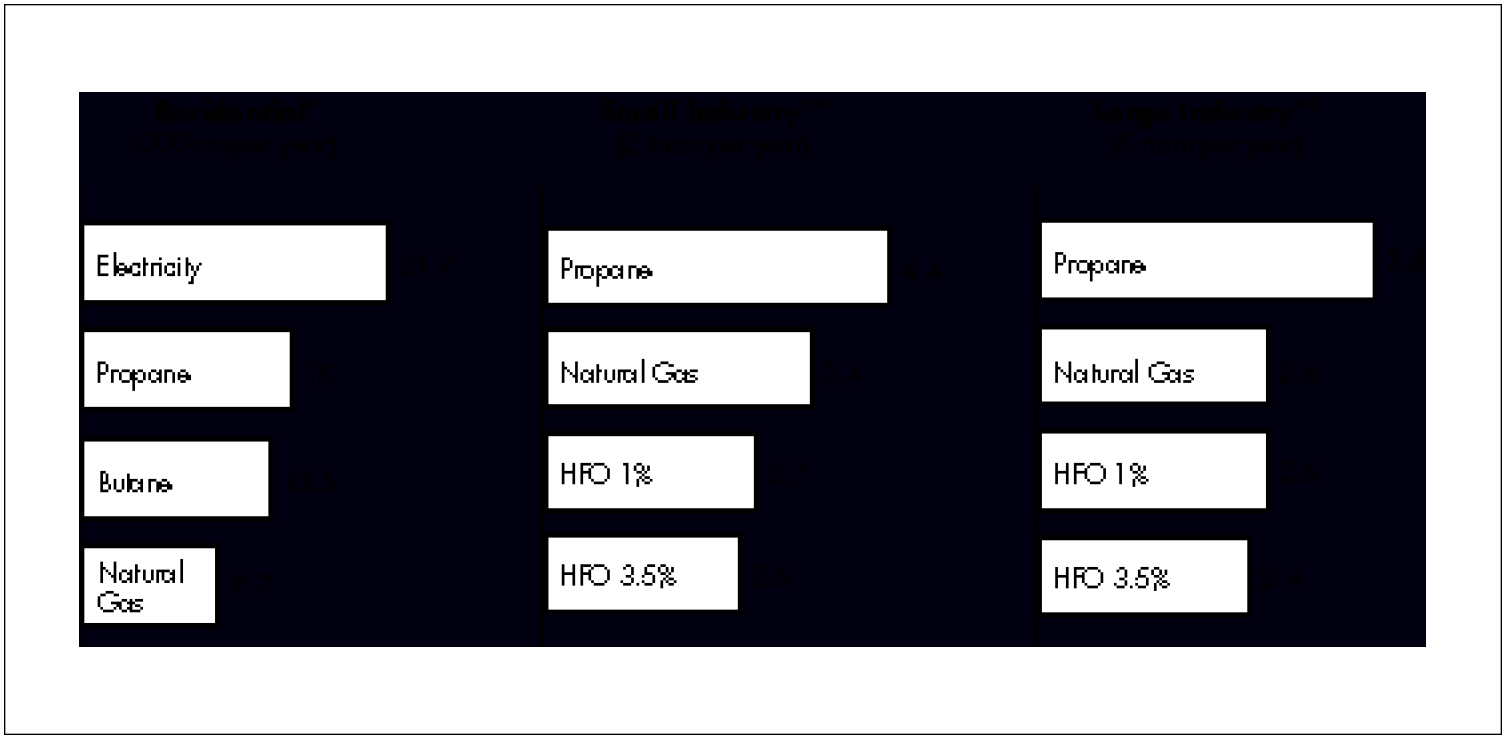
Transgás sells gas to the CCGT Turbogás under a long-term take-or-pay contract. Calculations for gas tariffs are renegotiated every two years (Chapter 7). In 1998, natural gas prices for electricity were estimated to be PTE 31,840 per toe,higher than heavy fuel oil (PTE 12,936 per toe) and steam coal (PTE 11,127 per toe)[23].

Tariffs for residential and commercial customers have a fixed and a variable part. The base for their calculation is set in the concession agreements and differs among distributors. The variable part is revised every three months according to the variation in price of gas and the inflation rate. The fixed part is revised no more than once each year according to the inflation rate. On average,the price of natural gas for the residential sector is lower than the price of butane, propane and electricity (Figure 34).

Tariffs for small industrial clients (more than 10,000 cm per year and less than 2 mcm) have no reference formula in the concession contracts. However,

23. *Energy Prices and Taxes,* IEA/OECD Paris,1999.

Figure 34
Energy Price Comparisons, First Quarter 1999*
(PTE/Therm)



* Includes VAT.
** Indicative prices.
Note: There is no reference to light fuel oil prices in the residential/commercial and in the industry sectors because consumption is very modest.
Source: GDP.

concession contracts set maximum prices and forbid price discrimination. Prices are reviewed every three months. Natural gas prices are lower on average than propane but higher than heavy fuel oil (Figure 34).

DEVELOPMENT OF GAS INFRASTRUCTURE AND SUPPLY

Investments in Infrastructure and the 1994 Energy Programme

According to GDP, cumulative investments in the whole gas infrastructure were PTE 229 billion in 1998 and 298 billion in 1999[24]. Total cumulative investments are expected to be PTE 545 billion in 2010. From 1998 to 2010, PTE 316 billion in investments are expected to be dedicated mainly to LDC networks (local distribution) and conversion from oil products to natural gas (60%), followed by the LNG terminal (13%), underground storage (9%), conversion of town gas to natural gas (8%), industrial connections (6%) and new pipelines (3%)[25].

The 1994 Energy Programme (see Chapter 3) provided funds to promote the introduction of natural gas in Portugal. Between 1994 and 1999, more than PTE 96 billion was spent on direct financial assistance. EU funds covered 40% of the technical cost of infrastructure. State aid was also provided for the conversion of town gas and other fuels to natural gas both in industry and in the residential/commercial sector. The difference from GDP data as mentioned above comes from the bank loans.

Table 9
Public Funding for the Promotion of Natural Gas, 1994-1999
(PTE and ECU millions)

	*European Union**		*State*		*Public Enterprises*		*Total*	
	ECU	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*
1994	2.02	401.3	0.00	0.0	3.03	601.9	5.05	1,003.1
1995	10.68	2,072.2	0.05	1.1	16.01	3,107.2	26.69	5,180.6
1996	27.52	5,342.4	0.46	88.4	40.83	7,925.1	68.81	13,355.9
1997	40.46	8,047.5	1.21	240.9	59.48	11,830.4	101.15	20,118.8
1998	50.38	10,100.3	2.10	420.6	73.47	14,729.8	125.95	25,250.7
1999	63.34	12,697.5	2.27	454.8	92.74	18,591.9	158.34	31,744.2
Total	**194.39**	**38,661.2**	**6.04**	**1,205.8**	**285.55**	**56,786.3**	**485.99**	**96,653.3**

* FEDER.
Source: DGE.

24. This amount includes funds from GDP, distribution companies, the state, EU and bank loans.
25. 1% is expected to be dedicated to administrative equipment, land, buildings, vehicles, etc.

Natural Gas Imports

In 1994, Transgás signed a 25-year contract with Sonatrach, the Algerian oil and gas company, for the import of natural gas gradually increasing to a plateau of 2.5 bcm in 2002. In June 1997, Transgás signed a contract with Nigerian Liquefied Natural Gas (NLNG) for the import of 0.35 bcm per year of gas equivalent LNG until the Sines LNG plant is available. Since the end of 1999,LNG has been delivered to the Spanish terminal at La Huelva and transported to Portugal. In June 1999, a 20-year contract with NLNG was signed for the supply of 1 bcm per year starting at the end of 2003. Transgás is negotiating other supply contracts.

In 1999, Portugal's maximum import capacity from Algeria was 4.5 bcm per year. The north–south gas pipeline also has a capacity of 4.5 bcm per year. In April 1999, the Ministry of Economy launched a bidding procedure for the construction of an LNG terminal at Sines,south of Lisbon. Building and operation will be undertaken by Transgás Atlântico,a joint venture between Transgás (51%) and EDP (49%). Work is planned to start in July 2000 and be completed in October 2003. The terminal will have an initial capacity of 2.4 bcm per year which can be extended to 4.8 bcm, of which 3.4 bcm can be achieved with limited additional investments. The plant will be able to handle LNG carriers of up to 165,000 cm. Two reservoirs with a total capacity of 210,000 cm will be built. In the first phase, the capacity will be 90,000 cm. The cost of the construction is expected to be PTE 50 billion. A new CCGT owned by a joint venture between Transgás and EDP is to supply electricity to EDP under a long-term purchase agreement, ensuring high utilisation of the terminal's capacity (see Chapter 7).

Grid Extension

The gas network covered 6,052 km in 1999 and is expected to reach 9,564 km in 2010 as follows (Figure 35):

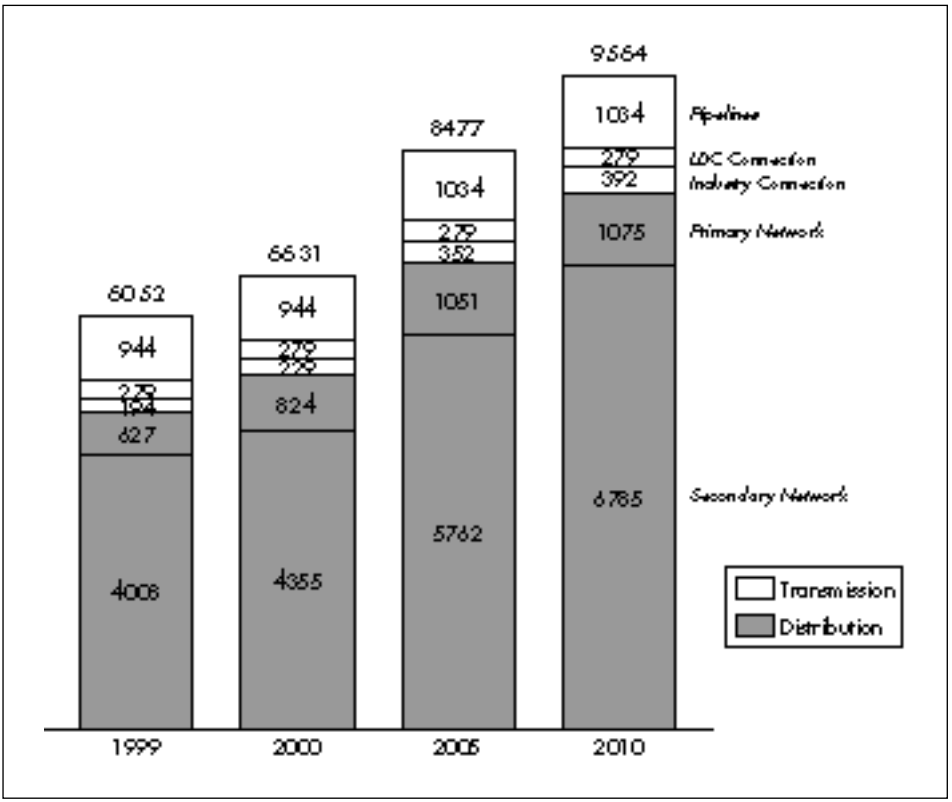
- According to market forecasts by GDP, the distribution network will increase from 4,635 km in 1999 to 7,860 km in 2010,mostly in the new distribution areas.

- The transmission grid will extend from 1,417 km in 1999 to 1,705 km in 2010, mostly because of increased connections with large industries. The pipelines Coimbra-Viseu (75 km), Portalegre-Guarda (185 km) and Bidoeira-Carriço (10 km) came on stream in 1999. Another one, Setúbal-Sines (90 km), is planned.

Evolution in Gas Supply

According to Ministry of Economy forecasts, natural gas supply is expected to increase at an annual rate of 19% per year until 2010, reaching 5.7 Mtoe (22.7% of total energy supply). Gas use in power generation is expected to multiply by more than ten between 1998 and 2010, reaching 3.9 Mtoe (more than 68% of total gas supply) in 2010.

Figure 35
Development of the Portuguese Natural Gas Grid, 1999-2010
(Km)



Source: GDP.

In industry and in the commercial/residential sector, gas consumption will multiply by five and eight, respectively, up to 2010. Industry will continue to be the second largest gas-consuming sector, with 1.2 Mtoe in 2010. In these sectors,competition is expected to become more difficult once natural gas has replaced propane and butane in areas where natural gas has a competitive advantage. (Natural gas has no competitive advantage over heavy fuel oil.)

According to GDP, Lisboagás will increase its number of clients from 245,000 in 1998 to 433,000 in 2010; Portgás, from 30,000 to 178,000; Lusitaniagás, from 17,000 to 103,000 and Setgás from 15,000 to 145,000. Beiragás and Tagusgás will have 10,000 clients each in 2010.

Most important investments in the future will be directed to the distribution grid, which will expand in areas where the density of consumers is smaller, where there are few large industrial consumers and thus where investments are less profitable. To this end,GDP is considering providing equity to distribution companies.

DEVELOPMENT OF COMPETITION

The 1998 EU gas directive aims to create a competitive gas market through common rules for transmission,distribution,supply and storage of natural gas. Member states have two years to implement the directive through national legislation. However, Member states in which commercial gas supply started less than 10 years ago are considered emergent markets and may ask for a ten-year derogation from Articles 4 and 18 (paragraphs 1,2 ,3 ,4 and 6) and/or from Article 20 of the directive on market opening[26]. Consequently, Portugal obtained a derogation until 2008.

In January 1999, the Ministry of Economy signed an agreement with the industry associations on the introduction of a regulator in the natural gas market. According to the agreement, regulations in the gas sector should contribute:

- To guarantee that the value-added in the gas sector is equitably shared between operators and consumers.
- To promote the development of natural gas.
- To stimulate the competitiveness of the operators and transparency.
- To promote competition.

The regulations should guarantee:

- Different tariff mechanisms for the different types of consumers.
- Quality standards for all categories of consumers.
- Regulations providing for third party access in due time.

The agreement also states the following:

- The state will be in charge of setting guidelines and general regulations. The regulator will follow the guidelines,issue specific regulations to implement the general rules,ensure that regulations are enforced and resolve disputes.
- The regulator should be autonomous from the state to ensure a level playing field for the different operators and to ensure transparency in decision-making, particularly because the state remains a major shareholder in gas companies and will remain so in the short term.
- The management of the regulatory body should be by a Board and a Consultative Council, both nominated by the Council of Ministers under a proposal of the

26. Article 4 on state authorisations for building and managing natural gas facilities; Article 18 on the designation of eligible customers; Article 20 on allowing natural gas companies to supply natural gas directly to eligible consumers.

Minister of Economy. The Consultative Council should represent the following parties: residential and industrial consumers,electricity consumers,the Ministry of Economy, the Ministry of Finance, the Ministry of the Environment, gas transport and distribution companies. The way members of the Board in the regulatory body are nominated should ensure their independence. They should not have any connection with gas transport or distribution companies.

NATURAL GAS SECURITY OF SUPPLY

Security of gas supply is a major concern of the government. All construction works related to the gas infrastructure have to be approved by the Minister of Economy, in consultation with the other ministries involved. The Tapada do Outeiro CCGT can switch from gas to middle distillates within 24 hours. Legislation requires Transgás to keep an amount of stored gas equivalent to 20 days of non-interruptible consumption.

Transgás is building a gas storage facility at Carriço in central Portugal for security of supply and to meet peak demand. Gas storage will develop in pace with demand. Total working capacity is expected to be 140 mcm, dispatched in four caverns. Total cushion gas is expected to be 70 mcm. Surface facilities are planned to be ready in January 2002; 70 mcm of gas will be available in September 2002 and the remaining 70 mcm in September 2004. The Carriço site allows the use of nine cavities with a total capacity of 315 mcm for working gas.

CRITIQUE

The benefits of the introduction of natural gas in Portugal are multiple. Natural gas has started to reduce Portugal's high dependence on imported oil and will continue to diversify energy supply. The use of natural gas in CCGTs will allow generators to provide electricity at competitive prices. Increased natural gas consumption will also help to alleviate increases in CO_2 emissions.

The government should be commended for the successful and rapid introduction of natural gas in Portugal. The financing schemes including state, international and private participation have allowed enough funding to be raised for substantial investments. The netback pricing mechanism has allowed natural gas to gain market shares in the energy sector. Natural gas has also been developed in priority as a fuel for CCGTs,where it can be sold at the highest price.

In spite of possible diversification of suppliers, Portugal is expected to remain very dependent on a single gas supply source. Portugal is also the last country in the supply chain which passes through three other countries before arriving at the Portuguese border. Therefore the government has rightly established gas storage requirements to address security of gas supply issues. The building of an LNG plant

and possible new interconnections with Spain are expected to increase security of gas supply since they will contribute to the diversification of supply sources.

The government should continue to monitor the gas market to ensure security of supply. In particular, it should ensure that the 20 days storage requirement and verification of its implementation are adapted to the liberalisation of the gas market and to the consequent increase in the number of market players.

Subsidies for gas infrastructure, particularly for distribution, have been necessary for the introduction of natural gas in Portugal and its expansion. These subsidies are partly funded by EU programmes. When the gas market in Portugal is mature, the government should consider phasing out these subsidies to allow gas to compete on a level playing field with other fuels which are not subsidised.

The rapid building of gas infrastructure and the increase in the number of consumers will help the government in implementing competition. The government obtained a derogation until 2008 for the introduction of competition in the gas market. GDP plans to be ready for competition in the gas market by that date. Setting a clear schedule for the implementation of the EU directive on gas and taking an early decision on its modalities would allow suppliers and large consumers to better prepare for the functioning of the gas market. For instance, such a schedule would allow new suppliers and large consumers to start negotiating gas contracts. Take-or-pay contracts already signed by Transgás, which involve a lower amount of imports than the expected level of demand, new LNG plants and possible future increases in natural gas import capacity are a strong incentive for newcomers to supply gas, provided that the future regulatory framework is clear enough.

GALP is expected to maintain a dominant position in the gas market. In 1999, GDP planned to own 300 to 400 MW of gas-fired power capacity in 2005, allowing an integrated supply of natural gas, electricity and heat. Transgás and EDP will be in a joint venture for the development of the new CCGT. The government and/or the future gas regulator should ensure that favourable gas pricing for GDP or EDP plants does not distort competition with the other players in the electricity market. Competition in the gas market should be introduced as quickly as possible to allow enterprises owning gas-fired power plants to choose their suppliers and limit the risks of price distortions (see also Chapter 7).

In addition, to ensure the development of fair competition, natural gas enterprises' activities should be effectively unbundled. Because the market is very concentrated, with risks of abuses of dominant position, legal unbundling would be the most effective solution to create a level playing field for competition. GDP has rightly started to legally unbundle its gas and non-gas activities. GALP should do likewise with its gas (import facilities, transport, storage, distribution and supply) and non-gas activities. GALP should also unbundle its electricity and oil activities since GALP includes Petrogal and GDP, which compete with each other in some segments of the energy market.

When competition is introduced, pricing principles for access to the grid and the use of storage and gasification plants need to be established. Because of the

expected dominance of GALP, regulated third party access with transparent tariffs should be the preferred option instead of a system where consumers have to negotiate with a single company. For continued, sound development of the gas market,these tariffs should allow for an increase in investment capacity in case of bottlenecks in the infrastructure.

The government should also consider establishing an independent transmission operator to ensure that no abuse of dominant position is exercised at the transport or distribution level. In addition, since GALP will hold a dominant share in distribution companies, the government should consider requesting GALP to divest some of its distribution assets. Diversity of owners in distribution would allow the regulator to better assess the costs of distribution and set cost-reflective prices for use of the grid.

Tariff control for end users is extensive and netback pricing has allowed natural gas to expand in the energy market by taking shares away from oil products. When competition is introduced in the gas sector, this system will be replaced by gas-to-gas competition for eligible customers. In future, particularly when gas pipelines are amortised,large consumers could be subsidised by setting prices above costs for captive consumers. Therefore, the regulator should ensure that tariffs for captive consumers are cost-reflective.

Unlike oil products,natural gas is not subject to excise taxes and enjoys a reduced VAT (see Chapter 3). Therefore,suppliers'interest in developing the market is enhanced by the tax advantage, which allows them a better profit while keeping consumer prices competitive. When the gas market is more mature with increased gas-to-gas competition,taxes on gas could be raised to better reflect the full cost of its use while still keeping taxes at a level which reflects its environmental advantages.

Establishing an independent regulator in the gas market is also a proper move for smooth transition to a competitive market. The government's functions of ownership and regulation will be separated and possible conflicts of interests will be avoided. The government has chosen regulators for the natural gas and electricity markets. Since both markets are closely linked,effective co-ordination should be established between the two regulatory bodies.

The regulator should deal with customers'complaints and monitor the behaviour of gas companies, particularly GALP, to avoid any abuse of dominant position; have enough power to track down any anti-competitive practice and take appropriate measures; start to prepare a tariff formula for end users and access to gas infrastructure, replacing price-setting through concession contracts.

RECOMMENDATIONS

The Portuguese Government should:

☐ Continue to favour diversity of gas supplies.

☐ Ensure that regulations providing for security of gas supply, particularly gas storage requirements,are adapted to the future competitive gas market.

☐ Phase out subsidies for gas infrastructure when the gas market is mature to allow gas to compete on a level playing field with the other fuels.

☐ Set a clear schedule for the introduction of competition in the gas market and take an early decision on its modalities so that suppliers and consumers have a firm basis to adapt to the new market.

☐ Ensure effective unbundling of gas import facilities, transmission, distribution, supply and non-gas activities to create a level playing field.

☐ Introduce regulated third party access to prevent any discrimination between users of gas infrastructure.

☐ Set up an independent regulator in charge of preparing for and ensuring fair competition,e.g.setting tariffs and dealing with consumers'complaints.

7

ELECTRICITY

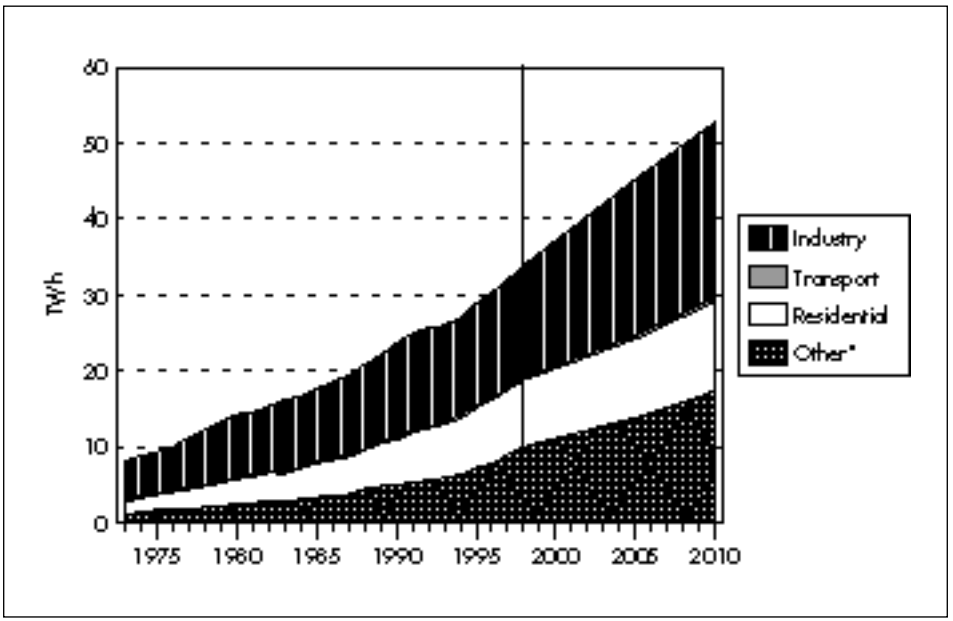
DEMAND AND SUPPLY

Electricity Demand

Electricity consumption increased at an annual rate of nearly 6% between 1973 and 1998 to 33.8 TWh,a fast pace in comparison with the European Union average of 2.5% per year. However, electricity consumption per capita (3.4 MWh in 1998) was the lowest in the European Union and the third lowest of IEA countries after Hungary and Turkey. Although increasing, electricity consumption per GDP (in purchasing power parity) was also at a lower level than the IEA Europe average (Figure 19 in Chapter 4).

The residential/commercial sector accounted for 56% of total electricity consumption in 1998. The corresponding figure in industry was 43% (Figure 36). The increase in the commercial sector (more than 8% per year between 1973 and 1998) has been the most rapid. Around two-thirds of electricity consumers are concentrated in the Porto and Lisbon areas.

Figure 36
Electricity Consumption by Sector, 1973-2010



* Includes commercial,public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

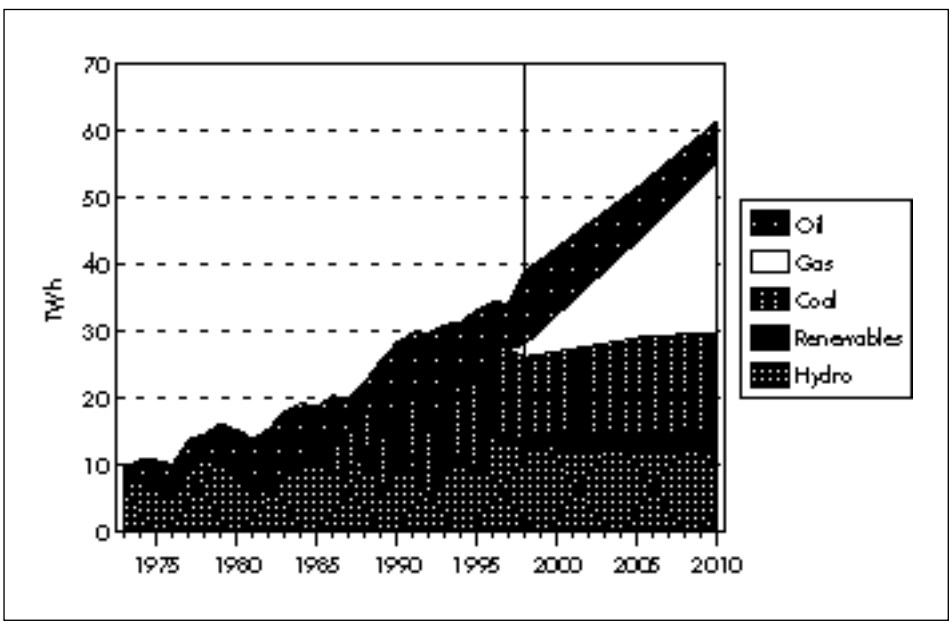
Electricity Supply

Total installed capacity was 10 GW in 1999. Hydro capacity was 4.4 GW, followed by oil (2.6 GW), coal (1.8 GW[27]), natural gas (0.9 GW) and renewable sources (0.3 GW). Gross electricity generation was 38.9 TWh in 1998 (Figure 37). The increase in generation has been in pace with consumption (Figure 38).

There have been large fluctuations in hydro electricity generation: in the 1990s, they ranged from a minimum of 5 TWh in 1992 to a maximum of 14.8 TWh in 1996. Within a given year, generation from hydro can vary by up to 50%. Electricity from oil and coal combustion has compensated for the reduction in hydro generation during dry years. Because of the large variations in hydro generation, reserve margins were as high as 41% in 1998. In 1998, electricity generation from non-hydro renewable energy sources was 1.2 TWh, a 68% increase from the level of 1990.

Owing to the small size of the electricity market, domestic production is concentrated in a small number of power plants (Table 10).

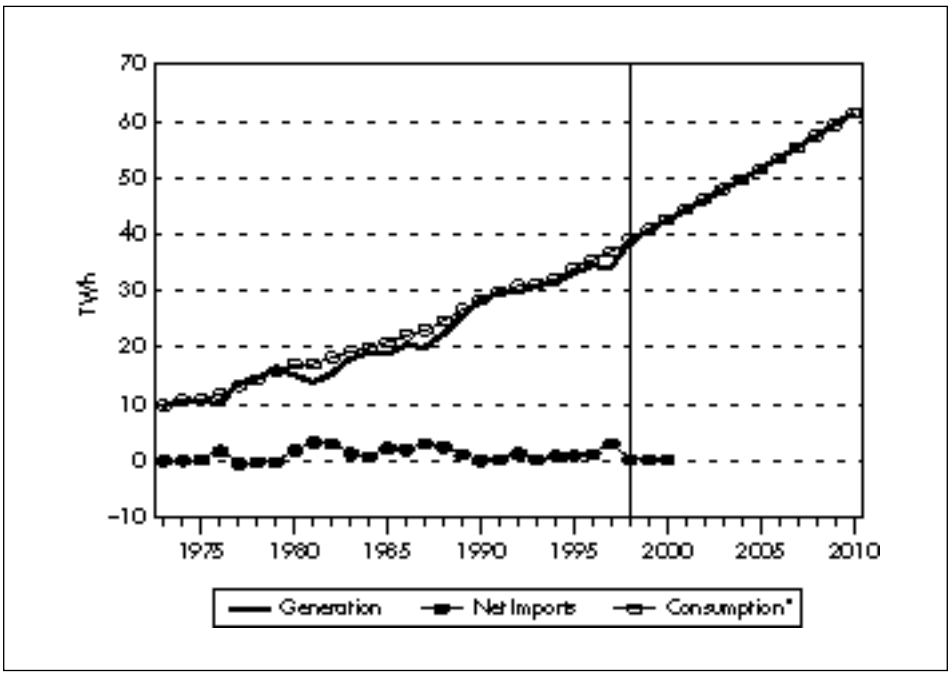
Figure 37
Electricity Generation by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

27. To diversify supply and meet the increase in electricity demand, the 1,192 MW Sines coal-fired power plant was commissioned between 1985 and 1989. Another coal-fired power plant of 615 MW was commissioned between 1993 and 1995.

Figure 38
Electricity Consumption, Generation and Net Imports, 1973-2010



* Includes losses.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris,1999,and country submission.

Table 10
Major Electricity Plants, 1998

Plants	*Date of Commissioning*	*Input Fuel*	*Capacity (MW)*	*Generation (TWh)*	*Share in Total Gross Generation*	*Cumulative Share*
Sines	1985	Coal	1 192	9.0	23.1	23.1
Setúbal	1979	Oil	946	5.3	13.6	36.7
Pego	1993	Coal	615	2.8	7.1	43.8
Tapada	1999	Gas	990	1.3	3.3	47.1
Miranda	1960/95	Hydro	369	1.1	2.8	49.9
Bemposta	1964	Hydro	240	1.1	2.8	52.7
Picote	1958	Hydro	195	1.1	2.8	55.5

Sources: Electricidade de Portugal,other.

In 1997, Electricidade de Portugal (EDP), the national electricity company (see below),converted two units of 125 MW each of the Carregado oil-fired power plant into gas-fired units. Two new CCGTs of 1,000 MW each are expected to be commissioned,the first one in 2003-2006 and the second in 2007-2010. The other anticipated power plants are based on hydro: Alqueva (240 MW) to be commissioned in 2002, Venda Nova II (180 MW) to be commissioned in 2004 and Baixo Sabor (140 MW) to be commissioned in 2007. Between 2000 and 2010, around 600 MW of oil-fired capacity are expected to be decommissioned.

Imports and exports depend on hydro conditions in the Iberian Peninsula. Portugal was a net importer of electricity in 1998 and a net exporter in 1999. There are five interconnections with Spain with a total capacity of 3,800 MW, mostly situated in the north of the country near the Douro and Tagus rivers. An interconnection is under construction in the north and another one is under evaluation. In 1998, imports amounted to 4 TWh and exports to 3.7 TWh. Electricity exchanges are used mainly for voltage and frequency optimisation. It is estimated that around 500 to 700 MW are available for commercial trade,depending on the period in the year and hydro availability. In 1998, REN, the Portuguese transmission company, obtained a licence from the Spanish Ministry of Industry and Energy to trade electricity in the Spanish Power Pool.

At the end of the 1980s, Portugal concluded a 300 MW power purchase contract with Electricité de France,the latter selling electricity to Red Electrica of Spain and Red Electrica selling electricity to EDP. However, this contract required the building of a new interconnection between France and Spain which was never completed.

ELECTRICITY GRID

In 1998,the length of the grid was 71,016 km for the high and medium voltage grid and 112,075 for the low voltage grid (Figure 39). Hydro plants are concentrated in the north of the country and thermal plants are mostly in the south, where consumption is the highest. The high voltage grid is designed mostly to transport electricity from the north to the south. Further capacity expansion is planned, in particular a 400 kV line between Sines and Alqueva[28] in the south of the country and a 220 kV line between Trajouce near Lisbon and Estarreja in the north.

INDUSTRY STRUCTURE

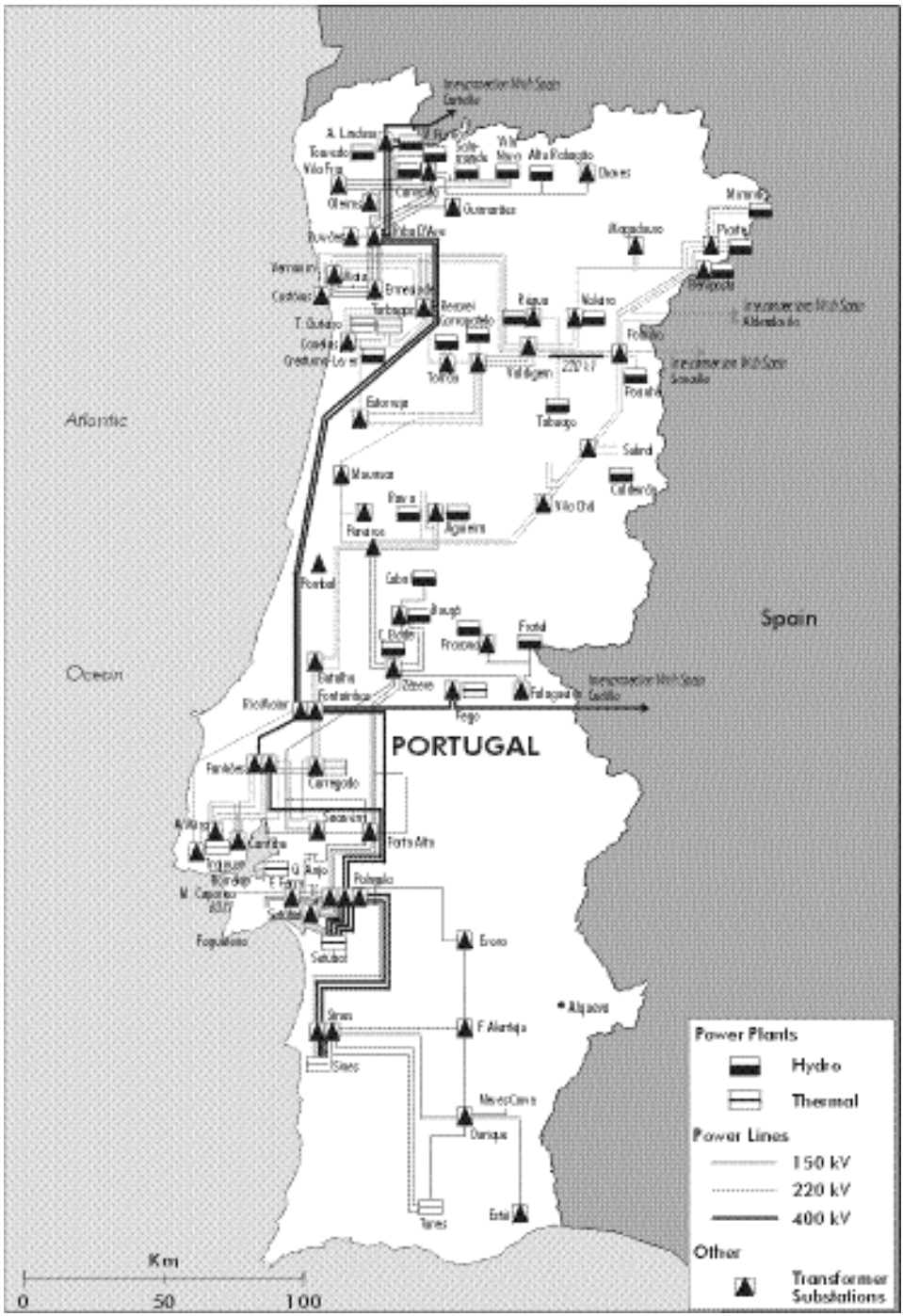
Electricidade de Portugal

The electricity supply industry is dominated by EDP, which in 1998 generated about 72% of electricity (28 TWh net) and was in charge of all transport and 99% of distribution. EDP was created in 1976 as an integrated electricity company after the

28. A project to continue this line to the Spanish border is under evaluation.

Figure 39

Map of the Portuguese Electricity Infrastructure



Sources: Entidade Reguladora do Sector Eléctrico,IEA.

nationalisation of several electricity companies. The EDP Group was formed in 1994 as a holding company. In June 1997,EDP was partially privatised with a 30% stake put on the market. In June 1998,the state sold a further 16.2% of its shares. Public entities' shares fell to less than 51% at the end of 1999 (Table 11). In May 1998,an agreement with Iberdrola of Spain gave the option to both companies to acquire 2.25% of each other's capital. Iberdrola exercised this option when the state's stakes were sold in June.

Table 11
EDP Group Shareholders, 1999

Shareholders	*Share (%)*
Portuguese State	44.0
Participações do Estado (PARTEST)	2.0
Caixa Geral de Depósitos,S.A.	4.8
Total Public Entities	**50.8**
Iberdrola	3.0
Other	46.2

Source: EDP, Annual Report.

Law requires EDP (as any other utility) to unbundle its operation on both a legal and accounting basis (Figure 40). The company is involved mostly in electricity activities but also in other activities such as services,international investments and telecommunications. In 2000,EDP acquired a 14.3% share in GALP, the new oil and natural gas holding (see Chapter 3). EDP's companies in electricity generation, transmission and distribution are the following:

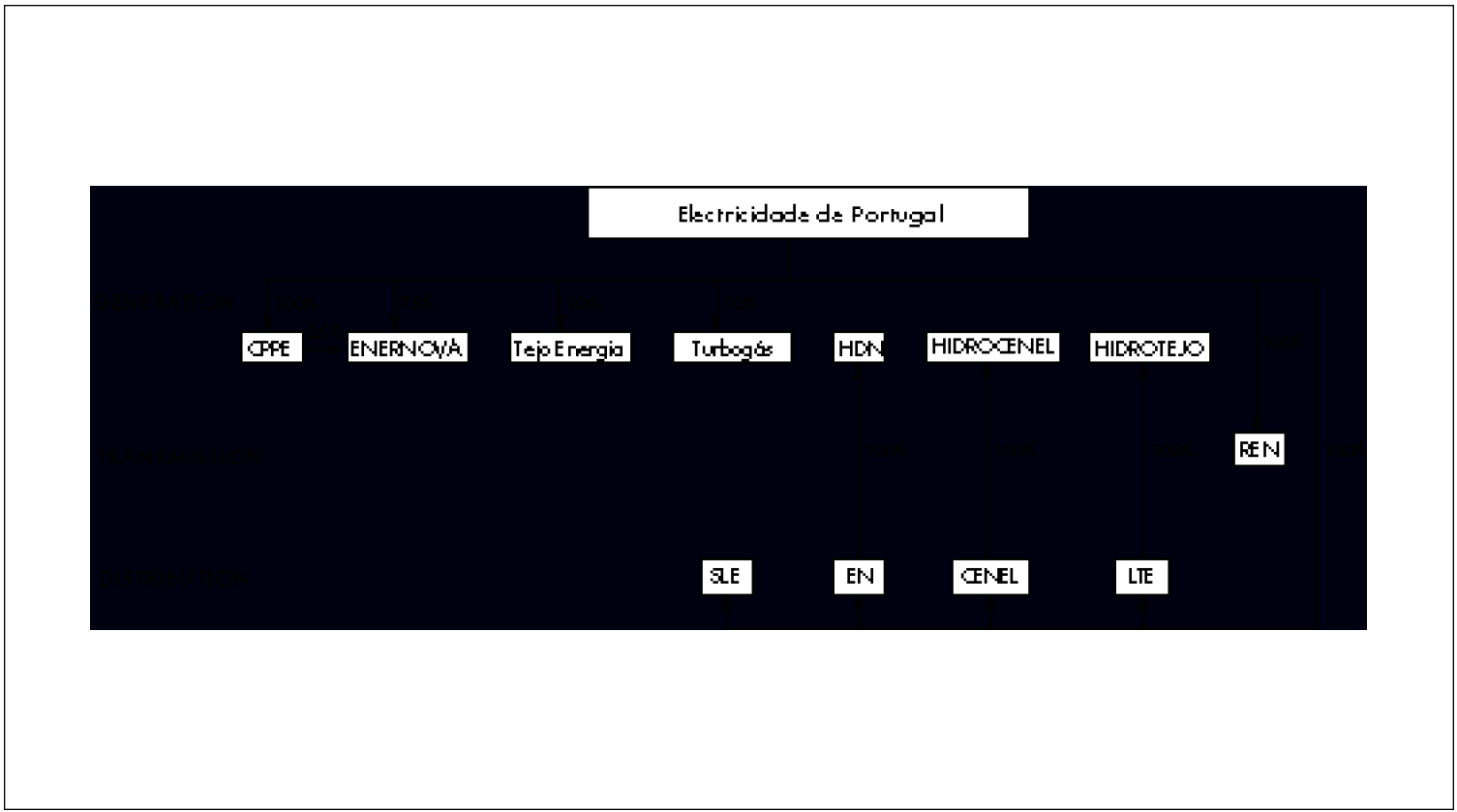
- Most of EDP's power generation is from the Companhia Portuguesa de Produção de Electricidade, S.A.(CPPE), which produced 26.8 TWh in 1998. Three companies, Energia do Norte (HDN), Energia do Centro (Hidrocenel) and Hidroeléctrica do Tejo (Hidrotejo), owned by EDP's distribution companies, own around 30 mini hydro plants, totalling 280 MW and producing 0.7 TWh in 1998. Enernova, an EDP subsidiary, owns around 20 MW of windmill capacity which produced 47 GWh in 1998. EDP is also involved in co-generation and holds a 10% stake in each of the two Portuguese Independent Power Producers (IPPs, see below).

- Rede Eléctrica Nacional S.A. (REN) is the owner and the operator of the 220 and 400 kV National Transmission Grid (RNT).

- EDP owns the four regional distribution companies[29]: Electricidade do Norte, S.A.(EN),Electricidade do Centro,S.A.(CENEL),Electricidade de Lisboa e Vale do

29. Other small distribution lines amount to around 1% of the market.

Figure 40
EDP Group Structure (Main Companies), 1999



Source: EDP.

Tejo, S.A. (LTE) and Electricidade do Sul,S.A. (SLE). Distribution companies are granted a 20-year licence by the DGE and the municipalities for operation. In turn, municipalities receive an annual rent. In 1998,EDP paid PTE 23,745 million to the municipalities. EN is the largest in terms of customers and LTE is the most profitable,because of lower distribution costs. EDP has announced the merger of the four distribution companies.

In May 1998,EDP signed a strategic alliance with the Spanish utility Iberdrola. The agreement has three objectives:

- To co-ordinate the functioning of hydro plants located on the same rivers in both countries.
- To co-ordinate investments in international and non-energy sectors.
- Joint planning investments in Portugal and Spain.

EDP turnover was PTE 603 billion in 1998,a 5.6% increase over 1997. Net income increased 12.7% to PTE 105 billion. EDP has implemented a programme to cut costs. It has reduced its staff level from 20,000 in the early 1990s to 13,932 in 1998 (a 10.3% reduction over 1997).

Independent Power Producers

A first IPP came on stream in 1993, followed by a second one in 1998. The coal-fired Pego power plant was financed and built by EDP. The plant is situated 150 km north of Lisbon, on the Tagus river. The first block (300 MW) came on stream in 1993, and the second in 1995, reaching a capacity of 615 MW in 1998. The plant was sold to TejoEnergia, a private consortium of National Power (45%), Endesa (35%), EdF (10%) and EDP (10%). TejoEnergia is remunerated according to its available capacity and electricity generation. In 1998,it produced 2.8 TWh.

The 990 MW Tapada do Outeiro CCGT came progressively on stream in 1998 and 1999 (see box). The plant is situated near Porto. It is owned by Turbogás, a consortium of PowerGen (50%), RWE Energie (25%), Siemens Project Ventures (10%),EDP (10%) and Koch Transporttechnik (5%). In 1998,it produced 1.3 TWh.

Co-generation

Under the 1994 Energy Programme,state and EU funds can support between 20 and 25% of capital investment, up to PTE 300 million, through zero-interest loans (Chapter 4). In addition, Decree Law 189/88 of 1988 has provided for must-take obligations by REN 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:

Tapada do Outeiro

The plant is staffed with 45-50 people.

The company has a 15-year purchase power agreement with REN, which can be extended for 10 more years. The plant is designed to generate electricity in base load and also to compensate for the shortfall in hydro generation during dry years when requested by REN. The plant is remunerated according to its available capacity and to electricity generation. Available capacity is calculated according to the reliability achieved by the plant during its operation. The efficiency of the plant has been set in the agreement with REN at 55-56%. Electricity prices depend on the price of natural gas. A larger amount of revenues is guaranteed at the beginning of the plant's operation than later in its life.

Turbogás has a 15-year gas supply contract with Transgás (see Chapter 6), which can be extended for 10 more years. Gas prices are linked to that of oil, and there is no take-or-pay clause. In case of a gas shortfall, Turbogás has a back-up contract with Petrogal, the national oil company, for the supply of light fuel oil.

- 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 consequence of these measures and in particular the buy-back tariff, co-generation capacity increased from about 600 MWe in 1990 to about 900 MWe in 1998. Generation amounted to about 4.5 TWh in 1998, including 3.2 TWh in autoconsumption.

Electricity from Renewable Energy Sources

Energy from renewable sources is promoted through grants and zero-interest loans. Electricity from renewables is also sold to REN under a favourable buy-back tariff (see Chapter 8). From 1990 to 1998, electricity generation from non-hydro renewables nearly doubled to 1.4 TWh.

The Entidade Reguladora do Sector Eléctrico (ERSE)

The regulatory authority ERSE (Entidade Reguladora do Sector Eléctrico) was created in 1995 and started work at the beginning of 1997. In 1999, it comprised around 45 members. The Minister of Economy nominates three commissioners with a term of five years[30]. ERSE's decisions can be appealed to the administrative court. ERSE is financed by a charge for use of the system. The regulatory authority does not receive directives from the government or parliament. ERSE's objectives are:

- To guarantee that the Public Electricity System (PES, see below) can supply electricity efficiently.
- To protect consumers'interests.
- To guarantee the economic and financial performance of the operators of the public service to allow them to fulfil their obligations.
- To promote competition.
- To issue objective and transparent regulations.
- To contribute to improvement in the functioning of the electricity sector from an economic,technical and environmental point of view.

Responsibility for regulation of the electricity system is shared by ERSE and the General Department of Energy (DGE). The main responsibilities of ERSE are:

- Setting tariffs for end-use consumers and third party access to the grid.
- Issuing regulations for the functioning of the electricity system and ensuring their implementation.
- Dealing with customers'complaints.
- Making recommendations on the expansion of the PES.

DGE is mainly responsible for:

- Issuing concessions and licences for operations in the PES and in the Independent Electricity System (IES).
- Planning the development of the Public Electricity System (new generators) and reporting on its development every two years.

30. Except for the first nominations,which have terms of five,three and two years.

- Assessing the consequences of the development of the independent system.
- Approving the modifications of purchasing power agreements.
- Issuing licences and authorisation procedures for the development of the transmission grid.

The National Electricity System

In 1995,the government created an electricity sector comprising a Public Electricity System (PES) and an Independent Electricity System (IES) as shown in Figure 41. Generators and consumers are either in the PES or in the IES. The PES is characterised by capacity planning and purchasing power agreements between generators and REN. The IES consists of the Non-Binding System, characterised by free contracts between generators and eligible consumers and the generators in the Special Regime, which includes co-generators and generators from renewable sources. Rules for the commercial relations between the entities in the PES and between the entities in the PES and the IES are set by the Code of Commercial Relations issued in September 1998.

The Public Electricity System

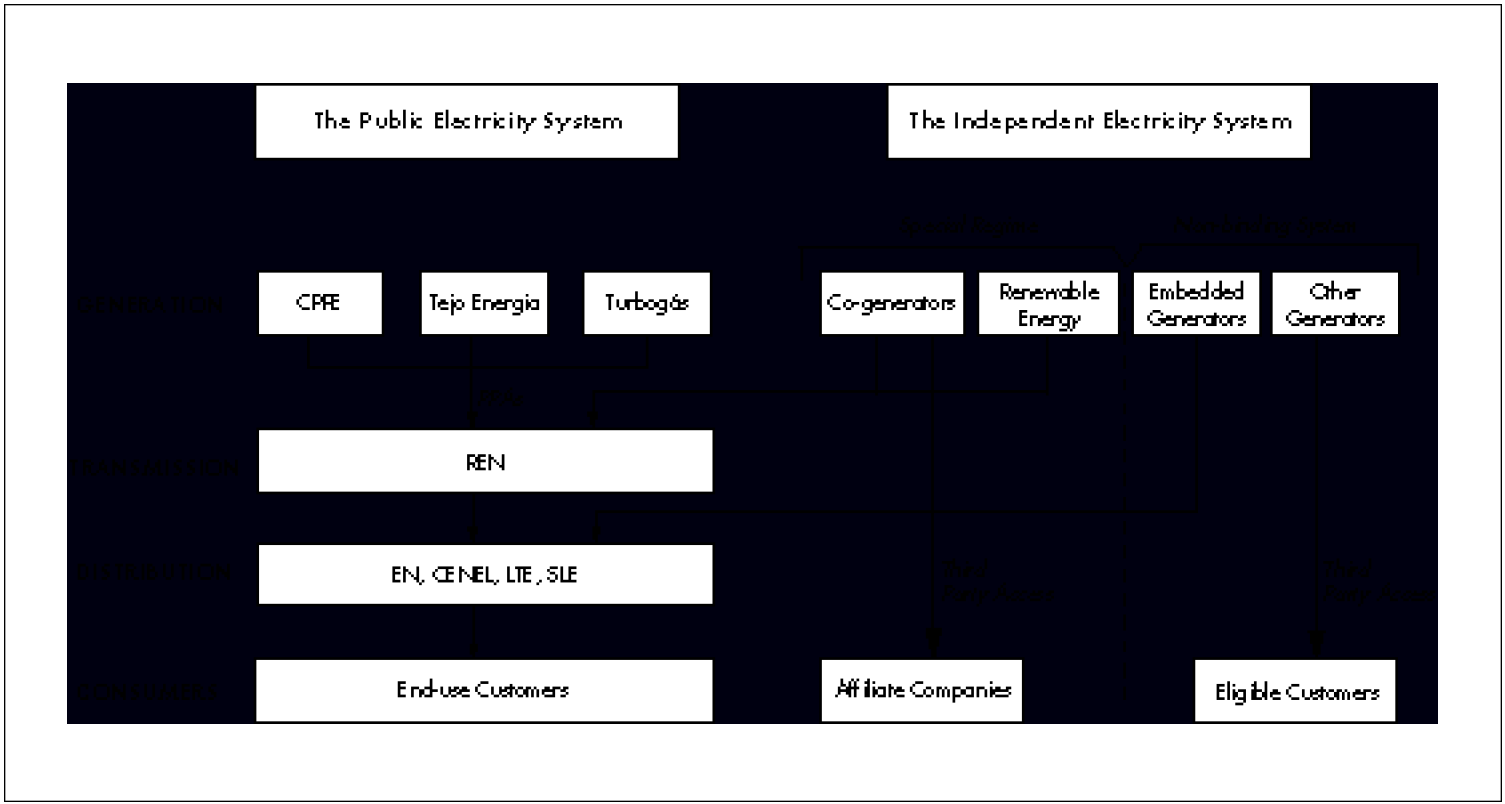
Generators in the PES are in charge of ensuring public service, e.g. security of supply and obligation of supply. Generation in the PES comprises CPPE as well as the two IPPs, Pego and Tapada do Outeiro, i.e. 85% of Portuguese electricity generation in 1998 (Tables 12 and 13). This system also includes the transmission grid owned and operated by REN[31] and the four distribution companies.

Every two years the DGE determines the needs for new generation capacity in the PES, based on the proposal made by REN, the concessionaire of the National Transport System. These "Expansion Plans" for new capacity are reviewed by the regulatory authority, which gives a non-binding recommendation. The plan establishes the technical characteristics of the projects, including the capacities of the plants and the fuel to be used. Then a competitive tendering procedure, monitored by the regulator, is organised.

The PES includes non-eligible customers and those eligible who have decided to stay in the PES. In 1995,non-eligible customers were defined as consumers below 100 GWh. In 1999,to comply with the EU directive on electricity, the threshold was lowered to 30 GWh for the year 1999. It fell to 20 GWh in 2000 and will fall to 9 GWh in 2001.

31. In 1997,REN was granted a 50-year concession contract.

Figure 41
The Portuguese National Electricity System



PPAs: Power purchase agreements.
Sources: EDP, ERSE.

Table 12
Electricity Generation* in PES and IES, 1997-1998**
(GWh)

	1997	*1998*
PES		
EDP-CPPE	22,936	26,798
Hydro	11,423	11,405
Coal	8,515	8,385
Oil	2,910	6,361
Natural Gas	87	646
Tejo Energia/Turbogás	3,605	4,057
Imports	5,378	3,971
Exports	2,481	3,699
Total PES	**29,438**	**31,127**
IES		
Non-binding System		
EDP	731	716
Other	0	0
Special Regime		
EDP	22	47
Other	1,752	1,917
Total IES	**2,505**	**2,681**
Total General	**31,944**	**33,808**
Autoconsumption	2,803	3,179

* Net generation.
** Continental Portugal only.
Source: DGE.

Table 13
PES and IES Contribution to the Electricity Sector, 1998

	PES	*IES*
Number of Participants		
Generation	3	Many
Transmission	1	0
Distribution	4	0
Generation Capacity (MW)	8,134	1,590
Net Generation (GWh)	30,955	5,510
Imports (GWh)	3,971	0
Exports (GWh)	3,699	0

Source: DGE.

Generators in the public system are granted a license from the DGE which obliges them to sell their electricity to REN. Generators conclude an individual power purchase agreement (PPA) with REN which covers the economic lives of most existing plants. For new plants, the PPAs are long-term contracts[32]. Electricity is sold exclusively to REN at a price which should cover the costs of supply. Prices include a capacity charge and an energy charge:

- The capacity charge covers all fixed costs and accounts for 75-80% of generation revenues. Plants that have generation costs below the contracted costs keep the benefit. When generation costs are above the contracted costs,the plants take a loss.

- The energy charge covers the plants' variable costs (e.g.fuels, maintenance and operations,start-up costs),and accounts for 20-25% of the generation revenues. Fuel costs are calculated on average international prices and are passed on directly to end-use consumers. Variable costs are calculated in advance and hydro availability is planned according to a normal year. The following year, a system of payment/reimbursement makes up the difference. When the contracted variable charges of the plants are higher than the actual charges, companies can keep the extra benefit. When the variable charges are higher than the contracted charges,the plants take a loss.

The Dispatch Code was issued by ERSE in April 1999 and will be revised in 2001. According to the Dispatch Code, REN operates the National Transmission System under conditions which should be transparent to all market participants,ensuring security of supply and adequate quality of service. REN is in charge of the following functions:

- Commercial Agent of the public system, to ensure the optimisation of dispatch according to the merit order in the public system.

- System Operator, to manage dispatch in the whole National Electricity System. According to the Code, the System Operator may change the merit order as planned by the Commercial Agent of the PES if that order does not comply with the obligations of security and quality of services.

- Market Operator, to manage the bids from the Non-binding System and from the Commercial Agent of the PES.

- Settlements.

- Transport.

These functions have separate accounts. The regulator may request a more efficient separation of accounts if necessary to improve the functioning of the system.

32. This system also includes the two IPPs. Tejo Energia signed a 28-year PPA with REN in 1993. Turbogás signed a 15-year contract.

In September 1998,ERSE issued a Tariff Code on end-use tariffs and a Code of Access to the Grid:

- The transmission tariff comprises a Transmission System Charge and a Global Use of the System Charge. The Transmission System Charge includes a rate of return on fixed assets of around 8% for the period 1999 to 2001. The Global Use of the System Charge incorporates ancillary costs such as back-up and the costs of buying electricity from co-generators, renewable energy plants and imports. Transmission pricing is calculated every year.

- The distribution tariff is set according to a price cap regulation. The regulation has been set from 1999 to 2001 and is revised every year according to the inflation index.

REN sells electricity to the distributors at a uniform rate: the bulk supply tariff which incorporates the price paid by REN to the generators,plus the Transmission System Charge and the Global Use of the System Charge.

The Independent Electricity System

The IES includes the Non-binding System (NBS) and the Special Regime. The NBS is the "competitive segment" of the Portuguese electricity sector. There are no PPAs: generators sell electricity to the market operator or directly to eligible consumers.

Generators in the IES comprise the non-binding generators and the other generators in the Special Regime:

- The non-binding generators include the embedded mini-hydro plants of the EDP group, totalling around 280 MW and selling electricity directly to EDP's distributors according to the buy-back tariff. Non-binding generators also include the potential generators wanting to sell electricity to the eligible client or to the market operator. The building of new electricity plants in the NBS is subject to authorisation by the DGE,which can refuse for reasons of general economic interest.

- The other generators are autoproducers, co-generators and electricity plants using renewable energy, all of which benefit from a buy-back tariff for their electricity. EDP participates in the independent system through its subsidiaries involved in co-generation and electricity production from renewable energy sources (Table 12).

Transmission and distribution lines can be built in the IES after DGE authorisation, provided that they are not linked to the grid in the PES.

Eligible consumers are allowed to choose their supplier in the Non-binding System. In 2000, this is the case for all consumers above 20 GWh. However, eligible

consumers between 9 and 20 GWh wanting to leave the PES and switch to the NBS have to give a one-year notice or pay the PES compensation [33] (see box). Eligible customers are allowed to re-enter the PES system. In 1999, eligible consumers accounted for 25% of domestic electricity consumption. Distributors are allowed to buy 8% of the needs of their captive customers outside the PES [34]. As a consequence, one-third of the total domestic electricity market was liberalised in 1999.

Compensation Payment to Leave the PES

C = 0.17*Pc*Tcu*n

C: sum to reimburse

Pc: Subscribed demand in kW

Tcu: tariff for demand on the high voltage grid (PTE 991.2/kW in 1999)

n: number of months notice before leaving the system

Generators in the NBS which do not sell their electricity to REN use the transmission and the distribution systems. The tariff for use of the grid is the same as in the public system.

According to the Code of Commercial Relations, generators and consumers in the NBS can contract with REN for back-up supplies. The contract for guaranteed power should include provisions on the maximum level of guaranteed power, the duration of the contract and the times when guaranteed power should be made available.

ELECTRICITY PRICES AND TARIFFS

Price of Electricity Sold to REN

According to ERSE, in 1998 the price of electricity sold to REN was lower in the PES than in the IES (Table 14). This is due to the buy-back tariff in the IES for electricity from renewable energy and co-generation. In 1998, the price paid by the grid for electricity from mini hydro was PTE 11.45 per KWh and the price for wind energy was PTE 10.48 per KWh (see Chapter 8). Import prices were also lower than in the IES. The average price paid by REN for electricity from co-generation was PTE 9.81 per KWh.

33. If large consumers quit the PES,this will lead to price increases for the other consumers in the PES. In an accord passed with the association of large consumers,large consumers agreed to pay a fee if necessary.
34. This share is met by the purchases of electricity from the embedded hydro plants.

Table 14
Price of Electricity Sold to REN by Category, 1998
(PTE per KWh)

CPPE	*Tejo*	*Turbogás*	*Total PES*	*Embedded Hydro*	*Special Regime*	*Total IES*	*Imports*
7.7	13.6	6.7	7.8	11.2	10	10.3	8.3

Source: ERSE.

End–user Prices and Tariffs

Before 1998,electricity tariffs were established by EDP after consultation with the ministry in charge of energy and the Department of Prices and Fair Trading within the Ministry of Economy. In the past,electricity prices for households and industry were high in comparison with the other IEA countries (Figure 42). There have also been some cross-subsidies in favour of households, which paid electricity prices well below the cost of supply.

At the end of 1996,the government and its social partners signed the Agreement for Strategic Alignment providing for a decrease in electricity tariffs to the EU average. They agreed that electricity tariffs should not decrease at the same pace for all the different categories of consumers.

Electricity price trends between 1973 and 1998 are shown in Figure 43. Prices for industry decreased between 1994 and 1998 while prices for households have increased,in spite of the abolition of the PTE 2.1 per KWh tax in 1992. In constant prices, electricity prices for industry have decreased since 1992 and prices for households have decreased since 1994.

In 1998,ERSE published a plan to bring electricity prices down to the EU average by 2000. Actual reduction was greater than planned because of the rapid decrease in electricity prices in the rest of Europe. In 1998,end-user prices were reduced by 1% for industry and increased slightly for households. Average electricity prices were reduced by 6.4% in 1999. They are projected to stabilise in 2000 and to fall 2% in 2001.

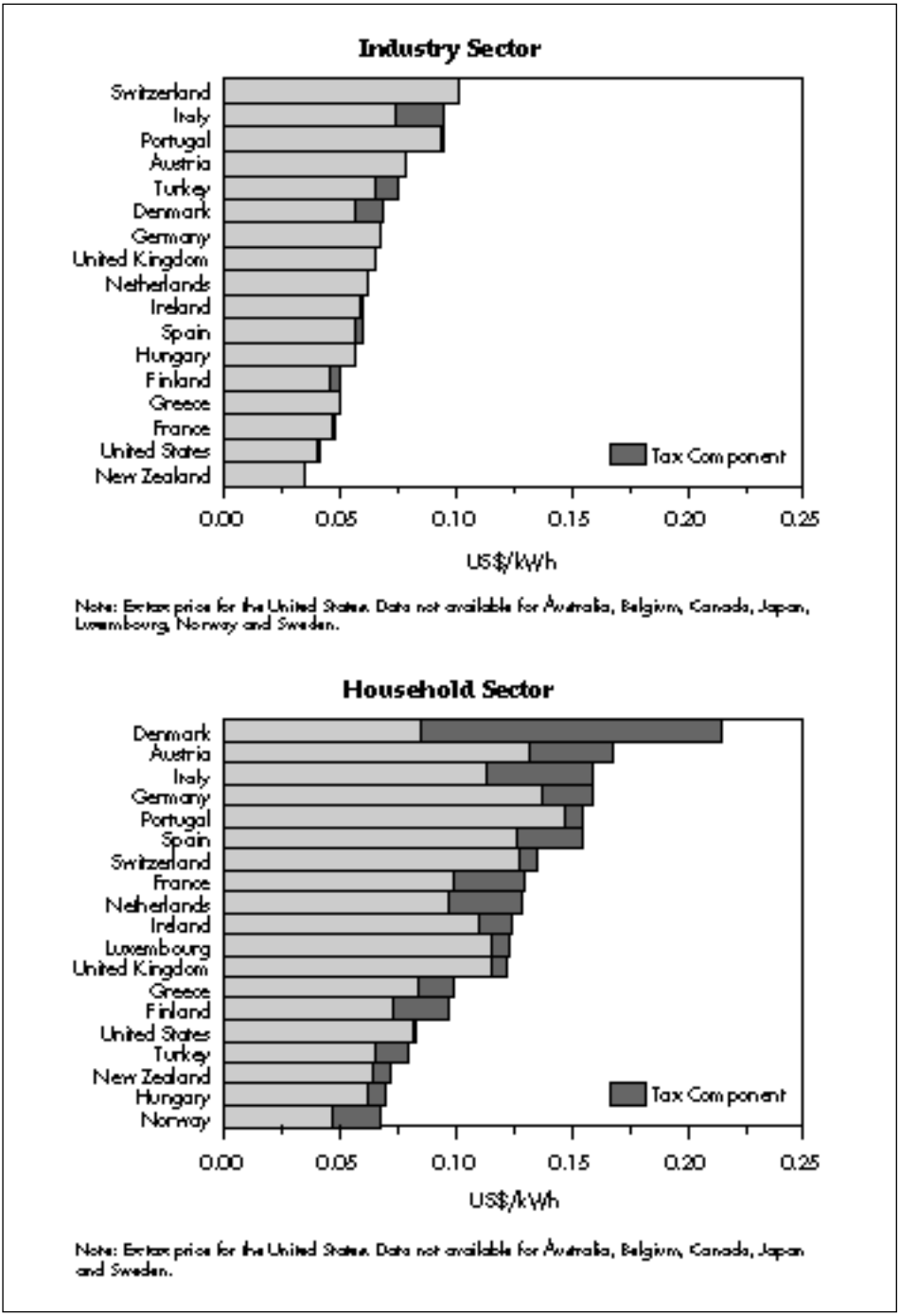
FORECASTS ON DEMAND AND TRADE

General

The Ministry of Economy forecasts that the increase in electricity consumption will continue. Domestic electricity generation is expected to meet demand. Operating capacity is expected to reach 13.1 GW in 2010. Hydro capacity will increase

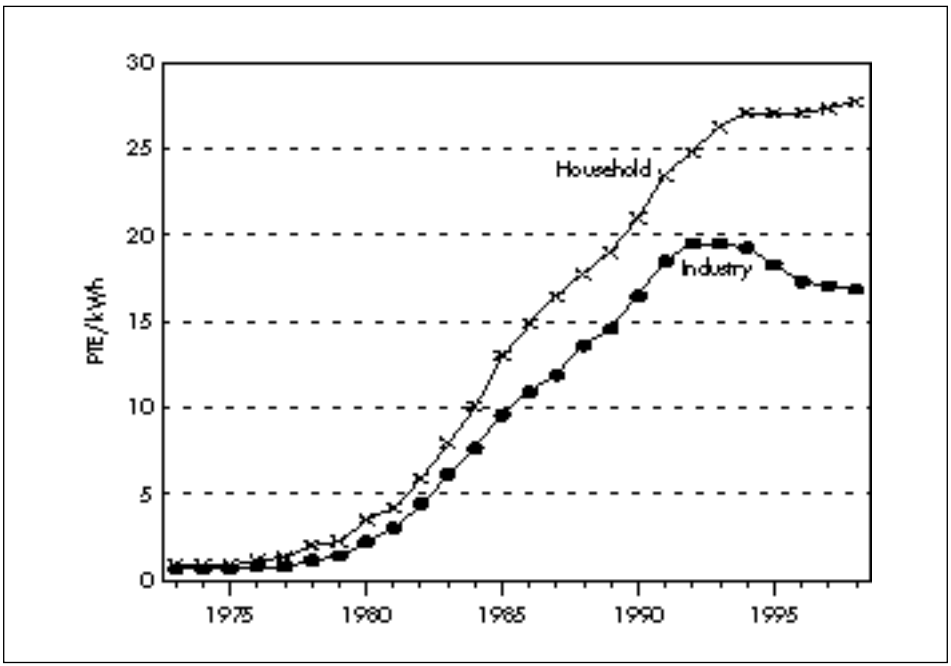
Figure 42

Electricity Prices and Taxes in IEA Countries, 1998



Source: *Energy Prices and Taxes*, IEA/OECD Paris,1999.

Figure 43
Electricity Prices in Portugal, 1973-1998



Note: Prices shown up to the end of 1987 are weighted averages of rates for all sectors of industry. Since the beginning of 1988,prices for industry refer only to medium voltage and 2,500 hours of annual use of subscribed power, as representative of Portuguese industry. The fact that large industrial consumers are not included in price calculations increases the average selling price to industries. This distortion should be taken into account when comparing prices in other countries.
Source: *Energy Prices and Taxes*, IEA/OECD Paris,1999.

marginally to 4.9 GW. Coal capacity will stabilise and oil capacity will fall. Most of the increase will be in gas capacity, which will reach 3.7 GW. In 2010,natural gas is expected to provide 41.7% of electricity generation,while the shares of oil and coal are expected to decline to less than 10% and to 23.4%, respectively.

Development of the IES and PES

According to the 1999 Expansion Plan, generation capacity in the IES will increase to 1.5 GW in 2000 and 2.5 GW in 2010, i.e. to less than 20% of total domestic generation capacity in 2010. Around two-thirds of capacity will be co-generators; the remainder will be provided by renewable energy plants. Sales to the grid will amount to 4.9 TWh in 2010 (Table 15), i.e. 8% of Portugal's expected electricity generation. PES electricity generation is expected to increase to more than 48TWh in 2010,mainly because of the increase in gas-fired power plants (Table 16).

Table 15
Forecasts on Electricity Generation by IES and PES, 2000-2010
(TWh)

	Final Consumption			*Losses*	*Sales to the Grid*		
	Total	*Auto-consumption*	*PES*		*Total*	*PES*	*IES*
2000	36.7	3.2	33.5	3.9	37.4	34.5	2.9
2005	44.3	4.3	40.0	4.6	44.6	40.4	4.2
2010	52.8	5.2	47.6	5.5	53.1	48.2	4.9

Source: General Department of Energy, May 1999.

Table 16
Breakdown of PES Electricity Generation by Fuel, 2000-2010
(TWh)

	2000	*2005*	*2010*
Hydro	10.3	10.6	11.1
Thermal	23.8	29.5	37.4
Natural gas	6.4	11.4	20.9
Coal	12.2	13.3	13.3
Fuel Oil	5.2	4.8	3.2
Total	**34.1**	**40.1**	**48.5**

Source: General Department of Energy, May 1999.

CRITIQUE

The Portuguese electricity generation system has managed to meet the rapid increase in demand and the large fluctuations in hydro availability. In addition, since the last review, measures have been taken to create a framework for a competitive environment,i.e. to make the law of 1995 on electricity liberalisation workable,and to increase the efficiency of the sector. In particular:

- An independent regulator has been set up.
- Codes for commercial relations, network access, dispatch and tariffs have been published.
- The electricity law was amended in 1999 to make it compatible with the EU directive. Other measures have been taken to foster competition, e.g. the two years notice for leaving the Public Electricity System (PES) has been reduced to one year, and a spot market is expected to be created in 2000.

The government has rightly worked for a stable and transparent regulatory framework in the electricity sector. However, at the end of 1999,the competitive part of the electricity system remained only virtual as no eligible consumer was buying electricity directly from generators[35] and no electricity generator had decided to build a power plant in this system. On the contrary, the first two IPPs, Pego and Tapada, were built in the public system as will be the future Combined Cycle Gas Turbine (CCGT). EDP has kept a dominant position in generation, transmission and distribution.

In its 1999 report,the DGE did not foresee a rapid development of the independent system: according to estimates,its growth would continue to be determined by the increases in co-generation and renewable sources (the Special Regime). As a consequence,the DGE is planning to increase energy generation capacity in the PES to fill the future gap between power supply and demand. Therefore, further measures are necessary to develop competition in the electricity sector.

In the public system,the administration decides on future generation capacity and fuel mix. This is complemented by the purchase power agreements (PPAs) in the public system which allow generators to pass along their costs which in the end are paid by electricity end users. Cost reductions are kept by the generators and do not benefit end users. Since generators benefit from such protection in the public system, there are no incentives to generate electricity in the independent system. Thus, the only generators in the independent system are the co-generators and generators from renewable sources (including those that belong to the EDP Group) which sell their electricity to REN at a premium. These generators have no incentives to sell to eligible consumers. There is effectively no true competition among electricity suppliers in either the public or the independent electricity markets.

Overall,the Portuguese system can be seen as a transitional arrangement that aims to introduce competition gradually. In this context,a key issue will be to determine the appropriate pace of reform. While a gradual transition may have benefits in terms of allowing market players to adapt to the new environment and mitigating the financial impact of stranded costs,significant benefits are lost by delaying the onset of effective competition.

If the government wishes to retain a separate PES and IES for a transitional period, the rules governing them should be revised to favour the development of competition. The government may consider amending existing PPAs between generators in the PES and REN. The duration of new PPAs has been reduced and the government should consider further reducing their duration. Exclusivity requirements in the PES could also be removed.

In the longer term,this dual system may not be sustainable as,inevitably, differences in regulatory regimes and prices will make one system or the other preferable to

35. However, in November 1999,an eligible customer from the Sonae Group made an agreement with ENDESA, a Spanish utility, for direct electricity supply. At the beginning of 2000, a total of eight industries had applied to be in the Non-binding System.

end users (i.e. it seems almost impossible that regulations could be fine-tuned enough to make the two systems equal to eligible end users). If, in the end, the independent system prevails,it would put non-eligible consumers at a disadvantage and would create pressure for further reform. If the public system prevails, the potential benefits of increased competition will be lost.

Therefore,the government should consider means to develop true competition in electricity generation. This would create stronger incentives for increased efficiency and better allow these efficiency gains to be passed on to end-use consumers. The aim of the government should be to create a single Portuguese market for electricity in which competition can develop.

A pool is expected to operate in 2000. REN and operators in the independent system would sell electricity in excess, and eligible clients would be allowed to purchase in the pool. It is not clear who will buy or sell since nearly all electricity supply is met through long-term or guaranteed contracts. This pool could function better in a liberalised system. Therefore, the government may consider using the idea of the pool as a means towards merging the PES and the Non-binding System into a single competitive market.

Electricity consumption per inhabitant is still low and is expected to grow at a fast pace with the increase in economic growth. This creates market opportunities for newcomers in electricity generation. Since natural gas has recently been available at a competitive price through the Maghreb-Europe pipeline (see Chapter 6), the most competitive generators in Portugal are CCGTs. It is thus important that all electricity generators, incumbents and new entrants, compete on a level playing field for gas purchases. Therefore,the government should ensure that all generators have equal access to gas and that no advantageous contractual conditions such as below-cost gas supply be made to a specific generator. The regulator should closely monitor the behaviour of GDP and ensure that the joint venture in electricity generation involving EDP and GDP does not reinforce EDP's dominant position in the electricity market.

There are direct incentives for co-generation as well as favourable buy-back tariffs, particularly for large co-generators. This may create an uneven playing field for the other electricity suppliers. Thus, the government should consider limiting these favourable conditions. The buy-back premium for co-generators should be kept at a minimum to create a better incentive for direct supplies to consumers. Also,limitations on co-generators wanting to sell electricity directly to consumers should be lifted in order to enlarge the number of potential customers.

Cross-border trading would improve the environment for competition by further enlarging the electricity market,as there are few electricity generators in Portugal. Eligible Portuguese customers are interested in importing electricity from Spain at a lower price. The Portuguese regulator has participated in a process (the so-called Florence process) to create a tariff system for enhancing European cross-border trading. Efforts to bring about a solution should continue.

Cross-border electricity trade also depends on available capacity in the grid. The decision to build new lines is in the hands of the DGE,which has undertaken a study to assess if and how much new capacity is needed. In its decisions,the DGE should consider the benefits of increased interconnections for better management of the Portuguese electricity system and for the creation of a larger competitive electricity market. The regulator, which already provides non-binding advice,and the System Operator could be given more power in the decision-making process for the increase in interstate transmission lines and also for any extension of the grid in Portugal.

To improve the functioning of the competitive electricity market, the number of eligible customers also needs to be increased. In 1998, there were only 60 industries with an annual consumption of more than 30 GWh,89 of more than 20 GWh and 189 of more than 9 GWh. The government could allow small and medium enterprises to form consortia in order to qualify as eligible consumers. This would reflect the importance of these industries in the Portuguese economy. As the majority of small and medium enterprises is in competition with foreign industries with low production costs, a decrease in their electricity prices would benefit their competitiveness and the Portuguese economy. The government should also allow independent electricity traders to enter the electricity market as this would facilitate competitive supply for small eligible consumers.

The government could relax the limitations on distributors wanting to buy electricity in the independent system. This measure would also increase the number of eligible customers and would enlarge the size of the competitive electricity market.

In 1995, the government rightly gave ERSE extensive powers to regulate the electricity sector. Since its creation,considerable progress was achieved by issuing the Tariff Code,the Code of Commercial Relations,the Code of Access to the Grid and the Dispatch Code. ERSE has also assumed an important role in promoting competition, for instance through the Florence process (see above). Its independence should continue to be ensured and its powers in promoting efficient competition should be extended. In particular, ERSE should have all the means to resolve disputes between suppliers and consumers.

The System Operator and the Market Operator should also be independent from the utilities and in particular from EDP, which could abuse its position as it is the dominant supplier and the owner of the transmission and distribution lines. There should not be any discrimination between the users of the grid; incumbents and outsiders should have equal access conditions. The present system, where REN is entirely in charge of the grid management, may not ensure the full independence of dispatch from EDP. Therefore, the regulator should consider, at a minimum, a functional separation of these activities. ERSE should be in charge of assessing the independence of these bodies and should be able to take rapid measures in case of discrimination. When the electricity pool is created,the same independence from utilities should be ensured for the manager of this new market.

EDP plans to merge its four distribution companies into a single company to improve operational efficiency. Although distribution costs vary widely between areas in Portugal, the regulator may have more difficulty in assessing distribution costs because comparisons between similar companies will no longer be possible. In addition, when diverse distribution companies are required to publish their distribution price,they have more incentive to reduce costs.

ERSE is in charge of setting prices for end users who do not buy electricity in the competitive market. ERSE has rightly removed cross-subsidies in electricity prices in favour of households,as agreed between the government and its social partners. Cross-subsidies in favour of eligible consumers should be avoided. If these eligible consumers can pay a price below the cost of supply, they will have no incentive to buy electricity in the liberalised market.

RECOMMENDATIONS

The Portuguese Government should:

- ☐ Give public support to competition in the electricity sector through the Expansion Plans prepared by the General Department of Energy, in particular by encouraging the competitive part of the independent system to develop.

- ☐ Consider replacing power purchase agreements between generators in the Public Electricity System and Rede Eléctrica Nacional by a more competitive system to better pass on efficiency gains to end users.

- ☐ Ensure that generators in the electricity sector benefit from the same purchase conditions for natural gas. Joint ventures in electricity generation involving EDP and GDP should not reinforce EDP's dominant position in the electricity market.

- ☐ Clearly determine the available capacity for international electricity trading and the terms and conditions for the use of interconnections.

- ☐ Encourage the development of tariffs for transmission and in particular cross-border tariffs allowing for effective trade and competition. Take measures to clarify the rules for handling of possible bottlenecks and reinforcement of the grid when new generation/consumption or trading requires it.

- ☐ Take into account the importance of small and medium enterprises in Portugal's economy, allowing them to form consortia in order to qualify as eligible consumers.

- ☐ Relax the limitations on the distributors for buying electricity in the Independent Electricity System.

☐ Remove the limitations on co-generators wanting to sell electricity directly to consumers.

☐ Safeguard the independence of the regulator and ensure that the resolution of disputes between consumers and suppliers is under its control.

☐ Encourage the regulator to ensure the effective independence of both the System Operator and the Market Operator to avoid discrimination between the users of the grid.

☐ Encourage the regulator to set cost-reflective prices for end users to ensure that there are no cross-subsidies in favour of eligible consumers.

8

RENEWABLE ENERGY SOURCES

PRODUCTION

Portugal and Luxembourg are the only two IEA countries whose energy production stems only from renewable sources. In 1998, Portugal's energy production from renewable energy was 2.3 Mtoe, compared with 2.1 Mtoe in 1990. Between 1990 and 1998, the largest increase was in electricity generation from non-hydro renewable sources,which nearly doubled:

- Hydro electricity is the main energy source produced in Portugal. Between 1990 and 1998, average annual hydro electricity production was 10.1 TWh. However, yearly production varies widely: its production ranged from a minimum of 5 TWh in 1992 (dry year) to a maximum of 14.8 TWh in 1996 (wet year).

- Small hydro capacity was 223 MWe in 1998,more than twice the level of 1990. Electricity deliveries to the grid from small hydro producers (less than 10 MW) increased from 226 GWh in 1990 to 578 GWh in 1997 and 608 GWh in 1998. From 1990 to 1997, about 130 MWe of small-scale hydropower projects were commissioned, reaching 223 MWe. No new capacity was commissioned in 1998 and 1999.

- Energy consumption from biomass was 970 ktoe in 1998,a slight decrease from 1990 (999 ktoe). Electricity production from biomass and waste increased from 689 GWh in 1990 to 1,023 GWh in 1998. In 1999, an electricity plant using biomass was connected to the grid. The plant is situated in the centre north of the country and is integrated with a project to clear forests. In 2000, another plant of 7 MW using wastes from a pulp and paper factory is expected to come on stream.

- Wind capacity increased rapidly, from 1 MW in 1990 to 47 MW in 1998. Electricity generation increased from 2 GWh in 1990 to 91 GWh in 1998.

- Portugal has two geothermal electricity plants in the Azores which produced 52 GWh in 1998. A 0.5 MW shoreline oscillating water column (OWC) wave power plant located at Pico-Açores was commissioned in 1999. When fully functioning, the plant is expected to supply around 9% of the electricity needs of the island.

PROMOTION OF RENEWABLE ENERGY SOURCES

Under the 1994 Energy Programme (see Chapter 3), measures have been taken to give direct support to energy production from renewable energy (wind energy, small hydro, biomass and solar). The General Department of Energy (DGE) is

responsible for allocating the available budget to the different energy sources. Funds are granted to technically feasible projects and to companies which have the financial capability to build and run the plants.

The DGE provides zero-interest loans to large projects, i.e. power plants linked to the electricity grid and projects of more than PTE 150 million. These loans amount to up to 50% of the investment for mini-hydro,up to 55% for wind energy and up to 60% for biomass. The DGE calculates an internal rate of return (net profit/ investment) of more than 7% for wind and mini-hydro projects and around 5% for biomass. The duration of loans is twelve years. A direct subsidy is granted to small projects (less than PTE 150 million) which can amount to up to 50% of the investment cost.

Between 1995 (starting date of the programme) and 1999,public funding amounted to PTE 31.6 billion,i.e. about ECU 160 million (Table 17). Funding from the FEDER programme amounted to 43.5% of the total (public and private).

Table 17
Funds Granted for Renewable Energy Sources, 1995-1999
(PTE and ECU millions)

	*European Union**		*Other***		*Total*	
	ECU	*PTE*	*ECU*	*PTE*	*ECU*	*PTE*
1995	7,113	1,380.4	12,722	2,469.1	19,835	3,849.6
1996	9,431	1,830.8	17,088	3,317.0	26,520	5,147.8
1997	12,851	2,556.1	16,374	3,256.8	29,225	5,812.9
1998	18,829	3,774.9	20,580	4,126.0	39,409	7,900.9
1999	21,123	4,234.9	23,088	4,628.9	44,213	8,863.8
Total	**69,349**	**13,777.1**	**89,854**	**17,797.8**	**159,203**	**31,575.0**

* FEDER.

** Public and private.

Source: Ministry of Economy.

The 1994 Energy Programme formally ended in 2000. At the beginning of 2000, only ongoing projects continued to receive public funding. A new plan is being discussed. Since July 1999, new projects have received bank loans and state funding has been used to reimburse the interest on loans to the banks.

Each project is evaluated by the DGE during the construction phase and after commissioning with the aim of better adapting the financing scheme to the needs of the project.

Other programmes to promote renewable energy sources are:

- Electricity from renewable sources benefit from an incentive buy-back tariff and power purchase obligations. The tariff is set according to the avoided cost of building a Combined Cycle Gas Turbine (CCGT) and transporting electricity. A premium linked to the environmental benefits of renewable sources[36] is added to this avoided cost. This buy-back tariff is voted in Parliament. In 1998, the average price paid by the grid for electricity from mini-hydro was PTE 11.45 per KWh and for wind energy, PTE 10.48 per KWh[37].

- Purchases of renewable energy equipment such as solar panels for residential use benefit from a reduced VAT of 5%. Investment costs in renewable end-use technology are also deductible from the income tax up to a certain amount.

- Research and Development (R&D) on renewable sources amounted to PTE 253 million in 1999,i.e. about two-thirds of total energy R&D. PTE 103 million was devoted to the Azores power plant. Funding for solar thermal R&D amounted to PTE 58.6 million.

CRITIQUE

Measures to promote renewable sources include, as in many other countries, subsidies for investments and an advantageous buy-back tariff. In granting subsidies to promote renewable sources, the DGE takes into consideration the economic viability of the project. When the funding programme started, available funds could finance all the projects presented to the DGE which met the technical and financial requirements. However, with an increasing number of projects, the DGE needs to be selective. Thus,in implementing a new energy programme after 2000,the DGE should choose the most cost-efficient projects to favour cost reductions in energy production from renewable sources.

Other measures could be taken to deal with specific problems:

- Forest ownership by pulp and paper companies has favoured projects using biomass by these companies. Other projects should also receive attention. For instance, specific measures could be taken to improve the efficiency of households'use of firewood,e.g. implementing standards,providing information on technical progress and incentive loans.

- When wind farms are connected to the grid,efficient planning and design of the interconnection would reduce costs and delays. Furthermore, increased transparency of the conditions and costs of connection to the grid and effective

36. The environmental premium is evaluated according to estimates of the cost of CO_2 abatement provided by the IEA/OECD.
37. As the buy-back tariff for peak load is higher than for off-peak and because mini-hydro plants are able to deliver more electricity at peak hours,the average buy-back tariff for electricity from mini-hydro plants is higher than for wind energy.

co-ordination between administrations and municipalities would speed up the completion of most projects.

As the buy-back tariff for electricity from renewable energy is the same for all renewable sources, it is an incentive to choose the renewable energy which produces electricity at the lowest cost. However, buy-back tariffs for electricity from renewables could better reflect the local costs of electricity supply and be increased in areas where those costs are higher, such as on islands. This would increase the attractiveness of renewable energy in those areas.

RECOMMENDATIONS

The Portuguese Government should

- ☐ Ensure that the promotion of renewable sources, including through a new Energy Programme, encourages a decrease in their costs, e.g. by introducing competition among them.

- ☐ Continue to seek the most cost-effective ways to promote renewable sources, including biomass and in the domestic sector.

9

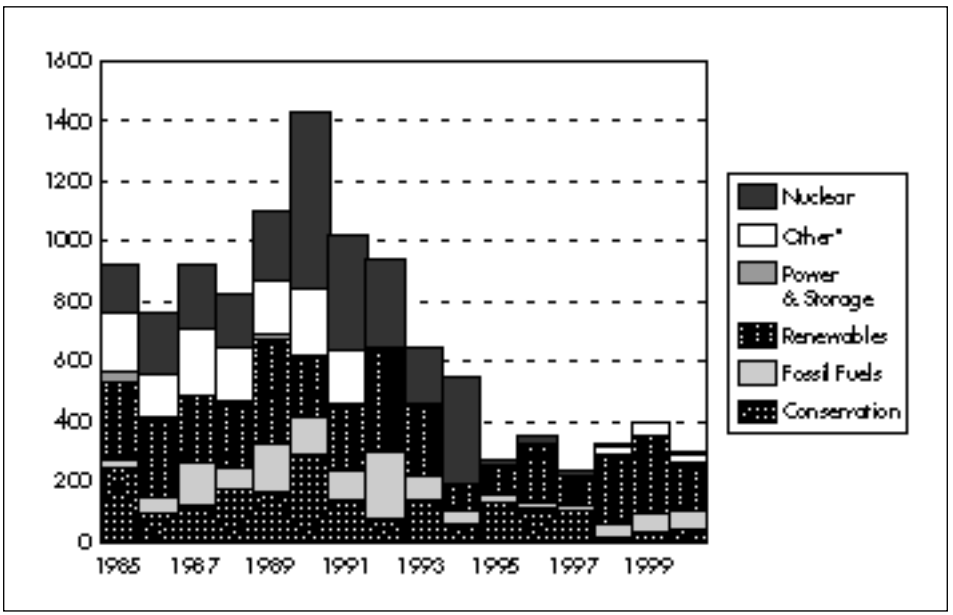
ENERGY TECHNOLOGY, RESEARCH AND DEVELOPMENT

ENERGY R&D FUNDING

The public budget for energy R&D was divided by six between 1990 and 1997, decreasing to PTE 235 million. It increased in 1998 and 1999, reaching an estimated PTE 400 million (Figure 44). The recent increase is mainly due to the funding of the wave power plant in the Azores (see below).

In 1999, expenditures on renewable energy were estimated to be PTE 253 million, i.e. two-thirds of all energy R&D. Expenditures for the wave power plant were estimated to be PTE 103 million, down from PTE 121.5 million in 1998. Expenditure will decrease since the plant came on stream in 1999 (see Chapter 8). Solar thermal receives the second largest amount (PTE 58.6 million in 1999). The other most important areas are coal (PTE 43.2 million in 1999), followed by energy conservation (PTE 35.7 million) and oil and gas (PTE 23.4 million).

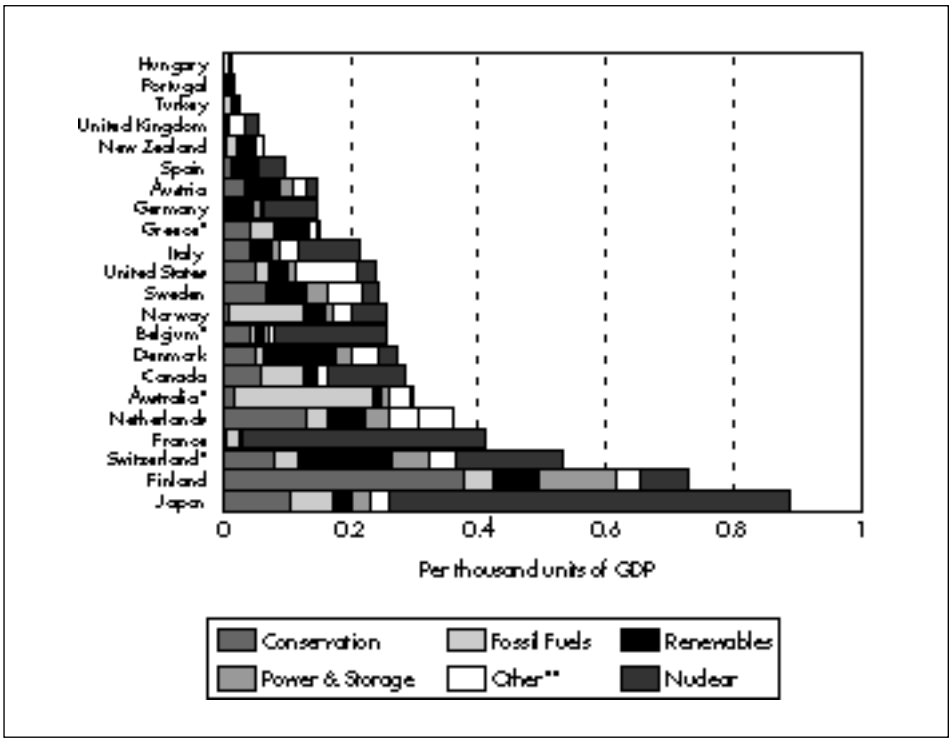
Figure 44
Government Energy Research and Development Budget, 1985-2000
(PTE millions)



* Cross-cutting technologies, system analysis, hydroelectric, hydrogen and energy technology information dissemination.
Note: 1999 estimated; 2000 planned.
Source: Country submission.

In 1999,EU funding amounted to around 50% of total public funding. Funding for energy R&D in comparison with GDP is among the lowest of all IEA countries (Figure 45).

Figure 45
Public Budget for Energy R&D vs. GDP in IEA Countries, 1998



* 1997.

** Cross-cutting technologies, system analysis, hydroelectric, hydrogen and energy technology information dissemination.

Note: Data not available for Ireland and Luxembourg.

Sources: *IEA Energy Technology R&D Statistics*, IEA/OECD Paris, and *National Accounts of OECD Countries*, OECD Paris,1999.

PUBLIC ENERGY RESEARCH INSTITUTES

Public energy R&D is undertaken mostly by the National Institute for Engineering and Industrial Technology (INETI), which reports to the Ministry of Economy. In 1992,INETI was transformed from a laboratory into an institute. As a consequence, it was given the following objectives:

- Enforcing contractual relations with industries, industry associations, universities, administrations, private research organisations and international public organisations and companies.

- Taking stakes in venture capital firms and high-tech companies.
- Supporting the development of other technological structures.
- Playing an active role in the programme called "National System for Quality Management".

INETI's Board of Directors establishes the general guidelines for the institute's activities. The research institute has approximately 900 people on its staff. INETI has five divisions, two of which are involved in energy research: the Institute of Environmental Technology (ITA) and the Institute of Energy Technology (ITE)[38]. All divisions are independent in their strategy and management. The Director of INETI is nominated for three years and can be renewed.

After a reduction in the 1990s, INETI's funding for energy increased in 1998 to around PTE 190 million. EU funding amounted to about two-thirds of total public funding. On the other hand,private funding for energy R&D projects decreased in the 1990s. However, Electricidade de Portugal (EDP) has maintained steady participation in R&D projects (see box).

R&D in EDP

In 1998, EDP was involved in 40 R&D projects. Special emphasis was given to the following:

- Control and monitoring of the environmental impact of thermoelectric power plants.
- Automation and control of power stations and substations.
- Introduction of metering technologies for low-voltage power.
- Demonstration projects in the area of renewable energies: wind, solar, biomass and wave energy.
- EDP participation in the wave power plant in the Azores amounted to PTE 105.3 million in 1998,PTE 64.7 million in 1999. It is expected to amount to 3.8 million in 2000.

At INETI, R&D on renewable energy has focused on solar photovoltaics. INETI participated in research on the wave power plant being built in the Azores (see Chapter 8). Other main energy-related projects include:

38. The other divisions are: Fine Chemistry and Food Technology (IBQTA),the Institute of Materials and Production Technology (IMP) and the Institute of Information Technology (ITI).

- Creating and up-dating a data bank on energy indicators for some products and some industrial sectors.

- Building a pilot plant for fluidised bed technology.

- Optimising coal blend preparation for improved combustion technology.

- Co-combustion of coal with a high-energy fuel recovered from plastics and paper waste.

- Optimising the use of coal in power plants.

Universities as well as two other institutes are also involved in energy research:

- The Institute of Nuclear Technology (ITN), which was separated from INETI in 1995. The institute owns and manages a nuclear research reactor. In 1998 and 1999,ITN undertook no research related to nuclear energy and no research on energy is planned for 2000.

- The National Laboratory for Civil Engineering (LNEC) which reports to the Ministry of Public Works. This laboratory deals *inter alia* with research on hydro, but no data on hydro R&D are available for 1998 and 1999 as the sums involved are very modest.

INTERNATIONAL COLLABORATION

A large number of INETI's projects on energy involve international collaboration, in particular with European enterprises or research bodies through EU funds. In addition, INETI is involved in five co-operative agreements with the IEA: Gas Technology Information Centre, Fluidised Bed Combustion, Photovoltaic Power Systems, Process Integration and Buildings and Community Systems.

THE 1997 REPORT ON THE FUNCTIONING OF R&D INSTITUTES

The government decided to reform Portuguese R&D institutes and in 1996 the Council of Ministers decided to invite an international team of R&D experts to assess these institutes. The team released its report to the Ministry of Science and Technology in 1997. The following box indicates the main findings, which also apply to energy R&D.

Main Findings of the International Team on Portuguese R&D

- With the decrease in funding, the proportion of spending allocated to investments has decreased because staff expenditures were maintained.
- Greater flexibility in administrative and financial rules is required.
- The definitions of missions, goals and tasks lack clarity, which inhibits the development of effective managerial practices.
- Internal communication is not straightforward.
- In some cases,the basic units are too small and cannot achieve the desirable and necessary critical mass.
- Internal and external evaluation is not widely practised.
- Interactions between institutes are limited.
- At INETI, work is driven by the scientific interest and competence of the researchers rather than by the needs of industry. There is little evidence of multidisciplinary projects or of co-operation among departments or institutes in solving clients'problems.

REFORMS OF THE PUBLIC R&D SYSTEM

The government plans to reform the structure of public research. There are plans to increase INETI's R&D budget for energy to PTE 240 million.

CRITIQUE

Public funding for energy R&D has decreased substantially and is one of the smallest of IEA countries with regard to GDP. In addition, private expenditures on energy R&D are modest. Because R&D funding is limited,it should be allocated efficiently. The reform of Portuguese R&D in the energy sector should aim for effective research on energy technologies and in particular on renewable energy and energy efficiency, thus ensuring coherence with Portuguese energy policy.

The 1997 report mentions the lack of interest in R&D by Portuguese private companies. Relations with industry need to be developed to better meet end users' needs. Therefore, in the R&D reform, a focus should be on projects which could attract the interest of the private sector. In this regard, closer relations with industry should be pursued to facilitate deployment of new technologies in the market.

In the reform, the government could draw on the 1997 report on the functioning of Portuguese R&D institutes. Research institutes need to start assessing the results of their projects. In addition to internal reviews, evaluations by external experts should be undertaken periodically. Priorities should be clearly defined and maintained over time. Funding should concentrate on these priorities and avoid financing projects that lack critical mass. Co-ordination between and within research centres should be developed to avoid overlaps and increase complementarity.

International co-operation in energy projects, and in particular participation in European projects, is well developed. Such co-operation is important to compensate for limited domestic funding. While co-operation should be maintained, research centres should concentrate on projects of major national interest.

RECOMMENDATIONS

The Portuguese Government should:

- ☐ Develop a national energy R&D strategy that is coherent with Portuguese energy policy and that encourages private companies to undertake R&D.

- ☐ Encourage public research institutes,and in particular the Instituto Nacional de Engenharia e Tecnologia Industrial, to sharpen the focus of public research, to assess the results of R&D programmes and to strengthen co-operation with industry to better secure market deployment of new technologies.

- ☐ Continue to ensure effective participation in international energy R&D programmes focusing on those which are of major national interest.

A

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1997	1998	2005	2010	2015
TOTAL PRODUCTION		1.40	2.07	2.31	2.32	2.35	2.51	..
Coal[1]		0.13	0.12	–	–	–	–	..
Oil		..	–	–	–	–	–	..
Gas		–	–	–	–	–	–	..
Comb. Renewables & Wastes[2]		0.64	1.15	1.12	1.12	1.14	1.22	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.63	0.79	1.13	1.12	1.04	1.09	..
Geothermal		–	0.00	0.05	0.05	0.04	0.04	..
Solar / Wind / Other[3]		–	0.01	0.02	0.03	0.12	0.15	..
TOTAL NET IMPORTS[4]		5.69	14.82	18.08	19.34	20.72	22.68	..
Coal[1]	Exports	0.01	0.01	0.04	0.05	–	–	..
	Imports	0.28	3.00	3.73	3.19	3.58	3.62	..
	Net Imports	0.27	2.99	3.69	3.14	3.58	3.62	..
Oil	Exports	0.23	2.50	2.42	1.98	..	..	..
	Imports	6.44	14.93	16.97	17.84	14.57	14.71	..
	Bunkers	0.80	0.61	0.50	0.38	1.08	1.36	..
	Net Imports	5.42	11.83	14.05	15.48	13.49	13.35	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	–	0.10	0.70	3.65	5.71	..
	Net Imports	–	–	0.10	0.70	3.65	5.71	..
Electricity	Exports	0.01	0.15	0.21	0.32	–	–	..
	Imports	0.01	0.15	0.46	0.34	–	–	..
	Net Imports	–0.00	0.00	0.25	0.02	–	–	..
TOTAL STOCK CHANGES		0.14	–0.47	–0.24	0.20	–	–	..
TOTAL SUPPLY (TPES)		7.23	16.42	20.16	21.85	23.07	25.18	..
Coal[1]		0.51	2.76	3.53	3.11	3.58	3.62	..
Oil		5.45	11.71	13.98	15.71	13.49	13.35	..
Gas		–	–	0.09	0.70	3.65	5.71	..
Comb. Renewables & Wastes[2]		0.64	1.15	1.12	1.12	1.14	1.22	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.63	0.79	1.13	1.12	1.04	1.09	..
Geothermal		–	0.00	0.05	0.05	0.04	0.04	..
Solar / Wind / Other[3]		–	0.01	0.02	0.03	0.12	0.15	..
Electricity Trade[5]		–0.00	0.00	0.25	0.02	–	–	..
Shares (%)								
Coal		*7.0*	*16.8*	*17.5*	*14.2*	*15.5*	*14.4*	..
Oil		*75.4*	*71.3*	*69.3*	*71.9*	*58.5*	*53.0*	..
Gas		–	–	*0.4*	*3.2*	*15.8*	*22.7*	..
Comb. Renewables & Wastes		*8.8*	*7.0*	*5.6*	*5.1*	*5.0*	*4.8*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*8.7*	*4.8*	*5.6*	*5.1*	*4.5*	*4.3*	..
Geothermal		–	–	*0.2*	*0.2*	*0.2*	*0.2*	..
Solar / Wind / Other		–	*0.1*	*0.1*	*0.1*	*0.5*	*0.6*	..
Electricity Trade		–	–	*1.2*	*0.1*	–	–	..

0 is negligible. – is nil. .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1997	1998	2005	2010	2015
TFC	6.11	12.68	15.92	17.17	18.26	19.61	..
Coal[1]	0.19	0.59	0.44	0.37	0.50	0.54	..
Oil	4.59	8.97	11.58	12.52	11.32	11.55	..
Gas	0.05	0.05	0.11	0.30	1.44	1.80	..
Comb. Renewables & Wastes[2]	0.58	1.00	0.96	0.97	0.86	0.82	..
Geothermal	–	–	0.00	0.00	0.00	0.00	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.06	0.07	..
Electricity	0.70	2.03	2.75	2.91	3.88	4.53	..
Heat	–	0.03	0.07	0.08	0.19	0.32	..
Shares (%)							
Coal	*3.1*	*4.7*	*2.8*	*2.1*	*2.7*	*2.7*	..
Oil	*75.1*	*70.7*	*72.8*	*72.9*	*62.0*	*58.9*	..
Gas	*0.8*	*0.4*	*0.7*	*1.7*	*7.9*	*9.2*	..
Comb. Renewables & Wastes	*9.5*	*7.9*	*6.0*	*5.6*	*4.7*	*4.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.3*	*0.3*	..
Electricity	*11.5*	*16.0*	*17.3*	*17.0*	*21.3*	*23.1*	..
Heat	–	*0.2*	*0.4*	*0.5*	*1.1*	*1.6*	..
TOTAL INDUSTRY[6]	2.71	6.22	6.82	7.53	6.92	7.39	..
Coal[1]	0.14	0.59	0.44	0.37	0.50	0.54	..
Oil	1.81	3.96	4.53	5.07	3.05	2.98	..
Gas	0.00	–	0.04	0.22	0.98	1.16	..
Comb. Renewables & Wastes[2]	0.32	0.59	0.54	0.54	0.45	0.43	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.44	1.05	1.20	125	1.76	1.97	..
Heat	–	0.03	0.07	0.08	0.19	0.32	..
Shares (%)							
Coal	*5.1*	*9.5*	*6.5*	*4.9*	*7.2*	*7.3*	..
Oil	*66.9*	*63.7*	*66.5*	*67.3*	*44.0*	*40.3*	..
Gas	*0.1*	–	*0.6*	*2.9*	*14.1*	*15.7*	..
Comb. Renewables & Wastes	*11.8*	*9.5*	*7.9*	*7.1*	*6.5*	*5.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.2*	*16.9*	*17.6*	*16.6*	*25.4*	*26.6*	..
Heat	–	*0.5*	*1.0*	*1.1*	*2.8*	*4.3*	..
TRANSPORT[7]	1.95	3.82	5.39	5.84	6.99	7.36	..
TOTAL OTHER SECTORS[8]	1.46	2.63	3.71	3.80	4.35	4.87	..
Coal[1]	0.04	0.00	–	–	–	–	..
Oil	0.87	1.21	1.69	1.64	1.32	1.26	..
Gas	0.05	0.05	0.06	0.08	0.47	0.64	..
Comb. Renewables & Wastes[2]	0.26	0.41	0.42	0.43	0.41	0.39	..
Geothermal	–	–	0.00	0.00	0.00	0.00	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.06	0.07	..
Electricity	0.25	0.95	1.52	1.63	2.09	2.52	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*2.4*	–	–	–	–	–	..
Oil	*59.7*	*46.0*	*45.5*	*43.3*	*30.4*	*25.9*	..
Gas	*3.2*	*2.0*	*1.7*	*2.1*	*10.7*	*13.1*	..
Comb. Renewables & Wastes	*17.9*	*15.6*	*11.4*	*11.3*	*9.4*	*7.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.4*	*0.4*	*0.4*	*1.3*	*1.4*	..
Electricity	*16.8*	*36.0*	*41.0*	*42.8*	*48.1*	*51.6*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1997	1998	2005	2010	2015
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	1.33	5.10	5.77	6.63	8.23	9.75	..
OUTPUT (Mtoe)	0.84	2.44	2.94	3.35	4.43	5.28	..
(TWh gross)	9.79	28.36	34.14	38.91	51.49	61.41	..
Output Shares (%)							
Coal	*3.9*	*32.1*	*38.2*	*31.0*	*27.9*	*23.4*	..
Oil	*19.2*	*33.1*	*19.8*	*27.5*	*15.2*	*9.7*	..
Gas	–	–	*0.3*	*5.2*	*28.4*	*41.7*	..
Comb. Renewables & Wastes	*2.0*	*2.4*	*3.0*	*2.6*	*3.5*	*2.9*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*74.8*	*32.3*	*38.4*	*33.4*	*23.4*	*20.7*	..
Geothermal	–	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	..
Solar/Wind/Other	–	*0.0*	*0.1*	*0.2*	*1.6*	*1.5*	..
TOTAL LOSSES	1.23	3.21	4.13	4.56	4.82	5.57	..
of which:							
Electricity and Heat Generation[10]	0.49	2.63	2.77	3.20	3.61	4.15	..
Other Transformation	0.23	–0.38	0.10	0.19	0.08	0.08	..
Own Use and Losses[11]	0.51	0.96	1.26	1.17	1.13	1.33	..
Statistical Differences	–0.11	0.53	0.11	0.12	–	–	–

INDICATORS

	1973	1990	1997	1998	2005	2010	2015
GDP (billion 1990 US$)	40.80	69.13	80.68	83.80	108.07	128.97	..
Population (millions)	8.63	9.87	9.95	9.98	10.10	10.20	..
TPES/GDP[12]	0.18	0.24	0.25	0.26	0.21	0.20	..
Energy Production/TPES	0.19	0.13	0.11	0.11	0.10	0.10	..
Per Capita TPES[13]	0.84	1.66	2.03	2.19	2.28	2.47	..
Oil Supply/GDP[12]	0.13	0.17	0.17	0.19	0.12	0.10	..
TFC/GDP[12]	0.15	0.18	0.20	0.20	0.17	0.15	..
Per Capita TFC[13]	0.71	1.28	1.60	1.72	1.81	1.92	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	17.5	41.5	51.2	55.8	68.2	62.6	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.5	1.9	1.6	1.2	3.4	4.3	..

GROWTH RATES (% per year)

	73–79	79–90	90–97	97–98	98–05	05–10	10–15
TPES	5.5	4.6	3.0	8.4	0.8	1.8	–
Coal	–2.4	18.2	3.6	–12.0	2.1	0.2	–
Oil	6.1	3.8	2.6	12.3	–2.2	–0.2	–
Gas	–	–	–	701.1	26.7	9.4	–
Comb. Renewables & Wastes	3.2	3.7	–0.3	–	0.3	1.3	–
Nuclear	–	–	–	–	–	–	–
Hydro	7.3	–1.8	5.2	–0.9	–1.0	1.1	–
Geothermal	–	–	47.2	13.3	–2.1	–	–
Solar/Wind/Other	–	–	8.9	25.0	25.7	3.9	–
TFC	4.7	4.2	3.3	7.9	0.9	1.4	–
Electricity Consumption	8.5	5.3	4.5	6.0	42	3.1	–
Energy Production	4.4	1.2	1.6	0.0	0.2	1.3	–
Net Oil Imports	8.1	2.9	2.5	10.2	–1.9	–0.2	–
GDP	2.9	3.3	2.2	3.9	3.7	3.6	–
Growth in the TPES/GDP Ratio	2.5	1.3	0.7	4.3	–2.8	–1.8	–
Growth in the TFC/GDP Ratio	1.8	0.9	1.1	3.9	–2.7	–2.1	–

Please note: Rounding may cause totals to differ from the sum of the elements.

Footnotes to Energy Balances and Key Statistical Data

1. Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases,peat is shown separately.
2. Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes tide, wave and ambient heat used in heat pumps.
4. Total net imports include combustible renewables and waste.
5. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
6. Includes non-energy use.
7. Includes less than 1% non-oil fuels.
8. Includes residential,commercial,public service and agricultural sectors.
9. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
10. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
11. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
12. Toe per thousand US dollars at 1990 prices and exchange rates.
13. Toe per person.
14. "Energy-related CO_2 emissions"specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e. coal and coal products,peat,crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO_2 emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1998 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

B

ANNEX

INTERNATIONAL ENERGY AGENCY
"SHARED GOALS"

The Member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1 **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2 Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3 **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4 **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of

* Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

IEA Members wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5 **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6 **Continued research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-Member countries, should be encouraged.

7 **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8 **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9 **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

C

ANNEX

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

bcm	billion cubic metres.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used.
DGE	General Department of Energy.
ECU	European Currency Unit.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
FCCC	Framework Convention on Climate Change.
GDP	gross domestic product.
GW	gigawatt, or 1 watt $\times 10^9$.
IEA	International Energy Agency, whose Members are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.
IES	Independent Electricity System.
LDC	local distribution companies.
LNG	liquefied natural gas.
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
mcm	million cubic metres.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
MW	megawatt of electricity, or 1 Watt x 10^6.

MWh	megawatt-hour = one megawatt × one hour, or one watt × one hour × 10^6.
NBS	Non-Binding System.
OECD	Organisation for Economic Co-operation and Development.
PEDIP	Strategic programme for the Development of Portuguese Industry.
PES	Public Electricity System.
PPP	Purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
REN	Rede Eléctrica Nacional,S.A.
RNT	National Transmission Grid.
SIURE	Incentive System for the Rational Use of Energy.
SLT	Standing Group on Long-Term Co-operation of the IEA.
SR	Special Regime.
TFC	Total Final Consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
toe	tonne of oil equivalent,defined as 10^7 kcal.
TPA	third party access.
TPES	Total Primary Energy Supply.
TW	terawatt,or 1 watt × 10^{12}.
TWh	terawatt × one hour, or one watt × one hour × 10^{12}

IEA PUBLICATIONS, 9, rue de la Fédération, 75739 PARIS CEDEX 15
PRINTED IN FRANCE BY STEDI
(61 00 04 1P) ISBN 92-64-17680-2 - 2000