2.7 ENERGY

Production and consumption of energy have serious effects on the environment and human health. The traditional energy model has been characterised by intensive use of oil, coal, gas, uranium, non-renewable fossil fuels and minerals and constant growth in demand. Factors such as climate change, increasing costs, especially of oil, and uncertainty regarding supply, have made changes in the world energy model essential. At a national level, this changing scenario means promoting a shift in technology towards low-carbon energy sources, a reduction in energy intensity and a major increase in renewable energies.

Energy consumption in Spain has grown in recent years, driven by transport, industry, services and the domestic sector. Within the European Union, according to Eurostat, Spain (alongside Portugal) is one of the countries that has most increased its energy intensity. In the period 1990-2006, final energy intensity grew by 4.14%, although a decrease was recorded in several individual years. Behind this trend there is a progressive reduction in average annual growth, which would indicate a possible change in the existing upward trend.

After the October 2006 Action Plan, the European Union passed an ambitious package of measures designed to address energy and climate change at the Spring European Council in 2007. It specified three major targets for 2020: a 20% reduction in greenhouse gas emissions; renewable

energies to account for 20% of energy consumption; and a 20% reduction in energy consumption as compared with the current trend.

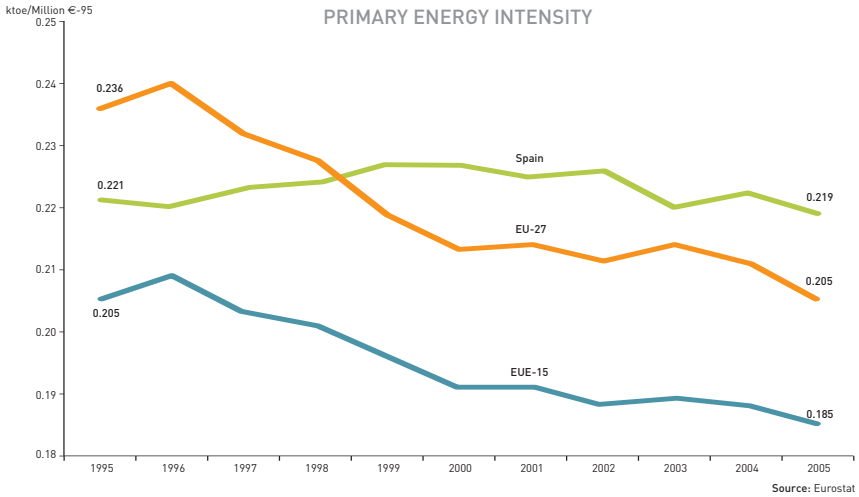
Applying these general goals defined by the European Union, the Spanish Ministry of Trade, Industry and Tourism *(Ministerio de Industria, Turismo y Comercio)* proposed a basic target: 12.1% of primary energy should be produced from renewables by 2010. Introducing sustainability criteria requires changing certain production and consumption patterns within Spain's energy models. As far as renewable energies are concerned, Spain has become a world leader, producing close to 20% of global wind power.

In 2006, there was a sharp reduction in CO_2 emissions intensity, i.e. energy emissions per unit of GDP, which contributed towards a total decrease of 6.46% for the 1990-2006 period. 2006 was also the first year in which annual primary energy consumption decreased. At the same time, the proportion attributable to gas rose, while that attributable to coal fell.

INDICATOR	GOAL	TREND
Primary energy intensity	Weaken the link between energy consumption and GDP	GDP growth is beginning to be decoupled from energy consumption
CO_2 emissions intensity	Decouple economic growth from CO_2 emissions	In 2006, CO_2 emissions intensity diminished in the sector
Renewable energies	Raise renewable energy production to 12.1% of total primary energy by 2010	Increase contribution of renewable energies to primary energy consumption
Eco-efficiency in the energy sector	Decouple economic growth from environmental pressures applied by the sector	Increase the sector's efficiency, reducing emissions and primary energy consumption

Primary energy intensity

After rising then stabilising, energy intensity is now decreasing in Spain



This indicator is the annual ratio between primary energy consumption (i.e. that derived from natural sources which have not undergone anthropogenic modification) and GDP. Primary energy consumption is calculated as the sum of energy consumption from five sources: coal, oil, natural gas, nuclear energy and renewable energies. GDP is considered at constant prices to avoid the impact of inflation (base year, 1995).

Following stabilisation in energy consumption in recent years, in 2005 there was a decrease in line with trends seen across the European Union as a whole. Between 2000 and 2005, primary energy consumption decreased in Spain by 3.65%. The decrease across the EU-27 was 3.90%. This reduction indicates increased energy efficiency. As a consequence, it points to ever-greater economic efficiency and improved sustainability. The indicator shows the degree of energy efficiency by linking energy consumption to economic growth.

NOTES

- Primary Energy Intensity (PEI) is defined as the ratio of primary energy consumption to Gross Domestic Product (GDP). It allows for analysis of the degree of energy efficiency by linking energy consumption to economic growth.

SOURCES

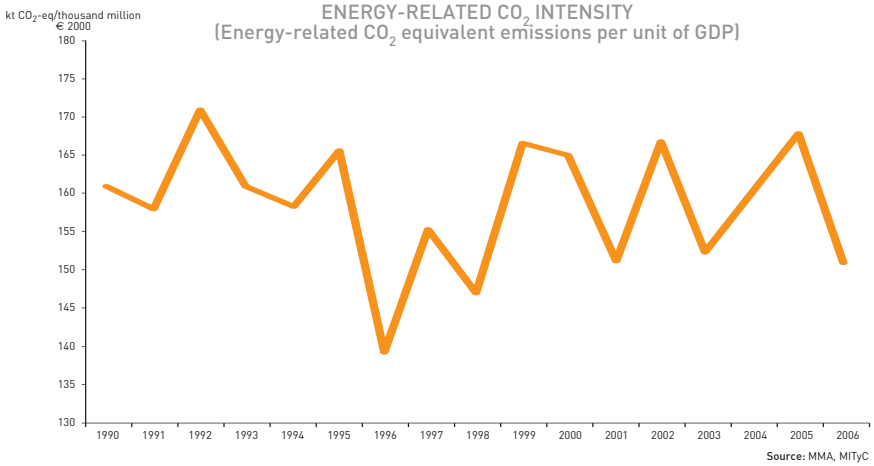
- EUROSTAT. Structural indicators. Short list. Environment, Energy Intensity (Indicator 13).

FURTHER INFORMATION

- http://www.idae.es
- http://www.cne.es/medioambiente.html
- http://www.mityc.es
- http://epp.eurostat.cec.eu.int/
- Spanish Ministry of Trade, Industry and Tourism (MITyC). Secretariat General for Energy *(Secretaria General de Energía)*. "Energy in Spain 2005" *("La Energía en España 2005")*.
- Spanish Institute for Energy Saving and Diversification (IDAE). Spanish Ministry of Trade, Industry and Tourism (MITyC). "Energy efficiency and renewable energy" *("Eficiencia energética y energías renovables")*. IDAE bulletin (Various editions).

CO_2 emissions intensity

In 2006, energy-related CO_2 intensity fell sharply



Oscillations in the intensity of energy-related CO_2 emissions are still very pronounced, as can be seen from the graph. These oscillations are due largely to variations in climate and rainfall. Cold winters mean lower energy consumption, while years with high rainfall see increased hydroelectric production, meaning less fossil fuel consumption. In the period 1990-2006, CO_2 emissions intensity fell by 6.46%. Total greenhouse gas emissions from combustion in energy production and transformation rose from 77,583 kilotonnes of CO_2 equivalent in 1990 to 116,700 kt in 2006.

NOTES

- Energy-related CO_2 emissions intensity is defined as the ratio between total CO_2 emissions from energy transformation industries and Gross Domestic Product. This indicator is very useful for analysing the impact of energy production in relation to a country's economic growth.
- The CO_2 emissions used to calculate the indicator refer to total combustion emissions in the energy production sector (according to IPCC categories) of the six greenhouse gases (expressed as CO_2 equivalent). Energy transformation covers combustion processes, which include electricity generation, combustion at refineries and transformation of combustible fuels, as well as combustion in mining.
- The six main greenhouse gases covered by the Kyoto Protocol, in order of relevance, are as follows: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and fluorinated gases, including perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6), although the latter have no impact in the energy sector as they are only emitted in industrial processes.

SOURCES

- Emissions figures: Spanish National Atmospheric Emissions Inventory *(Inventario Nacional de Emisiones a la Atmósfera)*. Sub-Directorate General for Air Quality and Risk Prevention *(Subdirección General de Calidad del Aire y Prevención de Riesgos)*. Spanish Ministry of the Environment (MMA - *Ministerio de Medio Ambiente*).
- GDP figures: 1990-2006: Spanish Ministry of Trade, Industry and Tourism (MITyC). "Energy in Spain 2006".

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- **http://www.idae.es**
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- **http://www.ine.es**
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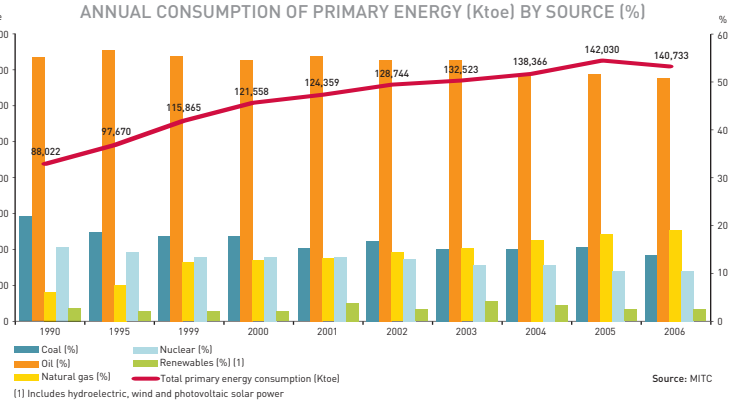
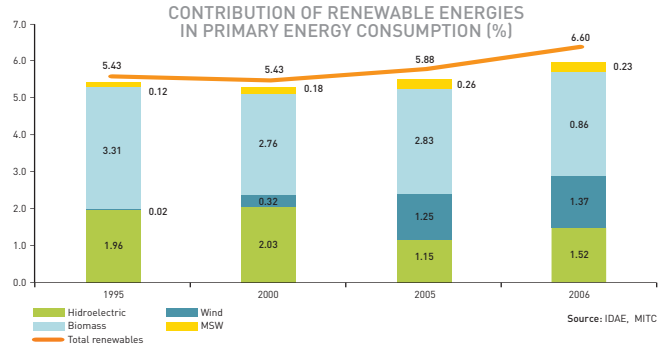
- Spanish Institute for Energy Saving and Diversification (IDAE). Spanish Ministry of Trade, Industry and Tourism (MITyC). "Energy efficiency and renewable energy". IDAE bulletin.

Renewable energies

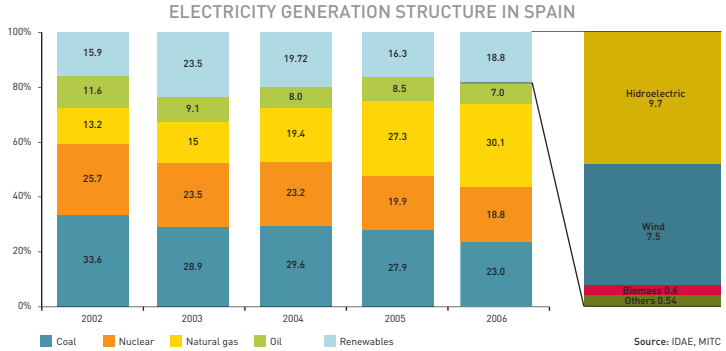
In 2006, annual primary energy consumption decreased for the first time. The proportion attributable to coal fell; oil remained the same; and gas increased





Fossil fuels continue to predominate in primary energy consumption, although some variations can be seen in comparison with previous figures. Compared with 2005, in 2006 the total percentage of renewable energies increased significantly, from 5.88% to 6.60%. Between 2005 and 2006, the percentage for coal decreased (from 16% to 14.2%), while that for oil remained practically the same (50.6% in 2005 to 50.4% in 2006). Meanwhile, the proportions for natural gas (20.5% to 21.5%) and nuclear energy (10.6% to 11.1%) both increased. The share corresponding to renewables rose from 2.5% to 3% (including here hydroelectric, wind and photovoltaic solar power).

As regards the country's electricity generation structure, the proportion of electricity from renewable sources increased again after the fall in 2005 attributed to unusual meteorological conditions. The part corresponding to oil and coal decreased, while that attributable to natural gas rose considerably. At the same time, nuclear energy's contribution remained constant.



NOTES

- The renewable energies total includes hydroelectric, mini-hydroelectric, wind power, biomass and urban waste, along with thermal and photovoltaic solar power and biogas.
- Development of renewable energy sources is a key aspect of national energy policy. On one hand, they make an efficient contribution to reducing the environmental impact of energy production and transformation. This is mainly in terms of greenhouse gas emissions, in particular CO_2, though emissions of other pollutants (SO_2, NO_X, particulate matter, etc.) are also reduced. On the other, a greater role for renewable energies in the overall energy balance also reduces the country's dependence on petroleum products and diversifies sources of supply through the development of inexhaustible and widely distributed energy sources. This in turn also cuts the need for transformation and transport, bringing a corresponding reduction in environmental impact.
- Development of renewable energies is supported by the existence of an appropriate regulatory framework to guarantee private investment in this type of energy source. Spain offers a series of incentives to encourage electricity generation from renewable sources, promoting the development of wind energy to the extent that the country is now ranked second world-wide in terms of wind energy facilities. The changes made to the incentive system in Royal Decree 436/2004 *(Real Decreto 436/2004)*, of 12 March 2004, are driving a major increase in solar energy generation (both photovoltaic and thermo-electric). There is also considerable development in the field of biofuels for transport, Spain now being Europe's leading producer of bioethanol, another of the targets of the PER 2005-2010 plan.

SOURCES

- Figures provided by IDAE - Dept. of Studies and Baseline Information *(Dpto. de Estudios e Información de Base)*. Spanish Institute for Energy Saving and Diversification (IDAE). Spanish Ministry of Trade, Industry and Tourism (MITyC).
- Spanish Ministry of Trade, Industry and Tourism (MITyC). Secretariat General for Energy. "Energy in Spain 2005".

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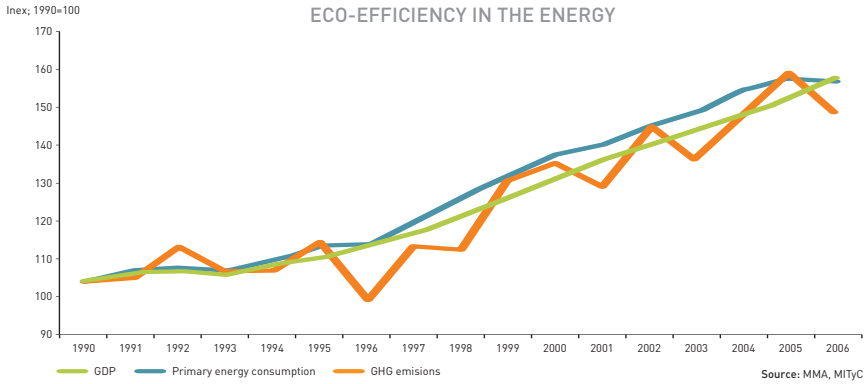
Eco-efficiency in the energy sector

In 2006, GDP growth continued, while greenhouse gas emissions and primary energy consumption in the energy sector both fell



The quest for energy efficiency in the EU pursues a specific target: to reduce greenhouse gas emissions by 20% against 1990 levels by 2020. This was the goal presented in March 2006 in the Green Paper "European Strategy for Sustainable, Competitive and Secure Energy (COM(2006) 105 final)", which identifies six priority areas: security and competitiveness of supply, sustainable development, solidarity, climate change, innovation and relations with third-party countries. Its priorities include defining and adopting an energy efficiency plan that will provide a 20% saving in energy consumption by 2020.

In Spain, 2006 provided positive figures for eco-efficiency in the energy sector: primary energy consumption and CO_2 emissions fell (moderately in the latter case) while GDP continued to grow. Leaving aside climatological oscillations derived from variations in rainfall from one year to the next, and the effects of hot or cold periods, 1990-2006 saw GDP growth similar to that of primary energy consumption. Between 1990 and 2006, emissions increased by 50.4%, while GDP for the same period grew by 60.8% and primary energy consumption by 59.9%.

NOTES
- In energy production, CO_2 accounts for the vast majority of greenhouse gas emissions, meaning that total GHG emissions (CO_2-eq) and CO_2 emissions have little impact on the analysis of eco-efficiency in the sector and production of the graph.

SOURCES
- Spanish National Atmospheric Emissions Inventory. Sub-Directorate General for Environmental Quality (Subdirección General de Calidad Ambiental). Spanish Ministry of the Environment (MMA). Data on total emissions from combustion in energy sector industries included within Energy (in accordance with IPCC categories).
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