

Portugal

Energy efficiency report



Objectives:

- 1.8 Mtoe of end-user energy savings by 2015, including 4.8 TWh of electricity savings
- 20% savings in final energy consumption by 2020

Overview	2009		2000-2009 (% / year)	
Primary intensity (EU=100) ¹	90	+	-0.9%	--
CO ₂ intensity (EU=100)	90	+	-2.0%	-
CO ₂ emissions per capita (in tCO ₂ / cap)	4.8	+	-1.9%	++
Power generation	2009		2000-2009 (% / year)	
Efficiency of thermal power plants (in %)	44	++	0.7%	+
Rate of electricity T&D losses (in %)	8	-	-1.2%	-
CO ₂ emissions per kWh generated (in gCO ₂ / kWh)	342	-	3.4%	-
Industry	2009		2000-2009 (% / year)	
Energy intensity (EU=100)	143	-	-0.6%	--
Share of industrial CHP in industry consumption (in %)	32	++	2.0%	-
Unit consumption of steel (in toe/t)	0.13	++	-8.1%	++

*2008 and 2000-2008 for steel

++ Among best countries + Better than the EU average - Below the EU average -- Among countries with lowest performances

Latest update: January 2011

¹ The European Union, as the best-performing region, is used as the benchmark.

1. Overview

1.1. Policies: 10% energy savings in 2015, 20% by 2020

Portugal adopted its National Energy Efficiency Action Plan (NEEAP) in 2008. It sets a final energy consumption reduction target of 10 percent, ie, 20.9 TWh (1.8 Mtoe), by 2015; 39 percent of those energy savings must be achieved in the transport sector, 30 percent in industry and 27 percent in the households and services sector.

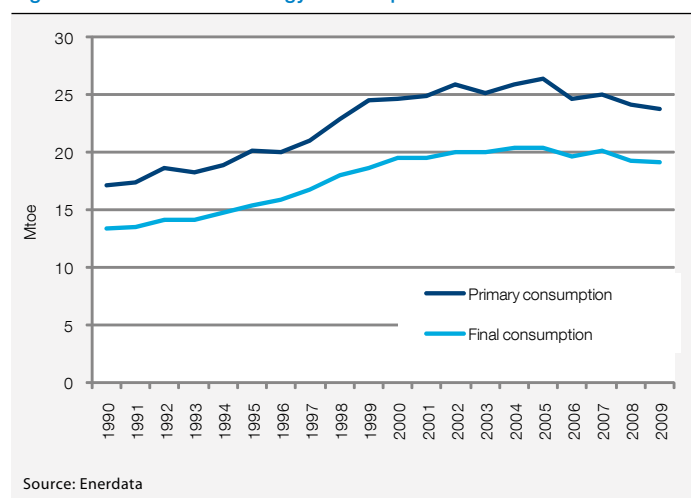
Portugal's National Energy Strategy 2020 (NES 2020) is a continuation of the NEEAP and sets a final energy consumption reduction target of 20 percent by 2020. The NES 2020 also sets targets for renewable energy sources: by 2020 they should account for 31 percent of final energy consumption, 60 percent of power production (including hydro).

An Energy Efficiency Fund was created in May 2010 with an initial allocation of 1.5 million euros (about \$2 million) to encourage behavioural changes and raise awareness, and to support energy efficiency projects (technology-oriented projects and projects not covered by the NEEAP).

1.2. Energy consumption trends: steady growth until 2000

Portugal's total energy consumption per capita represents two thirds of the EU average, at 2.2 toe in 2009. Total energy consumption (primary consumption) grew steadily until 2000 (3.7 percent/year). Between 2000 and 2007, it increased by just 0.2 percent/year, but in 2008 and 2009 it dropped as a result of the economic slowdown (-1.4 percent in 2009).

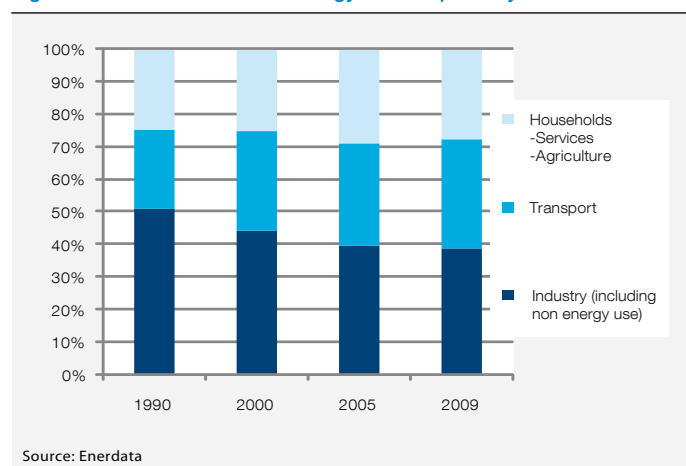
Figure 1: Total and final energy consumption trends



The share of industry (including non-energy uses) in final energy consumption dropped from 51 percent in 1990 to 39 percent in 2009. That fall in the proportion of energy consumed by industry is linked to increased consumption in the transport

sector, which doubled between 1990 and 2009: it currently accounts for 33 percent of final consumption (24 percent in 1990). Energy consumption in the residential and services sector increased by about 60 percent between 1990 and 2009, raising its share in final consumption from 25 percent in 1990 to 28 percent in 2009.

Figure 2: Distribution of final energy consumption by sector



Oil is the main fuel consumed. After a rapid growth between 1990 and 1998, oil consumption slowed down until 2005 and has been decreasing since then by almost 5 percent/year. Gas was introduced in 1997 and consumption has steadily increased (7 percent/year between 2000 and 2009).

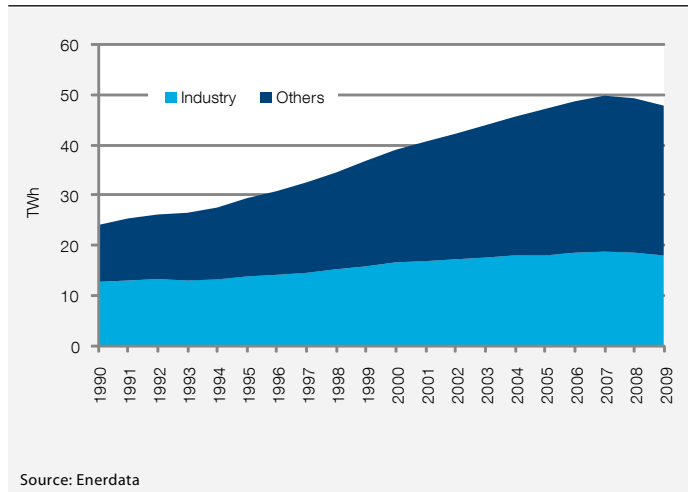
Portugal's electricity consumption per capita remains lower than the EU average, although it almost doubled between 1990 and 2007 (around 4,500 kWh/cap in 2009).

The share of electricity in final energy consumption is increasing regularly, from 15 percent in 1990 to 21 percent in 2009. Portugal's electricity consumption grew rapidly until 2007 (+4.4 percent/year) and has been decreasing since then (-2.2 percent/year).

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Figure 3: Electricity consumption trends by sector



Electricity consumption in industry increased strongly between 1990 and 2000 (+2.7 percent/year), slowed down until 2007 and has been decreasing since then (-2 percent/year). The share of the industrial sector in electricity consumption is now 36 percent, compared with 51 percent in 1990; that fall is due to the strong increase in the electricity consumption of the households and services sector (+5.3 percent/year over 1990-2009), which now accounts for 61 percent of electricity consumption, compared with 46 percent in 1990.

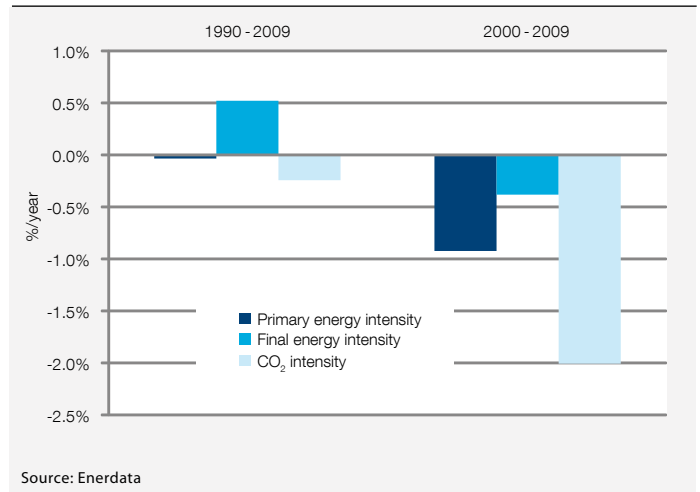
1.3. Energy efficiency and CO₂ trends: improvements since 2000

Portugal's primary energy intensity (total energy consumption per unit of GDP), measured at purchasing power parity, is 10 percent lower than the EU average (2009).

Between 1990 and 2009 the strong increase in energy consumption caused the final energy intensity (final energy consumption per unit of GDP) to grow by 0.5 percent/year; nevertheless, changes in the electricity mix led the CO₂ intensity (CO₂ emissions per unit of GDP) to decrease slightly, by 0.2 percent/year.

Significant improvements have taken place since 2000. Indeed, between 2000 and 2009 final energy intensity has fallen by 0.4 percent/year, while primary energy intensity has dropped twice as fast. The faster decrease in primary energy intensity is linked to a reduction in power conversion losses, driven by the rapid development of gas combined cycles and increased use of wind in power generation. The share of fossil fuels dropped from 84 percent to 77 percent between 2000 and 2009, which led to a more rapid decrease in the CO₂ intensity, which dropped by 2 percent/year over the 2000-2009 period. Portugal's CO₂ intensity, at purchasing power parity, is now 10 percent lower than the EU average (2009).

Figure 4: Energy and CO₂ intensity trends



2. Power generation

2.1. Policies: renewables will reach 60% of power production

The National Energy Strategy 2020 (NES 2020) plans to increase the share of renewables to 60 percent of electricity production and to 31 percent of final energy consumption by 2020.

According to the National Action Plan for Renewable Energies, which is part of the NES 2020, by 2020 the country's solar capacity is expected to reach 1,500 MW, tidal energy 150 MW, wind capacity nearly 7,000 MW and cogeneration from gas 1,800 MW.

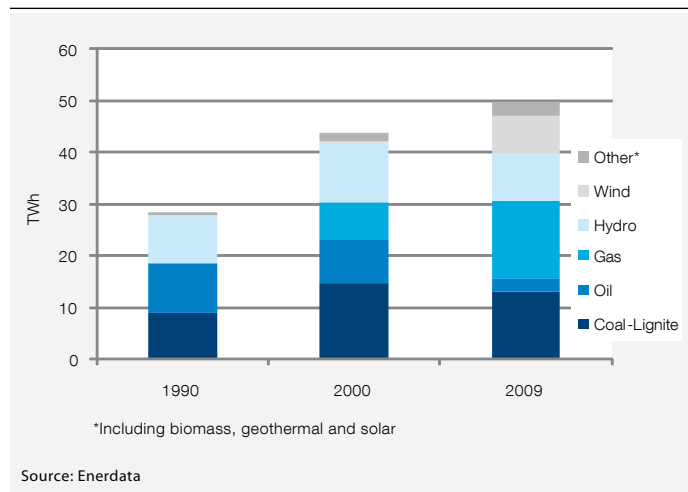
Since 1988 CHP has benefited from feed-in tariffs. In March 2010, a new remunerative framework for renewable cogeneration entered into force. Electricity produced from renewable CHP installations under 100 MW (special regime) can be remunerated with efficiency premiums, calculated according to primary energy savings, and with renewable energy premiums, calculated according to the proportion of renewable fuels consumed. Gas-fired CHP installations under 100 MW (general regime) benefit from a premium for market participation. Feed-in tariffs are also applied to electricity generated from photovoltaics (PV), wind, small hydro, marine and biomass and biogas.

2.2. Power generation trends by source: high-efficiency CCGTs and booming wind power

The share of CO₂-free generation was 39 percent in 2009, up from 35 percent in 1990. The share of hydropower production is now 18 percent, followed by wind with 15 percent and biomass with 5 percent. The boom in wind generation since 2004 combined with the introduction of natural gas in 1997 has led to major changes in the Portuguese power mix, which in

1990 was equally shared between coal, oil and hydropower. The share of coal and oil has been decreasing since 1992 (from 34 percent and 46 percent, respectively, to 26 percent and 5 percent, respectively).

Figure 5: Power generation by source



2.3. Efficiency of the power sector: high efficiency and shrinking CO₂ intensity

The efficiency of the power sector increased substantially over the period 1990-2009, from 48 percent to 55 percent. That improvement was noticeable in thermal generation, where the average efficiency rose from 39 percent to 44 percent thanks to the commissioning of new gas combined cycles. The CCGT capacity grew by 1.6 GW between 2000 and 2009, and now accounts for 28 percent of the thermal capacity (19 percent of Portugal's total installed capacity).

Figure 6: Efficiency of power generation and thermal power plants

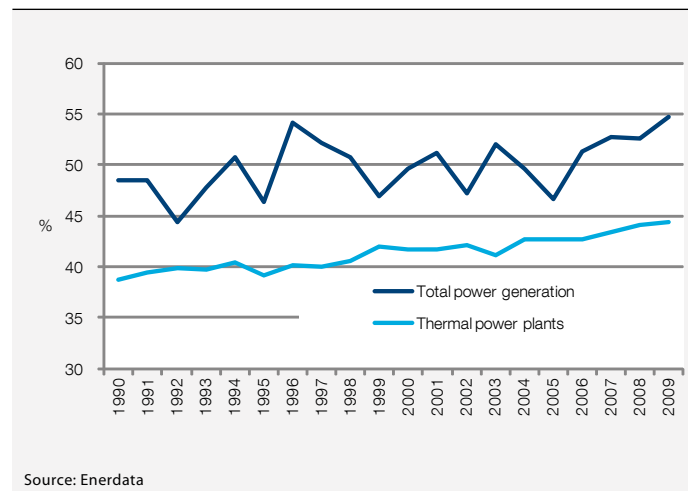
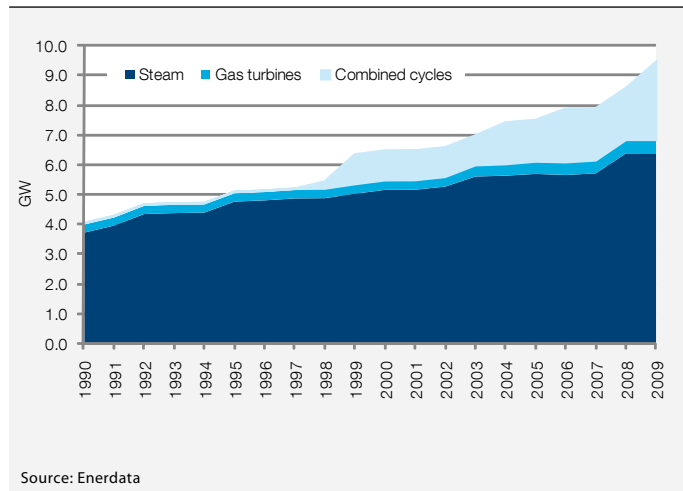
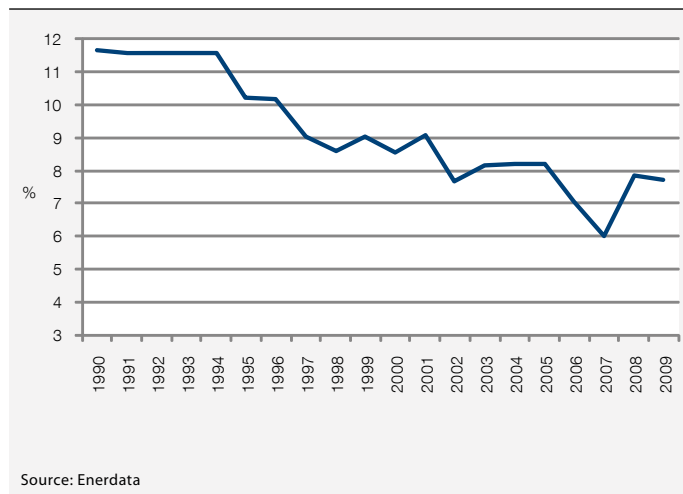


Figure 7: Thermal electricity capacity, by technology



The rate of T&D losses in Portugal decreased by 2.2 percent/year between 1990 and 2009 and is now around 7.7 percent (2009).

Figure 8: Electric T&D losses



The CO₂ emission factor for power generation has fallen by 32 percent since 1990, from 507 gCO₂ to 342 gCO₂ per kWh produced. That decline is linked to the sharp drop in electricity production from oil-fired power plants (from 33 percent of the power generation in 1990 to 5 percent in 2009), which were replaced by high-efficiency CCGT facilities and by wind turbines (accounting for 31 percent and 15 percent of total power generation in 2009, respectively).

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Figure 9: CO₂ emissions factor for power generation

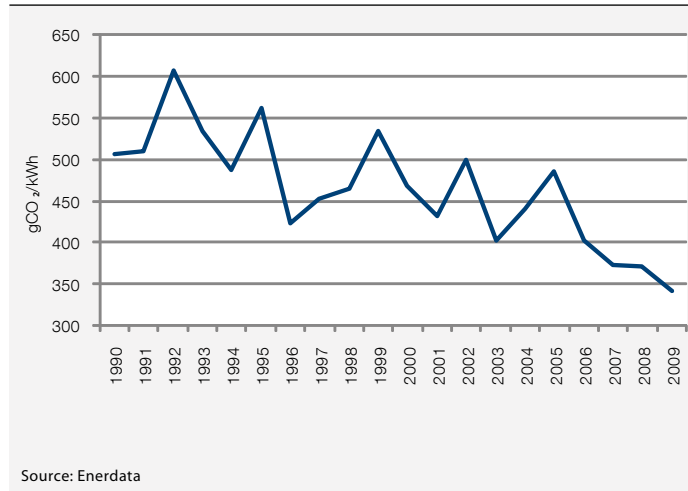
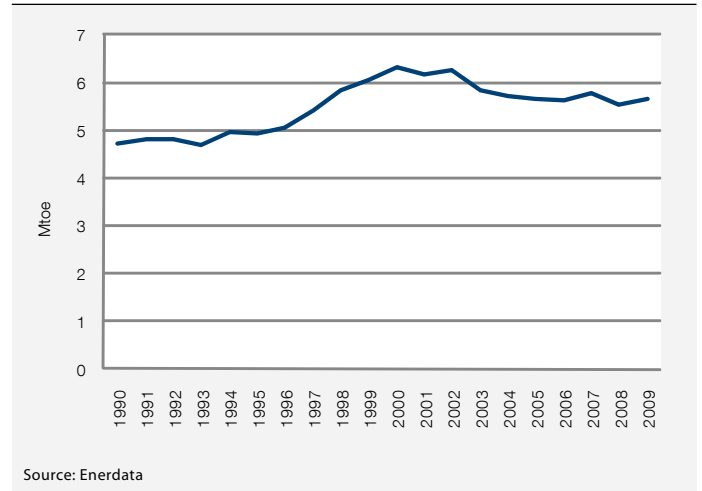


Figure 10: Industrial energy consumption



3. Industry

3.1. Policies: monitoring of energy-intensive facilities and CHP promotion

The Intensive Energy Consumption Management System (SGCIE) was created in 2008 as part of the NEEAP to register energy-intensive facilities (over 500 toe/year). Installations consuming more than 1,000 toe/year must conduct energy audits every 6 years, and have to reduce their energy and carbon intensity by 6 percent. The reduction goal for installations consuming between 500 toe/year and 1,000 toe/year is 4 percent, and audits are carried out every 8 years. The facilities concerned must elaborate “Plans for the Rationalization of Energy Consumption” (PREn) and are subject to financial penalties for non-compliance. These PREn agreements lead to tax exemptions (tax on petroleum and energy products), partial compensation for energy audit costs and 25 percent compensation for investments in energy consumption management and monitoring equipment and systems.

Other measures include the promotion of CHP installations or CHP conversion to biomass and natural gas; the creation of Energy Service Companies (ESCOs) (part of the National Strategic Reference Framework (QREN) system); financing of up to 35 percent of energy efficiency through the application of the Incentive System for Innovation; and launching energy efficiency tenders for small and medium enterprises.

3.2. Energy consumption trends: rising CHP generation and gas consumption

The energy consumption of the industrial sector grew by an average of 2.9 percent between 1990 and 2000 and has dropped by 1.2 percent/year, on average, since 2000.

Electricity consumption in industry increased by 40 percent between 1990 and 2009; its share in industrial energy consumption grew slightly over the period, from 22 percent to 26 percent. The market shares of oil and coal have fallen sharply, from 38 percent and 14 percent, respectively, in 1990, to 20 percent and 1 percent, respectively, in 2009. Gas is increasingly consumed in the industrial sector (+65 percent between 2000 and 2009) and its share in industrial energy consumption is now 19 percent. The share of biomass is exceptionally high, accounting for 27 percent in 2009.

Energy-intensive industries absorb about two thirds of industrial energy consumption. The production of non-metallic minerals (mainly cement) is the largest energy consuming sector (30 percent in 2009), followed by the paper industry (24 percent in 2009). The chemical and steel sectors consume 10 percent and 5 percent of industrial energy consumption, respectively.

Figure 11: Energy consumption of industry, by source

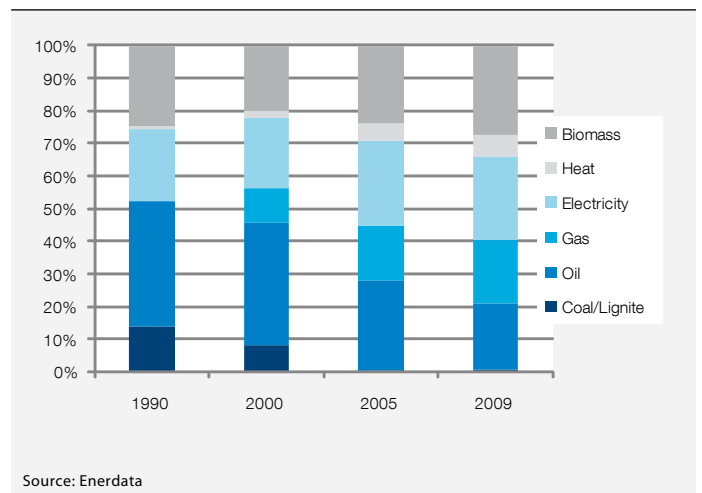
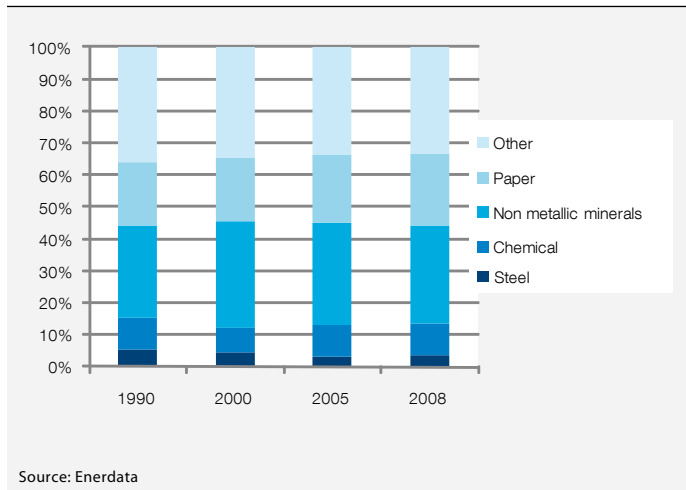


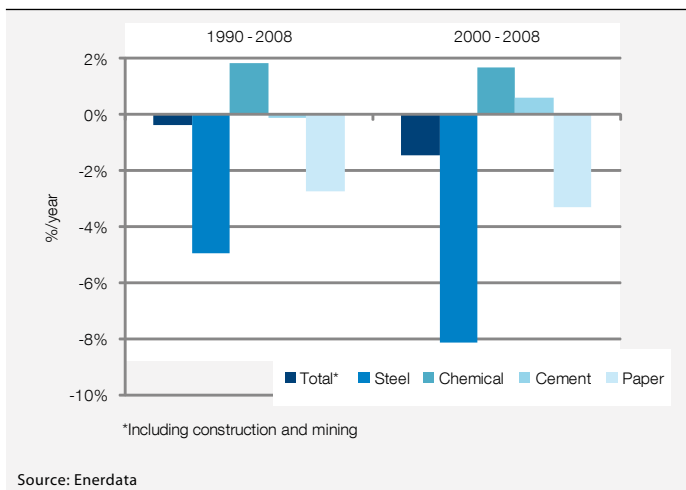
Figure 12: Energy consumption of industry, by branch



3.3. Energy intensity trends: very low energy efficiency improvements

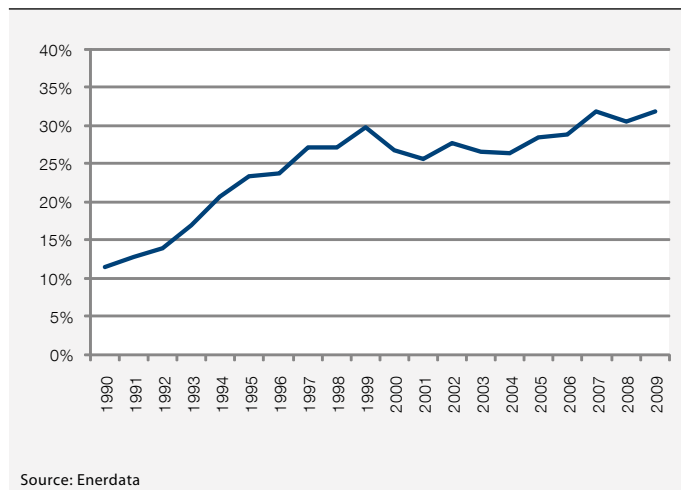
Industrial energy intensity (consumption per unit of industrial value added) decreased by just 0.4 percent/year over the period 1990-2008. Indeed, the reduction in energy consumption per unit of production in the cement branch, which is the largest industry in terms of energy consumption, was insignificant (-0.1 percent/year between 1990 and 2008); the unit energy consumption of this branch even increased after 2000. The paper and steel industries improved their energy efficiency (by 2.8 percent/year and 5 percent/year, respectively), but those improvements had a marginal impact, since their shares in industrial energy consumption are smaller.

Figure 13: Trends in the energy intensity of industrial branches



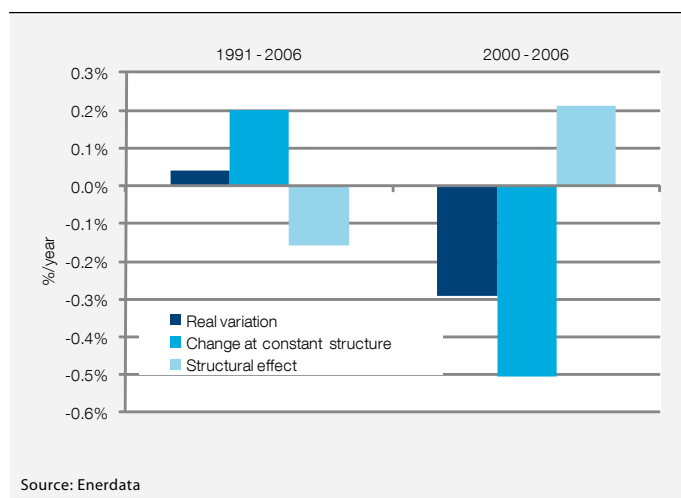
Combined heat and power generation in industry is very well established in Portugal: in 2009 it represented the equivalent of 32 percent of industrial electricity consumption, which is almost twice as high as the EU average (17 percent). It accounted for just 11 percent in 1990 and increased rapidly between 1990 and 1999.

Figure 14: Share of industrial CHP in industrial consumption



The energy intensity of the manufacturing industry in Portugal increased slightly between 1991 and 2006 (by less than 0.1 percent/year). That trend was the result of two opposite drivers. On the one hand, a growth in the energy intensity of industrial branches (+0.2 percent/year), which was partially offset by changes in the structure of the industry towards a greater share of the equipment sector in the total value added. That structural change made it possible to limit the efficiency loss in industrial branches. On the other hand, although over the period 2000-2008 the share of energy-intensive industries in value added increased (+0.2 percent/year), significant energy efficiency gains in most industrial branches made it possible to cut the energy intensity of the manufacturing industry by 0.3 percent/year.

Figure 15: Trend in energy intensity of manufacturing and structural effect



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