

WEC Study on Energy and Climate Change

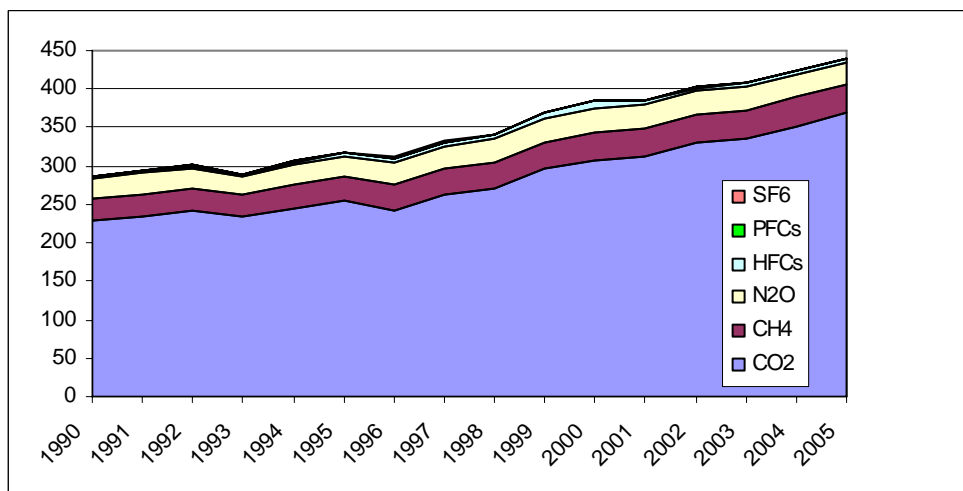
**Summary of climate change measures in Spain since 1990
Assessment against the three As defined by WEC**

APRIL 2007

Government strategy for the accomplishment of the Kyoto objective	
Kyoto objective for Spain: +15% GHG emissions in 2008-2012 / 1990	All sectors
- 37% increased Total emissions	
- +20% credits from Kyoto mechanisms (289,39 Mt)	
- +2% absorbed by sinks	

General context and basic data

Evolution of GHG emissions in Spain 1990 - 2005



Source: MIMAM

Total GHG (Mt) in Spain 1990-2005

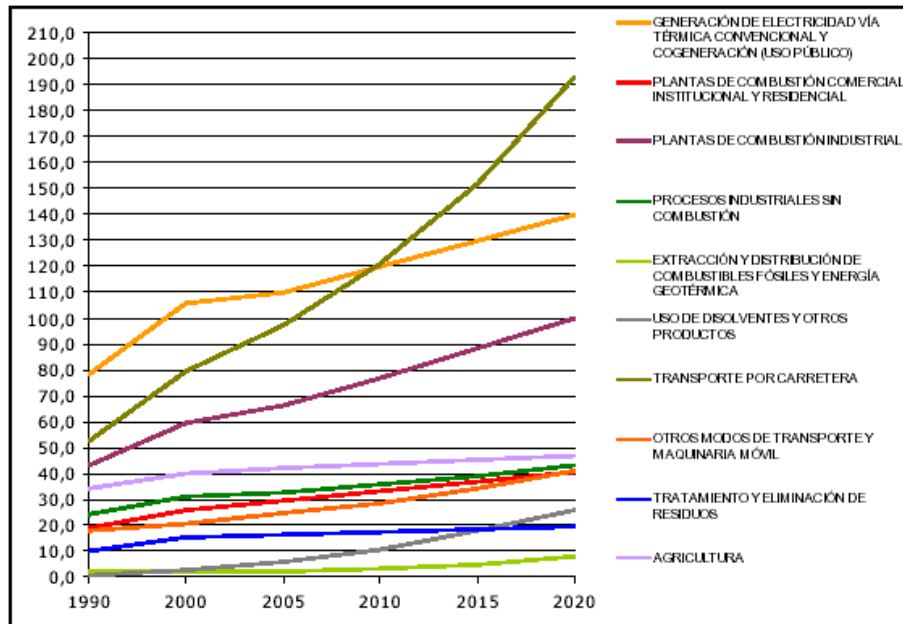
The key contributors to Spain's national GHG total, accounting for about 70 per cent of total emissions in 2000, are CO2 emissions from stationary combustion (which includes energy generation, manufacturing industries and energy uses in the residential-commercial sector) together with CO2 emissions from the transport sector.

In 2000, Spain's population was estimated at 39.9 million. During the past decade the population has grown on average by 120,000 (about 0.3 per cent) per year. A surge of immigration to Spain, as well as migration from rural to urban areas, has changed the demographic profile of the country in recent years while exerting increasing pressure on demand for energy and services. This has contributed to increases in emissions of greenhouse gases.

Most of Spain's policies are directed toward convergence with the EC and increasing economic development. As a result, the country has experienced steady economic growth since the mid-1990s. During the past decade it has achieved economic growth rates that are above the EC annual average of

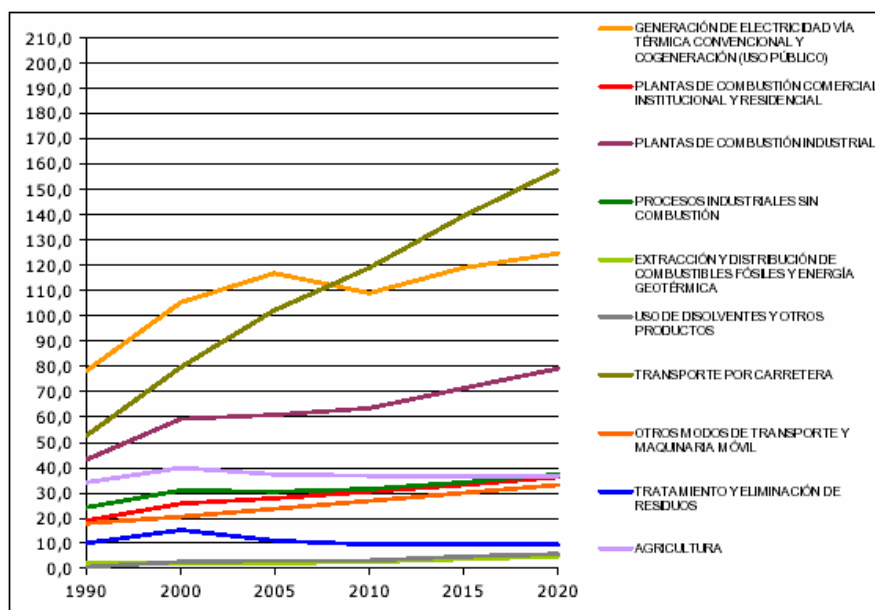
1.8 per cent. The average annual growth rate of gross domestic product (GDP) was 3.5 per cent from 1995 to 2000, and per capita GDP is still below the EC average.

Energy intensity has also been rising in the last decade, but here the difference between Spain and the EC average has been decreasing. However, it should be noted that in the 1990s the energy intensity of Spain's GDP increased from 0.165 to 0.172 kg of oil equivalent per US\$ of 1995, whereas in the same period the average energy intensity for the EC decreased from 0.198 to 0.177. Spain is one of the very few EC countries, if not the only one, where energy intensity is increasing on average, which is a factor in the growth of GHG emissions. Together with its economy and its energy demand, Spain's GHG emissions have grown rapidly, by 47 per cent between 1990 and 2004, and 52 between 1990 and 2005.



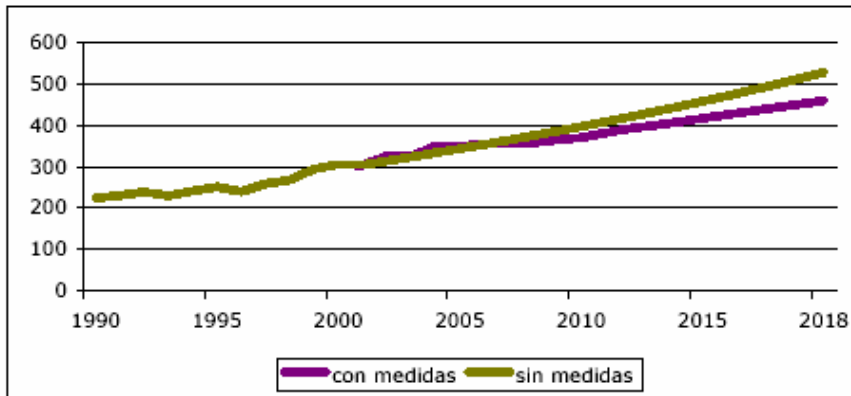
Evolution of CO2 emissions by sector in the reference (BAU) scenario

Source: MIMAM



Evolution of CO2 emissions by sector in the "with measures" scenario

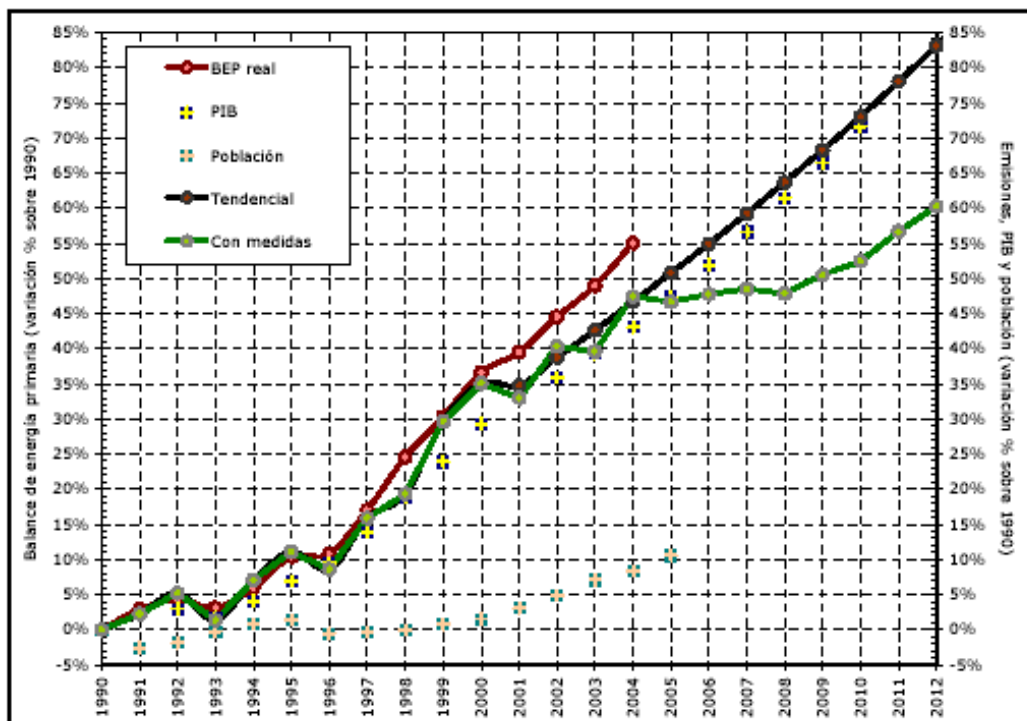
Evolution of CO2 (Mt) emissions in Spain and future trend up to 2018 in the reference scenario (green line) and “with measures” scenario (it does not include the impact of the last Renewable energy plan and the emissions trading directive, though the gap should finally be bigger).



Source: MIMAM

Energy sector. Policies and measures

Next figure shows the evolution of Primary energy balance, emissions, population and GDP, in both scenarios, BAU and with measures (green line)



The growth in emissions reflected the increasing energy demand driven by strong economic growth rate. In addition, the increased industrial energy demand was mainly satisfied through increased fossil fuel consumption. Despite the overall increasing trend, however, annual decreases with respect to the previous years' emissions can be observed in 1993, 1996 and 2001. These annual reductions resulted from higher rainfall and hence more availability of hydropower and less dependence on fossil fuels for

energy generation in those years. A decline in economic performance also contributed to a decrease in emissions in 1993.

These emission trends largely reflect the overall improved socio-economic situation in Spain during the 1990s which was characterized by strong economic growth, a construction boom, an increase in the size of houses, an increase in the overall use of domestic electrical appliances, the introduction of domestic central heating systems. This has resulted in a continuously increasing demand for electricity consumption, including significant additional energy demands resulting from tourism.

Since 1990 the main policies and measures introduced in the electricity sector having an impact on GHG emissions are the following:

1. Emissions trading		
Law 1/2005, 9 march Implementation of the EU Directive on emissions trading	Large CO ₂ emitters in the power and heat generation industry and in selected energy-intensive industrial sectors: combustion plants, oil refineries, coke ovens, iron and steel plants and factories making cement, glass, lime, bricks, ceramics, pulp and paper.	
National Allocation Plan 2005-2007 Royal Decree 1866/2004 of 6 september Allocates emission allowances top the affected sectors stabilising the emissions during the period 2005-2007 in relation to the emissions of the reference period 2000-2002. An additional effort will be needed for 2008-2012.	Total CO ₂ emissions in Spain in 2002: 401,34 Mt Total CO ₂ emissions in 2002 in the sectors affected by the ET law: 164.32 Mt - Total emission allowances allocated in the NAP: 160.28 MtCO ₂ /year - Emission allowances allocated to the power sector: 88.0 Mt CO ₂ /y	0,2% in the period 2005-2007 / emissions in 2002. (6,5 % in the power sector / 2002)
National Allocation Plan 2008-2012 ¹ Royal Decree 1370/2006 of 24 november Allocates emission allowances top the affected sectors stabilising the emissions during the period 2008-2012 in relation to the emissions of the reference year 1990 An additional effort of reduction will have to be carried out besides to assure the fulfillment the measures already anticipated.	Total CO ₂ emissions in Spain in 1990: 287,15 Mt Total CO ₂ emissions in 1990 in the sectors affected by the ET law: 131.66 Mt - Total emission allowances allocated in the NAP: 152,67 MtCO ₂ /year - Emission allowances allocated to the power sector: 54,05 Mt CO ₂ / year	15.9 % in the period 2008-2012 /emissions in 1990 -12.3% in the period 2008-2012 /emissions in 1990

2. Use of project-based mechanisms of the Kioto Protocol		
- Designation of the DNA as an interministerial commission for the aproval of projects and as focal point • Signature of Memoranda of Understanding for the promotion and development of projects with Latinamerican, Mediterranean and Eastern Europe countries.		
- Strategy to buy 100 Mt CO ₂ e for the period 2008-2012:	Spanish Carbon Fund with the World Bank)	Purchase of 34 Mt
	Agreement with the WB for the participation in existing funds	CDCF (4 Mt) and BioCarbon Fund (2 Mt)
	Latinamerican Carbon Initiative with the CAF	Purchase of 9 Mt
	Negotiating Agreement with the European Bank for Reconstruction and Development	3 Mt
	Negotiating agreement with the European Invenstments Bank	purchase of 8 Mt

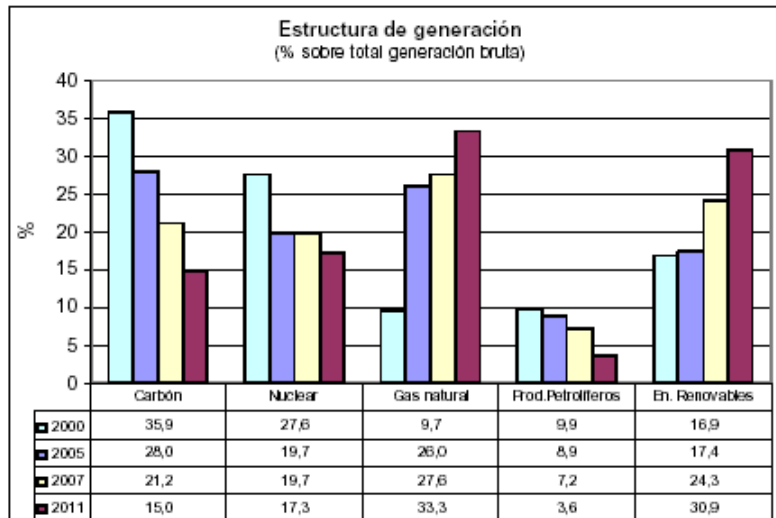
¹ Will need to be slightly modified to accomplish the requirements made by the European Commission

3. Energy planning	
National Energy Plan 1990-2000	Limit to a 25% increase CO2 emissions from energy (from 45% increase in a BAU scenario)
Estrategy for Energy and Environment 1995-2000	Limit to a 16-20% increase CO2 emissions from energy (from 25% increase in National Energy Plan)
Planning of the Electricity and gas Sectors. Development of the Energy Transport Network (2002-2011) Introduction of CCGT to cover additional electricity demand. Indicative planning	<ul style="list-style-type: none"> - 29.000 MW of CCGT installed in 2011 - Total increase of 20% of CO2 emissions from ordinary regime installations in the peninsula from 1990 levels - Increase of gas and electricity networks

4. Renewable energy ²			
Renewable Energy Plan 2000-2010	Between 41,5 and 19,5 Mt CO2 reduction by 2010		
National Renewable Energy Plan 2005-2010 Approved by Council of Ministers august 2005. Increase the Renewable Energy share in the Total Primary Energy Supply to 12 % in 20120 and increase its share in electricity generation to 29,4% in 20120 (indicative target for Spain in the EU Directive). The plan will lead to a total CO2 reduction during the whole period of 76.983.254 t.	Sector and Renewable Energy Source	Capacity increase in the period (MW)	T CO2 emissions avoided during the period
	Power Generation		
	Hydro (>50MW)		
	Hydro (10 - 50 MW)	360	827.254
	Micro Hydro (<10 MW)	450	1.504.926
	Biomass	1.695	17.348.380
	Biomass plants	973	5.638.283
	Co-combustion	722	11.710.097
	Wind	12.000	31.398.660
	Solar PV	363	505.885
	Biogas	94	595.274
	Solar thermal	500	1.071.940
	Total power	15.462	53.252.319
	Thermal uses		
Biomass		5.272.790	
Thermal Solar low temperature		2.485.131	
Total thermal		7.757.922	
Total biofuels (transport)		15.973.013	
Total CO₂ t avoided in the period		76.983.254	

5. Energy efficiency		
Energy saving and efficiency Plan 1990-2000	Reduce the final energy demand 7,6%, primary energy savings of 10093 ktep and energy efficiency improvement of 10,4%	
Energy Efficiency Strategy 2004-2012 Approved in november 2003 by the Council of Ministers. Savings objective for final energy consumption stands at 9,8 Mtoe annual savings achieved by 2012 compared to the baseline scenario. This equals 42 Mt of CO2 avoided per year from 2012 onwards. Strategy to be implemented through action plans.	Sector	CO2 avoided (Mt/year from 2012)
	<i>Final consumption:</i>	
	Industry	4
	Transport	16
	Other sectors: residential, services, agriculture	4
	Energy transformation Sectors	18
Total CO2 avoided in energy terms	42	
Action Plan 2005-2007: Approved by the Council of Ministers in july 2005. Objective: total primary energy savings of 12 Mtoe (equal to the 8,5% of the total primary energy consumption in Spain in 2004 and 20% of oil imports in that year).	Sector	Total CO₂ avoided in the period (kt)
	Industry	2.442
	Transport	14.483
	Housing	3.989
	Equipment	2.437
	Public services	515
	Agriculture and Fishing	173
	Total Final Use	24.038
	Energy Transformation	8.424
Total	32.462	

² The objectives will be modified to accomodate the new european objectives (Energy package, 10 january)



Fuente: Subdirección General de Planificación Energética.

Spanish Strategy for climate change and clean energy

The Spanish Government has presented to the National Climate Council a new strategy still under elaboration that will focus on climate change measures and clean energy. The strategy establishes new objectives and targets concerning renewable energy (10% biofuels for transport in 2020 and a new renewable energy plan 2008-2020 aiming at 20% renewables in the energy mix)and energy efficiency (including the elaboration of a new Action Plan for the period 2008-2012 aiming at reducing energy consumption more than 1% per anum), as well as demand side management, innovation and research.

Assessment of policies and measures against the 3 As

According to the definition made by WEC of the three As, the following points can be highlighted:

Accessibility :

- Provision of reliable and affordable modern energy services for which a payment is made.
- Depends on policies specifically targeted to meeting the needs of the poor,
- Afford commercial energy

Availability :

- Covers both quality and reliability of delivered energy.
- Continuity of energy supply
- Requires a diversified energy portfolio consistent with particular national circumstances together with the means to harness potential new energy sources.

Acceptability :

- Addresses environmental goals and public attitudes

The following assessment against the three As corresponds to the measures applied in Spain and described above.

Measure	Accesibility	Availability	Acceptability
Emissions trading	**	---	****
Use of Kyoto Mechanisms	****	---	****
Energy planning:			
- CHP	***	****	***
- Increase CCGT	***	****	****
- Networks	****	****	***
Renewable energy:			
- Wind	**	***	***
- Biomass	**	****	****
Energy efficiency at end use	**	****	****

In general, measures that increase the costs score low in accesibility from our point of view, like renewables, energy efficiency and emissions trading.

Each measure or policy has advantages and disadvantages. The assessment made is based on the pros and cons of each measure presented in the following tables.

Emissions trading:

Accesibility		Availability		Acceptability	
**		---		****	
Pros	Cons	Pros	Cons	Pros	Cons
	Increases costs	Not applicable		Market instruments for attaining environmental goals generally have good public support and positive environmental results	

Use of Kyoto Mechanisms:

Accesibility		Availability		Acceptability	
****		---		****	
Pros	Cons	Pros	Cons	Pros	Cons
Contribute to tech transfer and development Provide additional funding and investments to developing countries		Not applicable		Help complying with environmental goals Deliver results	Some groups in favour of only domestic measures

Promote CHP

Accesibility		Availability		Acceptability	
***		****		***	
Pros	Cons	Pros	Cons	Pros	Cons
Distributed generation Reduces losses	Increases costs	Reliable supply		Public acceptance Energy savings High efficiency	Produces emissions

Increase CCGT in generation mix

Accesibility		Availability		Acceptability	
***		****		****	
Pros	Cons	Pros	Cons	Pros	Cons
Competitive investment	Subject to volatile fuel costs	Reliable supply	Dependence on fuel imports	Less emissions High efficiency	Public opposition to the use of fossil fuels

Develop and extend gas & electricity networks

Accesibility		Availability		Acceptability	
****		****		***	
Pros	Cons	Pros	Cons	Pros	Cons
Improves security energy supply		Improves continuity and quality of supply			Networks may have public opposition

Wind

Accesibility		Availability		Acceptability	
**		****		***	
Pros	Cons	Pros	Cons	Pros	Cons
Indigenous no-cost resource	High investment costs	Indigenous resource	Intermittent supply	No emissions	Not always public acceptance (noise, visual and birdlife impacts,...)

Biomass

Accesibility		Availability		Acceptability	
**		****		****	
Pros	Cons	Pros	Cons	Pros	Cons
Indigenous resource	High investment costs	Indigenous resource		No accountable emissions Alternative to current agricultural practices	

Energy efficiency at end use

Accesibility		Availability		Acceptability	
**		---		****	
Pros	Cons	Pros	Cons	Pros	Cons
Energy savings Investment savings	Additional costs	Not applicable		Emissions avoided Better performance	Needs an increase of public awareness