CEDEFOP
European Centre for the Development
of Vocational Training

Skills for green jobs

Country report

Spain

Preface

The world is coping with a host of environmental problems and an urgent need to reduce carbon emissions. A greener future also provides enormous potential for much needed employment growth. However, without suitable skills, this potential cannot be realised. Today, skills gaps are already recognised as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services, and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs.

The European Centre for the Development of Vocational Training (Cedefop) and the International Labour Organization (ILO) worked together in carrying out the project 'Skills for green jobs', identifying skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The 'Skills for green jobs' study is embedded in the green jobs initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyse and promote creation of decent jobs as a consequence of the needed environmental policies.

The Skills for green jobs - European synthesis report (Cedefop, 2010) covers six EU Member States: Denmark, Germany, Estonia, Spain, France and the UK, and Annexes 1-6 are summaries of the country reports. The ILO global synthesis report, Skills for green jobs: a global view (Strietska-Ilina et al., forthcoming), analyses the situation in all 21 countries involved in the study (Australia, Bangladesh, Brazil, China, Costa Rica, Denmark, Egypt, Estonia, France, Germany, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Spain, Thailand, Uganda, the UK and the US). The reports are available at: http://www.cedefop.europa.eu (Cedefop's website; under 'Identifying skills needs', 'Skill needs in sectors') and: http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm (the ILO website).

Country reports benefited from major contributions from Kurt Vogler-Ludwig, Luisa Stock, Ida Bayer, Hanne Shapiro, Olav Aarna, Elvira Gonzales, Fernando del Rio, Cristina Castellanos, Cecile Mathou, Steph Charalambous, Michael Lawrie and Shane Beadle. The list of country experts is provided in each full country report.

NB:

The six full country reports are unedited and available only electronically. They were used as background information for Cedefop's *Skills for green jobs - European synthesis report*. Citations from the country reports are not permitted. They can only be taken from the synthesis report itself, available from Internet: http://www.cedefop.europa.eu/EN/publications/16439.aspx [cited 17.8.2010].

Table of content

List of tables and figures

Tables

Abstract

In Spain, the government strategy for green restructuring has been strengthened by measures to deal with the economic crisis. The core of Spanish restructuring is the energy policy which is based on renewable energy development and energy efficiency and saving. Within renewable energy, wind power and solar energy play a significant role. In addition to energy, important policies have been adopted in the fields of transport, water, pollution and conservation. This green restructuring has had important effects on the labour market with restructuring of existing occupations, creation of new green collar occupations and greening of existing occupations. Consequently, a skills gap has emerged leading to diverse skills responses. As observed in the case studies in this report, there has been public-private cooperation to address the skills gaps for the greening of economy. Government strategies have focused on centralised initiatives and incentive systems supported by a decentralised set of initiatives from different public bodies such as regional employment services and public foundations. Within the private sector there has also been a wide range of agents involved, from corporations providing skills training for their productive needs, to private training centres oriented to small and medium enterprises (SMEs).

Executive summary

In Spain, the challenges presented by climate change are shaped by its geographical location and its socio-economic characteristics. Spain is located in the sensitive area of Southern Europe, has experienced a high rate of population growth and has gone through significant economic development in the last years.

Green restructuring of the Spanish economy began around a decade ago targeting the energy, water, pollution, and transport sectors. The central government promotes greening in these areas through various regulatory frameworks and economic incentives. Energy and water policies are aimed at increasing efficiency while expanding production through use of renewable energy and desalination technology. Transport policy aims to make transport sustainable through developing electric cars. To meet the challenge of moving to a low carbon economy the Spanish environmental strategy aims at fostering growth of new green collar occupations in these sectors.

The majority of new green collar occupations have been found to be in the areas of renewable energy, waste treatment, green management and awareness. The greening process involves 'green' skills training. In some cases, this greening is required to reduce the environmental impact of existing occupations. In other cases, the greening is needed to introduce new green activities into these occupations. An example of the former would be the skills training for energy efficiency in fishery. An example of the latter would be the skills training of electricians for solar photovoltaic panels installing activities.

The drive towards green structural change in the Spanish economy has had important effects on labour markets. Firstly, new green occupations are growing in renewable energy, waste treatment, green management and awareness. Secondly, the shift of labour from the ailing construction sector to renewable energy and the restructuring of the automotive industry are creating new skills needs in two of Spain's largest industries. Thirdly, several occupations are beginning a process of greening, notably in water, agriculture, fishery, and transport.

This structural change has had implications for skills training across a wide range of occupations. Various actors have participated in identifying and delivering new skills training: regional governments, public employment services, universities, business associations, trade unions, corporations; SMEs, and private training centres. There has not been a comprehensive review of the implications of national greening policies on skills gaps at the national level so far.

The Spanish response to the current economic crisis has important green components and strategies dealing with the current economic crisis strategies have strengthened the greening process. Spain's large external deficit also means that renewable energy development and energy efficiency have a key role not just for environmental sustainability, but also for economic sustainability. Therefore, the Spanish environmental strategy, green structural change and economic recovery are interlinked.

Due to the recent economic crisis the renewable energy development strategy has been reinforced and additional support given to energy efficiency and saving initiatives. At the same time, the Spanish government has launched a strategy for the development of electric cars, complementing the European Green Cars Initiative aiming to produce electric cars for 2011 and solve the competitive problems of the industry. The introduction of the new technical building code promotes skills training to allow workers from the construction sector to start up in renewable energy.

Public provision of skills training has been complemented by responses from the private sector. Among the skills responses identified, two effective delivery mechanisms should be highlighted: the comprehensive and long term skills response at regional level and the skills responses within corporations. Both methods have benefited from taking a long term strategic perspective. Hence, further coordination is recommended to develop a clear and comprehensive green skills strategy allowing for synergies in economic, employment, education and environmental policy areas.

A clear strategy for the identification and provision of green skills will in turn allow for better anticipation of skills gaps and strengthen the process of moving towards restructuring in the economy. The creation of a network of regional centres for training in environmental skills coordinated at national level is recommended.

The green skills response has undoubtedly achieved some important results. The main is that there currently is a green restructuring occurring in the Spanish economy, which would have not been feasible without an operative skills training response. Also, training centres for greening of skills have been created with a long term perspective. Finally, innovations in Spanish corporations in the renewables and desalination sectors, together with public support in these fields, means that Spain is closer to overcome the main economic bottlenecks of the two central environmental and resources problems: energy and water.

1. Introduction

Spain faces a twofold challenge dealing with climate change. Firstly, it has responsibility to reduce its greenhouse gas emissions in order to minimise its contribution to global warming. Secondly, it has to adapt to projected effects of climate change such as the decrease of available water resources and desertification. As a response to these challenges, Spain has started a green restructuring of its economy, a process which has been enhanced by several measures to deal with the current economic downturn.

Green restructuring is based on Spain's energy strategy as well as measures in the fields of green management, awareness, water management, and waste treatment. The energy strategy aims to improve the ratio of emissions per gross domestic product (GDP) by increasing efficiency and saving and developing renewable energy sources. The greening of the economy involves the creation of new occupations: 'greening' of already existing occupations as well as restructuring of some of them. As structural change implies shifts in labour markets skill profiles are directly affected.

This report analyses the greening of the Spanish economy within its environmental and economic context, focusing on its skills implications and responses. The report is based on data collection, analysis of policy documents and case studies. Hence, primary and secondary data are used to describe the process of skills needs identification and the associated response as well as to explain the relations between identification, skills needs and green restructuring. Case studies are based on information and documentation from the institutions analysed and interviews with representatives.

The first part of this report describes the main environmental challenges in Spain as well as the main environmental strategies that are being implemented. A description of the green response to the current economic crisis is provided and the main skills identification processes and training responses is analysed.

The second part focuses on the green structural change and (re)training needs. Here green structural change is analysed from an economic perspective, considering its labour implications. Then the green response to the current economic crisis and its links with the green structural change is analysed. In this part different economic sectors are investigated for their role in green structural change in the current economic crisis (the automotive industry, the construction sector and renewable energy). Finally, a description of the main identification processes used to provide green skills training responses is given. Here, observations from the case studies will be drawn out and analysed.

In the third section new green collar occupations and the process of greening of existing occupations are analysed considering environmental, economic, and institutional factors. This section concludes with the description of the main skills identification processes and the most important skills training responses observed. The case studies play a significant role in these

observations. Finally, main findings are summarised in the conclusions and policy recommendations are made in the last section.

The case studies provide a concrete and detailed perspective of many of the existing identification methods and skills responses in Spain. Moreover, the agents involved in providing skills responses are observed to vary widely across the public and private sectors in the case studies. Despite the inclusion of skills measures within national greening strategies and initiatives organised by public bodies, insufficient anticipation of nationwide skills needs has led a wide range of agents, from corporations to trade unions, to provide skills training.

By contrast, some regional governments have organised comprehensive strategies at the regional level. One such example is detailed in the case study on the Cenifer foundation in the Navarre region. Another efficient skills training response is described in the case study on the training of wind power technicians by Iberdrola. The comprehensive and coordinated responses at the regional level and skills responses within corporations have been identified as examples of best practice in Spain. Both cases have benefited from a proactive approach, which is a key element for the success and effectiveness of responses for greening skills.

2. Policy context

2.1. Key challenges and priorities for the green economy

The challenge of adapting to climate change in Spain is bigger than the European average due to its geographical location and its socio-economic characteristics ([1]). The challenges are three-fold: increases in temperature, decreases in precipitation and sea level rise. Firstly, global warming will have serious effects on biodiversity and will damage ecosystems. In agriculture and livestock industries, the rise of temperatures could have mixed effects with higher temperatures having some negative effects and other areas if the agriculture industry benefitting from softer winter temperatures.

Secondly, decreases in precipitation will diminish water resources, with important consequences for agricultural production, forest density, soil erosion and fertility, and potential negative consequences for water supply in many cities. Moreover, water problems are enhanced by the current trend of urban growth and periodic droughts. The Ensembles Study ([2]), points out that rainfall will decrease by 20% in Spain over the 21st century. In the last 20 years, average water resources have decreased by 5% and have fluctuated from 100 to 350 yearly litres per m^2 per year due to weather conditions ([3]).

Economic development and population growth also affect the effort to mitigate climate change. Despite low birth-rate, Spain's population has risen around 16,4% between 1996 and 2008 due to migrant flows. As a result of these economic and demographic factors, greenhouse gas emissions are currently far from Kyoto Protocol commitments, reaching 420 Mt of equivalent CO_2 in 2008, 52% higher than in 1990 ([4]). However, due to current economic crises and, especially, to the improvement in energy efficiency, this figure is below the 440 Mt of equivalent CO_2 of 2005.

Although the external trade deficit has shrunk from 10 to 5% of GDP during the current economic crisis, the deficit remains a key challenge in the Spanish economy which is dependent on energy imports. Moreover, the crisis has highlighted another key economic challenge: the problem of the oversized construction sector. Finally, transport infrastructure in Spain is based on road transport presenting a challenge in shifting to railroad based transport.

([1]) IPCC (Intergovernmental Panel on Climate Change), states, in its Fourth Evaluation Report, approved at Brussels in April 2007, that climate change consequences will be especially intense in South Europe.

([2]) Ensembles Report of European Commission includes, Weather National Agency (Agencia Estatal de Meteorología, Aemet) estimates, which state that rains will decrease by 20% – 25% to the end of the present century.

([3]) Informe indicadores marm (poner cita).

([4]) According to Kyoto Protocol commitments, Spanish greenhouse emissions for 2012 should not rise more than 15% from 1990 levels.

Table 1: Key environmental and socio-economic challenges in Spain

Climate change	Socio economic characteristics	Emissions trajectory
Increases in temperature Decreases in precipitation Sea level rise	Population growth Economic development External trade deficit Energy dependency Transport infrastructure based on road transport Current crisis and size of construction sector	Emissions far above Kyoto Protocol commitments

The strategy for dealing with these challenges prioritises four areas: energy, water, pollution, and transport. Firstly, the energy strategy is based on reducing the energy/production ratio and increasing renewable energy production. Secondly, the water strategy is based on increasing efficiency of water consumption and increasing the water resources. Thirdly, reducing pollution and protecting natural resources is a green priority in itself. Fourthly, the transport strategy consists of the development of electric cars and promoting sustainable transport, including the shift from road to railway transport.

Table 2: Key priorities for the greening economy in Spain

Energy	Water	Pollution	Transport
Energy efficiency Renewable energy production	Water efficiency Increase water resources	Reduce pollution of economic activity Protect natural resources (forests, seas, rivers, etc).	Electric cars Sustainable mobility

2.2. The response strategy

2.2.1. General environmental strategy

The Spanish environmental strategy is promoted at different administrative levels of the state: central government, autonomous communities (governments in the 17 Spanish regions), local councils and specific bodies for implementing the environmental strategy. The strategy is composed by different laws, plans and decrees and has linkages with policies and strategies on other policy areas. In this context, several initiatives from the Autonomous Communities complement the government strategies, together with Agenda 21 at the local council level. A summary of the most important programmes in the Spanish environmental response strategy is displayed in Table 3, followed by a brief description of key strategies.

Table 3: Main programmes in the Spanish environmental strategy

Core Plans	
Response to climate change	
(a)	National Climate Change Adaptation Plan (PNACC) (February 2006) Spanish Office for Climate Change. Ministry of the Environment and Rural and Marine Affairs
(b)	Spanish Climate Change and Clean Energy Strategy (EECCEL) (November 2007) Ministry of the Environment and Rural and Marine Affairs
(c)	Spanish Sustainable Development Strategy (EEDS) (November 2007) Economic Office of Spanish Presidency
Response to the current economic crisis	
(a)	Spanish Economy and Employment Stimulation Plan (Plan E) (Started on January 2009) Spanish Presidency
(b)	Law of Sustainable Economy (LES) draft (December 2009) Spanish Presidency
Priorities	**Sector Plans**
Energy	(a) Promoting Plans for Renewable Energy (2000-2010) (PFER) (1999), Ministry of Industry, Tourism and Trade (b) The Renewable Energy Plan (2005-2010) (PER) (2005), Ministry of Industry, Tourism and Trade (c) Energy Saving and Efficiency Plan (2008-12) (2007), Ministry of Industry, Tourism and Trade (d) Electric and Gas Sectors Plan (PSGE) (2008-16) (2007), Ministry of Industry, Tourism and Trade (e) Emission Assignation National Plan (PNADE) (2008-12) (2007), Ministry of the Environment and Rural and Marine Affairs (f) New Technical Building Code (2006), Ministry of Housing
Water	(a) AGUA programme (2004), Ministry of the Environment and Rural and Marine Affairs (b) Water Quality National Plan 2007-15 (2006), Ministry of the Environment and Rural and Marine Affairs (c) Spanish Strategy for Sustainable Irrigation (2009), Ministry of the Environment and Rural and Marine Affairs
Pollution	(a) Forest Spanish Plan 2002-32 (2002), Ministry of the Environment and Rural and Marine Affairs (b) Quality of Waters National Plan: Drainage and Treatment, 2007-15 (2006), Ministry of the Environment and Rural and Marine Affairs, (c) Integrated Plan of Urban Waste (2007-15) (2006), Ministry of the Environment and Rural and Marine Affairs
Transport	(a) Spanish Strategy of Sustainable Mobility (EEMS) (2009), Ministry of Infrastructures and Ministry of the Environment and Rural and Marine Affairs (b) Railway Freight Transport Enhancement Plan (Plan E) (2009), Ministry of Infrastructure

2.2.1.1. Core plans

Key strategies at the national level are the Spanish Climate Change and Clean Energy Strategy (EECCEL) and the Spanish National Climate Change Adaptation Plan (PNACC). The first one is part of the Spanish Sustainable Development Strategy (EEDS) aiming to reduce greenhouse emissions from all sources, focusing especially on development of renewable energy. The PNACC aims to adapt the main planning processes of all relevant sectors and systems to the climate change response strategic needs. The plan defined an initial set of 15 sectors ([5]) and systems for carrying out "assessment actions" through a defined framework.

2.2.1.2. Energy

Renewable energy objectives are placed in a long term strategy, aiming to reach up to 20% of primary energy from renewable sources in 2020. On a shorter term, the strategy includes two Promoting Plans for Renewable Energy (PFER (2000-10) and PER (2005-10)). The PER aims to raise renewable energy contribution in primary energy supply up to 12,10% for 2010, involving a 30% rate of electricity consumption and a 5,83% rate of bio fuels over total oil consumption. The Renewable energy development has been encouraged through the feed-in tariff (FIT) system introduced in 1994 which has introduced the second highest level of feed-in tariff in Europe after the Netherlands. The Technical Building Code (CTE) established in 2006 an obligation to incorporate energy efficiency criteria and the use of solar, thermal and photovoltaic energy in certain new and existing buildings. These measures are expected to affect nearly half a million houses per year, multiplying by ten the surface of solar panels and reducing the energy consumption of buildings by 40%.

The Energy Saving and Efficiency Plan (2008-12) involves several sectors and forecasts to cut 238m tonnes of CO_2 emissions, a 2% energy saving per year, an amount that doubles the EU's end-use efficiency directive ([6]).

The Emission Assignation National Plan (PNADE) (2008-12) ([7]) states a reduction of total emissions by 16% from the previous plan (2005-07), including a reduction of industry emissions by 20%.

The Electric and Gas Sectors Plan (PSGE) (2008-16) ([8]) aims to promote economic development ([9]) and a more secure supply within an environmentally responsible strategy, with regard to the future demands from high speed railway (AVE) and desalination plants.

([5]) Biodiversity, water resources, forests, agriculture, coastal areas, inland hunting and fishing, mountain areas, soils, fishing and marine ecosystems, transport, human health, industry and energy, tourism, finance – insurance policies, urban planning and construction.

([6]) ENDS Europe, 25 July 2007, 'Spain details sweeping climate strategy'.

([7]) PNADE: Plan Nacional de Asignación de Derechos de Emisión (2008 – 2012), Emission Assignation National Plan. Ministry of the Environment and Rural and Marine Affairs.

2.2.1.3. Water

The Spanish government launched the AGUA programme in 2006, a comprehensive set of measures aimed to increase water resources and improve its management. Moreover, the Spanish Strategy for Sustainable Irrigation ([10]) aims to reduce water consumption by 7% and the Water Quality National Plan 2007-15 ([11]) aims to triple reused water. The Economic Report of President 2009 highlights the growing importance of desalinated water in Spain, stating the objective of producing 1000 hm^3 of desalinated water for 2012.

2.2.1.4. Transport

In transport, the core plan is the Spanish Strategy of Sustainable Mobility (EEMS) which includes 48 measures spanning the five areas of: territory, transport and infrastructure; climate change and energy; noise and air quality; health and safety; and demand management. The EEMS ([12]) highlights the importance of sustainable urbanism, the promotion of public transport, and further development of the railway system. Plan E also includes a Railway Freight Transport Enhancement Plan, which aims to shift freight transport from trucks to railway. This plan cooperates with other railway development plans, involving building 7,000 kilometres of high speed railways for combined passengers and freight transport, and the adaptation of passenger railways to freight transport.

2.2.2. Green response to the current economic crisis

In December 2008, the Spanish government launched a EUR 11 billion economic stimulus package, approximately 1% of GDP. The package included 600 million in environmental projects ([13]) and EUR 500 million on research and development, together with funding for infrastructure projects and investment in the ailing automotive sector, signalling the importance placed by Government on the 'green economy' and its role in promoting growth and development. Indeed, energy saving is a 'major structural reform that would create jobs and reduce the oil-dependent country's external deficit' ([14]). As a net energy importer, Spanish renewable energy policies are considered a Keynesian stimulus initiative pushing

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([8]) PSGE: Planificacón de los Sectores de Gas y Electricidad (2008 – 2016), Electric and Gas Sectors Plan (2008 – 2016), Ministry of industry, Tourism and Trade.

([9]) Planned investments reach EUR 9.220 million for electric network, and EUR 10.221 million for gas network.

([10]) Spanish Strategy for Sustainable Irrigation, Estrategia española de Regadío Sostenible, Ministry of the Environment and Rural and Marine Affairs.

([11]) Water Quality National Plan 2007 – 2015: el Plan Nacional de Calidad de las Aguas: Saneamiento y Depuración 2007-2015. Ministry of the Environment and Rural and Marine Affairs.

([12]) EEMS: Estrategia Española de Movilidad Sostenible, Spanish Strategy of Sustainable Mobility. Ministry of Infrastructures and Ministry of the Environment and Rural and Marine Affairs.

([13]) Bruegel (2009) 'Estimating the size of the European stimulus packages for 2009 – An Update'.

([14]) Financial Times, March 27 2009, 'Zapatero favours 'green stimulus'..

both short and long term growth through an import substitution strategy. Among the concrete measures of these green responses to the current economic crisis, the Organisation for Economic Cooperation and Development (OECD) cites as an example of green stimulus the EUR two billion spent by Spain in carbon capture and storage technology projects, forestry schemes and R&D (Research and Development) in energy and climate projects, representing 0,13% of GDP.

A key strategy for addressing the economic crisis in Spain is the Spanish Economy and Employment Stimulation Plan (Plan E) ([15]), a comprehensive and extensive strategy containing short term packages oriented towards introducing long term reforms in the economy to move towards a more sustainable structure. One of the strategic lines of Plan E is environmental sustainability, which includes different measures and projects: additional support for the EECCEL; funding for acquisition of newer, less polluting buses and cars (Plan VIVE) and for investment in a less polluting automotive industry, as well as tax reductions for workers who use public transport or collective measures such as car-sharing, R&D in electric car (MOVELE project); additional support to the Energy Efficiency and Saving Plan 2008-11; the Renewable Energy Plan 2011-20; the Law of Renewable Energy and Energy Efficiency; and the Railway Freight Transport Promoting Plan.

These green responses have skills implications, particularly in relation to new green jobs creation and greening of existing occupations. Plan E includes an important and comprehensive skills development strategy, from primary education to R&D projects in universities and research centres, which to some degree addresses the skills needs brought about by environmental policies. However, it does not provide any specific training programme for the new green jobs or greening of existing occupations.

The Law for a Sustainable Economy (LES) draft ([16]) outlines the future core strategy of the structural change of Spanish economy strategy. The LES draft states the objectives of reducing green house emissions by 20%, reaching 20% in renewable energy supply and 10% in renewable sources for transport by 2020. It also includes fiscal benefits for companies that invest in greening their activities.

Spurred by the economic crisis, the Spanish government recently launched the electric cars development strategy (November 2009). This strategy implies stimulating demand through green restructuring of the sector. Complementing the European Green Cars Initiative, the government has launched the Competitiveness Plan of Automotive Sector, which has been included in the Integral Plan of Automotive Industry, approved in February 2009. This plan supports the automotive companies for the development of more energy efficient and cleaner vehicles.

([15]) Plan E (www.plane.gob.es).

([16]) LES, Anteproyecto de Ley de Economía Sostenible (Law of Sustainable Economy Draft), November 2009.

2.3. The skills development strategy in response to greening

In this section an overview of public and private skills strategies in Spain is provided based on research into skills initiatives of public, private and social partners. Primary sources, secondary sources, e.g. expert's opinions from skills symposiums, policy documents and interviews inform this overview.

Despite the inclusion of some skills training responses in environmental policies and the progressive development of diverse environment-related programmes in the public education system, there is no explicit national strategy targeting skills needs for greening the economy. Many public strategy documents identify the need for more skills training but there is no overarching, comprehensive skills training strategy identifying the skills needs for the occupations involved.

In Spain, the regions are responsible for managing active labour market policies (ALMP), which include employment creation and occupational training for unemployed. They also manage education policies including formal vocational training and tertiary studies. Though harmonised and coordinated at the state level, they adapt employment and education strategies to their needs and strategic priorities. Hence, regional approaches to the 'green jobs' agenda and associated skills requirements vary greatly. Some regions have managed to integrate creation of green jobs with wider economic, environmental and social objectives to create effective skills programmes.

Thus initiatives from regional governments, other decentralised public bodies, the private sector and social partners form the core of the Spanish skills training response. Table 4 displays the main agents involved, their strategies and skills responses.

Table 4: Overview of skills responses in Spain

Agent	Strategies	Skills response
Central Government	National plans and strategies	Non-comprehensive responses
	Strategies for vocational training and higher education	New professional training Inclusion of new subjects within already existing programmes in vocational training and university programmes
Regional governments and decentralised public bodies	Employment policy implementation Environmental regional strategies Local initiatives	Green training centres Green training initiatives
Private sector and social partners	Corporations provide skills training for their productive needs	Training within corporations

	Private academies adapt to demand for new skills	Private courses
	Business associations fulfil skills gaps requirements from productive needs Trade Unions improve the skills of workers	Identification and organisation of skills responses by social partners (mainly for SMEs)
Mixed bodies	Tripartite Foundation (Ministry of Labour and Immigration, business associations and Trade Unions)	Courses on continuous training for employees Studies on continuous training for employees organised by companies

The Technical Symposium of Environmental Training within the Spanish Public Administrations ([17]) states that there has been a lack of strategic coordination of skills responses for the greening economy at different administrative levels. In a survey for this symposium, 90% of national skills experts affirmed that there is a clear need for a national environmental training plan in Spain. Specific needs were identified in providing training for public servants, detecting national skills requirements for the greening economy ([18]), as well as coordinating skills development policies and strategies with existing industrial, technology, economic and environmental policies. In Spain, the integration of the different environmental policies and the subsequent skills development strategies is still in a very early stage ([19]).

In the following sections the main skills strategies will be described according to the agents providing the response.

2.3.1. Central government

The skills response stemming from greening strategies promoted by the central government is analysed from two different perspectives: from the skills components in the green strategies analysed above and from skills initiatives within the education system and public bodies at the national level.

Skills response components in green strategies

([17]) 'Jornadas Técnicas sobre la Formación Ambiental en las Administracionoes Públicas Españolas' held during 3th, 4th and 5th of June of 2009, in Pamplona, Navarra. Available at: http://www.navarra.es/NR/rdonlyres/082E5062-6051-4B97-B963-7D401D59382B/130725/PROGRAMA.pdf.

([18]) 'Determinación de las necesidades formativas de los empleados públicos en materia de ahorro y eficiencia energética en las administraciones públicas', Manuel Garí Ramos, Director del área de Medio Ambiente del Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS).

([19]) Miguel Sanchez Serma, President of Autonomous Community of Navarra, during the Technical Symposium of Environmental Training in Spanish Public Administrations, June 2009.

Some of the strategies analysed above include measures to address the demand for new green skills. The EECCEL includes certain technical skills training programmes for green technologies targeting new professionals and skills development of existing 'green' professionals. EECCEL also includes driving training programmes in order to reduce greenhouse gas emissions and increasing energy efficiency in transport. EECCEL supports several climate change and environmental awareness programmes aiming to increase and improve conceptual skills related to environmental issues. Finally, the strategy promotes dissemination of good practices through magazines, journals and the internet with the purpose of promoting skills training and learning in companies and civil society.

Plan E incorporates an education and skills development strategy spanning primary education and R&D projects in universities and research centres. These measures aim to satisfy skills needs in environmental policies through the creation of education programmes with green components oriented towards training new 'green' professionals. However, Plan E does not clearly identify a skills training need related to the economic response to the financial crisis and does not provide any specific training programmes for new green jobs or greening of existing occupations.

The Renewable Energy Plan 2005-10 (PER) clearly identifies the lack of technical skills required to meet the renewable energy objectives in the plan ([20]). This is likely to be attributable to both a shortage of skilled workers and insufficient skills for many workers already carrying out jobs with a green component. The PER suggests that there is likely to be a shortage of technical skills in relation to installation and maintenance of solar-based renewable energy systems, as well as a need to provide further training for environmental and renewable energy experts in local councils.

The PER measures include training programmes for local council technicians, renewable energy installers and maintenance workers, as well as different training and information programmes in response to the skills development needs from the new CTE, approved in 2006. The CTE established an obligation to incorporate energy efficiency measures, such as the use of solar, thermal and photovoltaic energy, in some new and existing buildings. This new code involves extending skills development responses to professions such as architects and developers.

The Energy Saving and Efficiency Plan (2008-12) includes specific measures for raising awareness and energy efficiency habits in the agricultural sector. It also develops training courses for local council technicians; courses in efficient driving for transport professionals and driving instructors; courses for railway, air, road and ship freight transport management.

The EEMS sets the framework for the development of a transport skills training plan by the Ministry of Environment, Rural and Marine Affairs and the Autonomous University of

([20]) The renewable energy sector could be a source of skills tensions as it has already employed around 90.000 persons in Spain and this figure is projected to reach 270.000 persons by 2020. Source: ISTAS.

Madrid. The plan will include awareness measures for politicians and public servants in urban local councils. In addition, the EEMS suggests future actions on efficient driving courses and awareness initiatives, especially highlighting the promotion of public transport and bicycles.

Skills responses in the education system and public bodies at the national level

New green education programmes have been organised within regular vocational training and university courses. At the vocational training level, new training courses have been created on energy and water including the new Vocational Education and Training (VET) programme 'Energy efficiency and thermal solar energy technician' ([21]). At the higher education level, many new postgraduate programmes have appeared complementing and adapting undergraduate modules towards providing skills for new green occupations. At the same time, several existing courses have undergone a 'greening' through the inclusion of new subjects in university or vocational training programmes. One example of this is the inclusion of a module on environmental awareness in vocational training programmes ([22]).

Although environmental education has not been incorporated into business management education in general, some interesting examples exist such as the Environment Specialised MBA programme of the European School of Business Administration ([23]). In business management generic skills, such as leadership, communication or problem solving, are particularly important skills for certain green job profiles, e.g. corporate management, strategic planning or analysis, and non-technical skills like sales, communication, languages or business management ([24]).

Simultaneously, some public bodies have organised initiatives to support the national plans and strategies (see case studies on IDAE ([25]) and the Biodiversity Foundation). Such work include initiatives and funding for increasing energy efficiency in agriculture and cross sector skills training programmes designed by private sector academies or associations.

([21]) Further information about this new VET programme can be found at (in Spanish): http://www.mec.es/educacion/que-estudiar/formacion-profesional/que-puedo-estudiar/todos-los-estudios/energia-agua/eficiencia-energica-energia-solar.html.

([22]) 'Vocational training for employment and environmental education. From a demanding environmental education to a professional environmental education'. Original titile: 'La formación profesional para el empleo y la EA. De una EA reivindicativa a una EA profesionalizada', Alberto Martínez Villar, Treinta años de educación ambiental, ECODES.

([23]) The school is attached to Complutense University of Madrid. More detailed information about the postgraduate programme available in: http://www.escuelademedioambiente.com/master-mba-especialidad-en-medio-ambiente/.

([24]) 2008 study by the Confederación de Empresarios de Navarra (CEN, Navarra Businessman Confederation) with the collaboration of the Navarra Industry Association (AIN): 'Strategic talent in renewable energy sector'. This study was carried out for the Spanish region of Navarra.

([25]) IDAE: Institute for the Diversification and Energy Saving (Instituto para la Diversificación y el Ahorro de Energía), is attached to Ministry Industry and acts as central public agency for energy saving in Spain. It fosters several programmes for energy saving, as well as several studies of reference in the field.

2.3.2. Regional governments

Government bodies at the regional level have played an active role in green skills development. Some regional governments have carried out comprehensive studies of skills needs, developed long term skills strategies and established training centres. The Autonomous Community of Navarra is one such example. In 2002 this regional government initiated an environmental training plan and has now launched the II Environmental Training Plan for 2010-13. Another example is the programme carried out by the regional employment service in the Extremadura region providing skills training for solar energy designers. Both examples are detailed in two of the case studies. Moreover, there are several skills initiatives exist in other Spanish autonomous communities, such as Murcia, Madrid and Castilla y León.

2.3.3. The private sector and social partners

Various agents outside government are complementing the public skills training offer for the greening economy. In contrast with most public providers, companies in green sectors, private training centres, business associations and trade unions do not often follow a detailed strategy for green skills but apply their general training strategies to the green context.

Within the green sector, large companies tend to resolve skills gaps in their production needs in-house. However, the skills response is markedly different for SMEs and big enterprises. In some large companies comprehensive skills strategies have appeared introducing training programmes and environmental management systems for their workers. Big corporations often identify skills gaps themselves and organise their own skills response. In SMEs the skills response differs from the large companies and most SMEs cannot afford internal identification of skills needs and use foundations and private training centres to identify and tackle skills gaps.

Training centres and private academies have adapted programmes which have a green component to the rising demand. Their skills training offer is wide spanning courses for managers to courses for basic technical occupations such as plumbers. Some of the training courses offered by the private sector are subsidised by the government showing a degree of public-private sector cooperation and coordination. Such cooperation between social partners, private training centres and the public sector has been essential to provide SMEs the green skills training that they have needed.

Also, contributions of civil society and the media to developing the conceptual skills necessary for the effective implementation of environmental awareness strategies have played an important role. They have achieved good results as environmental awareness among workers of all qualification levels has increased considerably ([26]).

([26]) ISTAS: Environmental Perceptions of Workers, 2005.

2.3.4. Mixed bodies

An important agent in the Spanish skills development system is the Tripartite Foundation. This foundation is formed by the Ministry of Labour and Immigration, the major business associations and trade unions. It organises permanent programmes for continuous training of employees. Within these programmes there is no specific training courses for greening although in some courses there are green components (e.g. safety at work and regulation in construction sector). Moreover, the Tripartite Foundation carries out many studies on continuous training programmes within companies across Spain.

3. Anticipation and provision of skills

3.1. Green structural change and (re)training needs

3.1.1. Green restructuring and its impact on the labour market

In this section green structural change in Spain will be outlined considering environmental challenges, policy context and labour market implications. This sets that background for the sections on identification of skills gaps and skills responses. This section has been informed primarily by secondary data such as experts' opinions and government plans and strategies. Information from case studies has been essential to complete the description of green restructuring.

As outlined above, environmental challenges and policies, along with economic factors, have shaped green structural change in Spain. Energy policy has been shaped by the external deficit and the core of green restructuring is energy efficiency and renewable energy development with clear implications for the economy in terms of labour and foreign trade balance. Water scarcity has motivated another area of green restructuring: water efficiency and desalination. Both energy and water have promoted the development of green management activities, especially towards increasing energy and water efficiency. Simultaneously, the priority of pollution and protection of natural resources has promoted waste treatment activities and enhanced green management activities. Finally, the current economic crisis has pushed green restructuring from construction to the renewable energy sector and is changing the automotive sector as well.

Hence, three main kinds of green restructuring can be identified. The first concerns the economy as a whole: the shift from fuel imports to domestic renewable energy has macroeconomic structural effects in terms of labour and foreign trade. The second consists in the diversifying from one sector to another as exemplified by the restructuring from the construction sector to renewable energy. The third is restructuring processes within particular sectors as will be the case of the automotive industry if the electric cars strategy is implemented in the coming years.

3.1.1.1. Green structural change in the energy sector

Green restructuring of the Spanish economy started about ten years ago with reforms in energy policy. This policy ensured high prices for power produced by renewable energy sources, creating a solid profit in order to incentivise investments in the sector. At the same time Spain has had a severe external trade deficit. Stagnant productivity rates together with high inflation rates have decreased Spanish competitiveness. Before the current economic crisis, external deficit reached 10% of GDP. However, due to the fall in domestic demand,

and therefore in imports, the deficit has been reduced to 5%. This is still a high figure and reveals a weakness in the Spanish economy and points to the need for further restructuring.

In structural terms the green restructuring of the energy sector involves changes in trade, energy models and labour markets. The renewable energy sector is today composed of around 1,000 companies employing 89,000 people directly and an additional 100,000 indirectly. This is equivalent to about 1% of total employment. Energy restructuring has involved the creation of several new green occupations, mainly technical staff in the areas of building and installation (around 25% of jobs) and in operation and maintenance (around 75%).

In addition to restructuring in the energy sector, water, pollution and protection of natural resources have undergone green restructuring creating new green occupations and greening existing ones. These areas of are detailed in the following sections of this report.

3.1.1.2. Green restructuring from construction to the renewable energy sector

Economic crisis has sped up the restructuring process from jobs in construction towards renewable energy. Due to the current economic crisis there are approximately 622,000 unemployed in the construction sector – equivalent to 15% of total unemployment. Some large construction sector companies diversified their activities towards renewable energy in the last years before the crisis. These companies anticipated the future problems in construction sector, and invested in renewable energy. Meanwhile, companies in the energy sector also diversified their activities towards renewable energy with the liberalisation of the electricity market.

Due to the similarity of some occupational profiles in the construction and renewable energy sectors, there are potential synergies in the restructuring from construction to renewable energy which could reduce the skills gaps and ease the training responses. As some of the case studies will detail solar energy is becoming standard on many buildings in Spain strengthened by the new CTE. This regulatory change affects occupations of the construction sector, e.g. electricians, plumbers and installers, as these occupations can be retrained into solar energy installers or entrepreneurs. See Table 5 for an overview of occupational changes in the restructuring from the construction to the renewable energy sector. However, some construction sector occupations are not easily retrained into renewable energy occupations and as with any structural change it will require a long time for the change to take place.

3.1.1.3. Prospects for the automotive sector green restructuring

The crisis is also affecting the Spanish automotive industry which is the 3rd largest European manufacturer of cars. The automotive sector accounted for 6% of Spanish GDP in 2008 and represents around 25% of the country's total goods exports. The sector is declining for several reasons: competitive problems, demand for a more efficient transport mobility system, the high level of emissions coming from road transport (more than 22% overall), as well as the current economic crisis. Restructuring of the automotive sector is clearly needed for economic

and social sustainability and restructuring is being planned towards electric cars development. However, as this restructuring is only at in its initial phase and implementation still is still underway information on how occupations will be affected is scarce. An overall identification process for the skills gaps in the green cars strategy has not been established yet.

The electric car strategy also envisages the building of power supply access points which involves construction sector occupations such as electricians and building workers. This restructuring is implies a skills gap and a skills response is likely to be required. Electric cars development also implies increases in power production. Unless rising power consumption is met by renewable sources this structural change cannot be considered 'green'.

Table 5: Overview of structural change in different sectors

Policy or economic change	Adjustment in economic sectors	Impact on occupations	Size of labour market
Renewable energy development policies	Renewable energy sector: 1,000 companies	Several new occupations created and greening of already existing occupations Restructuring from construction sector	Direct employment: 89,000 jobs Indirect employment: 100,000 jobs
Economic crisis CTE	Crisis in the construction sector Restructuring to renewable energy	Electricians Plumbers Installer	Up to 622,000 persons unemployed within the sector
Economic crisis Transport policies	Building of supply points Electric car manufacturing	Engineers, industrial workers, construction workers linked with the building of supply points, electricians	Changes in industrial methods Employment created for building the supply points

3.1.2. Identification of (re)training needs

In this section the identification of (re)training needs is described based on the literature review and the primary data derived from case studies and observations. There is some overlap with skills identification for new and greening occupations and we refer to Section 3.2.3 for a more detailed discussion of the agents involved in identification of skills needs for the green economy.

Green structural change involves several retraining needs. The high level of unemployment reached during the current economic crisis calls for an active and extensive employment policy involving extensive skills training in all fields.

The skills implications of the diversification process from construction to the renewable energy sector depend on the characteristics of the occupations involved in both sectors. In some cases the retraining needs are wide and complete, e.g. for the retraining of bricklayers into solar panel installers. In other cases retraining is not feasible, for example for the retraining of low education occupations into professions that require university degrees.

The development of the renewable energy sector requires training of new professionals for all occupations involved and renewable energy objectives cannot be met solely by retraining former construction sector workers. But the restructuring process of the construction sector has a potential to ease renewable energy development through retraining in some occupations. Some occupations have a relatively short skills gap for the new occupation. For many occupations in the construction sector the skills gap is small, e.g. for electricians, plumbers or installers training to install solar energy panels on buildings. Certain technical skills are needed for these occupations to adapt to the particular technical specifications for installing photovoltaic and thermal solar panels but these new technical skills are not too different and can be acquired in a relatively short time span.

Table 6 details the retraining needs for several construction sector occupations. Electricians, plumbers and installers have relatively small skills gaps for becoming solar energy installers. On the other hand, economic and institutional skills gaps in renewable energy are wider. Because many renewable energy sources are not profitable under current market conditions certain administrative and entrepreneurial skills are needed to benefit from regulatory incentives.

Table 6: Retraining needs for electricians, plumbers and installers working in construction

Retraining to new green occupation	Skills gaps
Solar energy installer	Basic knowledge of solar energy Technical features of solar panels Technical skills of designing the installations Technical practical skills of installing the panels
Solar energy entrepreneur	Basic knowledge of solar energy Basic knowledge of renewable energy regulation Administrative skills for managing the bureaucratic procedures Solar energy projects design
Electric car related occupations	Essential skills gaps not yet identified

The identification process for skills training needs is not clear in the electric car development strategy. The strategy is currently being designed and therefore the identification of training needs can only be projected.

For the identification of retraining needs, a clear bottom-up method has been observed with workers and SMEs playing an active role. First, identification of training needs is made by

workers or SMEs demanding skills training from skills associations or trade unions to cope with green structural change when this is directly affecting them. Thus, workers and SMEs identify skills gaps in the first instance. Second, trade unions or business associations study the different demands from workers or SMEs in order to decide which skills training is most useful for workers' needs. Trade unions or business associations have the role of selecting the skills gaps to be addressed. Third, after selecting an area of skills gaps a training centre, public or private, is approached to detail the skills gaps and design the course contents for the skills response. Another possibility is that the second agent, e.g. a business association, organises the skills response itself.

Thus social partners, such as business associations and trade unions, play an active role in identifying and organising skills responses, one example being the work by ISTAS ([27]). Some business associations have identified the skills gaps from the associated enterprises and delivered courses to fill the gaps. A similar path has been often followed by trade unions or by their foundations, identifying green skills gaps from the workers, and in some cases, organising directly courses to solve them. Both social agents usually do not follow a green response strategy, but try to response to the skills needs of their members, enterprises or workers, in any context they appear.

In some cases companies themselves identify the training needs. Large companies, mostly in renewable energy sector, have the capacity to identify skills needs flowing from technological and legislative changes themselves. Identification methods in big companies have mostly been observed in new green and greening of already existing occupations cases and are therefore detailed in the subsequent identification section.

Finally, there are also studies from regional government's bodies, such as the Navarre region or the studies carried out by the National Employment Service, on employment trends and skills needs in renewable energy sector. Further information on this identification method will be detailed in the subsequent section. See Table 7 for an overview of agents involved in the identification of retraining needs.

([27]) Institute for Work, Environment and Health of the Trade Union CC.OO (Instituto Sindical de Trabajo, Medio Ambiente y Salud). The study 'Environmental Training Needs for Workers' identified important shortages of skills training for workers in SMEs.

Table 7: Agents involved in identifying skills needs and delivering training

Agent		Role in the identification process
Workers, SMEs	Notice skills gaps	Identification of skills gaps in the workplace and communication to an agent organising a response (e.g. trade unions and business associations)
Trade unions, business associations	Select skills for retraining	Identification of the most pressing or relevant skills needs and dealing with the training centres
Training centres	Designing response	Provide a more concrete identification of the skills gaps for the course design
National and regional employment services	Comprehensive role	Elaboration of studies and funding identification tasks for social partners and other skills providers

3.1.3. Skills response

Skills training responses for green structural change are carried out by several agents across the public and private sectors. Two main processes have been identified led by the public sector and social partners.

3.1.3.1. Public sector responses

Firstly, skills responses led by the public sector have been observed in regional government strategies for the renewable energy sector (mainly through ALMPs). Many local and regional governments are organising skills training in this context, e.g. the programmes undertaken in the Basque Country, Navarre and Extremadura. Here, regional governments attempt to anticipate the need for providing green skills as seen in the II Environmental Training Plan for 2010-13 in Navarre and the renewable energy training programme by Extremadura region Employment Service. The Basque Country Employment Service is also offering a vocational training course for energy efficiency and solar thermal energy.

These examples show that an increasing number of initiatives to provide a skills training response for the green structural change are appearing in the regions. This is true across industrialised regions (the Basque Country), less developed regions (Extremadura) and regions specialising in renewable energy (Navarre). Other regional and local governments are also initiating skills training programmes for renewable energy as a result of the economic crisis which created a higher need for active employment policies.

In addition to regional government strategies, several initiatives from public bodies follow a top-down process, such as the IDAE or the Biodiversity Foundation initiatives (see case studies).

3.1.3.2. Responses from the private sector and social partners

Skills responses coming from private sector and social partners follow the identification process where workers or SMEs communicate a skills gap to a trade union foundation or a business association. These organisations either undertake skills training themselves or entrust the skills response to a training centre. In this case the skills response does not follow directly from policy decisions but flow from direct demand from workers and SMEs.

There is often coordination between public and non-public skills responses. Some skills training programmes are in fact both public and private driven as when an initiative is created by a private agent (an academy or association) and funded by a public body offering subsidies to agents developing green skills training projects (city council, regional government, or EU funding). Here the initiative and the organisation of the response is coming from below but the essential funding is coming from the top.

The table below summarises the skills response processes using some of the examples from above.

Table 8: Overview of skills responses across the public and private sectors

Stages in the organisation of the skills response	**Leading Agents**	
	Public	**Non-public**
Initiative	Public employees of employment services or other public agencies	Workers, SMEs Large companies
Identification of skills gaps		Trade unions Business associations
Performance of the course	Public training centre/hired private training centres	Public / private training centres Social partners
Funding	Public funds ALMA	Companies and social partners Public funds

In the case of retraining needs for construction sector workers moving into renewable energy occupations there are several initiatives, some of them from regional or local governments, which provide the relevant retraining needs for becoming a professional in renewable energy (see case studies).

3.1.4. Case study

3.1.4.1. Proyecto Sol: solar energy entrepreneurs

Biodiversity Foundation ([28]) and Telecommunications Installations Businessmen Association (FENIE) are driving a skills training response in order to (re)train construction sector electric installers to become solar entrepreneurs. Together they have implemented the programme Proyecto Sol (Sun Project) with Biodiversity Foundation being responsible for finance and management while FENIE's role is focused on course design and performance. After designing the course, FENIE submitted it to Biodiversity Foundation, where it was accepted for a subsidy via the 'Emplea Verde' (Green Hiring) programme. This programme aims to improve employment and environment with a budget of 44.1 million Euros for the period 2007-13. The strategy of the 'Green Hiring' programme is to settle strategic links with public and private bodies to develop projects to train and improve environmental abilities of self-employed and workers of SME and promote the creation of new enterprises. The programme aims to achieve the objective of creating 1,000 new companies and provide new skills training for 50,000 workers.

The renewable energy strategy encourages entrepreneurs from the private sector to invest in solar energy in order to accelerate gross capital formation, and this has resulted in a need for skills training for this occupation. To this end economic incentives were settled through the feed-in tariff system involving the adoption of a complex regulatory framework by the solar energy entrepreneurs. Simultaneously, the current economic crisis in the construction sector and the new CTE drive the restructuring process from construction sector electric installers to solar photovoltaic energy entrepreneurs.

As a consequence of the contraction of the construction industry caused by the economic crisis the sector is in need of restructuring and a proactive policy dealing with the large and rising unemployment. According to the Labour Force Survey (EPA) unemployment in the construction sector has risen to 622,000 persons, which is equal to an unemployment rate of 25% ([29]) for the sector. This crisis has hit harder in the big cities and in coastal areas, especially in the Mediterranean seaboard regions, where restructuring needs therefore are higher. Electric installers are also suffering from the employment and economic problems of the sector.

Skills gaps/weaknesses

In order to benefit from the incentives of the new and complex regulatory frame, training in new entrepreneurial and administrative skills is needed. Therefore a skills gap can be

([28]) Biodiversity Foundation is a public foundation attached to the Ministry for Environment, Rural and Seaside.

([29]) Calculations from the data for third quarter of 2009, published in the Labour Force Survey (EPA), Spanish National Statistics Institute (INE), October 2009.

identified for construction sector professionals, especially electric installers, to become solar energy entrepreneurs. Skills gaps are mainly technical and entrepreneurial. For the professionals of the construction sector the technical skills gaps for installing a solar panel are not quite wide. Installing solar photovoltaic panels requires learning certain technical specifications and in some cases, a few additional skills for professional electricians.

However, benefiting from the current regulatory frame and its subsidies requires administrative knowledge and especially a training in entrepreneurial skills, such as project managing, administrative procedures, or accounting. Moreover, good organisation of skills is needed, in order to plan the solar energy projects as a whole, using human and technical resources in an efficient way and matching bureaucratic and technical issues. The correct planning of projects requires entrepreneurial skills which are not included within the mentioned construction sector professional skills background and therefore a skills training response was needed in this context.

Identification of skills needs

The above mentioned incentives have quickly raised the entrepreneurial skills demand, increasing the number of professionals of the construction sector interested in finding trained workers or receive training themselves to invest in solar energy and benefit from the current regulatory frame. The identification of the skills needs was made by FENIE staff, through the constant and growing information demands from the associated companies. As a FENIE manager stated, many companies were calling FENIE for information, both technical and especially administrative, showing the need for skills training in these fields and motivating them to organise and design the course.

'Solar energy administrative procedures are more complex than the ones demanded for other sources of energy generators', one interviewed FENIE manager commented. As a consequence of this demand from the associated companies, FENIE evaluated the prospects for this course and finally chose to organise the training. Thus, the identification of skills needs was made by FENIE staff from observation and direct contact with the productive side and without any external study or identification procedure.

Existing provision of education/training for the occupation

The regulatory frame for solar photovoltaic energy is in constant change, has more complex administrative procedures than other methods of energy production, and therefore requires specialised knowledge. Whereas there are general entrepreneurial training schemes outside the FENIE training, there are no specific training schemes for promoting solar entrepreneurs. The education and training system does not provide these entrepreneurial and administrative skills which have a key role in achieving renewable energy objectives and have a potential for restructuring the construction sector in the crisis context. The lack of these key skills within the existing provision of skills and the education system clearly reinforces the suitability of a skills training response in this context.

The skills response

Biodiversity Foundation and FENIE are performing a skills training programme for SME workers and electric installers in the construction sector. The Proyecto Sol programme aims to provide training in technical, administrative and entrepreneurial skills to these workers, easing their transformation into solar energy entrepreneurs, anticipating the creation of new photovoltaic energy companies and helping the restructuring of some electric installation companies into photovoltaic energy companies.

The course programmes began in October 2009 and are expected to cover 660 workers through 44 courses of 60 hours of duration (32 hours in-person course and 28 hours distance education course). Workers' age distribution is diverse, with an average of around 30-35 years, and due to the restructuring objectives of the course the group is restricted to employed electric installers of the construction sector. The course is organised across different regions in Spain.

The course is focused on solar installations on buildings. Therefore the course is offered to electric installers, who already have a deep background in the sector, as a way to allow them to diversify their activities as well as provide them with a chance to diversify their income away from contracts with big developers, many of whom are now in crisis. The course contents develop a comprehensive set of skills for all the phases related with the start up of solar energy projects in buildings, from technical design and orientation of solar panels, to the administrative procedures, including other skills such as training for the installation of the panels or other entrepreneurial and managerial useful skills.

The course has two main parts: one about technical skills for the installation of solar panels and a second one about administrative and entrepreneurial skills. The second part of the course can be considered the core of the skills training response, being the most innovative and the one providing a higher added value to the course. According to FENIE course managers, technical skills for the installation of solar panels are important but relatively easily learned by professional installers. The training in administrative and entrepreneurial skills in a sector with a rising and complex bureaucracy, with plenty of subsidies and administrative procedures, is really useful for installers, allowing them to become entrepreneurs. The course teachers are professionals with a long expertise in the field, mainly engineers, hired by FENIE. These professionals do not necessarily come from associated companies of FENIE, but from any company of the sector with expertise in technical, administrative and entrepreneurial skills in the field of solar energy.

Assessment of the effectiveness and organisation of this response

Proyecto Sol aims to answer the demand coming from environmental and social objectives, pursuing sustainable development as a green response to the current economic crisis. The skill training response initiative comes from a private sector association, and is funded by a public foundation. A mixed public and private driven skills training response to the skills needs from the greening economy can be therefore observed.

As this skills response is both due to the hard effects of the current economic crisis and the fast growth of the renewable energy sector it can be argued that it is a "partially green" structural change. However, Proyecto Sol is a coherent skills training response aiming to cover the skill gaps that the greening of the economic structure requires. Arising in response to an observed need in the sector Proyecto Sol is a direct answer to an existing skills gap, addressing the lack of practical and managerial skill by targeted training.

Nonetheless the full effectiveness of the response cannot be assessed yet, as the course has started recently and there is not yet any available data concerning this issue.

Sources: www.fundacion-biodiversidad.es and www.fenie.es.

Phone interviews:, Silvia Fernández Campa (Green Hiring Programme); Guadalupe García (International Department Chief) and Jose Antonio González (Secretary General of FENIE).

3.2. New and changing skill needs

3.2.1. New green collar occupations

New green collar occupations are found across several sectors involving quite different occupations, education levels and skills. According to their greening function, new green collar occupations can be classified in the following four wide groups ([30]):

(a) renewable energy;

(b) waste treatment;

(c) green management;

(d) awareness.

This analysis takes this classification as its starting point and each of these new green collar occupations are described in more detail below.

3.2.1.1. Renewable energy

Renewable energy includes occupations within wind power, solar photovoltaic, solar thermal, solar thermoelectric, biomass, biofuel and biogas. Within the renewable energy sector employment prospects are positive in general and are fostered by the aforesaid renewable energy policy strategies.

([30]) The following descriptions of the main new green collar occupations in Spain are based on ECOEMPLEO classification. www.ecoempleo.com.

Table 9: Employment in renewable energy

Type of energy	Jobs 2007	BI	OM	Jobs 2010	BI	OM
Wind	32,906	30,932	1,974	36,197	34,025	2,172
Small hydropower	6,661	5,595	1,066	7,327	6,155	1,172
Solar thermal	8,147	7,438	736	8,991	8,182	809
Solar thermoelectric	968	929	39	1,065	1,022	43
Biomass	4,948	3,068	1,880	5,443	3,375	2,068
Biofuel	2,419	1,572	847	2,661	1,730	931
Biogas	2,982	2,833	149	3,208	3,116	164
Other	3,494	2,979	515			
TOTAL	**89,001**	**80,473**	**8,528**	**94,058**	**85,243**	**8,814**

Source: ISTAS

Note: BI = building and installation; OM = operation and maintenance

The renewable energy sector is formed by more than 1,000 companies that employ to around 89,000 workers and create around 100,000 additional indirect jobs ([31]). These figures indicate that employment in renewable energy is around 1% of total employment in Spain. Within the renewable energy sector, wind power accounts for around 37% of total employment. New green collar occupations created in the renewable energy sector consist of 75.7% in construction, installation, manufacture and maintenance, while 24.3% are found in management, commercialization or engineering occupations ([32]). Half of renewable energy occupations have a technical profile and 82% are permanent contracts. The Spanish trade union CC.OO estimates that renewable energy employment could triplicate in the following years, achieving the figure of half a million for 2020 ([33]).

Many companies from other sectors (engineering, electricity, or installations) have diversified their core activities to the renewable energy sector. Only half of the renewable energy companies are specialised in renewable energy, while the other half perform additional activities. 80% of companies in the sector are SMEs ([34]) and around two thirds of the companies are independent from corporations and holdings. Average size is bigger than the national average with the average number of workers per company is of 87.3. The average size of the companies owned by national corporations or holdings is bigger than the independent companies, 218 workers compared to 42 in SMEs.

([31]) Using an indirect employment ratio of 1.12 (Source: ISTAS).

([32]) ISTAS: Employment in renewable energy and auxiliary industries in Spanish SMEs. Ecoinformas, 2006.

([33]) ISTAS: Employment estimates in renewable energy, 2007.

([34]) Less than 250 workers.

Prospects for the largest subsectors in renewable energy are briefly described here. Further detail on the identified skills gaps and requirements concerning these occupations will be provided in Section 3.2.3.

(a) wind power: employment prospects differ according to the occupation. For wind power installers prospects are moderate, and additional skills training due to technological innovations is required, while prospects are positive for maintenance staff and management occupations. The Renewable Energy Plan (2005-10) ([35]) estimates growth of wind power sector will result in 37,793 new jobs, including 3,113 jobs in maintenance work for installations;

(b) solar photovoltaic and thermal energy: employment prospects are positive for all the involved occupations. These occupations are mainly solar energy installers, solar energy maintenance staff and solar energy manager. The outlook for the sector is strengthened by the new Technical Building Code, which involves installation of thermal and photovoltaic panels on around 500,000 buildings per year. According to the Renewable Energy Plan (2005-10) 49.138 new jobs are projected in solar thermal energy and 30.202 new jobs in solar photovoltaic sector;

(c) biomass and biofuel: biomass production and employment does not have huge development prospects in Spain as low regulatory incentives are slowing its development. In contrast, prospects for biofuel are positive with a regulatory framework encouraging development of this sector.

3.2.1.2. Waste treatment

The second group, waste treatment, deal with the pollution from production and consumption and includes sectors such as sewage water treatment and recycling and waste management.

Sewage water treatment has experienced growth due to new regulatory changes ([36]) requiring extensive sewage water treatment in urban centres of more than 2,000 inhabitants. National policy and investment of 11,400 million Euros has had a positive impact on employment in the sector ([37]). At the same time, current urbanisation trends push demand for further water treatment installations. However, other factors, such as the mechanisation of low skilled occupations, could slow employment creation in the sector in the medium long term.

Recycling and materials management is an essential activity considering the amount of waste produced per head in Spain. This includes several activities such as urban waste management, dangerous waste management and recycling. Recycling and waste management employments

([35]) Renewable Energy Plan (2005-10). Plan de Energías Renovables 2005-10. IDAE and Ministry of Industry, Tourism and Commerce.

([36]) Sewage Water Treatment National Plan (Plan Nacional de Saneamiento y Depuración de Aguas Residuales 1995-2005, PNSD), and the Royal Decree – Law 11/1995, inspired in the European directive 91/271/CEE.

([37]) Quality of Waters National Plan: Drainage and Treatment, 2007 – 2015 (Plan Nacional de Calidad de las Aguas: Saneamiento y Depuración, 2007-2015), involves a budget of 19.000 M euros within the period.

perspectives are affected by several factors. Firstly, urbanisation, population growth and development of the tourism industry tend to increase total waste. Secondly, technological innovations that involve a mechanisation for some tasks reduce the employment prospects. Third, greener waste management, which includes selective waste collection or recycling techniques, is expected to grow in the coming years requiring additional jobs and skills training responses.

In summary, the employment prospects for this sector are moderate, except in selective waste collection, recycling, waste treatments, and dangerous waste management. These are all green collar occupations where employment prospects are positive in the medium and long term ([38]).

3.2.1.3. Green management

The third group, green management, organises and controls the shift in production to a more environmentally sustainable productive structure or manages goods with a high natural value. Examples of occupations in this sector are: protected natural reserves management, forest areas management, corporate environment protection activities and public body technicians and inspectors (located in local councils).

Natural reserves in Spain have grown from 5% to 10% of national territory from 1995 to 2005. This expansion of the protected areas, together with more complex and comprehensive regulation, has fostered a rise in the demand for natural reserves managers. However, the employment prospects for this occupation are low in the coming years because the sector has reached maturity after high growth over the last years. Forest areas management prospects are moderately positive, due to the implementation of the Spanish Forest Plan 2002-32 (Plan Forestal Español, 2002-32) and the policy trends in this field which involve a higher valuation for forest resources.

Within green management in the private sector employment prospects are positive, especially for corporate environmental occupations due to the development of a more complex and demanding regulation frame. Current regulation often has direct consequences for final corporate revenues. The conditionality of public administration contracts on environmental responsibility certificates of candidate companies is a strong motivating factor for the adoption of environmental management measures by the private sector. In Spain, this activity is being concentrated in specialised companies that provide services of environmental management and studies. Only a few large corporations are following a comprehensive strategy to include the environmental management within their productive processes.

([38]) ECOEMPLEO : Current state and trends of environmental employment in Spain, 2008.

3.2.1.4. Awareness

The last group of new green collar occupations are workers in environmental education and the environmental information sector. They have a key role in reaching environmental targets as these partially depend on the behaviour of consumers. According to the White Book on Environmental Education, occupations related to environmental education and awareness have experienced a considerable growth and diversification in the last years. However, the future prospects are stable for this sector, without expected rises in the demand for the involved occupations ([39]). The role of the private sector in this sector is increasing, complementing the public sector, as a major source of funding.

Summarising, several new green collar occupations have prospects for the medium and long term. The development of sectors with new green collar occupations is frequently incentivised through policy or regulation and the rising demand for these occupations often necessitates a skills training response.

3.2.2. Greening existing occupations

In this section the greening of existing occupations in Spain are studied. The greening of existing occupations is part of the overall green structural change and is therefore related to some of the fields described in the previous sections such as water resources or energy. In this section a description of the greening processes is provided followed by observations and analysis based on individual occupations within construction, water, transport, agriculture and fishery.

3.2.2.1. Construction

Electricians and plumbers are two occupations with a very high greening potential. These occupations are essential for achieving the objectives and implications of the Energy Saving and Efficiency Strategy 2004-12 and the new CTE. The greening of these occupations implies a skills gap which needs to be solved through a strategic skills training response. The occupations are well suited for becoming solar photovoltaic and thermal panel installers (as explored in the case study). However, this is only partial greening of electricians and plumbers as the greening is not associated with more energy efficient or less contaminating performance but with a new activity. Not all electricians and plumbers will become greener in this sense as many will continue with their previous activities.

3.2.2.2. Water

Another occupational group with a large greening potential is engineers, professionals and technicians working in the water sector. Environmental problems, such as droughts,

([39]) ECOEMPLEO : Current state and trends of environmental employment in Spain, 2008.

deterioration of groundwater and desertification, together with regulations such as the Water Framework Directive (2000/60/EC) provide new challenges that have spurred innovation in irrigation methods, construction of desalination plants and development of new water management and engineering processes. In this context, many engineering companies are diversifying their activities to environmental consulting and engineering, responding to a demand for green engineers and other qualified professionals and technicians in the water sector. The greening of these occupations is expected to increase demand for additional skills training (as is detailed in one of the case studies).

Desalination has played a large role within Spanish water policy in the last years. Desalination must address two main problems: energy costs and environmental impacts due to the high salt density of water returned to the sea. These economic and environmental problems have restrained its use as a solution to water shortage. Hence, technological innovation and environmental regulation are key to the success of desalination as a strategy for the water problem, implying a demand for the greening of occupations in this sector. The main desalination-related occupations are in innovation, construction and maintenance (one of the case studies explore the greening of desalination plants managers).

3.2.2.3. Transport

Another group of occupations with a high greening potential are related to the transport sector which is responsible for 39% of energy consumption in Spain ([40]). Sustainable mobility strategies have been incorporated into broader environmental activities and in the current crisis stimulus package, Plan E. These strategies aim to reduce the energy consumption of the transport sector, usually by vehicle substitution towards a more energy efficient fleet. As the greening of transport can often be made through vehicle substitution it does not necessarily involve a need for new skills. However, in some cases skill training is needed in order to improve energy efficiency. One example of such training for occupations in the transport sector is the driving efficiency courses for bus and truck drivers organised by the Ministry of Infrastructure, Institute for Diversification and Energy Saving (IDAE) and sector associations ([41]) providing skills for reducing fuel consumption per kilometre. Moreover, there is a big greening potential for measures such as car-sharing and bicycle schemes which require the greening of existing occupations and the creation of new green collar jobs.

([40]) Ministry of the Environment and Rural and Marine Affairs. Environmental Proflie of Spain, 2008.

([41]) Sector associations which participate in this course are ANFAC and UNIACAM. The measure started in 2007 towards the greening of 3.000 professional drivers of trucks and buses. Source: Ministry of Infraestructures: http://www.fomento.es/MFOM/LANG_CASTELLANO/OFICINA_DE_PRENSA/NOTICIAS1/2010/Febrero/100218-03.htm.

3.2.2.4. Agriculture and fishery

Occupations in the primary sector are also experiencing a greening process, led by an IDAE ([42]) initiative within the Energy Saving and Efficiency Strategy 2004-12 (detailed in one of the case studies). These occupations are mainly farmers, ranchers and fishermen. Spain's 100,000 farmers are responsible for 3-4% of the country's energy consumption. This could be reduced considerably through new machinery and technological substitution which require skills training. At the same time, Spain's fishing fleet is one of the largest and oldest in the EU with serious sustainability and profitability problems and a greening of this occupation is needed both for economic and environmental reasons.

Table 10: Overview of greening process in different sectors

Sector	Occupation	Driver of greening process	Kind of Greening	New capital requirements
Construction	Electricians, plumbers	Environment and policy driven	Change in the activities or product	Not important
Water	Engineers, technicians, water managers	Environment and policy driven	Change in the production methods	Yes
Agriculture	Farmers, ranchers	Economically driven	Change in the production methods	Yes
Fishery	Fishermen	Economically driven	Change in the production methods	Yes
Transport	Bus and truck drivers	Economically driven	Change in the production methods	No

As observed in Table 10 greening processes within one sector often affects more than one occupation. Sometimes this is because the same factor drives the greening process across the whole sector. Two main drivers of the greening process have been observed: environmental concerns/policy and economic drivers. The first is based on regulations reflecting environmental priorities and the second is based on economic savings obtained by the greening. This is usually related to energy efficiency and saving.

Two kinds of greening processes have been identified by this study (see Table 11). The first entails diversification within the same occupation towards new activities or products which have a positive impact on the environment and climate change. The second is based on a shift in production methods towards more environmentally responsible methods, e.g. through increasing energy efficiency. Both processes are explored in the case studies. An example of the former would be electricians becoming skilled in installing solar photovoltaic panels or bus drivers learning more energy efficient training skills. The latter could for example be farmers becoming skilled in farming in a more energy efficient manner through use of new

([42]) IDAE: Institute for Diversification and Energy Saving (Instituto para la Diversificación y el Ahorro de Energía).

machinery or production methods. Both greening processes are essential to promote green structural change.

In the second kind of greening, shifting to more environmentally responsible production methods, two different gaps have been identified in this study. Firstly, there is a capital greening gap which could be narrowed by increasing energy efficiency though capital substitution (generally involving technological change). Secondly, there is a non-capital greening gap which could be addressed by increasing energy efficiency through organisational changes or improving attitudes of workers. As an example, a capital greening gap would be the change in agriculture from old harvesters to new and less polluting ones. By contrast, an example of a non-capital greening gap would be switching off the lights in office buildings when they are not in use. Closing this non-capital greening gap involves training in conceptual skills, such as environmental awareness. A non-capital greening gap could be found in almost every occupation from farmers to highly qualified white collar workers, and this is one of the key challenges of greening economy. Thus, conceptual skills training responses, such as awareness campaigns, should continue and perhaps incorporate new training methods. Most workers are aware of environmental problems ([43]) but the persistence of this non capital greening gap means that there is a skills gap in this context.

Table 11: Greening processes for occupations

	What is the greening?	**Capital requirements**	**Example**
Greening of occupations	Change in activities or product	Requires new capital	Electrician installs solar energy panels
	Change in production methods	Requires new capital	Farmer shift to a less polluting harvester
		Does not require new capital	Work at offices is adopted to reduce light consumption

Finally, it has been observed in the Spanish case that greening occupations tend to be those of blue collar rather than white collar workers. Blue collar activities tend to be more energy intensive than white collar activities, hence the potential greening gap is wider for blue collar workers than for white collar workers. Moreover, renewable energy and other key green sectors, such as the waste treatment sector, mainly consist of blue collar workers. Nevertheless, the continuing greening of white collar occupations, such as management and consulting, is equally necessary for managing the transition towards a greener economy.

([43]) According to the study on Environmental Training Needs for Workers by ISTAS.

3.2.3. Identification of skill needs

Identification of skill needs for the greening economy in Spain is made through several initiatives in public, private and mixed bodies, involving different methods. This study found five main methods of identification:

(a) worker demand;

(b) company demand;

(c) private academy marketing studies;

(d) public initiatives;

(e) comprehensive and organised studies at national or regional level.

The first method of skills identification, demand from workers, has played a key role for the identification of skills needs in solar energy sector, motivating the organisation of several courses (see case study on Proyecto Sol). This identification is made directly by staff involved in the affected occupations observing workers who want to develop new activities and demand a greening of their skills. This demand is communicated through trade unions, associations, Non-Governmental Organisations (NGOs) or training centres, where training responses can be organised.

The second identification method, company demand, is clearly differentiated depending on company size. Large companies tend to identify needs in their own departments and provide the skills training needed internally. The case study on Iberdrola illustrates this. Iberdrola's different departments identify the skills gaps needed for their productive process on a yearly basis, communicating these to the training department which organises the skill training needed. In contrast, SMEs usually communicate skills gaps to regional bodies, training centres or corporate associations (see case study on Fonama). Corporate associations also identify the skills gaps of the organisation through this method sometimes.

The third method of skills identification, which is entirely market driven, is marketing studies by private academies. This identification procedure is for example used by the IIR training centre in its skills response for desalination plant maintenance and operation managers. As part of their overarching business strategy companies are interested in targeted organisation of skills training and use marketing studies to identify demand for their products and related skills needs.

The fourth method of identification consists of several initiatives from public bodies, identifying in the skills gaps for greening economy. Some are integrated within a certain skills development response, while in others consist of studies on skills needs. An example of skills identification as part of skills initiative from a public body will be explored in the IDAE case study. Identification of skills needs sometimes takes the form of an in-depth study, while in

other cases it is based on the professional opinion of IDAE ([44]) experts and collaborating university professors. Another example of public initiatives on skills needs is the Navarre region, a leading region in renewable energy. Regional government has identified the main skills shortages in the region through the project 'Strategic talent in renewable energy sector' ([45]). Also the 'Technical symposium of environmental training in Spanish public administrations' ([46]) in June 2009 gathered experts to discuss about the skills gaps within public administration workers in relation with the needs for the greening economy.

Finally, the fifth identification method observed is the skills studies at regional and national level. One such example is a comprehensive study undertaken by the Public Employment Service in order to identify the occupations and the skills needs in the renewable energy sector. The study 'Employment and skills training prospects in renewable energy sector' ([47]) is based on interviews and on a questionnaire made to more than 1,000 sector companies. It is assessed by a wide expert's panel, which include representatives from trade unions, corporate associations, universities, companies, training centres, Navarre Employment Service and independent experts. It aims to provide a complete description of sector related occupations, including basic educative profiles, skills needs and employment prospects.

An important initiative is ECOEMPLEO, the Valencia Observatory for Environmental Employment and Training ([48]). This body is committed to the study and analysis of employment trends and skills needs in environmental sector. The observatory originated from the study 'Present situation and trends of environmental employment in Valencia Autonomous Community', and is supported by several public and private bodies in Valencia region. ECOEMPLEO carried out the study 'Present situation and trends of environmental employment in Spain' detailing a collection of new green collar occupation profiles.

([44]) IDAE, Institute for the Diversification and Energy Saving (Instituto para la Diversificación y el Ahorro de Energía), is a public body that belongs to the Spanish Industry, Commerce and Tourism Ministry.

([45]) This study was carried out for the Spanish region of Navarra, by the Confederación de Empresarios de Navarra (CEN, Navarra Businessman Confederation) with the colaboration of the Navarra Industry Association (AIN).

([46]) The symposium was held in Pamplona between 3th – 5th June 2009 with the original title of 'Jornadas Técnicas sobre Formación Ambiental en las Administraciones Públicas Españolas'. Symposium programme can be found at www.navarra.org/NR/rdonlyres/082E5062-6051.../PROGRAMA.pdf.

([47]) The development of this study was communicated by the Occupations Observatory Manager of Public Employment Service of Spain though a phone interview in November 2009.

([48]) ECOEMPLEO (Observatorio Valenciano del Empleo y la Formación Medioambiental): www.ecoempleo.com.

Table 12: Agents involved in skills identification

Identification method	Agents usually involved	Related case study
Workers demand	Trade unions, associations, NGOs or training centres	Fundación Laboral de la Construcción
Companies demand	Big corporations Internal identification departments	Iberdrola
	SMEs: Regional bodies, training centres or corporate associations	Biodiversity Foundation, Proyecto Sol
Private academies marketing studies	Marketing departments of private academies	IIR
Public bodies' initiatives	Experts from public bodies, university professors	IDAE FONAMA CENIFER\
Comprehensive and organised studies at national or regional level	National Public Employment Service, Regional Public Employment Services, employment observatories	

3.2.4. Skills response

Several skills training responses can be observed in Spain initiated by different agents. Three types of skills responses have been identified in this study: long programmes within the education system, courses for specific occupations, and skills responses in corporations. These skills responses are summarised in Table 13.

The first kind of skills response, long programmes within the education system, is providing a growing range of courses related to new green collar occupations. These courses are either set within the vocational training system for technical occupations or within managerial postgraduate programmes in universities. University training tends to be directly focused on new green collar jobs whereas the vocational training system usually provides wider technical skills training programmes. It can be observed that green collar related courses have experienced considerable growth within the context of the current crisis.

The second type of skills response, the courses for specific occupations, has been fostered and financed both by public and private bodies, including regional and local governments, employment services, associations, foundations and trade unions. Private training centres have played an important role in this kind of skills response. The Autonomous Community of Navarra is an interesting example of this type of skills response. In 2002 this regional government launched an environmental training plan, currently in its second phase, the II Environmental Training Plan for 2010-13. Another example of good practice is the training

programme provided by the employment service in the Extremadura region for renewable energy occupations. This programme is offered to both employed and unemployed and focuses on the skills needed for wind and solar power related occupations. This programme is explored in further detail in one of the case studies.

Social partners, such as business associations, foundations, trade unions or private training centres also form part of this kind of skills response. These agents usually have the role of identifying skills gaps, designing courses and monitoring performance. They can also deliver the skills response directly by giving the course (see Section 3.1.3). This kind of skills response is effective in delivering greening of existing occupations as skills gaps a typically small and the training period is short. As has been observed in several of the case studies, professionals, both employed and unemployed, do not tend to take long and comprehensive courses in order to green their skills. In contrast, they prefer shorter and focused courses in order to learn the skills needed to perform a new green collar occupation related to their original one.

Finally, the third kind of skills training, skills responses in corporations, is also focused on specific skills needed for the new green collar occupation. Corporations identify the skills needed for their activities within their departments and the skills training response is internally organised. Here, the corporation identifies the skills gaps though reports from the different production departments, while the skills training is provided either by experienced staff within the training department, or by external trainers.

In addition, the Tripartite Foundation ([49]) is offering some green skills training within continuous education courses oriented to employees. These courses are not specifically designed for the greening of existing occupations, but include some green skills training. An example is the environmental regulation contents within one course for construction sector employees.

([49]) Tripartite Foundation is a reference institution in Spain for continuous education training. It is formed by Ministry of Labour and Immigration, the main business associations (CEOE, CEPYME), and the main trade unions (CC.OO, UGT). More information about the Tripartite Foundation can be found in the website: www.fundaciontripartita.org.

Table 13: Types of skills responses observed

Kind of skills response	Agent(s)	Sector	Funding	Occupation	Who receives training
Programmes within the education system	Universities Vocational training schools	Public and private	Mainly public	New green occupations	Students Unemployed
Courses for specific occupations	Regional and local governments Business associations Foundations Trade unions Private training centres	Public, civil society and private	Mainly public	Greening	Workers Unemployed
Skills responses in corporations	Skills identification and training departments	Private	Private	New green occupations / greening	Workers

Delivering the skills response requires action from identification of skills needs to design of training courses, performance monitoring and funding. The various agents involved in providing the skills response are usually responsible for just one or two of the functions, and therefore cooperation between them is essential for the effective organisation of a response. The skills training system is thus a complex and flexible system where each agent tends to be specialised in certain functions. The fact that these agents have delivered coordinated and flexible skills training programmes shows that the skills training system is able in general to react to skills gaps emerging from structural change. However, there has also been a noticeable lack of sufficient skills responses from the government which is absent as an active agent in providing skills responses to the greening strategies set out in its policies.

3.2.5. Case studies on new green collar occupations

The support for renewable energy development in Spain has meant a growing demand for wind power technicians, a new green collar occupation responsible for the operation and maintenance of the wind power installations including reparation tasks. Focusing on this occupation in the next two case studies allows comparison between skills development in a big corporation and a public training centre. Thus, a comparative discussion follows.

3.2.5.1. Iberdrola: wind power technicians

Since deciding to make an entry into the market for renewable energy, Iberdrola, a large Spanish electricity company, has expanded this line of business and in 2007 Iberdrola Renovables became listed on the Stock Exchange as a subsidiary of the Iberdrola group. In order to develop competences in the wind power sector, Iberdrola has reached several

agreements with Gamesa, another large player in the renewable energy market. Although the company's business activity is currently based on wind energy and small-hydroelectric power stations, it also works with thermal solar energy and other technologies related to biomass and tidal energy.

In the field of wind power, Iberdrola has seen considerable growth, increasing its investments in Spain, USA, UK and the rest of the world ([50]).

Table 14: Installed wind power capacity

Iberdrola capacity in Spain (MW)				
Year	2006	2009	2006-09	Growth
Installed capacity (MW)	3,662	4,806	1,144	31,2%

Source: Iberdrola Renovables

Iberdrola wind power capacity grew by 31,2% between 2006 and third quarter of 2009 with an additional 1,144 MW installed in Spain over the period. Skilled workers for installing this additional capacity and for later operation and maintenance activities were been needed. Despite the lack of official data from Iberdrola about the number and variation of workers employed in wind power operation and maintenance (OM), approximately 297 additional workers can be estimated power installed/OM employments ratios used in the PER 2005-10 ([51]).

According to Iberdrola ([52]), one of the occupations most needed is wind plant technicians maintaining the smooth running of wind farms. Apart from the technical knowledge needed, several skills ranging from computer skills to physical strength are mandatory for this occupation. Moreover, experience is not common because wind power has only started to be exploited recently. This occupation requires engineering or mechanical and electrical vocational training, technical skills such as electric and mechanic connections, tools use, electric controls, plan interpreting, and a theoretical background for the working mechanisms of wind mills.

Improvements in technology such as resource optimisation, new materials, cell efficiency improvement building and design also have to be integrated. In the case of wind power maintenance technicians, innovation processes such as new aero generators of up to two MW is an example of a technological improvement that directly affect the job profile. The location

([50]) In addition to the 4.806 MW of wind power capacity installed in Spain, Iberdrola investments abroad reach 5.275 MW, including 3.459 MW in USA and 802 MW in UK. Source: Iberdrola Renovables Third Quarterly Report 2009 (http://www.iberdrolarenovables.es/wcren/gc/es/doc/Resultados3T09.pdf).

([51]) This ratio, made from data at national level, estimates that for each additional MW of wind power installed, around 3,9 new OM employments are created. Considering the additional 1.144 MW installed by Iberdrola between 2006 and 2009, the new workers needed by Iberdrola for OM tasks should round 297 employees.

([52]) Human Resources Department of Iberdrola Renovables, National Observatory of Occupations, Spanish Wind Energy Association, and Association of Producers of Renewable Energy.

of wind mills in the sea is another innovative trend that affects the occupation ([53]). A high level of knowledge of safety standards is required given the considerable restrictions of working at height.

Skills gaps/weaknesses

Iberdrola identified several skills gaps for wind plant technicians. The main gaps where found in mechanical, electrical or engineering skills such as electric and mechanic connections, tools use, electric controls, and plan interpreting. Specific skills gaps for were identified for the following areas:

(a) a good competence in driving is essential as workers sometimes need to go across different kinds of soil in bad weather conditions to visit wind farms;

(b) safety training is critical for maintenance tasks performed in the nacelle and hub of the wind turbine at a height of 40 to 60 metres;

(c) advanced computer skills and the use of computerised diagnostic tools are just as fundamental as familiarity with maintenance and electronic testing equipment;

(d) ability to solve practical problems is necessary in situations where only limited standardisation exists;

(e) capacity to use heavy equipment (crane and rigging) required for facility maintenance are vital;

(f) specific technical knowledge of components is required as features of nacelles in the wind turbine generator differ depending on the supplier.

These skills gaps are not basic but on the contrary quite specific. This means that the skills set of Iberdrola wind power technicians needs to be shaped and strengthened with certain skills for specific tasks.

Identification of skills needs

Iberdrola Renovables uses an internal procedure to detect the skills needs of each business unit. At the end of the year, each department surveys the training needs of new and existing workers. However, this is process take place throughout the year and new needs may be demanded and fulfilled when they arise. Programmed training covers about 70% of all training given in the company.

In Iberdrola, the skills identification procedure is specific to the concrete skills gaps in the production process. Thus, the training is better suited to meet the future skills needs of a worker than an open course in a training centre, which cannot take company specific skills gaps into consideration. Other characteristics of this identification method are its

([53]) Environmental Occupational Profiles. ECOEMPLEO (www.ecoempleo.com).

standardisation and continuity. Through feedback on skills needs in the yearly reports from each department skills demands are continually updated.

Existing provision of education/training for the occupation

New training related to renewable energy has been developed in the vocational training system. In level 2 training courses in the European Qualification Framework (EQF) there are programmes in electric and automatic installations, in mechanisation, and in welding and boiler production and maintenance. In level 3 of the EQF, training focuses on development of projects of thermal and fluid installations, maintenance of thermal and fluid installations, energy efficiency and thermal solar energy. Also, in earlier courses some technical knowledge will have been provided, such as training in installations of heating, ventilating and air conditioning, or maintenance of industrial equipment.

Hence, technical knowledge seems to be basically covered by the education and training system. Nevertheless, some of the skill needs mentioned above are not provided, which means Iberdrola has to manage its own skills response in order to upgrade specific technical and maintenance skills required for the job profile. The lack of external courses offering these skills necessitates organisation of internal training courses. In-house training also has significant advantages, e.g. allowing a more flexible schedule for workers.

The skills response

There are five areas of training in Iberdrola Renovables: workplace hazards prevention, environment, technical knowledge, languages and computer skills. The first three are fundamental to the wind power technicians.

The skills training is covered either by Iberdrola's own training school or by external trainers depending on the level of expertise needed for the course. Iberdrola typically provides their own training courses for wind or mini hydraulic power while external trainers are used for biomass or thermal solar power.

Characteristics of each type of nacelle in wind turbines depend on the supplier. Wind power technicians need to be familiar with each of these types of turbine in order to be able to do their tasks. Internal training is provided for this knowledge. In addition to the technical knowledge other skills required are also taught in internal courses. Examples of these courses are listed below, with further information about the number of courses given, the number of employees per course and its duration in hours.

Table 15: Courses offered by Iberdrola Renovables corporate training centre for wind power technicians

Employees	Courses	Course description	Duration (hrs)
175	18	Incidents and tasks at wind farms	30
63	6	Operation and maintenance of wind farms	34
10	1	Industrial communications in wind farms	13
87	5	Blades course	12
214	11	Wind power	28
264	9	Wind generators electric operations procedures	8
5	1	Meteorological towers	8
70	7	All-terrain vehicles driving	8
78	5	Download procedures (wind)	8

Source: Iberdrola Renovables

Some of the courses are given just once, while others take place more than 10 times. This reflects that Iberdrola needs to provide skills training to a considerable number of employees in areas such as wind power and incidents and tasks at wind farms. Furthermore, considering the estimate of 297 new employees for wind power OM in Iberdrola, the 264 workers that attended the "wind generators electric operations procedures" course indicates that most of wind power plants technicians in the company needed a further skills training in this field.

Assessment of the effectiveness and organisation of this response

Iberdrola's skills response seems adequate as the identification is made from the occupational level and the skills training is designed to match the identified skills gaps directly. Considering the large expansion of wind power capacity it can be argued that the skills response is adequate for the performance of this new green occupation. Iberdrola has installed 1,144 new MW ([54]) between 2006 and 2009, which represents around 9, 5% of the Renewable Energy Plan (2005-10) target of 12,000 MW new capacity. Hence, a first assessment of the effectiveness and organisation of this response is positive.

Furthermore, since the main skills gaps identified by Iberdrola for this occupation are not basic but quite specific it should be mentioned that the skills training response at national or regional level also appears to be delivering good results.

Sources: www.iberdrolarenovables.es; National Observatory of Occupations; Spanish Wind Energy Association and Association of Producers of Renewable Energy.

([54]) Estimations from data from Renewable Energy Plan (2005 – 2010), IDAE, Iberdrola Renovables Third Quarterly Report 2009, and Iberdrola Renovables Yearly Report 2007.

Phone interviews: Javier Azorín (Training Manager, Human Resources Department of Iberdrola Renovables).

3.2.5.2. CENIFER: Wind power maintenance staff

The other case study related to the new green collar occupation of wind power maintenance staff is the training response given by a public training centre, CENIFER foundation (Training Centre for Renewable Energy). This training centre was set up in the Navarre region by the regional government and enterprises of the sector. While the Iberdrola case study was an example of a skills response given by a large corporation, the present case study describes the skills response in a public training centre. Its skills response has a wider effect on SMEs compared with corporate responses such as that of Iberdrola.

Wind power maintenance staff is responsible for the good performance of the wind power installations, checking and organising reparations, ensuring correct energy efficiency performance and managing material resources for maintenance of the wind power installations. Wind power maintenance manager is a long term occupation needed after the wind mills are installed and is one of the occupations with best perspectives within the renewable energy sector in Spain ([55]).

Navarre's particular geographical location and climatic conditions together with a clear corporate and public strategy have been key to the fast and successful development of wind power in the region. Since 1994, when there was no renewable energy production in Navarre, the region has expanded its electricity production from renewable sources to 65% including 993 MW of wind power and almost 100 MW of photovoltaic power ([56]). The regional government and local companies have declared their aim to achieve a target of 100% of electricity from renewable sources in the coming years ([57]).

The fast development of renewable energy has seen a rise in demand for renewable energy specialists, including wind power maintenance staff. In this context, CENIFER foundation was set up as a public sector initiative with the goal of delivering skills training for renewable energy.

CENIFER offers a wide range of renewable energy courses, including a wind power maintenance course delivering training in the skills needed for this new occupation. The foundation also organises training for trainers (technical updates) and participates in international programs. Due to CENIFER's excellent performance, it was designated as National Renewable Energy Training Centre, becoming a skills training reference centre in

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([55]) Environmental Occupational Profiles. ECOEMPLEO (www.ecoempleo.com).

([56]) Regional Government of Navarre.

([57]) Nature. July 2007. 'Energy-Go-Round: How did a little Spanish province become one of the world's wind-energy giants?'.

Spain training workers and students from all over Spain. This case study will focus on the skill training response given by CENIFER for wind power maintenance staff.

Skills gaps/weaknesses

Skills for the wind power maintenance occupation requires mechanical or electrical vocational training or an engineering background, which usually involves technical skills such as electric and mechanic connections, tools use, electric controls, and plan interpreting. Specific skills and knowledge is also needed, such as basic knowledge on wind and technical specifications of nacelles and aero generators, Additional skills related to this occupation that are not usually provided by vocational training programmes are: cartography, climatology, health and safety at work, environmental quality systems, environmental impact studies, project management, stock management, and information management. Skills gaps tend to occur in areas that are not covered by general vocational training and that are company specific (see also case study on Iberdrola).

Some administrative and bureaucratic skills gaps appear as wind power maintenance staff also have responsibility for writing and overseeing administrative reports and documents as a part of the job. Further skills gaps are likely to appear in the next years from innovations processes, e.g. new 2MW aero generators, location of wind mills in the sea, or use of more resilient and less costly materials ([58]).

Identification of skills needs

The course for wind power maintenance staff is offered as part of the standard training in CENIFER. There is no methodical identification of skills needs for wind power maintenance staff, rather this is an initiative with the objective to provide the skills needed for wider greening of the economy.

The course programme has been developed by CENIFER experts, in collaboration with professionals, enterprises and corporations, in accordance with their own evaluation of the skills training needs in the renewable energy sector. Hence, direct observation of skills needs has not fed directly into the skills response which has taken a top-down approach to the identification of skills gaps. When CENIFER foundation was created there was a clear lack of wind power staff as wind farms were still very small scale and the need for a skills this area was obvious.

Existing provision of education/training for the occupation

Wind power maintenance staff usually has a vocational training degree in fields such as maintenance and production services, electrics and electronics, mechanics, photovoltaic, or small scale wind installations. Skills training for wind power maintenance staff also

([58]) Environmental Occupational Profiles. ECOEMPLEO (www.ecoempleo.com).

occasionally take place in the public education system within certain vocational training programmes. However, it is not very common and, as highlighted by CENIFER staff, formal courses have a long duration and do not focus on the specific skills needed for one certain occupation. In contrast, the CENIFER course focuses on more detailed skills needs and is suitable both for employed and unemployed workers who cannot afford to spend the time or money on long term training in renewable energy.

Short courses like these are not offered widely in Spain, especially for wind power maintenance staff as is seen by the range of students attending CENIFER's courses. Workers from all regions of Spain attend the courses which in this way complement national environmental policy objectives.

The skills response

Since 2006 CENIFER has offered several courses for wind power maintenance staff approximately twice a year. Some improvements are integrated from one course to the next one. The course content focuses mainly on wind electricity systems and maintenance of wind power installations, including classes on health and safety at the workplace.

Theoretical background to wind electricity systems is provided exploring electric generators and wind parks in depth. Generator components are described together with their control systems and operation scenarios. Skills related to mapping and technical sketches are also highlighted. The part of the course related to wind power installation management includes practical skills: technical specifications of spare parts, warehouse organisation, management software, economic management of the installations, planning skills,; technical and economic indicators related skills, environment impact, safety and security documents, and writing of reports on operation and incidences. The legal framework is also explained together with specific risks from wind power operation tasks, often stemming from weather conditions.

The wind power maintenance is an intensive short course with capacity for 15 persons training eight hours per day over 10 days. The course includes an average of 40% of practical training complementing the theoretical learning. The schedule is designed to allow the participation of professionals who are already in employment. The age profile of the students is quite heterogeneous, ranging from 20 to 50 years. Unemployed students benefit from subsidies for the course fee from the Navarre Employment Service. The education requirements for the course are graduation or higher level vocational training in an engineering related field. Candidates are not accepted unless they prove professional experience of at least three years in the field. This requirement is imposed in order to provide comprehensive skills training for wind power maintenance in a relative short span of time. The gender profile of the students is mainly male, reflecting the gender profile in the sector.

Teachers are sector professionals and do not belong to the core CENIFER staff. They come from private companies, are self-employed or work as trainers in private academies.

Assessment of the effectiveness and organisation of this response

According to CENIFER staff, the current demand for this profession in the Navarre region is met by the available skilled workforce. Navarre has been able to cover the jobs needed for this new occupation, facilitating the rapid expansion of renewable energy production in the region in the last 15 years. This points to the efficiency of the skills response. Moreover, a study carried out by the Navarre Employment Service on the skills needs of the renewable energy sector, shows that most companies do not have problems finding installers or maintenance managers ([59]). However, this does not mean that CENIFER's mission is accomplished. Current national and regional policy entails further development of renewable energy indicating that demand for wind power maintenance staff will continue to grow in the coming years.

There are no specific studies on the impact of CENIFER courses on the development of renewable energy or on the direct impact on the professional development of the students. The only formal evaluation procedure of the skills training response that has been carried out is feedback from students at the end of the course which, according to CENIFER staff, is widely positive.

The evidence from this case study shows that the skills training response is positive overall, so much that it can be argued that there is no longer an immediate need for further skills training in the Navarre context.

Sources: www.cenifer.com.

Phone interviews: CENIFER's Technical Secretary.

3.2.5.3. Comparison of the Iberdrola and CENIFER case studies

From the above descriptions of the training responses given by Iberdrola and CENIFER to the same skills needs for wind power technicians several observations can be made. Skills responses can be observed to work at two levels: a level where general green skills are provided to existing skills (previous vocational training), and an applied level where basic skills are enlarged and complemented with concrete skills training towards specific needs. The skills training provided by Iberdrola fall in the latter category whereas CENIFER's tend to fall in the former. This is only to be expected as skills needs in Iberdrola are likely to be more detailed and concrete compared with CENIFER. The identification of skills in Iberdrola

([59]) El Talento Estratégico en el Sector de las Energías Renovables. Servicio Navarro de Empleo. 2008. Strategic skills in renewable energy sector. Navarre Employment Service. 2008. http://www.navarra.es/home_es/Temas/Empleo+y+Economia/Empleo/Informacion/Observatorio/Estudios+e+Investigaciones/1Sectoriales/Estudios/Talentoestrategicosectorenergiasrenovables_2008.htm.

is made directly from the workplace whereas in CENIFER the identification of skills is made by an expert panel based on from experience from different companies.

Similar approaches apply to the skills response. In Iberdrola many of the courses are specific while in CENIFER training is much wider (although several general courses also exist within Iberdrola's offer). In CENIFER training is usually provided by experienced professionals from enterprises, while Iberdrola tend to provides training in-house and only occasionally use external trainers. The use of sector experts and professionals means that there is wide dissemination of expertise and knowledge for this profession which has the further benefit of contributing to Spain's broader goal of green structural change.

In conclusion, the skills responses seem to be complementary. A basic and wide training as provided by CENIFER is needed in order to train the workers in broader skills needed in the workplace. At the applied level further training may be needed.

3.2.5.4. FONAMA: Solar energy installations project designer

The potential of solar energy is high in the Extremadura region which is one of the regions with the most hours of sunshine per year in Spain. In Extremadura the target has been to increase the surface of solar thermal energy installations from 3,310 m^2 to 170,055 m^2 from 2004-10. Solar photovoltaic energy was planned to increase from 0,54MW to 13.39MW between 2004-10 ([60]). 1,069 jobs in solar photovoltaic energy and 1,950 jobs in solar thermal energy were expected during 2005-10 ([61]) for the installation, maintenance and manufacturing of components. This large scale roll out of solar energy involved training of solar energy installations project designers which consequently pushed demand for a skills training response.

Solar energy installations project designer can be considered a new occupation as the solar panels are a new renewable energy source in Spain. This occupation is responsible for designing and organising solar energy projects, including viability studies and administrative procedures such as subsidies applications. Project designers are also responsible for managing other green collar occupations in the sector, e.g. installers during the installation works ([62]). Essential skills required for this occupation are knowledge of electric equipment, solar energy systems and the regulatory framework in Spain.

The regional government in Extremadura has led the skills training for solar energy installations. The funding comes from the Extremadura Regional Employment body and the programme is managed by a public regional enterprise, Promotion of Nature and Environment, FONAMA (Fomento de la Naturaleza y el Medio Ambiente, S.A.). Fonama's skills training programme focuses on workers in the construction sector, usually self-

([60]) Renewable Energy Plan (2005-10), Ministry of Industr, Tourism and Trade.

([61]) Figure estimated from Renewable Energy Plan (2005-10) ratios.

([62]) Environmental occupations profiles. Ecoempleo (www.ecoempleo.com).

employed or employed in SMEs as plumbers, electric and heating installers. Fonama's renewable energy training programme expects to answer the rising demand for renewable energy specialists in the region which, according to the regional minister for industry, will reach 3,000 persons for 2012.

The construction sector is becoming more closely related with the new green sector of solar energy, especially since the introduction of the new Technical Building Code. Occupations in the construction sector, e.g. plumbers, electric and heating installers, are related with solar energy installations project designers. Some basic skills are similar between these occupations and those for solar thermal energy projects. There is therefore a large potential for workers in the construction sector to learn additional skills and find employment in the solar energy sector.

Skills gaps/weaknesses

The skills gap between solar energy installations project designers and existing construction sector occupations such as plumbers, electric and heating installers is not that wide. Skills for using appropriate tools and hydraulic or electric knowledge already exist in these occupations. However, new skills training is needed in administrative procedures and subsidies management in order to develop solar energy projects within the new regulatory framework and benefit from its economic incentives. Also, specific technical features on solar panels, both photovoltaic and thermal, need to be learned in order to adapt the skills of installers and plumbers to solar panel installation works. Finally, management skills, such as budgeting and reporting, safety studies and the use of maps for the installation are also important and are not included within previous skills training.

Identification of skills needs

Identification of skills needs has been made by the Extremadura Employment Regional Service (Sexpe). According to Sexpe, the main outcome of the identification process was the lack of a regional reference centre for renewable energy training. Hence, the main reason for the development of the programme was this factor together with the potential of employment creation.

The concrete contents of the course were been designed by Fonama in collaboration with the enterprises of the sector already operating in the region, offering their experience on an expert panel. Thus, this is an example of a public driven response, coming from a regional body, with important private collaboration for the course design and performance.

Existing provision of education/training for the occupation

The training response was designed for workers in the construction sector who already have professional skills and often a vocational training degree. This vocational training is usually in electric installations or plumbing and takes place in through the vocational training system. The existing VET programme for installations includes the technical skills needed for the

installation of electric and electronic equipment, including the reparation of the existing installations. At the same time, the existing VET programme for plumbing include knowledge of water pipes systems and the main technical skills for installing and repairing the pipes. Hence, installers' technical skills are nearer to solar photovoltaic installations, while plumbers' skills are closer to solar thermal installations. The skills response provided by Fonama upgrades these already existing skills, enabling workers to install solar panels and to becoming solar energy installations project designers through designing projects.

The skills response

Courses are provided by private training centres. Priority is given to people with previous experience in plumbing and electric installation but is also offered to unemployed people. During the first phase Fonama trained 1,080 new renewable energy specialists, mainly photovoltaic, thermal solar and wind energy installers as well as renewable energy project managers. The second phase of the programme is training 780 renewable energy installers and 420 solar installations project designers through 80 courses. Trainees have mainly been professionals from the fields of construction, electric installations, plumbing and heating.

Fonama skills training for designers is provided through 28 courses in the Extremadura region. Each course is 125 hours and trains 15 workers. Courses are oriented towards workers in the construction sector, preferably employed in SMEs or self-employed. Former occupations of trainees are plumbers, electric and heating installers and the gender composition is mainly male. Targeting these occupations for the training means that the skills gap is small, increasing the efficiency of the skills training response.

Course contents include a comprehensive set of skills related with solar energy projects, from basic physics concepts about solar energy to concrete skills for the project designer job. The main skills addressed in the course are:

(a) solar energy;

(b) electricity concepts;

(c) solar radiation concepts;

(d) low temperature solar thermal systems;

(e) technical features of the panels;

(f) connections of panels to electric network;

(g) weather influences on panels performance and maintenance;

(h) installation of panels;

(i) installation of panels in buildings;

(j) batteries;

(k) thermal and thermoelectric solar energy projects management;

(l) maps of solar energy projects;

(m) budget of solar energy projects;

(n) safety at work studies skills.

Assessment of the effectiveness and organisation of this response

Currently, the second phase of this response is being carried out. The first phase finished in June 2009 and there has only been non-formal evaluation of its results. Hence, it is not possible to assess the effectiveness of this response on the basis of data. However, several characteristics of the response point to a likely positive evaluation. Firstly, considering the employment demand projections made by the regional government of Extremadura, which estimate 3,000 new workers in the sector by 2012, Fonama's skills response can be considered sufficient as 2.280 workers have already been trained. Secondly, considering the existing provision of education, the course contents seem to be adequate for the skills training of the target group as it benefits from a relatively small skill gap towards the training in new green collar occupations. Thirdly, the skills training include administrative and entrepreneurial skills often constitute an obstacle for the effective functioning of new green occupations. Finally, cooperation with companies within the region is good practice which has tended to give good results. However, the skills response could be improved through the creation of a permanent training centre in Extremadura region, as CENIFER in Navarre. If a long term and comprehensive development of renewable energy in Extremadura region is the objective then a permanent response is required.

Sources : www.fonama.comxa.com and www.empleaextremadura.com.

Phone interviews: Rosa Riballo (FONAMA); Jose Manuel Blanco (manager, Anfora training centre) and Jesus Manuel Alarcón (chief of training department, Extremadura employment service).

3.2.6. Case studies on greening existing occupations

3.2.6.1. IIR: desalination plant maintenance and operation managers

Spain has seen a fast development of the desalination sector becoming the 4th largest producer in the world and achieving an international competitive position. Many Spanish desalination corporations have developed huge projects in Algeria, India, UAE, USA and the UK. Both public and private demand accounts for the growth of the desalination industry and its related technology development. Public demand usually involves big projects for desalination of sea water which are normally contracted by large corporations. Demand from agriculture and industry involves smaller projects which are developed also by SMEs.

The main problems related with desalination technology are low energy efficiency and large environmental impacts. These factors necessitate greening of desalination plant maintenance occupations to ensure a more energy efficient performance and minimise environmental impact. Greening these occupations has a double impact: first, it improves energy efficiency

and minimises the impact of returning salt to the sea; second, it forms part of the solution to Spain's main environmental problem: water shortage. Several occupations are linked to the three main activities in the desalination sector: innovation; construction and maintenance. Innovation and construction activities do not suffer skill shortages whereas the fast increase in desalination plants in the last years requires several skilled occupations for plant maintenance. This case study focuses on the greening of maintenance activities and the related occupations of maintenance and operation managers.

Due to the technical complexity of desalination the maintenance and operation of plants is the responsibility of a group of managers. This group is typically divided into different managerial areas related to the processes of desalination: a general manager, production manager, maintenance manager or treatment manager. As energy efficiency and environmental requirements of desalination involve the whole managerial team, we will focus on this group of occupations, instead of one specific occupation.

Several universities and training centres are offering water management related courses for desalination plant. The Institute for International Research (IIR) is a large private training centre with a long expertise in skills provision belonging to the international Informa Plc Group. It offers more than 600 courses across various professional fields, as well as conferences, seminars and long distance learning courses. IIR has developed a short course designed for desalination plant maintenance managers in response to the need for improving the performance of desalination plants and fulfilling environmental regulation requirements. This case study focuses on IIR's course for desalination plants maintenance managers.

Skills gaps/weaknesses

There is an inherent skills gap flowing from the environmental and economic problems of desalination. The skills required for the greening of this occupation are mainly technical and managerial. Firstly, technical knowledge of the specifications of machinery is required in order to ensure the energy efficiency of performance. Other skills related to this are the development of comprehensive control and maintenance plans and training in new technological innovations for energy recovery. Secondly, the development of environmental plans and training is also needed for the minimising the environmental impact of the plants.

Identification of skills needs

Identification of the skills needed for this occupation has been made by IIR. As a private training centre, IIR has its own department for the identification of skills needs in several fields. These departments develop market studies to identify the main characteristics of skills training demand and these studies are later tested against expert opinions.

Existing provision of education/training for the activity

Desalination plant maintenance managers require different kinds of engineering education according to the particular processes they are responsible for. Most often an industrial

engineering background is required, but others areas such as chemical engineering can also be suitable. Knowledge of electricity, electronics, hydraulics, chemistry and reverse osmosis membrane systems is especially important.

The existing education and training system is not offering courses for addressing the identified skills needs for the concerned occupation. Some postgraduate programmes have been created in universities but they are not oriented to the greening of maintenance managers. Greening of already existing occupations is not usually offered by the existing education and training system, and if it is it is difficult for employees to fit with their work schedule. Many workers cannot take longer full time courses. They tend to demand short courses focused on the specific skills needed in order to improve or shift their performance at work.

The skills response

IIR organised a course for desalination plants maintenance managers from the whole of Spain in Madrid in February 2009. The course cost 1,599 € and provided intensive training in the practical skills and technical knowledge needed for desalination plant managers. To adapt to the time constraints of plant managers, the course was concentrated in 12 hours within two days.

The course consisted of four main parts:

(a) the first focused on the technical principles of desalination plants, paying special attention to the latest technological innovations in key areas of the desalination process. This part was taught by a technical director of a large corporation in the desalination sector;

(b) the second part focused on the environmental impacts of desalination, describing the main alternatives and factors for this impact. The teacher for this part is a director of ACUAMED, the main public company which contracts desalination plants for the AGUA programme;

(c) the third part explained the design and development of a desalination plant maintenance plan. Here training in some software skills was included, considering technical, economical and environmental variables. This part was taught by desalination plant general managers;

(d) finally, the fourth part was about energy efficiency. Here, main the factors related to energy efficiency were explained as well as energy recovery techniques, such as Pelton turbines. This part was taught by a project manager of a desalination corporation.

Trainees were maintenance managers, mainly male and aged over 30 years old. The course was also opened to managers of water treatment and management companies, public sector technical managers and environmental and engineering consulting group managers. Hence, networking between participants was another outcome of this course.

Assessment of the effectiveness and organisation of this response

There has been no feedback mechanism to evaluate the effectiveness of this response. However, a first assessment should highlight the professional profile of the students and the teachers of the course. Experts with experience in the taught techniques and skills are giving the course directly to those who are already performing the maintenance manager occupation. Focusing on this group has obviously a minor effect in employment terms but a higher effect in economic and environmental terms. This impact is probably more important for sustaining the desalination strategy in the long term and ensuring coherence with other environmental objectives. Furthermore, the positive effects of this response are likely to appear in the short- to medium-term. The response could be improved through a longer course where contents could be explored in more detail and more practical workshops provided.

Sources: www.acuamed.com; www.marm.es and Desalination in Spain, Ministry of the Environment and Rural and Marine Affaire, 2009. (La desalinización en España, Ministerio de Medio Ambiente y Medio Rural y Marino, 2009).

Phone interviews: Iván Cortés (IIR Customer Department).

3.2.6.2. IDAE: farmers, ranchers and fishermen

Agriculture is responsible of 3-4% of energy consumption in Spain. The sector comprises up to 100,000 farmers spread across the peninsula. Corporate structure is differentiated due to historical reasons with many smallholdings in the North West coexisting with several large estates in the South. Spanish agriculture is diverse ([63]) and therefore different techniques and measures must be applied in order to reduce energy consumption and reduce energy consumption in the primary sector. Large improvements in efficiency are possible across the range of agricultural techniques practiced. Meanwhile, Spain has one of the largest fishing fleets in the world (the largest in the EU) with a registered fleet of around 13,000 ships. The average age of ships is more than 30 years implying that huge improvements could be made in fuel efficiency.

In this context there are opportunities for promoting a large scale 'greening' of these occupations through skills training in using new technological innovations and sustainable practices. All farmers, ranchers and fishermen are likely to become greener in the coming years.

The Institute for the Diversification and Energy Saving (IDAE) is a public body under the Spanish Industry, Commerce and Tourism Ministry. It was founded in 1974, with the

([63]) Many kinds of agriculture are found in Spain, from greenhouse intensive agriculture to extensive wheat crops, fruits, vines and olives, to quote some examples.

objectives of promoting renewable energy and energy saving. IDAE carries out studies on the use of energy in the industrial sector and has extended its scope to all economic sectors. IDAE manages a set of measures for reducing energy consumption and increasing efficiency in agriculture, developing skills for farmers, ranchers and fishermen.

Use of energy in agriculture and fishery in Spain could be improved considerable contributing to higher profitability and sustainability of the primary sector. The IDAE programme aims to reach these occupational groups in order to train them skills for a more efficient use of energy. The programme for energy saving and efficiency in agriculture is carried out in combination with other measures such as the modernisation of the tractor fleet and changing irrigation systems. The total budget for the programme is 93.5m Euro. In combination the measures are expected to save 348,000 tonnes of oil equivalent (toe) in the sector, reducing energy consumption from 4,950,000 toe to 4,600,000 toe in 2012. This implies a total energy saving of 7.1%, or 5.2 Mt of CO_2, between 2004-12.

Skills gaps/weaknesses

Energy efficient agriculture can be developed through skills training in technological advances and sustainable practices. As the activities performed by the occupation would not differ drastically after the greening process, the skills gap is not wide and can be addressed through basic courses. The skills gap arises mainly from the lack of energy efficiency which can be tackled through three main options: shifting to more energy efficient inputs, changing productive organisation, or using new machinery.

Due to the variety of activities within the agriculture sector, the specific skills differ from one crop or livestock to another. Some of the most important skills improvements are related to knowledge of crop techniques, driving new kinds of agrarian vehicles, using new machinery that allows a deeper processing of raw materials at the workplace, the structure of crops in greenhouses, and alternative fertilisers.

Identification of skills needs

The identification of the skills needs has been made by IDAE experts in collaboration with professors and researchers from universities. This expert group researches the possibilities for further energy efficiency in Spanish agriculture and industry, following a complex methodology. The identification methods are adapted to each particular field.

From this identification study of the energy saving potential in the agriculture and fishing sectors the same expert group designed specific skills training responses for increasing energy efficiency in these sectors.

Existing provision of education/training for the occupations

Provision of existing skills training for the occupations is not directly addressed by the formal education system. In Spain, compulsory education does not train the skills needed for farmers

and fishermen and skills for these occupations are usually provided in the work place. Therefore, a tailored skills response is needed for the greening of these occupations.

The skills response

IDAE organises free training courses for trainers in energy saving and efficiency in agriculture, stockbreeding and fishery. The courses are aimed at regional representatives in charge of developing projects related to the promotion and training in efficient use of energy in agriculture and fishery.

Each course follows a methodology for energy efficiency in agriculture or fishery which is published previous to the training. The programme of training for trainers is designed to reach the dispersed community of around 100,000 farmers across Spain. Around 70-80 regional trainers attend the IDAE courses every year, representing the different autonomous communities and disseminating their knowledge through other courses to local farmers.

A total of 1.320 courses have been given to 37,000 farmers over the last five years. In 2008, 337 courses were given to 9,700 farmers. Course attendance is set to a minimum of 30 farmers per course. The profile of the workers involved in this skills training is mixed between businessmen and labourers and due to the characteristics of the sector the gender composition is mainly male. The courses are delivered through presentations complemented with guides and written documents and further training is offered according to needs. Courses inform farmers about the economic advantages of increasing energy efficiency, highlighting the possibilities for technological innovations to reduce energy costs. Courses also provide comprehensive information about how to implement the suggested changes, including information on subsidies for the purchase of more energy efficient capital, such as new tractors or harvesters.

Examples of topics in energy efficiency courses for farmers, ranchers and fishermen organised within the programme are:

(a) tractor fuel saving;

(b) saving and energy efficiency in irrigated agriculture;

(c) saving and efficiency in cattle installations;

(d) saving and efficiency in agrarian works;

(e) saving and energy efficiency and farms structure;

(f) saving and energy efficiency and nitrogen fertilisation;

(g) saving and energy efficiency in greenhouses.

In 2009 course content covered conservation and sustainable agriculture, energy crops and biomass production, and energy efficiency in fishing. Practical skills aim at reducing fuel consumption becoming less dependent on fossil fuels.

Assessment of the effectiveness and organisation of this response

The IDAE programme is a large scale and coherent measure for achieving the objectives of Spanish environmental policy. There are no evaluation studies of the direct results of the course due to the high number of farmers who have participated. A rigorous evaluation would require a study of the energy efficiency over a selected number of farmers to estimate the energy consumption in agriculture at the national level after the training. However, according to IDAE staff, the course is in demand by autonomous community representatives every year, showing a positive response to this skills training programme.

Considering that 1,320 courses have been given over the last five years to 37,000 farmers within a target group of 100,000 this implies a potential greening of 37% of the sector. This extension of the response points to a positive impact of the initiative. However, it might be positive to include permanent courses instead of changing the courses yearly. That would provide a more comprehensive and long term response. Moreover, the technical contents of the courses could be increased to ensure wider uptake of energy efficient measures.

Finally, the IDAE project is an example of training for the greening of farmers and ranchers which should be studied in more detail in order to create a future network of regional training centres for the greening of agriculture. This network could provide a permanent green skills training to farmers and ranchers, saving efforts of designing new responses and adapting to the regional characteristics of agriculture.

Sources: www.idae.es.

Personal interview: Ángel Sánchez de Vera Quintero (Services and Agriculture Department Chief).

3.2.6.3. Fundación Laboral de la Construcción: installers (electricians, plumbers)

In 2002, the European Union approved the 2002/91/CE directive, which required member states to develop a regulatory framework for the construction sector in order to limit energy consumption and increase energy efficiency. In order to achieve national environmental objectives and fulfil the EU requirements, the CTE was modified in 2006 to include new measures reducing energy consumption of buildings by 30-40% in the long term ([64]).

One measure is the obligation to incorporate solar thermal and photovoltaic energy systems in certain houses. Thermal panels are used to warm (non-heating) water and photovoltaic systems provide electricity to the building. More than half a million houses are expected to be

([64]) Estimated by IDAE.

affected by this regulatory change per year. The implementation of the CTE affects several occupations within the sector and involves skills training for installers, particularly in occupations such as electricians or plumbers, who can learn to install solar energy systems with additional training.

The demand for courses in solar panel installation is driven by different agents, including companies, public bodies and individuals. Some city councils want workers to receive training in solar energy installations in order to install solar panels on council buildings, sometimes companies want to diversify their production towards solar energy, and in other cases public employment services, or even individuals, require this training to re-skill and increase opportunities for employment.

Courses provided by Fundación Laboral de la Construcción (Foundation for Workers in Construction) aim to train workers in these occupations to install solar energy panels on buildings. Fundación Laboral de la Construcción promotes vocational training and health and safety in the construction sector. It carries out regular surveys among companies in the construction sector to identify skills demands and provides training for affiliates in issues pertaining to environmental impacts, waste management, and quality of work environment. Fundación Laboral de la Construcción contracted Cefoim, a skills training agency in Madrid, to deliver the courses.

Skills gaps/weaknesses

The skills gaps for plumbers and electricians to learn installing thermal and photovoltaic solar panels are not wide. Professional electricians and plumbers have developed their technical skills from vocational training through work experience, and are usually able to install solar panels after a short course where they learn the main technical features of the panels. Therefore, a greening of already existing technical skills is needed in this case rather than training in new skills. This small gap makes it possible to roll out the new CTE within a short time span.

Identification of skills needs

Fundación Laboral de la Construcción identified skills needs through direct demand from workers of the construction sector. However, the skills training need was identified by Cefoim before demand such training experienced a sharp increase ([65]). As a skills training centre, Cefoim develops training courses with a long term perspective as a key strategy. They began delivering courses in solar energy installation three years ago when the demand was not yet high. Later Fundación Laboral de la Construcción contracted the course from Cefoim to meet the need for the greening of these occupations.

([65]) Communication with Cefoim's Commercial Manager.

Existing provision of education/training for the occupations

Basic technical skills for these occupations are taught in vocational training schools for electricians and plumbers. In the last years certain vocational training courses have appeared that offer technical skills training for solar energy installations within longer educational programmes (usually a duration of one or two years). These long training programmes, designed for new workers, are not suitable for employed workers. They cannot afford such a long training period and demand training programmes focused on the specific skills they need. Thus, in order implement the new CTE measures a skills training response for existing occupations is needed.

The skills response

Fundación Laboral de la Construcción is offering short courses in the technical skills needed for the installation of solar energy systems in buildings. These courses are explicitly oriented towards providing the new technical skills required for the implementation of the CTE and focus on workers in construction sector who can easily transition to become solar panel installers. Fundación Laboral de la Construcción has contracted this course from Cefoim which is a technical training centre located in South Madrid offering a variety of courses across several sectors and occupations such as construction, road and railway transport, carpentry, installation and maintenance, and management.

The courses develop a comprehensive set of skills for installing solar panels, including design, and are focused on both photovoltaic and thermal solar energy. Training is delivered as short courses of 18-23 hours on weekends in order to ease attendance of employed workers. Flexibility regarding time and attendance was a key issue for this course. In order to reach professionals who are already in employment it was necessary to adapt to their schedules and timing needs.

Cefoim's has created an innovative solution to reach the whole of the country from their headquarters in South Madrid. Courses are either given in Cefoim offices or in a mobile workshop classroom in a large lorry. This vehicle travels around Spain to where demand for the courses is located. The lorry carries extensions with it and doubles in size once it is set up as a classroom. The mobile classroom carries all the equipment for the workshops (internet access, wind and solar power generators, solar thermal panels, etc.) and can house up to 20 students at the same time.

Assessment of the effectiveness and organisation of this response

As the course is very recent there is not yet any data on the capability and employability of trainees indicating the effectiveness of the response. Nevertheless, the response has several positive points that should be highlighted. Firstly, it has been designed as a response to meet workers' demand, which is a reliable method to address the skills gaps from the production stage. Secondly, the skills response can be considered adequate in terms of what is needed of a flexible course for an existing occupation. It is not usually possible for workers to attend the

fulltime courses that the VET systems offer, so the flexibility of the schedule is ideal for the target group. Third, despite this being a response for the greening of an existing occupation, the course has potential for retraining and easing the process of restructuring from the construction sector to renewable energy.

Sources: www.fundacionlaboral.org and www.cefoim.net.

Phone interviews: Ana Escobar (Training Department of Fundación Laboral de la Construcción) and Daniel Herrera (Commercial Director of Cefoim).

4. Conclusions

4.1. Main 'greening' shifts in economies and labour markets

Spain has gone through a greening process over the last decade with major shifts in sectors related to energy, water, pollution and transport. The current economic crisis has also had a severe impact on the built environment and spurred a greening process in construction. The greening is policy driven with the central government fostering the green shifts through regulatory changes and long term programmes. As a result, green activities, such as green management and awareness, have developed and expanded in these core sectors.

The core of the Spanish energy strategy is based on energy efficiency and energy production from renewable sources. This strategy has achieved important results: around 20.5% of net electricity production comes from renewable sources, energy intensity has improved by 11.3% from 2004-08, and energy consumption from domestic sources has risen to 21.6% ([66]). This strategy has involved a shift from imports to national production and has therefore had a positive impact on GDP. Hence, this greening process creates employment and economic growth in the whole economy. The greening and domestication of energy production is projected to have created 89,000 direct jobs in the renewable energy sector and around 100,000 additional indirect jobs ([67]).

Spain's water strategy is based on three objectives: efficiency and saving; ensuring water quality; and increasing available water resources. Desalination technology has played an important role in moving towards these objectives. So far some important results have been achieved. First, water consumption per habitant has diminished by 5.4% between 2005 and 2007 ([68]). Second, the water consumption/GDP ratio has been decreasing since 2004. Third, desalinated water has increased by 153% over the last decade3 and Spanish water corporations have developed world class expertise in desalination plant and management. As a result, desalination has undergone a greening process itself reducing energy consumption by 1.6 kWh/m3 from 2000-10.

The current economic crisis has become a factor for the 'green'shift from the construction sector to renewable energy. The crisis has been particularly severe in the construction sector, where unemployment has risen to 622,000 ([69]). Many occupations in this sector have a high potential for training in renewable energy and energy efficiency. Moreover, the new CTE has

([66]) Source: Energetic Balance 2008. IDAE. www.idae.es.

([67]) Source: ISTAS. Using an indirect employment ratio of 1.12.

([68]) Source: INE.

([69]) Source: INE (Spanish Statistics Institute).

fostered a shift from the construction sector to renewable energy through the requirement to install solar panels on certain buildings.

The economic crisis has also affected the automotive industry which is suffering a competitive crisis. As a response, an electric car strategy is currently being designed by the government, the automotive industry and social partners to facilitate a greening of the automotive sector shifting production towards more energy efficient and less polluting cars. But although this strategy implies a major greening of the industry in the coming years the effect on employment numbers are not likely to be huge as car production is unlikely to increase unless Spain gains a competitive advantage and increases its market share. There is expected to be some new green skills required for occupations in the sector, however.

4.2. Skills implications and development

4.2.1. Anticipation and identification of skill needs

Various agents are involved in skills identification process, including regional governments, local councils, foundations, companies, universities, trade unions and workers themselves. Skills needs are identified in different ways. This study has found four main methods of skills identification:

(a) direct observation of demand from the workforce;

(b) demand from private companies;

(c) initiatives from public bodies;

(d) studies organised at national or regional level.

Trade unions, private training centres and employers usually identify skills needs directly from workers demands, in many cases from self employed or SME workers. Likewise, some foundations and business associations identify skills needs from employer demand. By contrast, corporations usually identify skill needs through their own departments. In public bodies the identification of skills needs is performed by their own experts often in collaboration with university or other external experts. Finally, comprehensive and organised studies at national or regional level are carried out by the public employment services or observatories, such as ISTAS or Ecoempleo.

The role played by workers, SMEs and corporations in identifying skills needs could point to a lack of anticipation by the agents involved in the skills response. A rather “reactive” approach seems to be the standard – agents providing training do not seem to anticipate the skills needs of workers and enterprises. This could be attributable to the lack of a clear green skills strategy. Big corporations are an exception both in anticipating and identifying skills needs.

Comprehensive and organised studies at the national and regional levels must be undertaken in order to provide the detail needed to better anticipate skills gaps. The first comprehensive study at the national level by the National Employment Service will be finished in March 2010 long after the initial policy decisions on greening the economy were taken. Another example of this lack of anticipation of skills needs is Plan E, which includes several measures for sustainable development and greening of the economy but does not include skills identification or responses for these developments.

With regard to concrete skills needs two main groups of skills have been identified across occupations: technical and administrative on the one hand and managerial on the other. The second group of skills needs is partly a result of the complex and changing incentive system of environmental policies, particularly with regard to renewable energy. Table 16 summarises the main new and changing skills for the most significant occupations undergoing a greening process.

Table 16: Skills requirements across new and greening occupations

Sector	Occupations and processes	New and changing skills
Renewable Energy	Solar energy entrepreneurs	Technical skills related to solar panels features Administrative skills related to economic incentives of renewable energy investments Entrepreneurial skills for project planning and management
	Wind power technicians	*General*: Basic knowledge on wind; technical specifications of nacelles and aero generators; cartography; climatology; health and safety at work; environmental quality systems; environmental impact studies; project management; stock management; and information management. *In some cases*: A good competence in driving; safety training; advanced computer skills and the use of computerised diagnostic tools; ability to solve practical problems; capacity to use heavy equipment (crane and rigging); specific technical knowledge of components of nacelles
	Solar energy installations project designer	Administrative procedures and subsidies management Technical features on solar panels, both photovoltaic and thermal Management skills, such as budgeting and reporting, safety studies and the use of maps for the installation
Water	Desalination plant maintenance and operation managers	Technical and managerial skills: Technical knowledge of the specifications of machinery;

		development of comprehensive control and maintenance plans; training in new technological innovations for energy recovery; development of environmental plans and training.
Agriculture	Farmers	Using new machinery (new tractors, harvesters); more energy efficient farms structure design; nitrogen fertilisation techniques; efficient greenhouses design; irrigation design.
Transport	Professional drivers (bus, trucks, taxi)	Skills on more energy efficient driving
Constructio n	Installers (electricians, plumbers)	Technical features of the solar panels Solar energy regulation knowledge
Automotive Industry	Engineers, industrial workers, construction workers linked with the building of supply points, electricians	Concrete new and changing skills related to the development of the electric car have not been identified yet

With regard to the projected restructuring in the automotive industry with the development of electric cars, concrete skills gaps have not yet been identified as the electric car strategy is still in the design stage.

4.2.2. Response policies and programmes

Most of the national environmental strategies mention the existence of skill gaps and stress the need for solving these but do not include a comprehensive skills training response or strategy. However, a few environmental strategies do include concrete skills training measures: Firstly, the EECCEL includes technical skills training programmes for new and existing green professionals, plus efficient driving training programmes. Secondly, the Renewable Energy Plans promote training programmes for local council technicians, renewable energy installers and maintenance workers, including training and information about the CTE. Finally, the Energy Saving and Efficiency Plan (2008-12) includes skills responses for raising awareness and energy efficiency for farmers. It also includes training responses for local council technicians; efficient driving courses for transport professionals and for driving instructors; and courses for railway, air, and road and ship freight transport management.

Despite the lack of a comprehensive national green skills training strategy, a variety of responses, both for employed and unemployed, have been fostered by public and private agents. Regional governments, public employment services, universities, and specialised public bodies play an important role. These agents offer a range of courses for the green economy, from long and full-time courses to short ones. Some courses have been outsourced and public institutions have also funded courses offered by the private sector directly. With regard to regional governments, there have been comprehensive and organised skills responses in some regions, as has been observed in Extremadura and especially in Navarre.

These are examples of successful public-private skills initiatives which have achieved impressive results.

However, it seems that the bulk of the skills responses offered are concentrated on occupations with medium education levels. The 'reactive' identification procedure and deficient anticipation mentioned above maybe the reason for this. In the absence of a clear green strategy (except in for large companies) workers and SMEs have little capacity to anticipate skills needs, rather they 'react' to demands of the market and do not upgrade skills strategically. This is the responsibility of the public sector. Furthermore, the lack of anticipation of skills needs in the public sector may have created bottlenecks in some areas of production as the private sector has needed to complement the existing provision of skills.

4.2.3. Effective delivery mechanisms

With regard to delivering skills training responses, the private sector has played an active role. Several academies and private training centres offer courses for new green occupations – mainly for greening existing occupations. Corporations organise skills training for their employees using both in-house and external trainers. The public and private sectors have cooperated in providing training for greening occupations in many cases, and many courses delivered by private academies or training centres are funded by the government.

Three main kinds of training programmes have been observed:

(a) long programmes within the formal education system;

(b) short courses for specific occupations;

(c) skills responses in corporations.

Long courses in the formal education system have been particularly suitable for training new green occupations but these courses are not easily adapted to provide training for the greening of existing occupations which require intensive courses for specific skills training. Skills responses in corporations are designed specifically for their productive needs and have shown good results as these courses are tailored to the skills needs of their workers.

On the basis of the case studies two effective delivery mechanisms are highlighted due to their effectiveness: comprehensive and coordinated training responses at the regional level (Cenifer), and training within big corporations (Iberdrola). In the first instance, coordination between the regional government and companies has been essential, providing a proactive approach to joining up economic, labour market, environmental and education strategies. This response has led to the creation of a permanent centre for anticipating, identifying and providing training for existing and new occupations, in line with a well defined regional renewable energy strategy. It is also interesting that although Cenifer was set up with the collaboration of large corporations it has also provided training to SMEs fostering their development in the region. As a result renewable energy development in the Navarre region has been impressive: in 15 years renewable electricity production grew from zero to 65%.

For the second mechanism, training within big corporations, the permanent provision of training, its accuracy and anticipation of skills needs have delivered the skills required to meet the Iberdrola's development strategy. One of the keys to continued competitiveness is that the company has enough resources to develop its strategic long term plans, anticipating future skills needs. Iberdrola has an integrated skills identification system for detecting skills gaps within the work place. Hence, they benefit both from anticipating future skills needs and from tailoring existing skills to meet their short term needs. The total installed capacity of the company points to the success of the skills training: Iberdrola has installed 1,144 new MW between 2006 and 2009, which represents around 9, 5% of the Renewable Energy Plan (2005-10) target of 12,000 MW ([70]).

Based on the case studies in this report four main points can be said to form an essential part of a good skills strategy: well defined regional green strategies, (integrating economy, employment, education and environment); strategic anticipation of skills needs in companies before skills gaps appear in the productive stage; coordination between regional governments and companies; and research into future skills needs for timely anticipation and delivery of skills provision.

In absence of effective delivery mechanisms social partners, such as business associations and trade unions, could take the role of identifying skills gaps and anticipating skills needs in order to provide SMEs with the information they need for developing the future skills required for the green economy.

([70]) Estimations from data from Renewable Energy Plan (2005-10), IDAE, Iberdrola Renovables Third Quarterly Report 2009, and Iberdrola Renovables Yearly Report 2007.

5. Recommendations

5.1. Policy recommendations

In policies directly related to skills several recommendations are made to address an coordinate involvement of social partners and the public sector at national and regional levels;

(a) at the national level a more proactive and anticipating policy should be implemented by the central government. Stronger collaboration between the ministries responsible for environment and employment is advisable in order to anticipate the effects of the green strategies on employment. Achieving the objectives in environmental policy areas would be easier if the required skills response was provided in a more forward looking and coherent manner;

(b) at the regional level forward looking response strategies have also been lacking in many cases – this is regrettable given the possibility for implementing skills training through ALMP and education and training policies. However, some regional governments, such as Navarre, have taken a proactive approach to skills policies. These are examples of best practice in delivering effective skills training to be followed by other regions;

(c) a more proactive attitude to anticipating policy trends and the future skills needs is advised on behalf of social partners such as business associations and trade unions. The issue could be included in the social dialogue agenda. Since social partners are in part responsible for managing continuous vocational training, this could offer employers and workers training opportunities even before the market demands them. It could also provide SMEs some of the comparative advantages enjoyed by large corporations, who are better able to foresee the market economic trends;

(d) coordination between these actors is essential to provide a strong and coherent public response and to support the private initiative, which has so far taken the lead. Better integration and mutual reinforcement between public strategies in economy, employment, training, R&D and environment is recommended at national and regional level. With regard in particular to ALMP and VET systems, a more proactive approach towards fulfilling economic and environmental objectives would ease the greening process considerably and avoid future skills bottlenecks;

(e) the creation of synergies across anticipation and identification procedures, course design, knowledge sharing and dissemination of good practices could be achieved by creating a network of regional specialised training centres in renewable energy or, alternatively, networking existing renewable energy training. It is important that such a network is coordinated at the national level and, following the example of Navarra, these regional training centres should collaborate with regional companies improving anticipation of skills gaps and broaden input into the course design;

(f) this would allow a more equal development among regions, ease the regional mobility of workers and perhaps contribute to evening out the huge differences in unemployment between different Spanish regions.

5.2. Recommendations for education and training

This report highlights eight areas for improving skills identification and skills training responses in Spain:

(a) identification of skills needs could be better forecasted with a positive effect on the timing of skills provision. A comprehensive study of skills needs at the national level is currently being undertaken by the National Employment Service. It would have been positive if such a study was linked with the design of the main green strategies (many of them conceived around one decade ago). Stronger public-private cooperation is highly recommended for anticipating future skills needs in order to avoid possible skills bottlenecks. CENIFER foundation is an example of good practice in this area;

(b) as observed in the Iberdrola case study, large corporations often have departments for the skills identification. These departments identify concrete skills needs in the productive stage. This skills anticipation and identification could bring benefits to SMEs also. The main obstacle is scale and therefore detailed and comprehensive identification by a public body is recommended. This would also reinforce the previous recommendation;

(c) the regulatory frame, especially in relation to renewable energy, is very complex and still goes through frequent modifications. As observed in some of the case studies, this has produced a non-technical skills gap for some occupations. A simpler and more constant regulatory framework should be introduced in order to reduce the level of skills required for administrative tasks and thus improve the transition towards a greener economy;

(d) Spain is pioneering key fields in desalination and renewable energy technologies and should capitalise on the advantage of having leading companies in renewables and desalination. Investment in innovation could be very profitable if a comparative advantage is achieved and further investment in R&D is recommended for consolidating areas of competitive advantage as well as reducing the costs of greening the economy further;

(e) most of the observed training responses have targeted technical blue collar workers. However, there are sizeable skills gaps for high level white collar workers such as green managers. Broadening the options for skills training in white collar occupations is advised as optimal management and resource efficiency will continue to be key for the green economy. Furthermore, training of greener managers is likely to induce improvements in the activities of anticipation of skills needs, strengthening the whole skills response system;

(f) better coordination between public and private agents can be recommended in the education and training field. As the ALMPs, employment services and education policies

are managed by regional governments they will have a core role in coordinating the training for green skills. With regard to this coordination a proactive attitude is essential;

(g) many of the greening processes can be carried out by greening existing occupations. Some of the training responses described in the case studies derive from a lack of flexible courses within the regular training system. Therefore flexible training offers within the VET systems that suit the schedules of employed workers and focus on specific skills for greener performance of occupations are recommended;

(h) the system for continuous training of employees should be adapted to include more green skills training. Every occupation will undergo a greening process in the coming years even if this is based on a shift in production methods without any change in the machinery or tools used. Hence, the continuous training system should be ready for the challenge of greening in all occupations. This should be a strategic goal of the continuous training.

5.3. Recommendations for further research

Four recommendations related to further research on greening of the economy and the related skills responses have emerged from this report:

(a) considering the role of regional governments in Spain, it is recommended to undertake research within the 17 Spanish regions on the greening strategies, skills gaps, identification processes and skills responses. A national database on employment, investments and productivity could be created on the basis of such research and a multiregional study could be useful for disseminating good practices across the country;

(b) as has been observed in this report many skills responses cannot be fully evaluated yet because they are still in their initial phases. Hence, in the coming years evaluation of the current skills responses is advised in order to learn from current experiences and strengthen future skills responses. In order to assess the skills response, data on labour productivity of the green sector should be produced. Once the greening process is effectuated and the major skills gaps have been overcome the next objective should be the improvement of productivity. Data on the results of the skills responses should be produced in order to identify optimum skills responses for the long term;

(c) in-depth studies are recommended for specific occupations, especially high level white collar occupations, such as green managers. Occupations and activities related to awareness should be studied in more detail as these occupations play a key role in the greening process. Hence, the creation of case studies on green management and awareness related occupations would improve identification methods and skills responses;

(d) studies on issues such as the gender dimension of green jobs would positively widen the perspective on green jobs. Understanding the impact of green structural change on the composition of the work force in different sectors and on overall employment and

income levels is essential to explain the evolution of developed economies in the next decades. Hence, further research is recommended in this field in order to identify regional and social impacts as well as the main bottlenecks of the greening process.

List of key resource people

The following table presents the list of key resource persons. Only people who have provided key information for inclusion in the report are listed.

Institution	Person/Function	Related Case Study
Biodiversity Foundation	Silvia Fernández Campa. Green Hiring Programme Guadalupe García: International Department Chief	Biodiversity Foundation
FENIE	Jose Antonio González, Secretary General	
Iberdrola Renovables	Javier Azorín, Training Manager	Iberdrola Renovables
CENIFER	Technical Secretary	CENIFER
FONAMA	Rosa Riballo	FONAMA
Extremadura Employment Regional Service (Sexpe)	Jesus Manuel Alarcón, Chief of Training Department	
Anfora Training Centre	Jose Manuel Blanco, Manager of Badajoz office	
IIR	Iván Cortés, Customer Department	IIR
IDAE	Ángel Sánchez de Vera Quintero, Services and Agriculture Department Chief	IDAE
Fundación Laboral de la Construcción	Ana Escobar, Training Department	Fundación Laboral de la Construcción
Cefoim	Daniel Herrera, Commercial Director	

Acronyms and definitions

ALMP	Active Labour Market Policies
CC.OO	The Spanish Trade Union
CTE	Technical Building Code
EECCEL	Spanish Climate Change and Clean Energy Strategy
EEDS	Spanish Sustainable Development Strategy
EEMS	Spanish Strategy of Sustainable Mobility
EQF	European Qualification Framework
EU	European Union
FENIE	Foundation and Telecommunications Installations Businessmen Association
GDP	Gross Domestic Product
IDAE	Institute for the Diversification and Energy Saving
IIR	Institute for International Research
LES	Law of Sustainable Economy
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
OM	Operation and Maintenance
PER	Renewable Energy Plan
PFER	Promoting Plans for Renewable Energy
PNACC	National Climate Change Adaptation Plan
PNADE	Emission Assignation National Plan
PSGE	Electric and Gas Sectors Plan
R&D	Research and Development

Sexpe	Extremadura Employment Regional Service
SME	Small and Medium Enterprise
VET	Vocational Education and Training

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