Climate Change and Employment in Europe

‘Kyoto’ section

Country Report: Spain

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Executive Summary

This document presents an analysis of the effects of carbon dioxide emission mitigation Policies and Measures on the economic activity and employment in Spain. The investigation is based on the review of the literature and on the results of a series of face-to-face interviews with selected stakeholders. Actors interviewed include representatives of public authorities, employers and employers' organisations, trade unions, and environmental NGOs. They are active in the following sectors: Energy, Industry, Transport, Building and Construction.

Spain's lively economy experienced an important growth, exceeding the European average, in the last few years. Greenhouse gases emissions increased in all sectors in the recent years, making Spain the second European country the furthest away (+52% in 2005) from its Kyoto emission commitment (+15%) in absolute terms. Spain's Kyoto target will only be reachable with an extensive use of the flexible mechanisms.

The Government, at national and regional level, put in place a comprehensive mix of Policies and Measures in order to curb down greenhouse gases emissions, the national Allocation Plan being the central element. Its design has been accompanied by a notable social consultation process, which includes trade unions and companies representatives. Other important Policies and Measures are the Strategy for Energy Savings and Energy Efficiency, the Renewable Energy Plan, and the Strategic Infrastructures and Transport Plan.

The impact on employment of greenhouse gases mitigation Policies and Measures is generally perceived as minor by the interviewees. Nevertheless, some fields, such as Renewable Energy for instance, could see their activity enhanced by such policies. In the same way, cost-benefit analyses of energy efficiency measures commonly conclude to a net positive balance in terms of employment. Some fear for employment in the coal sector as a shift away from conventional energy is expected. In general, Spanish electricity companies are well positioned in the sense that they have long undertaken strategic move towards a production from cleaner sources and are relatively well implemented in the international renewable energy market.

New opportunities, and thus possible positive impact on employment, are expected in the transport sector in terms of proximity transportation and combined rail-road freight and passengers transport. Similarly, energy conservation schemes in the residential sector are expected to lead to a net increase in terms of overall employment.

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Abbreviations and Acronyms

APPA	Asociación de Productores de Energías Renovables (Renewable Energy Producers' Association)
CANE	Climate Action Network Europe
CDM	Clean Development Mechanism
CER	Community of European Railway and Infrastructure Companies
EU	European Union
EU ETS	European Union greenhouse gas Emissions Trading Scheme
GHG	Greenhouse Gases
GICC	Grupo Interministerial de Cambio Climático (Interministerial Climate Change Group)
IEA	International Energy Agency
INE	Instituto Nacional de Estatistica (National Statistic Institute)
ISTAS	Instituto Sindical de Trabajo, Ambiente y Salud (Trade Union Institute of Labour, Environment and Health)
ktoe	kilo (10^3) tons of oil equivalent
MITRE	Monitoring & Modelling Initiative on the Targets for Renewable Energy
$MtCO_2$	Mega (10^6) tons of Carbon Dioxide equivalent
NAP	National Allocation Plan
NGO	Non-Governmental Organisation
PSOE	Partido Socialista Obrero Español (Spanish Socialist Workers' Party)

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1. Introduction and Overview

This document represents the national report for Spain presenting the findings related to the 'Kyoto' section of the research project 'Climate Change and Employment in Europe'.

The report is organised as follows. After the introductory chapter where some national circumstances and the methodology are presented, the state of the national Carbon Dioxide (CO_2) emissions is exposed as well as the reduction targets. In the chapter 3, the different climate change mitigation Policies and Measures are presented. Also, the position of stakeholders in regards to emission scenario is discussed. The chapter 4 presents an analysis of the impacts on economic activities and employment of such Policies and Measures in different sectors. Before the conclusion, considerations about the social transition due to climate change mitigation are made in chapter 5.

Hereby, the *Instituto Sindical de Trabajo, Ambiente y Salud* (ISTAS, Trade Union Institute of Labour, Environment and Health) wishes to cordially thank all the interviewees for their contribution to this study.

Land

Spain is located in Southwest Europe, and is surrounded by the Bay of Biscay, the Pyrenees and Southwest of France, the Mediterranean Sea, Portugal, and the Atlantic Ocean. The Spanish territory, beside the Iberian mainland, includes also de Balearic (Mediterranean Sea) and Canary (Atlantic Ocean) Islands, the cities of Ceuta and Melilla located on the African Mediterranean coast, as well as three small islands off the coast of Morocco (Islas Chafarinas, Penon de Alhucemas, and Penon de Velez de la Gomera). The total area represents 504'782 km^2, out of which about a quarter is arable land and another 10% used for permanent crops.

Population

Due to a considerable increase in life expectancy and a stagnant birth rate, together with significant incoming migration movements, Spain has experienced a substantial population growth in the last 5 years. Indeed, the population increase in 2005, relative to the previous year, represented 2.4%, with a total population reaching just over 43 million. In comparison, the population increase in the EU25 represented 0.5% the same year[1].

[1] Data source: Eurostat database, http://epp.eurostat.ec.europa.eu; viewed 30 June 2006.

Politics

The Spanish constitution allows for a highly decentralised administrative system. Autonomous Communities and, to a lesser extent, Local Entities enjoy of significant competences in important matters related to climate change, such as energy demand, consumption patterns, and soil use. The Environmental Sectoral Conference assumes the responsibility of coordinating issues in which political responsibility is shared between the Central Government and the Autonomous Communities.

Economy

In 1989, Spain joined the European Economic Community, and in 1999 the Monetary Union. The Spanish economy has been characterised by a considerable expansion in the recent years, with GDP at constant prices increasing by almost 70% between 1985 and 2004 (Ministerio de Medio Ambiente 2006a). Spain experienced one of the most important GDP growths amongst Western European countries during the last few years[2]. Also, the access to the Monetary Union allowed for the Spanish economy to flatten its cyclical pattern.

Tourism, as the principal driver of the Spanish economy, represented over 11% of the total GDP in 2003 (Ministerio de Medio Ambiente 2006a). The number of tourists coming to Spain is still rising. By contrast, agriculture keeps decreasing its relative contribution to GDP, as it is the case in many comparable European countries.

Employment in Spain

Out of the total active population (approximately 17 million people), about 6% was working in the agricultural sector in 2001. The service sector employed the largest proportion of the active population, around 62%, while workers in the industry and the construction sectors accounted for 20% and 12 % of the total respectively[3].

Unemployment has been relatively high in Spain during the past decade. In the recent years, however, the Spanish unemployment rate has significantly decreased, going from 19.5% in 1994 to 9.2% in 2005, value which is now just above the EU25 average of 8.7%[4].

[2] Data source : Eurostat, 'Eurostatistics, Data for short-term economic analysis', 5/2006, http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-BJ-06-005/EN/KS-BJ-06-005-EN.PDF, viewed 29 June 2006.
[3] Data source: Instituto Nacional de Estadistica (INE), http://www.ine.es/, viewed 30 June 2006.
[4] Data source: Eurostat database, http://epp.eurostat.ec.europa.eu; viewed 30 June 2006.

Past and current climate[5]

The climate conditions in Spain vary significantly due to the complex topography of the country and its geographical setting. The mean annual temperature ranges from below 0°C in altitude in the Northern part of the Peninsula (the Pyrenees) and in the South (*Sierra Nevada*) to about 18°C in the some regions (*Almeriense*, *valle del Guadalquivir)* (see Figure 1). In terms of annual accumulated precipitations, the spatial difference varies from barely 150 mm to over 2500 mm (Ministerio de Medio Ambiente 2006a). Annual mean rainfall is relatively abundant in the Northern and North-Western part of the Peninsula. In contrast, most of the central area of the Peninsula, as well as most of the Balearic Islands and Canaries Islands experience very little total rainfall. The inter-annual variability is very high, depending mainly on atmospheric circulation patterns in the Northern Hemisphere, and the Northern Atlantic Oscillation in particular. Also, the considerable range of extreme daily values is noteworthy. The sequences of consecutive rainless days can exceed 4 month in the South (Ministerio de Medio Ambiente 2006a).

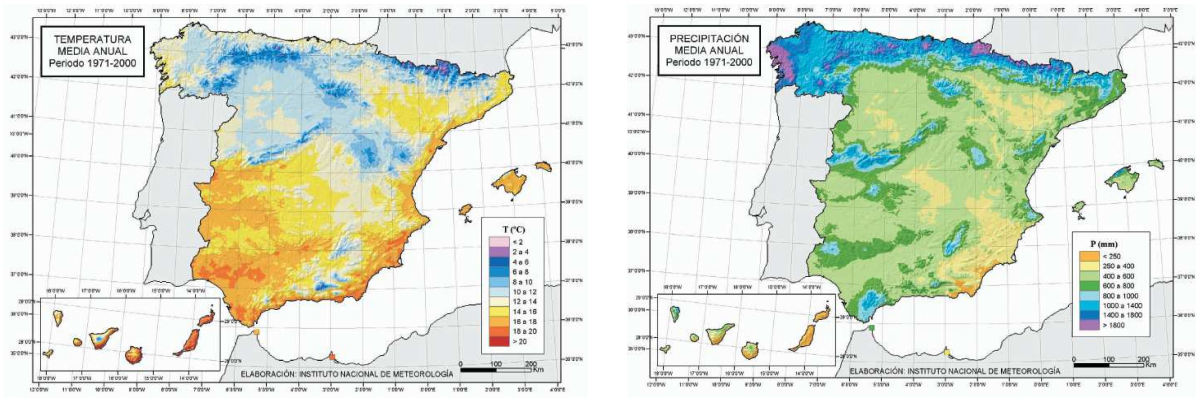

Figure 1: Annual mean temperature in °C (left) and precipitation in mm (right) for the period 1971-2000.
Source: Instituto Nacional de Meteorologia in Moreno Rodríguez 2005, pp.7 & 10.

During the 20th century, overall temperatures rose in Spain at a higher magnitude than the global mean, and particularly so in winter. In general, precipitations tend to decrease, and are characterised by a high variability.

Future climate

General Circulation Models presents a resolution that is too coarse for the evaluation of local climate change impacts. They are often couple to a Regional Climate Model in order to obtain more detailed data. Within the framework of the PRUDENCE project, the PROMES regional

[5] The data are derived from Moreno Rodríguez 2005 unless mentioned otherwise.

climate model from the University Castilla-La Mancha in Toledo was used in combination with the general circulation model HadAM3H from the Hadley Centre for Climate Prediction and Research (UK) in order to estimate the future climatic conditions in Spain (see Figure 2).

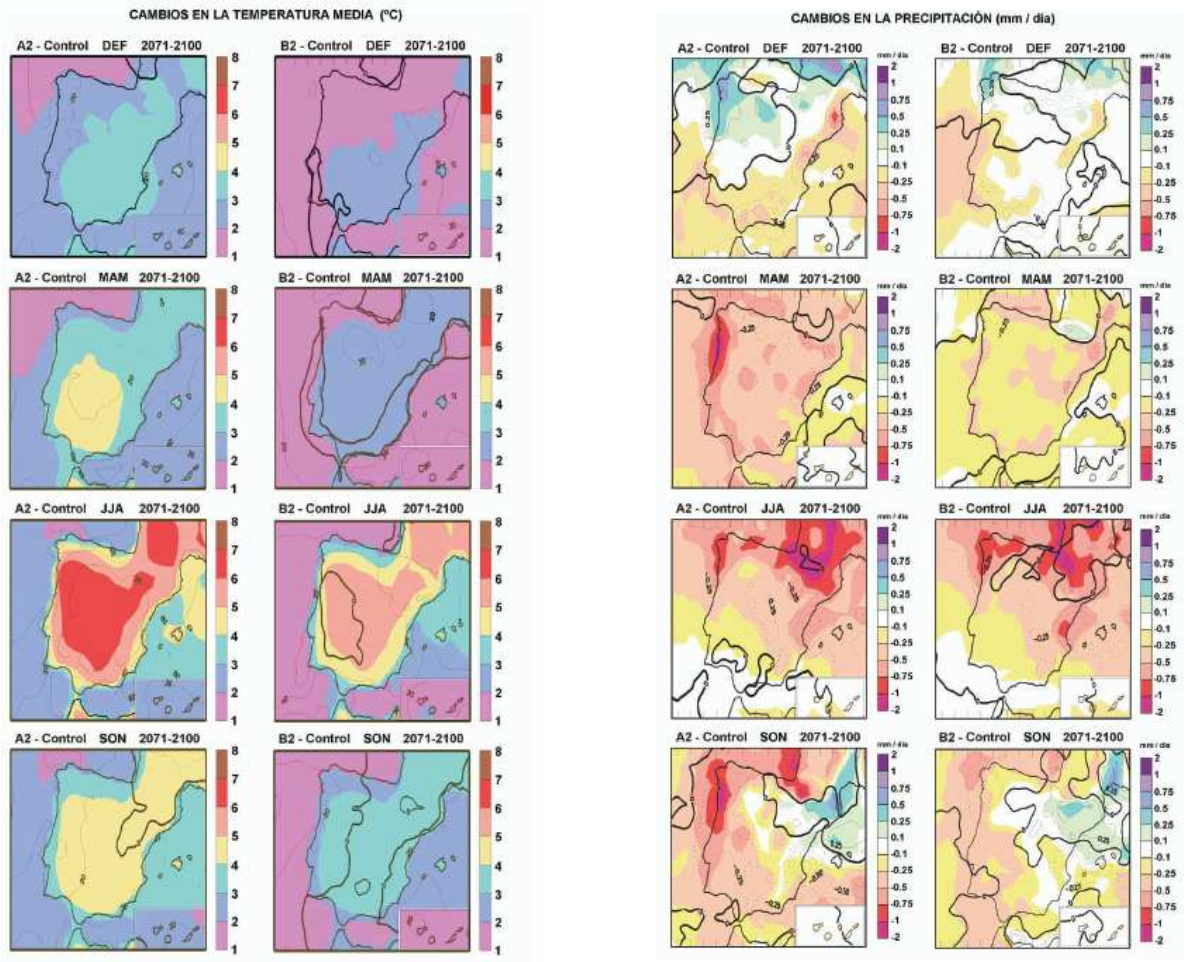

Figure 2: Forecasted changes in daily mean temperature in °C (left) and precipitation in mm/day (right) in the Iberian Peninsula, Canaries and Balearic Islands, under A2 scenarios (first columns) and B2 scenario (second columns).
The values represent the difference in the conditions between the simulated period (2071-2100) and the control period (1961-1990). DEF: December-January-February; MAM: March-April-May; JJA: June-July-August; SON: September-October-November.
Source: Moreno Rodríguez 2005, pp.44 & 45.

According to those models, the mean temperature will rise in Spain at about 0.4 °C/decade in winter and 0.7 °C/decade in summer with some variation according to the emission scenario[6] assumed. It is therefore foreseen for the temperature to have increased by between 5 to 7 °C in summer and 3 to 4 °C in winter by the last third of the current century. In terms of precipitation, the outcome of the models varies notably. Nonetheless, there seems to be a

[6] For more details on IPCC emission scenarios, see IPCC 2000, 'Special Report on Emission Scenarios', Summary for Policymakers, <http://www.grida.no/climate/ipcc/emission/index.htm>, viewed 27 June 2006.

consensus that the total annual precipitation will decrease significantly. The decrease will be stronger in spring than summer.

Furthermore, an increase in the intensity and frequency of abnormal monthly mean temperature is expected in the future, during all seasons, to the extent of about 20%. The frequency of extremely high temperatures will increase substantially on the Peninsula in spring and in autumn to a lesser extent. No such changes could be noted in the Balearic and Canaries Islands. The frequency of extremely cold days will tend to diminish. No significant change of abnormal precipitation could be observed.

To summarise, Spain, and Southern Europe in general, is usually seen as particularly vulnerable to climate change (Moreno Rodríguez 2005). Climate predictions foresee an exacerbation of extreme conditions, such as droughts and heatwaves, challenging even more the environment as well as socio-economic systems already under stress.

1.1 Methodology

The source of information to sustain the investigation presented in this report is twofold. Firstly, an extensive literature review and analysis has been conducted in order to collect relevant national data in terms of greenhouse gases emission, emission reductions and their potential influence on the economic activity and employment in different sectors. Also, position papers from sectoral actors and other stakeholders represent valuable insights about the opinion of and perception of GHG emission mitigation issues and climate change in general. Furthermore, the examination of official governmental documentation allowed for a comprehensive evaluation of national strategies.

Secondly, a series of interviews have been conducted, allowing for fetching the opinion of selected key stakeholders in Spain. Out of the 25 actors contacted, 21 responded favourably to our request and accepted an interview[7]. The groups of actors interviewed included national, regional and local public authorities, employers and employers' organisations, trade unions, and environmental Non-Governmental Organisation (NGO). The stakeholders contacted active in the private sector belong to the following broad economic sectors: Energy, Industry, Transport, Building and Construction. In regards to the public sector, governmental officials as well as a sample of local and regional public authorities' representatives, in Catalonia and Andalucía mainly, were contacted. The actors interviewed got offered the opportunity of

[7] For an overview of the actors contacted, please refer to Annex A.

commenting on an earlier draft of this report, although it must be noted that such process has been undermined somewhat by the language barrier. More detailed information about the methodology is available in the common section of this project.

2. CO_2 emissions and emission targets

Energy and CO_2 emissions

A strong increasing trend is to be reported in all sectors in the recent years in regards to energy consumption in Spain. Noteworthy in 2005 is the fact that, for the first time in the recent years, the use of primary energy has increased at a lesser rate (+ 3%) then GDP[8] (+ 3.4%). The total Primary Energy Consumption reached 136'102 ktoe in 2003. The energy-mix (see Figure 3) is expected to change in the next years in Spain. Indeed, the focus is put on encouraging renewable energy sources and gas-fired combined cycle plants to the detriment of conventional and nuclear energy[9].

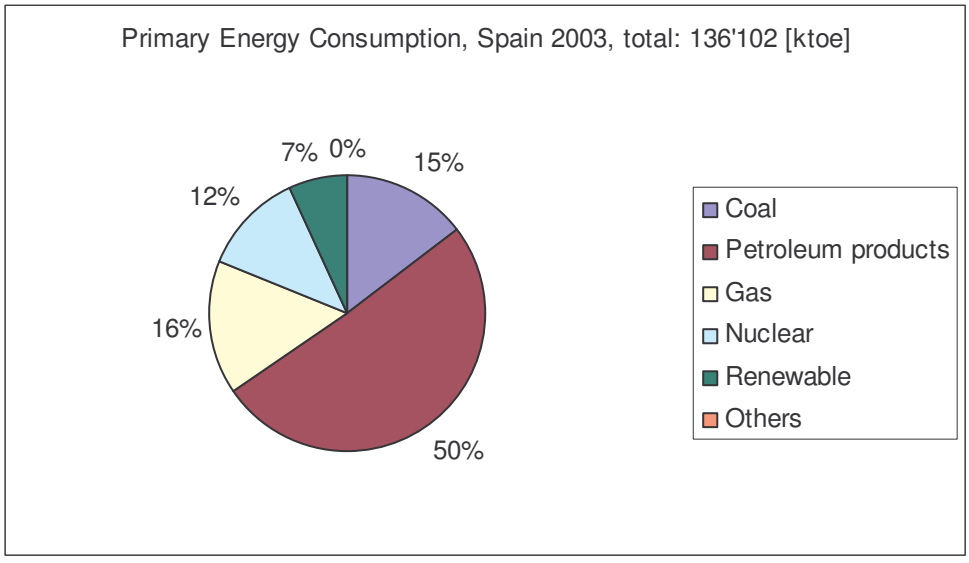

Figure 3: Primary Energy Consumption in Spain in 2003, [ktoe].
Source: own compilation of data from International Energy Agency (IEA), http://www.iea.org/, viewed 25 September 2006.

Greenhouse gases emissions have followed the economy trend of the last few years, implying a steady growth with very few exceptions. The Kyoto Protocol has been signed in 1998 and ratified by the Spanish Government in 2002. In 2005, the Spanish greenhouse gases

[8] Data source: Speech by Arturo Gonzalo Aizpiri, *Ministerio de Medio Ambiente* (Ministry of the Environment), at the Expo CO_2, 4 June 2006, Barcelona.
[9] A detailed map of the current Spanish electricity system can be found at: http://www.ree.es/cap07/pdf/infosis/maptra2005.pdf, viewed 25 September 2006.

emissions were over 52% (Nieto 2006) above the baseline reference year[10]. The Kyoto Protocol objective is set to +15% over the baseline for the case of Spain. CO_2 emissions contribute the most (more than 80%) to the total greenhouse gases emitted, followed by CH_4 and N_2O respectively. The share of greenhouse gases attributable to the energy sector accounts for about three quarters of the total. The other contributors are, in order of importance, the agricultural sector, the industrial processes, and waste treatment and disposal group.

Nuclear Energy

Spain disposes of 8 main nuclear power generation units in operation, and a few other minor ones, with a total generation capacity of 7'892 MW[11]. There is currently no strictly defined strategy in regards to nuclear energy to date. Nevertheless, one of the electoral promises of the current Prime Minister, José Luis Rodríguez Zapatero (PSOE, *Partido Socialista Obrero Español,* Spanish Socialist Workers' Party), was to initiate a debate on a nuclear energy involving several stakeholders and to pose the foundations of a phase-out calendar before the end of his mandate (March 2008).

Emission targets and scenarios

According to national projections, a 'business as usual' scenario would lead for the greenhouse gases emission to be over 83.1% over the reference level by 2012, the end of the first commitment period of the Kyoto Protocol. Under a more optimistic scenario, assuming the fulfilment of the plans and measures approved as well as the sectoral legislation applied, the greenhouse gases (GHG) emission would exceed by 60.3% the baseline by the same date (Ministerio de Medio Ambiente 2006a). Those figures reveal the challenge Spain is facing to comply with its international commitments in regards to climate change mitigation.

Following the requirements of the European Directive on Emission Trading[12], Spain published in 2004 it first National Allocation Plan for the period 2005-2007. This first step served as a trail period. The National Allocation Plan (NAP) 2008-2012 represents a difficult compromise between allowing for the compliance to the national objectives defined under the Kyoto Protocol framework and maintaining the national and regional economic competitiveness and employment. This implies a reinforcement of the emission reduction

[10] 1990 for CO_2, CH_4, and N_2O; 1995 for HFC, PFC, and SF_6.
[11] Information source: http://www.mityc.es/Nuclear/, viewed 25 September 2006.
[12] Directive 2003/87/EC, for more information, see http://ec.europa.eu/environment/climat/emission/implementation_en.htm, viewed 7 July 2006.

measures promoted by the first NAP while avoiding potential adverse social effects. It has to be noted here that the emission cap is only practically reachable taking into account an extensive use of the so-called flexible mechanism, and notably the Clean Development Mechanism (CDM).

The basic objective of the second NAP is for greenhouse gases emissions not to exceed 37% of the baseline time five during the period 2008-2012. Taking into account some 5.5% left aside as reserve for new companies entering the scheme during the commitment period, the second NAP allocates 152.66 $MtCO_2$/year (54.69 and 72.81 $MtCO_2$/year to the electricity and industrial sectors respectively), representing a reduction of 19.6% compared to the 2005 emissions. The allocation methodology differentiates between the electricity generation sector and the industrial sectors, acknowledging their different emission reduction potential as well as their distinct exposition to international competitors.

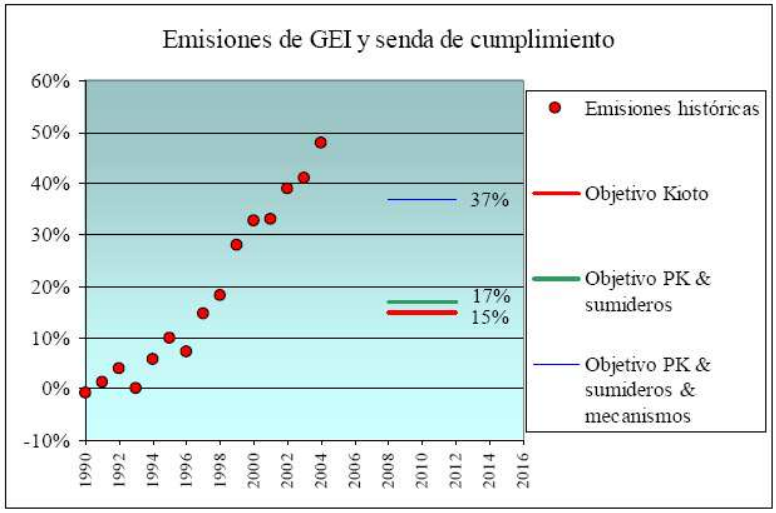

Figure 4: Greenhouse gases emissions in Spain and Kyoto commitment.
Source: Ministerio de Medio Ambiente 2006b, p. 15.

In 2004, the total greenhouse gases emissions in Spain accounted for 427.9 $MtCO_2$ (Ministerio de Medio Ambiente 2006b). The amount represents a 48% increase compared to the baseline, which is well above the cap defined by the country's Kyoto Protocol commitment (see Figure 4). Out of all EU member states, Spain is currently the second EU country, behind Italy[13], the furthest away from its Kyoto target in absolute terms. Due to an important economic growth in the recent years, the average annual per capita emission in Spain (10.8 tons of CO_2) almost attains the European average (11.2 tons of CO_2) nowadays.

[13] Data source: JIKO Info, 4/06, Wuppertal Institute, http://www.wupperinst.org/download/JIKO-Info_2006-4e.pdf, viewed 22 September 2006.

A surplus of 289.39 $MtCO_2$ are expected to be compensated by the use of the flexible mechanisms during the commitment period 2008-2012, representing a 20% of the baseline emission time 5. About half of this amount will be required by the so-called diffuse sectors (not included in the European Directive). However, each plants allocated emission allowance under the NAP can only make use of the flexible mechanisms up to 50% of the assigned emissions during the whole commitment period. Finally, it is estimated that 28.94 $MtCO_2$ (2%) will be absorbed by carbon sinks, such as afforestation and reforestation activities, as well as by carbon intake due to agricultural and forestry management.

The emission allowances allocation is based on: the national gases emission inventory 2006, a questionnaire addressed to industrial associations, the national emission rights register, national emissions forecasts, and public consultation. Spain represents a clear example of the difficulty of combining strong growth, in terms of both population and economy, with a limitation of greenhouse gases emissions.

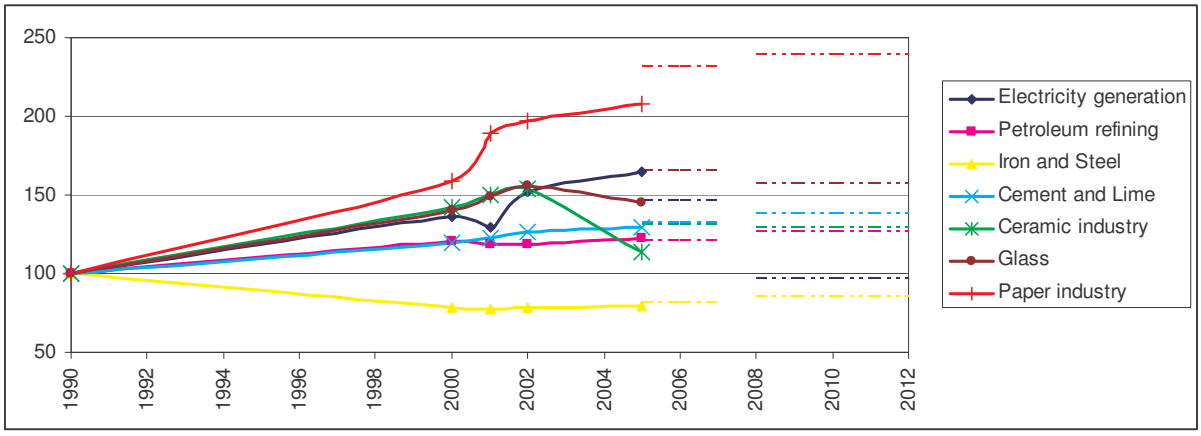

Figure 5: Historical greenhouse gases emissions in sectors covered by the EU ETS and respective emission allowance allocated by the first and second NAP (scaled to 100 by 1990).
Own calculations and compilation of data from Ministerio de Medio Ambiente 2006b.

Figure 5 displays the historical GHG emissions for the sectors covered by the EU ETS as well as their respective (in the same colour) allocations by the first and second NAP scaled to 100 in 1990. This illustrates the fact that the electricity sector allocations for 2008-2012 is well bellow the 2005 emissions, which is not the case for either of the other sectors. The electricity sector seems to be the least exposed to international competition, thus having the capacity of internalising the potential additional cost (Ministerio de Medio Ambiente 2006b). The emissions allowance for the industrial sector is based on their historical emissions, the expected growth in the respective activities as well as technological aspects.

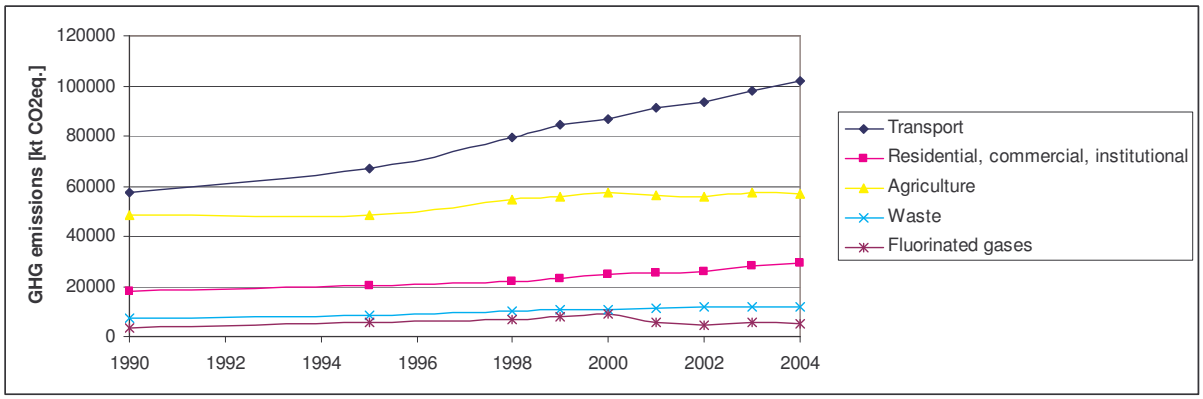

Figure 6: Historical greenhouse gases emissions of diffuse sectors in Spain, in ktons of CO_2eq.
Source: Own compilation of data from Ministerio de Medio Ambiente 2006b, p. 16.

An increase of the emissions is to be reported in all major diffuse sectors in the recent years (see Figure 6). The transport sector's emissions had risen by 77% in 2004 with respect to 1990, while in regard to emissions from waste, this increase represents 60%.

3. Mitigation Scenarios, Strategies, Policies and Measures 2012/2030

This chapter presents the different greenhouse gases emissions reduction measures in place in Spain. As already mentioned previously, because of the particular repartition of the political power between the central government and the different autonomous regions, climate change mitigation issues are not dealt with evenly across the country. It is therefore important to consider Policies and Measures at national, regional and local levels, together with initiatives from the private sector.

3.1 National Allocation Plans

Within its Directive 2003/87/EC, the European Union establishes a scheme[14] with the aim of facilitating greenhouse gases emission allowance trading within the Community. This Directive stipulates that each Member States shall develop a National Allocation Plan in which it states the quantity of allowances it intends to allocate. The Directive does not affect all the economic sectors but rather focuses on the ones considered as responsible for the majority of GHG emissions. Nonetheless, the text underlines the fact that policies and

[14] Hereafter referred to as European Union greenhouse gas Emissions Trading Scheme (EU ETS).

measures should be implemented in all sectoral activities in order to generate substantial emission reductions.

Period 2005-2007

The first Spanish National Allocation Plan, designed by the *Grupo Interministerial de Cambio Climático* (Inter-ministerial Climate Change Group), assigns greenhouse gases emissions allowance for the period 2005-2007, as required by the abovementioned EU Directive. The total allowances represents about 514 $MtCO_2$ for the whole period, allocated to 957 installations (Ministerio de Medio Ambiente 2004b), representing an increase of about 3.5% compared to the average emissions between 2000 and 2002. The allocation is relatively balanced over the period for all the sectors except electricity generation. Indeed, the emission allowances of coal-fired installations are cut by a quarter in 2007 with respect to 2005. Also, the 20 fuel oil-fired plants see their emission quota going from about 1.5 $MtCO_2$ to zero. In contrast, combined cycles' allowances increase by two thirds.

Out of the four sectors on which this study focuses (energy generation, industrial energy consumption, transport, and construction), only two are included in the NAP. The majority of the emission allowances are distributed to the electricity generation sector with 85.4 $MtCO_2$/year in average. The industrial energy consumption sectors receive 70.2 $MtCO_2$/year, the most potent sectors in order of importance being cement, refineries, iron and steel. The paper and pulp sector is allocated 45% more than its 2000 emissions, mainly due to the strong growth experienced in the sector. On the other hand, the electricity and ceramic sectors receive less than their respective 2000 emission levels (Kolshus et al. 2005). The level of coverage, that is the proportion of emission allowances with respect to the estimation of emissions in 2006, ranges from 89 to 97% depending on the sectors, with an average at about 95%.

Period 2008-2012

The second National Allocation Plan for the period 2008-2012 was yet to be completed at the time of writing. A draft, however, has been submitted by the Government for public information and consultation. The second NAP is a compromise between on the one hand a necessary significant reduction of greenhouse gases emissions in order to comply with the Kyoto commitment and on the other, the necessity of guarantying the competitiveness of the Spanish economy and employment. The objective is therefore to limit the allocation of

emission allowances in the sector presenting the best emission reduction opportunities so as to minimise the potential adverse social and economic consequences.

Importantly, the overall emission reduction objective has been reviewed compared to the first NAP. Indeed, the national emission target moved from a 24% over the 1990 levels in the first NAP to 37% over 1990 in the second version. The difference will be covered by a more extensive use of the flexible mechanisms (289.4 $MtCO_2$). Hence, the first NAP foresees a proportion for international allowance credits of 7% of 1990 emission levels, while in the recently published proposal for the second NAP that particular proportion jumped up to 20%. The repartition of the emission between sectors included in the EU ETS and the others remains the same as in the previous NAP, 45%.

Another major change is the fact that the electricity generation sector sees its emission allocation reduced by as much as 51%, compared to the first NAP, to 54.7 $MtCO_2$/year in average over the Kyoto first commitment period (2008-2012). In contrast, the industrial energy consumption sectors receive 72.8 $MtCO_2$/year, a slight increase compared to the precedent NAP.

In regards to the energy sector, in line with the first NAP, fuel oil power stations will be assigned no emissions allowances, with the exception of insular and extra-peninsular installations. The assignation for combined cycle power plants is based on the 'best-available technology' principle.

3.2 Regional autonomous governments and local/regional initiatives

Due to the split of power, some autonomous governments are sovereign for energy matters. Their initiatives, as well as local actions at city level, play an important role in regard to climate change mitigation. This section considers some of them, in an illustrative non-exhaustive manner.

Andalucía

For instance, the *Plan de Medio Ambiente de Andalucia 2004-2010* (Environmental Plan of Andalucia) aspires at supporting technological development, as well as sustainable production and consumption. More concretely, the *Plan Energético de Andalucia* 2003-2006 (Energy Plan for Andalucia) aims at a 15% of the total Energy demand to be produced by renewable sources by 2010 (Consejería de Empleo y Desarrollo Tecnológico 2003, p.73).

Catalonia

The Catalan government sees two options prevailing in order to curtail CO_2 emissions, firstly through the adoption of strategies for energy savings and energy efficiency in processes and equipment, in buildings and vehicles, as well as changes in consumer habits. Secondly, it aims at a change towards forms of energy with lower CO_2 intensities, such as from renewable resources, while excluding nuclear energy as a means of achieving the Kyoto commitments (Llebot Rabagliati et al. 2005, p.173). Also, the autonomous government suggests adding turbines and generator groups to existing reservoirs where the hydrostatic potential is currently not made use of.

Renewable energy represents a priority for the Catalan government in terms of energy generation (Generalitat de Catalunya 2005). Its *Pla de l'Energia de Catalunya* (Catalan Energy Plan) entails ambitious objectives in regards to energy production from renewable resources which are compatible with those set by the European Union. The Spanish government aims at producing 29% of the national electricity from renewable energy by 2015, while the target for Catalonia in this regard represents 20.5%. The somewhat lower target for Catalonia takes into account lower potential for hydropower and windpower compared to other Spanish regions.

Local actions

The Madrid city council is currently designing strategies for sustainable energy and climate change, including the promotion of renewable energy and energy efficiency, as well as a plan of action for the adaptation to and the mitigation of climate change. Also, it is currently elaborating a plan for commissioning a green fleet in order to mitigate the environmental impacts of municipal authority transport requirements.

Similarly, the *Plan de mejora energética de Barcelona* (Barcelona Energy Improvement Plan) comprises energy analyses and environmental impacts studies, as well as future scenarios estimations. Based on that information, a series of 55 projects have been implemented at city level. They include new directives, incentives for installations (solar thermal), educational programs, as well as the creation of a consortium in charge of the application of such measures. Those local actions focus on energy savings, the promotion of renewable energy and energy efficiency. Concretely, the plan aims at reducing greenhouse gases emissions by 20.3% and diminishing the energy requirements by 4.14% by 2010

compared to a business-as-usual scenario, which in fact corresponds to a stabilisation of the energy consumption in absolute terms.

3.3 Other initiatives

This section addresses governmental measures, other than the NAP, that aim at curbing greenhouse gases emissions in particular, but not exclusively, for the sectors that are not included in the EU Directive 2003/87/EC, such as transport, building and construction sectors notably.

Energy Savings and Energy Efficiency

The *Plan de Acción 2005*-2007 (Action Plan) of the *Estrategia de Ahorro y Eficiencia energética en España 2004-2012 (E4)* (Strategy for Energy Savings and Energy Efficiency in Spain) aims at avoiding the emission of 32.5 Mt CO_2 with a series of measures. The greatest energy reduction potential is expected in the transport sector (about 40%), followed by the industry and construction sectors (see Figure 7).

	2005	2006	2007	Total 2005-2007
Industria	89	733	1.620	2.442
Transporte	1.407	4.421	8.655	14.483
Edificación	92	1.173	2.724	3.989
Equipamiento	90	596	1.751	2.437
Servicios Públicos	61	157	297	515
Agricultura y Pesca	20	53	99	173
Total Uso Final	1.760	7.134	15.145	24.038
Transformación de la Energía	937	3.039	4.447	8.424
TOTAL	2.697	10.173	19.592	32.462

Figure 7: Sectoral objectives in terms of avoided ktons of CO_2 emissions.
Source: Ministerio de Industria, Turismo y Comercio 2005a, p. 22.

The actions foreseen in the industrial sectors are threefold. 1) Voluntary agreements would allow associations of companies or public administrations to reach defined objectives in terms of energy saving. 2) The plan includes financial assistance for audits in order to identify potentials for energy saving. And 3), the plan foresees direct financial assistance targeted to energy efficiency and energy saving projects in the industry.

As far as the transport sector is concerned, similarly, three groups of actions are set up. Firstly, modal changes are promoted. Secondly, the plan aims at a more efficient use of transport means. And thirdly, an increase of the energy efficiency of vehicles is encouraged. Those measures together should avoid the emission of 14.5 Mt CO_2 for the period 2005-2007.

Energy saving measures in the construction sector will target four aspects. Construction norms will ensure a certain level of energy efficiency in new buildings. Measures, such as insulation, windows changes, sun protection, in order to increase the energy efficiency of existing buildings will be promoted. The refurbishment of existing thermal equipment (heating and cooling systems) will contribute to an energy consumption reduction. And finally, indoor lighting systems will be improved.

The Plan of Action 2005-2007 implies 7'926 million EUR of investments, involving both public and private funds. The cost-benefit analysis carried out reveals that, assuming a conservative 10 EUR/ton of CO_2, the plan is globally profitable, with a global Internal Rate of Return of 24% by 2012.

Renewable Energy

The *Plan de Energias Renovables 2005-2010* (Renewable Energy Plan) encourages the development of alternative energy production, with a final objective of avoiding the emission of 76 Mt CO_2/year in average for period 2005-2010. The plan compares three scenarios. In the 'current scenario', current growth rates in all energy types are assumed to remain constant in the future. In such circumstances, the objectives, both national and European, will not be met. The 'probable scenario' considers the probable evolution of the renewable energy sector during the next few years, taking into account the enhanced potential of growth in each renewable energy fields. Such scenario would allow for meeting the predefined targets. And finally, the 'optimistic scenario' pictures a major increase of the renewable energy share (see Figure 8).

	Producción en términos de Energía Primaria (ktep)			
	2004 (1)	2010		
		Escenarios de Energías Renovables		
		Actual	Probable	Optimista
TOTAL ÁREAS ELÉCTRICAS	5.973	7.846	13.574	17.816
TOTAL ÁREAS TÉRMICAS	3.538	3.676	4.445	5.502
TOTAL BIOCARBURANTES	228	528	2.200	2.528
TOTAL ENERGÍAS RENOVABLES	9.739	12.050	20.220	25.846
Escenario Energético: Tendencial				
Consumo de Energía Primaria (ktep)	141.567	166.900	167.100	167.350
Energías Renovables/Energía Primaria (%)	6,9%	7,2%	12,1%	15,4%
Escenario Energético: Eficiencia				
Consumo de Energía Primaria (ktep)	141.567	159.807	160.007	160.257
Energías Renovables/Energía Primaria (%)	6,9%	7,5%	12,6%	16,1%

Figure 8: Synthesis of scenarios for Energy and Renewable Energy, in terms of primary energy (ktep).
Source: Ministerio de Industria, Turismo y Comercio 2005b, p. 31.

The 'probable scenario' allows for reaching a share of 12.1% of energy provided by renewable sources in terms of primary energy by 2012. Also, biofuels will represent 5.83% of the total fuel consumption for transport in 2010, which is above the target (5.75%) defined by the European Commission.

Transport

Between 1995 and 2004, passengers transport has increased significantly by road (38%), by rail (25%), by boat (62%), and by plane (72%) (Ministerio de Medio Ambiente 2006b). Freight transport also increased notably. Therefore, during that period, the CO_2 emission attributable to the transport sector rose by about 76%, making it the diffuse sector that contributes the most to anthropogenic greenhouse gases emissions (see Figure 6). Those trends are mainly due to the growth in the economic activity as well as to the increasing requirements for personal mobility.

The *Plan Estratégico de Infrastructuras y Transporte 2005-2020* (Strategic Infrastructures and Transport Plan) mainly focuses on developing rail transport. Significant public investments (about 250 billion EUR) aim at improving the national network, promoting rail transport of goods with a clear commitment to intermodality, as well as a better integration into European transport systems (Ministerio de Fomento 2005). The environmental aspects of the strategy include notably the sectoral emissions. Although not precisely quantified, it is estimated that the plan will contribute to an emission reduction of 20% by 2020 with respect to a hypothetical scenario without the plan (Ministerio de Medio Ambiente 2006b).

Construction sector and housing

The construction and housing sector contributed to over 25% of the total greenhouse gases emissions in 2002 (Ministerio de Medio Ambiente 2006b). There is a significant saving potential in the residential energy use. According to the *Estrategia de Ahorro y Eficiencia energética en España 2004-2012 (E4)*, 7.5% of the energy used in the sector can be saved by 2012 compared to a scenario based on current tendencies, representing a total of 40 Mt CO_2.

The recently introduced *Código Técnico de la Edificación* (Building Technical Code) is expected to result in energy savings of 30-40% and a reduction of GHG emissions of 40-55%. The Code has a fivefold objective. It aims at limiting the energy demand for space heating, increasing the energy efficiency of heating systems, bettering the energy efficiency of lightening systems, encouraging the use of solar thermal energy for hot water preparation, and favouring the installation of photovoltaic systems.

3.4 Strategy and position of stakeholders

The extent to which climate change related issues are considered by stakeholders, as well as the awareness of climate policies, seems to be related to the perceived potential consequences at stake. Indeed, for some companies, like the ones affected by the NAP, greenhouse gases emissions form integral part of main strategic decisions. Yet, other stakeholders admit very little involvement in such issues.

There has been some preoccupation about the potential effects of climate change mitigation measures for employment in some sectors. Although the creation of new platform for debate amongst the actors remain extraordinary, many interviewees declare for climate change issues to have been integrated into existing discussion and information forums, alongside with other topics. Yet, in some cases, generic consultation processes with social partners have been undertaken, as will be described further with the series of round-tables regarding the socio-economic consequences of the NAP. This trend confirms the necessity and utmost importance of information, as underlined by many interviewees.

Generally, the overall potential impact of greenhouse gases emission reduction Policies and Measures on employment is perceived as minor by the interviewees. Nevertheless, some fields, such as renewable energy notably, could see their activity enhanced by such policies. Also, the requirement for audits and consulting work in order to assess greenhouse gases emissions and energy issues in general is likely to increase. In the contrary, coal-based

activities for instance are perceived as been adversely affected by such measures. Some interviewees brought forward the possible expansion of the demand for 'total service' type of providers, in the energy field notably. Such companies would then provide a wide rage of energy services, including heating and cooling, lighting, gas and electricity supply for instance.

The Policies and Measures currently in place might allow for reaching the targets set by the Kyoto Protocol. Further emissions reductions in order to mitigate climate change will imply further measures. Those, according to several stakeholders, should imply a deeper and more fundamental debate, involving perhaps the questioning of our values. Indeed, current lifestyle and consumption patterns seem incompatible with drastic climate change mitigation policies.

In general, no major technological breakthrough is expected by the interviewees. Nonetheless, CO_2 capture and storage is sometimes seen as a potentially attractive option, albeit the numerous uncertainties and the opposition of some environmental NGOs.

Scenarios

In general, 2030 is perceived as very far away in the future for most of the interviewees to pronounced themselves on a preferred scenario, especially in the climate of uncertainty around post-Kyoto international commitments. Nevertheless, some general tendencies can be drawn from the interviews.

There is obviously no consensus between the actors of different sectors. Interestingly, the stakeholders in the energy sectors seem the most favourable to a strong increase in the share of renewable energy production. This could be explained by the fact that the major companies producing electricity in Spain are already well settled in the renewable energy market. Nevertheless, the penetration of renewable energies in the market strongly depends of government funding and policy commitment, according to them.

On the consumer side, the enthusiasm for renewable energy is lukewarm. The principal argument against a significant increase in the share of electricity produced from renewable sources is the fear for electricity prices to increase. In the same line, many actors stated that they failed to see how the contribution of nuclear power to the electricity production could practically be set aside in times of ever increasing electricity requirements.

At governmental level as well, most strategies aim at 2010 or 2015 at best. The action plans of such schemes are designed for even shorter-term, 3 to 5 years. Uncertainties of all types,

but especially in regards to international post-Kyoto commitments, render the design of long-term policies in terms of greenhouse gases emissions elusive.

4. Impacts of mitigation Policies and Measures on activity and employment

In general, empirical data directly relating the influence of climate change or mitigation measures to employment are scarce, if not inexistent. The outcome of the interviews, together with the literature review, demonstrate that the influence of climate change or greenhouse gases policy measures on the economic activity and employment in particular has not been subject of intense investigation so far. For the purpose of our study, it is therefore necessary to rely on indirect information mainly in order to draw potential consequential tendencies in terms of employment.

Major determinants

It is useful to start with considering some of the major determinants to the economic activity before entering into the details of the potential effects of climate change mitigation policies.

Spain experienced a relatively strong GDP growth during the last 10 years. Eurostat foresees a stabilisation of the economic growth at approximately 3% in the next few years. Such figures remain above the forecasted EU25 average.

As already mentioned, the population in Spain was just over 40 millions at the beginning of this century. According to the estimates of the Spanish National Statistic Institute (INE), a relatively strong population growth is to be expected during the first couple of decades, reaching 45 millions by 2012. After about 2020, the population should stabilise, at least of a decade, at around 46 millions. Due to the current situation in terms of immigration flows, notably towards the Canary Islands, those figures are likely to be surpassed.

4.1 NAP I & II

In most cases, the emission allowance in the framework of the first National Allocation Plan has been relatively ample, resulting disappointing for environmental NGOs (see CANE 2006), for most industrial sectors. Such allowances include the consideration of the sectoral projected growth during the period 2005-2007. From that viewpoint, no adverse impacts on the competitiveness of the Spanish industrial sectors are expected (González Diego 2005). For

the first NAP, allowances have been allocated mainly based on historical emissions. There is a tendency, supported by the European Commission and the environmental movement, for further assignation strategies to combine grandfathering with product-based benchmarks. This is, to take into consideration the technical improvement potential. The Spanish second NAP embraces this concept.

Several interviewees noted the fact that, due to an even more generous emission allocation in other countries in the framework of the first NAP for some specific sectors, Spanish companies had to sometimes buy emission allowances from international competitors. This is perceived as unjust by some stakeholders, especially because of the fact that, in some cases, the energy efficiency of Spanish companies was higher than those of their competitors. A cautious coordination of the different National Allocation Plans in this regard by the European Commission is perceived as fundamental.

It is quite evident that the industrial sectors adversely affected by the second NAP will try to internalise the additional cost of emitting greenhouse gases into their total prices. This seems possible in local, regional or inter-regional markets, but however problematic for companies evolving in competitive global markets, such as the steel industry for instance. Indeed, a Spanish (or other) company could lose competitiveness compared to competitors located in country with less stringent allowance schemes or in a country which is not committed to emission caps. Not only could such a case have adverse social consequences in terms of employment but as well, the overall greenhouse gases emissions could actually increase if such activity was to be partially or totally delocalised.

The NAP is believed to enhance technological upgrades. Due to the EU ETS, emission reductions have now acquired an economic value and influence companies' strategies. Those strategies will include a shift towards a lower carbon-intensity of the electricity production, particularly in Spain due to the current circumstances in terms of compliance with the Kyoto emissions targets.

It seems easier for companies which have been historically committed to environmental values to define low-carbon strategies. Those companies will benefit from comparative advantages as they might already be active in low-carbon markets such as the renewable energy sector. At global level, the effect of climate change mitigation measures on employment is generally perceived as minor. Although those measures might result in generating additional costs, new opportunities will arise. For example, investments in energy

efficiency measures will have direct positive effects on businesses. The Spanish Government, through its *Plan de acción 2005-2007* (Action Plan, Ministerio de Industria, Turismo y Comercio 2005a) within the framework of the *Estrategia de ahorro y eficiencia energética en España 2004-2012* (Strategy for Energy Savings and Energy Efficiency in Spain, Ministerio de Economia 2003) program effectuated a coarse cost-benefit analysis of the measures proposed and concluded to a net positive balance for the national economic activity, and thus for employment as well.

The EU ETS requires a whole range on new professions, such as carbon brokers or emissions verifiers, that did not exist before, or to a much lesser extent. Also, demand for consulting resources can be expected to increase in order to conduct audits and the like to advice companies in their strategic decisions. Those new professional opportunities seem to be limited to relatively well-educated employees.

4.2 Energy Generation sector

Some interviewees expect a substitution effect, from conventional to renewable energy sources, in terms of employment, fearing adverse effects in terms of jobs in the conventional electricity generation. This has to be put into perspective, however. Indeed, although the share of final energy consumption from renewable sources is expected to increase significantly in the future, it is unable to cover the increase in the overall energy demand. In other words, the final energy consumption from conventional sources (coal and petrol) will still increase by about 14% between 2004 and 2010 in Spain, according to previsions made for the Renewable Energy Plan (Ministerio de Industria, Turismo y Comercio 2005b, p.320). Moreover, the net balance due to the probable shift in electricity generation is expected to be positive since renewable energy are renown for being more employment-intensive than conventional electricity production.

As already mentioned, since emitting excessive amount of carbon dioxide becomes costly, there will be an increase in alternative electricity production, and thus a change in the energy-mix. If the price of emission allowances is high, the shift away from traditional fossil fuel production could possibly lead to the decommissioning of some power plants. Some interviewed stakeholders claim for the NAP to have lead to the closure of some plants already, mainly old and small coal plants which have been now replaced by cogenerators. Nevertheless, it has to be underline that not only is the production price relevant for determining the energy-mix. The production has to adapt to the demand (base load and peek

load) and hence include different types of production. Also, according to the information gathered during the tripartite round-table about the NAP, the change in the energy-mix has not happened as expected. This supports the hypothesis claiming for CO_2 emissions to be only one factor of the production price that, together with others (gas and coal prices for instance), determines the competitiveness of a generation alternative. Furthermore, other external factors can play an important role too. In 2005 in Spain, the low hydropower capacity due to the drought combined with a low electricity production from nuclear energy because of a series of technical failures obliged a more important production from fossil fuels.

Some fear for the electricity price to go up due to the additional cost of CO_2 emissions, with its adverse impact on employment. Yet, according to some studies (de Leyva et al. 2003), the effects of electricity price increase could be offset by the triggered energy savings and energy efficiency measures. Also, the energy sector being relatively regulated, electricity prices do not only depend on markets, but as well on different policies. Another perceived side-effect is that if electricity prices were to increase, it could have a positive impact of public awareness in terms of climate change.

It has to be noted that, in terms of employment, there is a current negative trend in the ratio jobs/MWh produced in most kinds of the electricity production due to the increase in productivity. Notably technological progress, such as with advanced control systems for instance, contributes to that tendency.

All companies producing electricity interviewed in Spain have long undertaken strategic moves towards a production from cleaner sources (see for example Iberdrola 2005, Endesa 2005), such as gas-fired combined cycles and cogeneration, as well as renewable energy (mainly wind, mini-hydro and photovoltaic to a lesser extent). Climate change forms integral part of the strategy decision-making process in those companies, so much so that some of them have created interdepartmental groups dealing with climate change issues in the company structure. Also, most companies interviewed have designed emission reduction programs, including energy savings and energy efficiency measures, as well as the reduction and venting of fugitive gases with high greenhouse potential (see for example Repsol 2005). In that regard, the company Endesa claims to have reduced its relative emission by 32%, from 0.7 to 0.47 tCO_2/MWh, between 1990 and 2003 (Endesa 2003, p.62).

In order to adequately deal with the potential adverse effects in terms of employment in the coal industry, redeployment opportunities in other areas should be promoted. Alternatively, it

has been suggested to promote cleaner coal technologies. In that respect, some interviewees active in the sector don't set aside a possible regain of coal for electricity generation due the recently development in clean-coal technologies.

International companies have the advantage of benefiting from a larger catalogue of options in order to reduce greenhouse gases emissions. The marginal cost of emission reduction measures represents a crucial factor for companies' strategies. A large company with different activities, different types of plants in different locations (including abroad), seems in a better position to curb its emissions. Such corporations could make the most of the Kyoto Protocol's flexible mechanisms. Those flexible mechanisms as well could result in positive impacts on employment since an important part of the high-value added associated activities, such as consulting work, emission trading, is located in Europe.

No significant delocalisation of electricity production is expected as the electricity generation sector in Spain is competing against other countries included in the EU ETS as well. Assuming that those countries' NAPs do not disproportionably favour Spanish electricity generation companies' competitors, they will be no market distortion from that viewpoint. However, as mentioned by one interviewee, if Spain was to import more electricity, from France for instance where nuclear energy plays a major role, in order to contribute to the national emission reduction, the effect on employment would be negative overall as such technology requires very little employment per unit of electricity produced.

Renewable Energy

In general, renewable energy sources are seen as promising, both in terms of environmental protection and in economic terms, the latter not least because of the forecasted increase in fossil fuel prices. Considering the Policies and Measures mentioned in the previous chapter, the renewable energy sector can definitely being seen as a potentially winning branch of activity. Nevertheless, as the renewable energies are perceived as not yet quite mature (current shortage of supply in hardware for wind and photovoltaic for instance) by some stakeholders, a transition phase based on the predominance of natural gas might be necessary. Also, if the share of renewable sources in the energy-mix was to be increased, some fear an increase in the price of electricity. They also argue that renewable energies decrease the security of electricity supply. From an employment point of view, however, reducing the energy dependency by enhancing renewable energies is believed to promote domestic economic activity and employment (Iberdrola 2005).

The potential for renewable energy in Spain is seen as significant (Greenpeace 2005, MITRE 2003). The windpower sector in Spain is already well established and active not only domestically, but as well internationally, with companies in the field evolving amongst worldwide leaders. In 2005, wind energy supplied about 8% of the electricity demand in Spain, thereby surpassing for the first time the proportion of electricity generated by hydropower plants (Nieto 2006). Hydropower represents a significant share of the renewable electricity production but benefits, however, from limited growth options. Bioenergy holds many promises as well. The Catalan government set ambitious target for biofuels for instance. Both photovoltaic and thermal solar energy should also increase their respective share.

The *Plan de energías renovables en España 2005-2010* (Renewable Energy Plan) highlights the socio-economic benefices, such as the creation of employment and the contribution to regional development, associated to the promotion of renewable energies (Ministerio de Industria, Turismo y Comercio 2005b). Not only the analysis in this document states that there is a form of consensus that the promotion of renewable energy constitutes a positive impact on employment, but as well that the new job opportunities are in some cases located in areas where professional alternatives are scarce. Similarly, Greenpeace (2003) notes the positive impact of wind energy in regards to employment and underlines that often jobs as created in relatively marginal areas, such as in coastal regions in the case of off-shore wind parks. The *Asociación de Productores de Energías Renovables* (Renewable Energy Producers' Association) also emphasizes the positive impact on employment of promoting renewable energy, and argues that, in the case of biofuels, the jobs created entail an additional social value. Indeed, those jobs support the primary sector and are mostly created away from urban areas and thus favour rural development (APPA 2005, p.109).

A study focused on the production of electricity from thermo-solar plants (Varela et al. 2006) evaluates the impacts of the Renewable Energy Plan for that particular branch of activity in terms of employment. They come to the conclusion, with an input-output economic model, that the plan would generate 220 jobs directly, as well as the equivalent of about 47'000 job-years indirectly.

The concretisation of the Renewable Energy Plan is estimated to create approximately 100'000 jobs overall (see Figure 9), predominantly in the area of wind energy (about 40% of the total). The other fields in which significant employment is expected to be created are, in order of importance, biofuels, solar energy both thermal and photovoltaic, and biomass. As mentioned in the document, those estimates are to be taken with care due to the high

uncertainties. Nonetheless, it is believed that the *Plan de fomento de las energías renovables* 2000-2010 (Promoting Plan for Renewable Energy), which was operative before the new strategies mentioned above, has created more than 95'000 jobs in the wind energy sector during the period 1999-2004.

ÁREAS TECNOLÓGICAS	Generación de Empleo Neto		
	Constr. e Inst. (empleos)	O + M (empleos)	Total (empleos)
Eólica	34.680	3.113	37.793
Hidroeléctrico	729	607	1.336
Solar Térmica	3.234	1.398	4.632
Solar Termoeléctrica	11.175	465	11.640
Solar Fotovoltaica	9.075	111	9.186
Biomasa Eléctrica	389	8.687	9.076
Co-combustión	137	1.813	1.950
Biomasa Térmica Doméstica	1.916	2.914	4.830
Biomasa Térmica Industrial	264	316	580
Biogás	239	71	310
Biocarburantes	6.939	6.654	13.593
TOTAL AGREGADO	68.777	26.148	94.925

Figure 9: Estimated employment generation due to the Renewable Energy Plan per renewable energy technology.
Source: Ministerio de Industria, Turismo y Comercio 2005c, p. 77.

Similarly, it has been estimated that the *Plan Energético de Andalucía* (Energy Plan of Andalucía) allows for 14'288 jobs to be created during the period 2001-2006. Furthermore, it is expected for another 11'312 jobs to be facilitated between 2007 and 2010 (Consejería de Empleo y Desarrollo Tecnológico 2003).

The Monitoring & Modelling Initiative on the Targets for Renewable Energy country report for Spain (MITRE 2003) demonstrates the significant positive impact on employment of ambitious renewable energy policies. The report highlights the significant employment opportunities due to the increasing renewable energy penetration in Spain, effect that can be amplified with the adoption and implementation of proactive renewable energy strategies. This study takes into account the impact on the national market, including the construction, the installation and operation of renewable energy plants. It also considers the employment benefits arising from exports of renewable technologies to other EU countries, as well as employment losses in some sectors due to the substitution of demand in the conventional fuel sector, notably the fossil fuel and nuclear sectors. In addition, the macroeconomic effects of supporting renewable energies will trigger employment losses due to the direct knock-down

effect in other sectors of the national economy. However, the study foresees a net growth in employment in Spain resulting from the increased penetration of renewable energy. According to the most optimistic scenario, 288'000 full-time equivalent jobs per year could be created by 2020. Agriculture (bioenergy) is seen as benefiting the most, followed by the wind and photovoltaic energy sectors. The proportion of skilled and unskilled employment is not expected to change significantly.

4.3 Industrial Energy Consumption sectors

In 2005, carbon dioxide emissions attributable to industrial energy consumption accounted for 22% of the total greenhouse gases emissions (Nieto 2006). The CO_2 emissions target set by the Kyoto Protocol for Spain is extremely ambitious compared to the current national emission trends. It is therefore very unlikely for Spain to comply with its emission cap without to make a substantial use of the flexible mechanisms. Spain and its industry will represent a net buyer of emission credits overall. Some industrial sectors or companies, depending on the distribution of the emission allowances, could see their comparative advantages diminishing and face international concurrence.

Similarly as for the energy generation sector, climate change related issues has been included in the Spanish industry strategic choices since several years, especially in the fields with high-energy requirements. Greenhouse gases emission restrictions are perceived as incentives for plants upgrade and processes amelioration in order to increase their efficiency. Nonetheless, certain stakeholders highlight the fact that emission reduction measures are costly, and that this additional cost will be passed on to the consumer, with the associated social risk. This additional cost for the consumer is perceived as potentially leading to a negative impact on employment. Also, the reduction of the profit margin could induce companies to rely more on temporary contracts or to subcontract activities, potentially leading to a worsening of working conditions, according to certain stakeholders. However, as mentioned above, measures for energy savings and energy efficient improvements also results in new opportunities for companies.

The autonomous Catalan government defines, in its *Pla de l'energia de Catalunya* (Catalan Energy Plan), a strategy of energy efficiency for 2006-2015. The strategy suggests reducing by 10.6% the final energy consumption compared to the scenario of current tendencies extrapolation (Generalitat de Catalunya 2005). The Catalan government aims at a reduction of

the energy intensity of the economy (ratio final energy consumption/GDP), which might in fact not lead to a reduction of energy consumption in absolute terms.

Actors in the paper sector, for which 20% of the product costs are represented by energy, are preoccupied by the evolution of electricity price. Recently in sector, an important auto-generation capacity has been commissioned in the form of the installation and commissioning of independent cogenerators, which seems to be very profitable. The Spanish paper industry is characterised by a higher proportion of small businesses than in the EU. Smaller companies working with perhaps older-fashion inefficient technologies and benefiting of little investment capacity could be affected the most by greenhouse gases emission mitigation measures. Furthermore, the administrative tasks required by the NAP result more difficult and costly for small businesses.

After a generous allocation in the framework of the first NAP for the sector, the *Observatorio de la competitividad industria papelera* (2006) (Observatory for the Competitiveness of the Paper Industry) claims, on behalf of the Association of Spanish Pulp and Paper Manufacturers (ASPAPEL), for the NAP II not to properly take into account the extraordinary growth experienced in the sector during the recent years. The daft of the second NAP allows the industry for a 3% growth while the abovementioned institution calls for a 5.26% growth rate. The emission allowances are perceived as being insufficient by sectoral actors, negatively impacting their competitiveness. They demonstrate that their principal competitors located in France, Germany, Finland, Sweden, and Portugal, benefit from more generous allocations (Observatorio de la competitividad industria papelera 2006). Beside this, the potential for energy saving is rather low in the sector due to the widespread use of cogeneration, technology which is considered as being currently the 'best available'. That potential is estimated at 0.70%/year according to the Strategy for Energy Savings and Energy Efficiency in Spain (Ministerio de Economia 2003).

Yet, and as underlined by many interviewees concerned by climate change, the emission allocation of the second NAP needs to be below the level of projected emissions in the absence of actions. In this case only, the market will play its role and financial incentives will encourage companies to undertake measures so as to restrain their greenhouse gases emissions.

4.4 Transport sector

There is an important emission reduction potential in the transport sector, sector which was responsible for over 30% of the total greenhouse gases emissions in 2003 (Ministerio de Medio Ambiente 2006a). In general, there is an increase of the mobility of the population, which more than offsets the positive evolution in energy efficiency of vehicles. Environmental NGOs argue that, for sectors not included in the European Directive, emission taxes could play an important role for the mitigation of carbon dioxide emissions. Also, one actor argued that if drastic emission reduction measures are not undertaken in the diffuse sectors, the industry will bare the burden of that inaction, seen as the total emissions is predefined.

On the one hand, emission reduction measures in the transport sector are perceived by some sectoral actors as potentially beneficial for the railways transport as it is responsible for much less greenhouse gases emissions per unit of transport-km than the other means of transport. It could possibly open for new opportunities in proximity transportation and combined rail-road freight and passengers transport. In contrast, however, the Community of European Railway and Infrastructure Companies (CER), in its position paper, fears for the EU ETS to decrease the competitiveness of railways transport, passenger and freight services, compared to other modes of transportation (CER 2005). The CER blames the European carbon trading scheme for being responsible for the recent significant increase in electricity prices. The rail sector is affected by the electricity market, while its competitors (airlines and road transport) are not, or to a much lesser extent. This could imply, in turns, a negative impact on employment in the rail sector if airlines and road transport were not included in the emission reduction measures in the near future, according to the CER.

The shift of freight transport from the road to the rail is generally seen as an attractive option in order to mitigate the sectoral carbon dioxide emissions. Such moves would in principle be beneficial in terms of activity and thus employment in the branch, while being possibly detrimental for the employment in road transport. Nevertheless, intermodal transport appears to be supported by most of the interviewed stakeholders. Another potential for emission reduction that has been brought forward during the interviews is the improvement of the transport fleet maintenance, especially urban buses. Similarly, emission mitigation measures are seen as a means of enhancing a modernisation of the fleet. Yet, for several transport companies, climate change issues are perceived as of relatively minor importance.

New technologies, such as biofuels and hydrogen, seem promising but far from playing a significant role in the market in the near future. In the case of hydrogen, one sectoral actor underlined the unconditional need for it to be produced with renewable energy sources. Hydrogen could for instance be used to store the excess of energy produced by wind generators during low demand. There is a call for additional investments in Research & Development in those two areas.

4.5 Construction and building sector

The construction and housing sector in Spain is booming. In 2005, over 800'000 houses have been built in Spain, surpassing from far away other major European countries. The sector was employing 2'111'689 persons in 2003[15], representing a non-negligible share of the national employment.

The new Building Technical Code, once in place, is expected to lead to a carbon dioxide emission reduction of 30-40% for each building, while creating a bearable 1% increase of the construction costs (Nieto 2006). Jeeninga et al. (1999) found in their study that the effects of energy conservation schemes in the residential sector in Spain would have overall positive effects on employment. There would be an initial negative effect in the year of investment. Indeed, the investment, localised in a sector (electrical products) with a rather low labour intensity, results in reduction in demand in other sectors with generally more labour intensive activities. Also, grants would lead to a reduction in state budget and thus a reduction in employment associated with governmental spending. However, the savings in energy expenditures would lead to an increased income and hence consumption of other goods. This results into a transfer of the demand from energy sectors to other sectors, resulting in a net increase in terms of overall employment over the period of time considered (1995-2010).

5. Social Transition

A shift toward an economy based on a lower carbon-dependence will have socio-economic consequences, as described in the previous chapter. Such changes can be eased by including the respective stakeholders in the design of adequate transition measures.

[15] Data source: Instituto Nacional de Estatistica (INE, National Statistic Institute), http://www.ine.es/, viewed 22 September 2006.

Social dialog

The design of both NAPs has been accompanied by an important social consultation process, including notably trade unions and companies of the different sectors affected. The preservation of national companies' competitiveness represents a key concern for the Spanish government. In the *Declaración para el Diálogo Social* (Declaration for the Social Dialog), signed on July the 8th, 2004, the Government, together with business representatives and trade unions, agreed on developing a platform to discuss the Kyoto Protocol commitments and their consequences on the economic activity and employment. The next step has been a law (1/2005) which regulates the framework of emission allowances trading, in which a series of round-tables are foreseen in order to facilitate the dialog between public institutions and sectoral actors. The *Real Decreto* 202/2006 (Royal Decree) concretises those plans and describes the practical details of the round-tables. Those tripartite meetings concern each industrial sectors affected by the NAP, namely electricity generation, petroleum refining, iron and steel, cement and lime, glass, ceramics, and paper.

Another good example of constructive social dialog is the one about nuclear energy. A round-table platform has been initiated by the government, as the consequence of an electoral promise, in order to debate about the future of nuclear energy in Spain as well as about the consequences of a potential nuclear phase-out[16]. They include different groups of actors, such as public authorities, nuclear industry, environmental NGOs, and academics. The principal outcome of such meetings so far has been the establishment of a constructive dialog between the different stakeholders. Broadly, there are three main positions: the nuclear industry advocates the prolongation of nuclear plants life-time, environmental NGOs request a schedule for a nuclear phase-out, while other actors suggest intermediate solution such as the so-called *Plan Puente* (Plan Bridge). For instance, such plan promotes a gradual phase-out of nuclear electricity generation. During the first phase, revenues from nuclear energy generation would be used to finance alternative energy from renewable sources notably.

Transitional measures

Climate change mitigation will create opportunities, but also create burdens in certain activities. It is therefore of utmost importance for climate mitigation measures to be accompanied on the one hand by instruments allowing for supporting the emergence and the

[16] For more details about the round-table, please refer to: http://www.mityc.es/Energia/Secciones/Mesadialogo/, viewed 28 September 2006.

growth in winning sectors. On the other hand, adequate measures should be put into place in order to deal with negative effects. For instance, in the losing sectors, assistance to workers must be provided in order to facilitate the transition. The Declaration for Social Dialog and its respective sectoral round-tables mentioned above seems to be an ideal platform, where trade unions are also represented, to develop such transitional measures. To date, however, after a first round of meetings, no such initiative arose from the discussion yet.

As the demand for professional expertise will changed due to adjustments in economic activities, needs for education and training will change as well. The new Building Technical Code, for instance, will increase the demand for insulation material, windows changes, the installation of sun protection, the refurbishment of space heating and cooling systems, and renewable energy equipments, implying the corresponding increase in the demand for respective professionals. One local initiative, as an example, is noteworthy in that sense. The city of Barcelona, through its program *Barcelonactiva*[17], proposes courses for professionals in order to develop or extend their practical knowledge in energy-efficient buildings and renewable energy technologies. This action anticipates the expected increasing demand of qualified professionals in those fields triggered by the application of the national and local energy strategies.

6. Conclusions

Meeting internationally agreed climate change mitigation targets will represent a challenge in Spain and may imply adjustments in the majority of economic sectors. In general greenhouse gases emission mitigation Policies and Measures are not perceived as prejudicial to employment. Rather the contrary, some fields could see their activity enhanced by such measures.

Spain disposes of a broad mix of Policies and Measures with the aim of curbing down greenhouse gases emissions. The central element is the National Allocation Plan, which responds to the requirements of the European Directive in that regard. Noteworthy to mention are also the Strategy for Energy Savings and Energy Efficiency, the Renewable Energy Plan, the Strategic Infrastructures and Transport Plan for the transport sector, as well as the new Building Technical Code for the construction sector. While climate change policies seem to

[17] Website: http://www.barcelonactiva.es/, viewed 5 July 2006.

be a high priority in the European agenda and hence in Spain, the impact of mitigation measures on employment has received little attention so far.

Forward-looking companies which have been taking measures to move towards less carbon-intensive productions in an early stage seem in a better position to face the challenge posed by emissions restrictions. Also, such adjustments seem often easier for big companies than littler businesses. Greenhouse gases emission mitigation measures may lead to sectoral shifts, for example from conventional electricity generation to renewable energy production. Social measures in order to alleviate the impact in sectors adversely affected are of utmost importance.

In the energy sector, some fear adverse effects in the conventional energy generation sector due to the probable change in the energy-mix. The net balance, however, is expected to be positive. For example, the concretisation of the Renewable Energy Plan is expected to create about 100'000 jobs, predominantly in the area of wind energy.

New opportunities, and thus possible positive impact on employment, are expected in the transport sector in terms of proximity transportation and combined rail-road freight and passengers transport. Similarly, energy conservation schemes in the residential sector are expected to lead to a net increase in terms of overall employment. The new Building Technical Code will increase the demand for insulation material, windows changes, the installation of the solar protection, the refurbishment of space heating and cooling systems, and renewable energy systems, implying the respective increase in the demand for professionals active in those fields.

Some local actions aimed at dealing with the changes in training requirements are in place in order to anticipate the expected increase demand of qualified professionals in those fields enhanced by the application of national and local energy strategies. Also, professionals for new activities, such as carbon brokers and emission verifiers for instance, will be required. The majority of those opportunities will be offered to relatively well-educated candidates principally.

The design of the National Allocation Plan has been accompanied by an important social consultation process, including notably trade unions and business representative of all sectors affected. During the interviews, the need for comprehensive employees' information processes has been underlined several times.

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Annex A

Overview of stakeholders contacted for interview:

Sector	Number of companies/ organisations/ authorities contacted	Number of interviews conducted	Number of written replies	Negative answers/ rejection	Reasons for rejection*
Public Authorities	6	6	3	0	
Trade Unions	6	5		1	d
Employers Organisations	5	3		2	g
Environmental NGOs	2	2		0	
Steel companies	0	0			
Aluminium companies	0	0			
Cement/Building Materials	0	0			
Electric Equipment	0	0			
Building, Construction & Refurbishment	1	0		1	e
Power	3	3		0	
Oil, Gas	1	1	1	0	
Transport	1	1	1	0	
Hydrogen	0	0		0	
Others	0	0			
Total	**25**	**21**	**6**	**4**	

Reasons for rejection:
(a) No interest to take part in study
(b) No reply at all
(c) Not responsible for topic
(d) No time for interview/written response
(e) No reply after email/phone contact
(f) Company too small
(g) Cannot answer the questionnaire