CEDEFOP | European Centre for the Development of Vocational Training

International Labour Office

EN

ISSN: 1608-7089

skills for green jobs

EUROPEAN SYNTHESIS REPORT

CEDEFOP

Skills for green jobs

EUROPEAN SYNTHESIS REPORT

Luxembourg: Publications Office of the European Union, 2010

A great deal of additional information on the European Union
is available on the Internet.
It can be accessed through the Europa server (http://europa.eu).

Cataloguing data can be found at the end of this publication.

Luxembourg:
Publications Office of the European Union, 2010

ISBN: 978-92-896-0660-8
ISSN: 1608-7089
doi:10.2801/31554

Designed by Christopher Adam I ArtDirector, Greece
Printed in the European Union

PRINTED ON PROCESS
CHLORINE-FREE RECYCLED PAPER (PCF)

The **European Centre for the Development of Vocational Training** (Cedefop) is the European Union's reference centre for vocational education and training. We provide information on and analyses of vocational education and training systems, policies, research and practice. Cedefop was established in 1975 by Council Regulation (EEC) No 337/75.

Europe 123, 570 01 Thessaloniki (Pylea), GREECE
PO Box 22427, 551 02 Thessaloniki, GREECE
Tel. +30 2310490111, Fax +30 2310490020
E-mail: info@cedefop.europa.eu
www.cedefop.europa.eu

Foreword

Climate change and environmental degradation are jeopardising livelihoods and future sustainability in many areas of economic activity around the world. Alongside other drivers of change such as globalisation and rapid technological change, they are causing important shifts in labour markets and skills needs. Public policies and enterprise strategies in many areas follow calls for innovative, clean and greener economies. Availability of skills for green jobs plays a crucial role in triggering change and facilitating just and timely transitions.

The International Labour Organisation (ILO) and Cedefop launched a global research project to investigate skills needs for structural shifts caused by greening the economy, new and changing occupational profiles, and major skills constraints.

The 'skills for green jobs' project is embedded in the green jobs initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organisation (IOE) and the International Trade Union Confederation (ITUC), to assess, analyse and create decent jobs as a consequence of the needed environmental policies.

At European level this work contributes to the Europe 2020 strategy (European Commission, 2010) in which sustainable growth means building a resource-efficient and competitive economy, reinforcing the competitive advantages of businesses, particularly in manufacturing and SMEs, and through assisting consumers to value resource-efficiency.

The work of the two organisations – Cedefop and ILO – complemented each other in respecting areas of institutional expertise. While Cedefop covered research in the EU region, the ILO concentrated on other parts of the world. Both organisations have contributed their knowledge on vocational training and the labour market resulting in many case studies and analyses of broader relevance.

This European synthesis report was prepared under the responsibility of Cedefop. It explores skills development in response to the greening agenda at national, regional and local levels in six Member States: Denmark, Germany, Estonia, Spain, France and the UK. The report *Skills for green jobs:*

a global view (ILO, 2010), which compares experiences of 21 countries at very different stages of development across the world, including those in the EU, was prepared by the ILO and published separately ([1]).

Many examples of good practice demonstrate that public policy, together with private initiatives, can foster expansion of green transformation and harness energy efficiency and renewable energy potential, all of which requires transformation of the skills base. Skills development responses need to focus on adding to existing competences, emphasising core skills, including those in mathematics, engineering, technology and science.

Every job can potentially become greener. Understanding the environmental impact of a job, and its possible contribution to greener economies, needs to be mainstreamed into education and training systems. Integrating sustainable development and environmental issues into existing qualifications and capturing new and emerging skill needs on the greening job market are a massive task.

Countries' experiences in skill response strategies vary. Some countries are developing innovative strategies and policies to respond to changing skill needs; others are adjusting existing mechanisms and systems. The report has assembled case studies across a wide spectrum of challenges which offer a broad array of approaches to promote transition to new labour-market requirements and greening workplaces with sustainable, productive and decent employment.

Aviana Bulgarelli
Director of Cedefop

Christine Evans-Klock
Director of the Skills and Employability Department International Labour Organisation

([1]) The report covers 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 global report and full versions of background country reports can be found at http://www.ilo.org/skills

Acknowledgements

This European synthesis report is a joint effort and reflects the contributions of all those working on the project. Peter Szovics from Cedefop ensured the overall coordination and management of the project. Valuable contributions were also made by other Cedefop experts, namely Manfred Tessaring, Alena Zukersteinova and Eleonora Waltraud Schmid.

Cedefop would like to acknowledge the contribution of James Medhurst (research team leader), Vanessa Foo and Jeppe Graugaard from GHK Consulting in cooperation with the Danish Technological Institute, Economix Research & Consulting and Centro de Estudios Económicos Tomillo. They gathered and carried out the analysis of the material and drafted and presented their findings to Cedefop. The country reports, including case studies ([2]), belong to the study contract with Cedefop No 2009-0134/AO/RPA/PSZO-AZU-Skills-green-jobs/004/09. 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 the full country reports.

This project was conducted in cooperation with the International Labour Organisation and will result in the *Global synthesis report*, to be published in 2010. Many thanks go to Olga Strietska-Ilina and her team members Christine Hofmann, Mercedes Duran Haro and Shinyoung Jeon who commented on the emerging findings.

Parts of this publication were presented during the technical validation workshop on skills for green jobs held in Geneva on 17 and 18 May 2010.

([2]) Full country reports with case studies are available online at: www.cedefop.europa.eu

Table of contents

Annexes

Tables and boxes

Tables

Boxes

Executive summary

The potential for green job creation is enormous – and the case for government support to drive this forward is clear – industry cannot do it alone.

The case for moving towards a low-carbon economy and achieving green, sustainable growth has been well documented over recent years. It has gained further ground as governments look for ways out of the economic downturn and means for reducing unemployment at the same time as meeting their climate change obligations, renewing energy infrastructure and complying with other environmental legislation.

Research shows that green investments, particularly in renewable energy and ecoconstruction, are potentially significant engines for job creation. A study recently commissioned by the UK government estimated that 400 000 gross jobs could be created by 2015 if plans to reduce greenhouse gas emissions were realised (Innovas, 2009). In the US, money invested in energy efficiency and renewable energy is estimated to produce between two and a half and four times as many jobs as the same dollar invested in producing energy from oil (Pollin et al., 2009).

Government intervention is crucial to support this job creation. Government action to reduce damage to the environment and health is often a prerequisite for developing markets for greener technologies and services. Even when such policies are in place, investing in development of new technologies can be prohibitively risky for businesses and expensive in the early stages. As in other sectors, specific measures from the innovation policy toolkit may be needed to address market failures that impede development and deployment of new green technologies. Government subsidies for research and early stage deployment can accelerate innovation and provide a signal of certainty to industry that they too should be coinvesting in, for instance, clean energy.

The challenges of funding innovation are particularly acute for small and medium-sized enterprises (SMEs). They tend to have greater problems accessing finance (made worse by the current economic recession). SMEs also face barriers in accessing affordable training to upskill and take advantage of new market opportunities. Persuading the workforce to upskill requires convincing them that it is both affordable and profitable. A recent survey found

that although most electricians were keen to train in photovoltaic installation, they were reluctant to pay the training provider EUR 2 050 to do so ([3]).

Industry is beginning to take a more proactive role in meeting climate change obligations, driven by considerations such as:

(a) 'new markets growing around greenhouse gas emissions, [reduction targets] from carbon credit trading to [...] new technologies and processes [...];
(b) global supply chains responding to changing regulatory requirements and purchasing demands;
(c) response to consumer demand and companies [...] seeking [...] first mover competitive advantage by developing, deploying and selling low emissions services and products;
(d) rising economic costs associated with climate change – [... reflected by the fact] several large insurers now [... rate] climate change as a top risk along[side ...] terrorism [...]' (BVET, 2009, p. 8).

However, as governments and industry increase efforts to take advantage of the economic opportunities provided by the low-carbon economy, the need to ensure there is a workforce with the skills required to exploit those opportunities becomes more pressing. Growth in demand is likely to increase competition for workers with high-level, specialist skills. The skills strategies developed by governments with the private sector need to recognise and anticipate this demand to ensure new and existing workers are equipped to support and share in the success of these future growth sectors.

Europe's policy-makers now need to ensure that their support for skills and training matches the focus and ambition of their strategies for promoting investment in green innovation and infrastructure.

The European Union's (EU) new strategy for sustainable growth and jobs, Europe 2020, puts innovation and green growth at the heart of its blueprint for competitiveness. It follows on from the European economic recovery plan, a fiscal stimulus of around EUR 200 billion launched in 2008 that focused investment on clean technologies and infrastructure.

In Member States reviewed in this study, economic stimulus packages have been directed towards the same types of activity – construction, the

([3]) Quoted in the workshop 'Green skills, green jobs: opportunities for the south west low-carbon economy', South-West Observatory Skills and Learning, in the UK on 27 November 2009.

automotive sector, energy efficiency and renewable energy. However, there are no explicit overarching national strategies targeting green skills needs in any of the six Member States in this study. Some Member States are moving faster than others to rectify this, with France launching its recent mobilisation plan for green jobs ([4]), and the UK government recently launching a consultation exercise, entitled *Meeting the low carbon skills challenge* (BIS, 2010).

The fundamental weaknesses in the EU's skills base matter more to its capacity for green growth than shortages in specialist 'green tech' know-how.

The EU suffers from systemic weaknesses in its skills base which limit its productivity and competitiveness in today's economy, and reduce its capacity to exploit the opportunities offered by green growth. These deficits in management skills and technical job-specific skills (many of which are related to science, technology, engineering and mathematics [STEM]) are a greater concern than shortages of 'new' green skills.

Indeed, there is consensus that few of the critical skills for transition to a low-carbon economy are new. The French Ministry of Education states that 'very few jobs today are based purely on new competences' (Ministère de l'Éducation, forthcoming). The Aldersgate Group, a high-level coalition group of UK businesses, politicians and environmental groups, suggested that the fundamental skills for most environmental or low-carbon jobs already exist, and that the emphasis of skills investment should be to develop training to improve existing skills rather than creating new ones.

Demographic and cultural changes are contributing to the skills shortages experienced in the low-carbon sectors. In some countries, there is a shortage of engineers able to replace those retiring, resulting in a shortage of people with the skills to deliver major infrastructure projects. In 2008, 64 000 job vacancies for engineers in Germany were still open, according to the calculations of the German Economic Research Institute, a shortage estimated to cost the German economy around EUR 6.6 billion (Laboratory demographic change et al., 2009). The lack of availability of engineers remains the largest problem for the environmental sector in Germany, and is exacerbated by the fact that graduation rates have been low in recent years and fewer school

([4]) *Plan de mobilisation des territoires et des filières sur le développement des métiers de la croissance verte.*

graduates are applying for apprenticeships (see Annex 2). Across Europe, STEM subjects are declining in popularity at secondary and tertiary education levels.

Fundamentally, the bulk of jobs – whether classed as 'new green jobs,' existing occupations which require greening skills, or those requiring 'retraining' – already possess a base of highly relevant skills and simply require a 'topping-up' of their competences. This topping-up is most likely to be characterised by additional training to familiarise workers with new concepts and practices that will enable them to operate in low-carbon industries, but at a level which is unlikely to be onerous.

Box 1. **Europe's skills in science and technology underpin its long-term competitiveness**

Hans van der Loo, head of European Union liaison at Royal Dutch Shell, has stressed the importance of improving Europe's competence in mathematics in order to improve competitiveness. He draws a direct link between technical knowledge and economic growth, but notes that interest in maths and sciences tends to decline as countries become more prosperous.

'Education has long been acknowledged as the cornerstone of Europe's success. With the challenges ahead, it will become even more important in determining the future of Europe's prosperity and role in the world. Competence in mathematics, science and technology (MST) is becoming more and more fundamental as a strategic enabler for a sustainable, innovative and competitive Europe. Yet shortages in these disciplines are already imminent, calling for measures to substantially curb this downward trend in enrolment in technical studies and restore the health of the European talent pipeline' said van der Loo (EurActiv.com, 2010).

This study shows that the retraining required for workers to convert to an occupation in an entirely different greener industry, may be less than expected. Case studies suggest that skills development responses, required to enable a person to fulfil a new occupation, are often a matter of upskilling, or 'adding to' existing core skills. For example, workers with experience in shipbuilding and in the oil and gas sector are highly sought after in the wind-turbine industry for their skills in welding, surface treatment and outfitting. Table 1 illustrates how existing occupations can upskill to fulfil new green occupations, mainly through an 'add-on' of knowledge.

Table 1. **Examples of upskilling to new occupations**

	Occupation(s)	Core training	Upskilling	New occupation
DK	Industry electrician/ energy technologist	VET qualifications/ tertiary engineering qualifications	Knowledge of energy sources, ability to integrate energy systems, project management	Manager in renewable energy
DK	Industrial operator/ industry electrician	VET qualifications/ upper secondary qualifications	Assembly, installation of parts, use of tools	Wind-turbine operator
EE	Construction worker	No professional standard	Knowledge of energy systems, data analysis, project management	Energy auditor
FR	Recycling sector worker	General certificate of vocational qualification (CQP)	Sorting and reception techniques, knowledge of conditioning and storage	Waste-recycling operator
FR	Product design and services	22 initial training courses with varying specialisation	Integrating environmental criteria in design process, integrated assessment and life cycle analysis	Ecodesigner
DE	Electronic/ mechatronic technician	Initial vocational training	Electronics and hydraulic systems, safety procedures, operation and services	Wind power service technician
DE	Plumber/ electric and heating installer	Initial vocational training	Technical training, knowledge of administrative procedures, entrepreneurial skills	Solar-energy entrepreneur/ installations project designer
UK	Engineer in energy sector	Tertiary engineering qualifications	Installation and maintenance of low-carbon technologies, customer service skills	Smart-energy expert/smart-energy manager
UK	Commodity trader/Broker	Tertiary qualification	Practical skills on functioning of carbon market, understanding of trading tools	Carbon trader/broker

There are some areas in which significant investment in skills delivery will be needed, mainly because of the scale of action required. This is most notable in energy efficiency and construction of zero-carbon homes, both of which are heavily driven by national legislation. The concern over the ability of the construction industry to meet low-carbon requirements with its existing workforce is based more on the volume of workers that require upgrading of skills – even if the actual skill requirement for the individual is relatively low (Bird and Lawton, 2009).

Relative to topping up existing skills sets and the more generic skills required, the more specialised, 'newer' skills sets appear to be of less importance in moving towards a low-carbon economy. Skills development responses ought to be prioritised in favour of building on existing skills sets, as well as improving the generic skills of people across the entire workforce. These generic skills refer both to skills required in almost any occupation – such as leadership, commercial understanding or management – and to generic green skills that should apply to any occupation. These largely relate to understanding how to prepare the workplace for new environmental legislation, and improving energy and resource efficiency.

Regions are taking the lead in both identifying skills needs associated with a low-carbon economy and providing skills development responses to match. Joined-up approaches, where the regions, industry and educational bodies work together to identify gaps and provide solutions, are emerging in several Member States.

The approach to identify skills needs for the economy as a whole varies across the six Member States examined in this study. In Denmark, identifying skills needs is primarily the responsibility of trade committees which draw on labour-market information and external studies. In France, observatories help social partners to take decisions on employment and training policies by generating employment and training forecasts. In Estonia, the national ministries update labour demand forecasts each year. In the UK, there are calls for British businesses to take greater responsibility in defining their skills needs and to cooperate more closely with universities to deliver them (BIS, 2010).

The country reports in this study describe how skills needs are identified for the economy as a whole. They also indicated that these methods, approaches, systems and institutional responsibilities do not explicitly identify current and future skill needs for a green-jobs labour market. One clear finding is that

efforts to identify skill needs for jobs in a low-carbon economy have been taken most prominently by the regions, in cooperation with other partners – industry and educational bodies, such as universities and vocational institutions.

In four of the Member States examined, Denmark, Spain, France and the UK, regions are playing a primary role in identifying skills needs for jobs in a low-carbon economy. Regional actors are well placed to identify local strengths and weaknesses and can bring together key players such as industry, research institutes and educational facilities to provide appropriate responses.

Box 2. **A region leads the way in wave energy** ([a])

The south west of England has 70% more coastline than any other region in the UK and is sitting on an untapped source of wave energy. EUR 37 million ([b]) of investment is being pumped into a 'wave hub', which is the first large-scale wave energy farm in the world, and an offshore electrical socket connected to the national grid by a buried underwater cable, to which a series of wave energy devices could be connected. The region is working with the central government's Department for Business, Innovation and Skills to develop a marine-energy skills demonstrator and is looking to identify needs to develop future training. Technical and business skills, such as accessing finance, are likely to be particularly important. It is estimated that up to 6 000 people with the right skills could be required in wave farm installation if the sector takes off. At the universities of Exeter and Plymouth in the south west, the curricula for courses relating to the low-carbon economy, such as degree programmes in renewable energy, is underpinned by engineering skills. These are seen as crucial in ensuring graduates have the appropriate competence base for the low-carbon economy, and as many as 90% of graduates each year are already being recruited into the low-carbon sector.

([a]) Workshop *Green skills, green jobs: opportunities for the south west low carbon economy*, South-West Observatory Skills and Learning, in the UK on 27 November 2009.
([b]) Where GBP 1 = EUR 1.14 in exchange rate conversion as of 15 April 2010.

Local and regional governments are often able to offer incentives and support development of new technologies and have more detailed local knowledge. These case studies show regions working closely with industry – in some cases launching employer surveys to gather information (e.g. Lindoe, Denmark) – to understand skills gaps and shortages and to develop training initiatives to address them.

In the UK, regional-level intervention has been encouraged by central government, through creating several low carbon economic areas (LCEAs). These LCEAs are intended to capitalise on the particular geographic and industrial assets of individual regions to secure global competitive advantage for the UK. Focus is placed on stimulating employer demand for low-carbon skills and accelerating the growth of low-carbon industries and supply chains. LCEAs are also intended to attract skills investment, fill labour-market information gaps and demonstrate skills solutions for the wider skills system.

Skills development responses need to focus on adding to existing competences and placing emphasis on core skills in STEM.

Use of the word 'green' in reference to both jobs and skills is unhelpful, and only really has value in attracting students and apprentices to work in the low-carbon economy, given the appeal of the word 'green' in the current financial climate as a promoter of job creation (Bird and Lawton, 2009). Boundaries between what is and is not low-carbon work are becoming increasingly blurred as economic activities improve their resource efficiency and, as this study illustrates, much of the skills base relevant for low-carbon jobs can be found in existing occupations. Strategic skills responses, therefore, ought to focus more on topping up current competences than to try to 'reinvent the wheel' in creating new competences.

For this reason, the distinction between new green occupations, existing occupations which require greening skills and those declining and deemed to require retraining, is only relative and highly dependant on the country context and the stage of greening the economy. First, an occupation lacking a set of corresponding occupational standards does not necessarily make it new. Member State experts disagree on whether a job is 'new' or simply an existing job but with some new elements – for example, an energy auditor in Estonia may be considered as a new green occupation but in Germany, it could be seen merely as a shift in the competences of an auditor, which is a long-established occupation. Further, the skill set of people in declining occupations may not necessarily be obsolete. On the contrary, case studies covering diversification from one industry to another suggest that such 'declining' occupations have extremely valuable skills sets for new occupations, particularly in engineering and maintenance roles within renewable energy. Much of the competence base they have is directly transferable to the emerging low-carbon sectors.

Focus needs to be placed on ensuring that a large proportion of the

workforce tops up their current skills sets, through affordable and accessible modules tailored to their particular needs. Core skills – including STEM skills – need to be improved at secondary and tertiary levels, as they provide the basis for high-level low-carbon skills, and engineering needs to be made more attractive by both governments and industry, to retrain.

Government has a role to play in ensuring that learners, providers and employers are more 'joined up' for creating training products relevant to industry needs. More emphasis needs to be placed on application, as opposed to theory. Vocational education and training (VET) providers should improve links with companies developing demonstration technologies, to attract further students to the industry.

Further, both generic skills – for example management, leadership, communication – and generic green skills – such as improving resource efficiency in the workplace and understanding environmental legislation – are equally important to the skills agenda. Improvements in provision of training on both is crucial to almost the entire workforce and not just a small subsection of the population who work in highly specialised technologies.

Conclusions and recommendations

None of the Member States examined put in place integral skills response strategies as part of their environmental strategies and programmes. Often, positive employment impacts of strategies are noted with reference to the need for skills responses to exploit potential, but no overarching skills strategies are integrated. France is the most advanced in this respect, with its recent mobilisation plan for green jobs ([5]). Skills strategies that address systemic weaknesses in the labour market are being updated and will benefit green jobs.

A sectoral approach for identifying and anticipating skills needs for a low-carbon economy is not sufficient – and may miss the innovation and job growth potential in exploiting new markets for green technologies. The Grundfos case in Denmark shows that businesses are able to exploit their core competences for new forms of service provision – which would not have been captured with a narrow sectoral focus on skills. Taking a cross-sectoral perspective to skills needs identification is therefore crucial.

([5]) *Plan de mobilisation des territoires et des filières sur le développement des métiers de la croissance verte.*

National and regional governments need to play a proactive role in ensuring that countries' first-mover advantage in low-carbon technology (wind energy in Denmark) is used systemically to stimulate job creation through coordinated employment, skills upgrading and innovation policy. They should also be aware of the implications of removing support such as subsidies and feed-in tariffs, as illustrated by the recent collapse of the solar photovoltaic industry in Spain.

Regional governments lead the way in providing comprehensive and organised skills responses, developing successful public-private initiatives that achieved impressive results and could be considered best practices. Creating networks of regional training centres, coordinated nationally to create synergies and disseminate such best practices, would improve input for course design and mobility of workers between regions.

In the future, every job will be a green job, contributing to varying degrees to continuous improvement of resource efficiency. Understanding the environmental impact of an occupation needs to be mainstreamed into education and training systems. Integrating sustainable development and environmental issues into existing qualifications is much more effective than creating new training standards. Every new apprenticeship ought to have a low-carbon element, as is the case in Australia now.

Diversifying the range of training tools used needs to be encouraged. E-learning, such as the online library and interactive tool dedicated to energy efficiency training being tested in France (FEE Bat initiative), should be promoted across other Member States, and will help to improve accessibility of skills development responses to the broader population of the workforce.

Continuing initiatives for targeted support and promotion of STEM in compulsory-level education are needed. Early promotion of STEM careers is also necessary, as are incentives for the take-up of STEM subjects at university (the Confederation of British Industry in the UK is currently considering a EUR 1 100 'golden carrot' for each student enrolling in a STEM degree).

The number of trainers and teachers able to teach new techniques and aware of environmental issues is not sufficient, and shortages are particularly acute in agriculture and the construction sectors – more emphasis needs to be placed on training the trainers.

Improving the image of low-carbon occupations is also crucial and efforts should be made by both governments and industry to improve the attractiveness of taking up a career in such occupations.

Introduction

This report brings together the findings from six country reports. The study is based on research in Denmark, Germany, Estonia, Spain, France and the UK.

Chapter 1 summarises the major challenges and priorities arising from climate change and the resultant greening policies and strategies, including those caused by stimulus packages adopted in response to the current economic crisis. The chapter identifies major sectors with greening potential and those particularly affected by green stimulus packages and programmes adopted in response to the crisis. It also examines whether skill response strategies are incorporated into larger 'greening' policies and programmes.

Chapter 2 summarises skills needs of new occupations, new skills for greening existing occupations and retraining needs in sectors undergoing structural change due to policy implementation and the introduction of greening technologies and practices.

Chapter 3 summarises methods, tools, systems and institutional frameworks for anticipating and assessing skills used to ensure that skills supply meets, quantitatively and qualitatively, current and future labour-market demand for green-collar workers at national, sectoral, regional, company and training provider levels.

Chapter 4 summarises the way skills responses are organised to provide an effective response to the challenge of greening the economy, paying particular attention to planning initial and continuing training, institutional frameworks, systemic provisions, delivery channels, ad hoc versus anticipated skills responses, and the skills response of different actors.

Chapter 5 summarises skills policies and strategies, skills provision at national, sectoral, local or enterprise levels, and further research needed to meet the demands created by greening the economy.

Annexes 1 to 6 are summaries of the country reports, individual stand-alone documents, containing detailed analyses including case studies on which the findings are based.

CHAPTER 1

Environmental challenges and skills response strategies

Climate change is the main environmental policy priority across Member States and is often related to other environmental pressures and policy areas, for example water scarcity and energy. A significant amount of money has been dedicated to dealing with climate change and moving towards a low-carbon economy through national stimulus packages adopted in response to economic crisis. The focus for green stimulus spending tends to be energy efficiency in buildings, renewable energy, low-carbon vehicles and sustainable transport. Although all Member States recognise, in general policy statements, the skills dimension of climate change and low-carbon policies, there are few overarching, strategic skills responses for the environment. The exceptions are France, which has implemented a plan for mobilising green jobs, and the UK, where a strategy is currently in consultation.

1.1. Environmental challenges and strategies

The dominant environmental challenge across all Member States studied is climate change. In Spain, climate change is the most critical environmental issue and has been for several years. In Estonia, climate change is one of a wide range of environmental challenges. In the other Member States climate change policies represent an extension of well-established environmental policies.

The reported environmental challenges are similar in all six Member States; with climate change mitigation and adaptation the dominant challenge, resulting in very strong focus, in subsequent policy measures, on the energy-producing sector and energy-using activities.

In Denmark, Germany, France and the UK, the broad range of environmental challenges are well understood and have featured in well-developed environmental policies and regulations for many decades. This has in turn given rise to well-developed environmental industries that have generated demand for an increasing number of jobs and corresponding skills

responses. In these cases, managing labour-market responses to new environmentally-driven activities is not a new requirement.

For Spain, the track record in defining and formulating environmental challenges and policy responses is smaller. However, in part because of the availability of Structural and Cohesion Funds, definition of environmental needs and responses has developed extensively over the past 15 years. At the same time, clear climatic pressures of higher temperatures, lower rainfall and higher sea levels has driven a clear policy focus on managing energy and water resources.

For Estonia, a new Member State previously operating under the Soviet regime, development of environmental policy and regulations and the associated environmental sector is in its infancy. Availability of the Structural Funds forced attention onto specification of environmental needs and investment in basic environmental infrastructure. At the same time, the historic legacies of pollution provided a well-defined problem set. A particular characteristic of Estonia is extraction of oil from oil-shale reserves that gives rise to significant environmental impacts. The economic importance of the resource means that investment to mitigate impacts is a high priority.

1.2. Green stimulus packages

Not all Member States have introduced a green stimulus package. Packages introduced target the same types of activity – energy efficiency (especially in buildings), low-carbon vehicles (driven in part by restructuring benefits) and other forms of more sustainable transport (rail, waterways).

As part of the economic programmes designed in response to the economic crisis, Germany, France, Spain and the UK included 'green stimulus packages' which outline significant environmentally-related investment mainly in energy efficiency in buildings; low-carbon vehicles and other forms of sustainable transport. Denmark and Estonia did not create explicit environmentally-focused investment packages. In Denmark, the 'stimulus' was based on tax cuts equivalent to around EUR three billion. In Estonia, concerns about meeting State budget deficit requirements to join the Eurozone in 2011 resulted in a failure to introduce any significant economic stimulus package, although approximately EUR 390 million was spent on a package aimed at supporting export sectors of the economy and increasing energy efficiency of buildings.

Table 2. **Overview of green stimulus packages in each Member State and the major components**

	Package	Total fund and % green investment	Composition	Comment
DE	Twin stimulus packages (November 2008 and January 2009)	EUR 100 billion 13.2%	Energy efficiency (buildings); low-carbon vehicles (scrappage bonus, loans to develop low-carbon engines, emission-based vehicle taxation scheme); public transport systems	Biggest stimulus package with largest absolute amount dedicated to climate-related themes in the EU
FR	Economic revival plan (December 2008)	EUR 26 billion 21.2%	Energy efficiency (buildings); low-carbon vehicles (scrappage bonus, premium for low-carbon cars; investment in high speed rail); renewable; grid infrastructure	Highest proportion of package allocated to climate-related themes in the EU
UK	Recovery plan (November 2008) and additional support for automotive industry	GBP 22.1 billion 6.9%	Energy efficiency (buildings; new carriages; British waterways network; low-carbon vehicles; scrappage scheme). Extension of renewable obligation from 2027 to 2037; flood defence funding	
ES	Stimulus packages (November 2008 and October 2009)	EUR 16 Billion	Water/waste infrastructure; environmental, innovative and social projects	Another round of stimulus spending suggested as a possibility in 2010, with 'greener focus'
DK	Tax cuts (June 2009)	EUR 3 billion Not applicable	Not officially a stimulus package as such	Tax cuts form the basis of the stimulus plan
EE	No stimulus package adopted	Initial vocational training	Electronics and hydraulic systems, safety procedures, operation and services	Approximately EUR 390 million were proposed for supporting exports and increasing energy efficiency in buildings (only partially adopted)

Source: Member State reports

1.3. Sectoral focus of recent environmental strategies and programmes

All Member States focus on the same areas of 'greening potential' – energy efficiency in buildings, renewable energy, construction and transport – reflecting the dominant focus on climate change.

Renewable energy is the primary focus of recent environmental priorities, together with energy efficiency especially in buildings in all Member States. This reflects the importance of the sectors for reducing greenhouse gases as well as having the potential to increase national energy security and generate employment.

The vehicle sector has also been a major sectoral priority in Germany, France and the UK because of the benefit of restructuring and investment in new vehicles for jobs and industrial regions.

Also, there continues to be major investment through State-funded investment programmes, utilities and suppliers in environmental infrastructure, products and services. These activities are at least as significant as the more headline-grabbing stimulus packages, albeit representing less a departure from 'business as usual' and hence less need for specific labour-market responses to meet skills needs.

1.4. Development of skills response strategies as part of environmental strategies and programmes

None of the Member States examined have put in place integral skills response strategies as part of their environmental strategies and programmes. Often, positive employment impacts of the strategies are noted with reference to the need for skills responses to exploit potential, but no overarching skills strategies are integrated. France is the most advanced in this respect, with its recent mobilisation plan for green jobs. Skills strategies that address systemic weaknesses in the labour market are being updated and will benefit green jobs.

Despite including some individual skills training responses in environmental strategies and programmes, and progressive development of diverse environment-related programmes in vocational and higher education systems, there are no explicit national strategies targeting skills needs for greening the economy. Public strategy documents identifying the need for more skills training are found across Member States but there is no overarching comprehensive skills training strategy identifying skills needs for the occupations involved.

All Member States acknowledge the importance of skills development in enabling climate change policies to be fully effective and to realise economic and employment goals. However, with the exception of the new French plan (for the mobilisation of green jobs – Box 3) there is no strategic skills response for the environment in any of the Member States.

Member States with a more established history on response to environmentally-driven skills requirements, believe that, except for some immediate short-term issues especially in relation to renewable energy and energy efficiency programmes, existing systems of anticipating and responding to skills needs are adequate. In Spain, there is a less developed national system but this is compensated, at least in part, by strong regional initiatives to define and address climate change policy-induced employment change.

To the extent that existing systems are considered less than adequate, this is seen as a systemic weakness rather than specific to the environmental sector. There are common problems across Member States relating to the labour market that undermine economic performance and labour-market efficiency as a whole, even if they also apply to the environmental sector. These problems include weaknesses in integrating labour demand assessments and skills responses and lack of take-up of technical education and training in science and engineering.

Box 3. **Mobilisation plan for green jobs in France (2009)**

The objective of the plan is to adapt existing training programmes and qualifications, and create new ones where necessary, in line with the 600 000 green jobs that the Grenelle Round Table suggested could be generated by 2020. The corresponding jobs created should be accessible to all levels of education. This plan is articulated along four themes:

(a) identification of the relevant professions – this includes setting up a national observatory to understand the new professions and relevant fields and to quantify them;

(b) definition of training needs and setting up training and qualification pathways – this will enable professional skills to be recognised. Assessment of available initial training, lifelong learning and recognised acquired experience will allow creation of a reference system of the relevant professions and skills in sustainable development as required by employers and to set up measures required for skills adaptations;

(c) recruitment for sustainable development jobs – actions to help job-seekers meet the requirements of the many jobs, currently on offer, that cannot be taken up as skills are lacking;

(d) promotion and development of the professions for green growth – announced by the French President, at a national conference on green jobs which took place in January 2010.

The plan is considered necessary, as the lack of adequate skills, notably in the construction industry, has already been shown to hinder new job growth. Companies are struggling to recruit qualified technical staff. Graduates are rarely trained in energy efficiency and professionals are not always familiar with new technologies.

Source: Le Grenelle Environnement (2009).

CHAPTER 2

Emerging skill requirements

Sectors examined, undergoing green restructuring for environmental concerns or declining markets, were generally able to adjust production models to take advantage of growing markets for green products and services. Existing training systems coped with the demand for new skills whenever new green occupations (such as energy auditors) were created, or whenever existing green jobs (such as in agriculture and forestry) required further green competences. In general new, or additional, green dimensions to occupational profiles can be achieved by topping up existing skills.

2.1. Green restructuring

Examples of green restructuring with similar experience were identified across the Member States. Skills shortages have been addressed by producers without major problems, aided by existing sectoral support systems.

Labour-market policies, including education and training responses to industrial restructuring, are well developed in all Member States. Even in Estonia, which has less experience of these types of policies, there is strong focus on the need to invest in higher skills as part of the process of adjusting to, and managing, structural industrial change.

Relevant experience of green restructuring in the Member States examined, tends to be concentrated in few activities where traditional industries faced with declining markets have been able to reorientate their production models and processes to take advantage of markets driven by environmental priorities (Box 4).

In the main, refocusing these traditional sectors has not been substantially limited by a lack of relevant skills, but at the same time producers have invested in defining and responding to the new skills required. Current sectoral-related training systems have been able to cope.

Box 4. **Green restructuring**

Restructuring occupations and skills profiles were observed in heavy industry, manufacturing, power and transport. Examples of sectors where this process was effectively managed are:

(a) shipbuilding and related marine engineering activities which refocused on offshore renewable energy activity, including construction of offshore wind farms and their supply and maintenance.
In Denmark, the closure of Lindoe shipyard led public authorities and the energy sector to establish a forum for retraining workers in offshore renewable energy as a means of creating new jobs for the Lindoe workforce.
In the UK, shipbuilders Harland & Wolff used diversification marketing strategy to produce a range of renewable energy products, such as turbines for offshore wind farms, wave and tidal energy devices;

(b) vehicle manufacture and related supply chains refocused on hybrid vehicles reducing greenhouse gas emissions and meeting other customer demands.
Many European automotive manufacturers are developing and producing low-carbon vehicles for commercial deployment. It generated demand for new skills, as observed in provision of training in hybrid technology at BMW production plants in Germany, creation of a low-carbon technologies training centre by Nissan and the regional authority in north east England, and the Heuliez electric cars manufacturing plant in France;

(c) in extractive industries and power production, measures to increase efficiency and reduce pollution by employing new technologies and management systems are creating new skills requirements.
In Estonia, higher-education programmes related to the oil shale industry were revised and coordinated to minimise pollution across the supply chain and advance production and uptake of new oil shale technologies. The Estonian energy company Eesti Energia developed a training programme for employees aimed at furthering integrated management principles and sustainable practices.

2.2. New occupations and greening existing occupations

The distinction between new environmentally-driven occupations and greening existing occupations is often difficult to sustain and requires a significant element of judgement. Systems for defining and responding to environmentally-driven skills needs are already well established in most Member States.

National reports find a general problem in seeking to differentiate between new occupations and evolution and change in existing occupations. Environmental policies and programmes will probably not give rise to completely new occupations with a novel set of competences. It is, therefore, a matter of degree in adding to and changes in competence profiles that would differentiate an occupation as new or existing.

Box 5. **New green jobs – Old wine in new bottles?**

In the sectors covered in this report, no entirely new skill sets for green occupations were found. New green jobs tend to evolve as skills are topped up in existing jobs, or as competences applied across traditional sectoral demarcations. Grundfos, Danish global manufacturer of pumps, is an example of how new cross-sectoral qualifications, combining technical and analytical skills, emerge from existing competences.

Although Grundfos is a manufacturing company, business growth in recent years was based on applying core competences to new forms of service provision. Recently, Grundfos was contracted by the *Deutsche Bahn* (German railways) to analyse their energy consumption across all activities with a view to improve their energy use. Grundfos expects that energy systems analysis could become a major new global service market. New occupations for optimising energy use in Grundfos have a skills profile somewhat similar to that of a building service technician.

This illustrates how a purely sectoral approach to skills anticipation will often be insufficient to capture innovation and job growth potential where companies are broadening their service offers across sectors and entering new markets.

This is partly a reflection of long-standing environmental policies and related development of environmental industries which already generated a structure for defining environmentally-driven competences and related qualifications. In Germany, France and the UK, the scope to define new occupations seems to be lowest.

Box 6. **Competences for cleantech occupations**

Across all Member States there has been growing support for products and services improving operational performance and efficiency while reducing inputs, waste and energy consumption (cleantech). This gave rise to new occupations, such as managers and operators of renewable energy systems, and hybrid or cross-sectoral occupations, such as energy auditing and efficiency services. The skills profiles for such occupations are not entirely new and often amalgamate skills from related occupations.

A study by Brøndum & Fliess (2009) reviewed the new occupational profiles that emerged as a result of new market opportunities from eco-friendly solutions in Denmark and found that 12 competence fields characterise cleantech occupations:

(a) core vocational knowledge (processes, technologies, materials, market and market dynamics);
(b) understanding market and user behaviour (specification of solutions);
(c) impact of globalisation – competitive advantage, business models, partnerships;
(d) innovation (process, product, business models);
(e) ICT;
(f) knowledge of production technology – installation and maintenance;
(g) knowledge of material technologies, such as alternative materials, reuse of materials;
(h) environment, climate, sustainability;
(i) communication – including English and team cooperation;
(j) process and planning;
(k) automation;
(l) test and documentation.

In the main, national reports have tended to define the occupations driven by expansion in the renewable energy sector as 'new', reflecting emergence of a new energy subsector; or where the occupation is related to adopting new business models (typically a greater emphasis on services than on production of goods), as in Denmark. For Estonia, given major modernisation of the economy, emergence of specific environmentally-driven occupations tended to be swamped by the overall step-change in investment in industrial productivity and efforts to upskill the labour force.

Greening occupations occurs with addition to, subtraction from or changes in existing competences, often recognised as either diversification of an existing occupation (or sometimes seen as a hybrid of two or more occupations, such as an increase in environmental management responsibilities); or increased specialisation of an occupation (such as in water or waste sectors as technologies and operations become more advanced).

Greening is also associated with industry at large, as a result of the general requirement for producers to be more environmentally aware and to improve resource efficiency, requiring improved production methods and use of new technologies (called cleantech in Denmark). This broader requirement is perhaps most explicit in the UK industrial activism strategy that seeks to focus industrial R&D investment in globally-significant technologies and sectors including low-carbon industries. It is also implicit in the industrial investment strategy in Estonia.

2.3. Overview of occupations generating demand for green skills

Case studies in individual Member States identified a range of specific occupations that generated a demand for green skills. These occupations and related sectoral context are summarised in Table 3.

Table 3. **Overview of Member States' case studies on green skills**

Sector	Occupation	DK	DE	EE	ES	FR	UK
New							
Process industries	Research and training	✔		✔			
Power	Renewable energy management			✔			
	Solar energy	✔	✔		✔	✔	
	Wind power		✔		✔		✔
Waste	Waste recycling					✔	
Services	Green business management		✔				
	Energy auditing/smart energy			✔		✔	✔
Greening							
Primary	Agriculture and fishery				✔	✔	
	Forestry/land management	✔		✔			✔
Power	Marine technology						
	Power technology			✔			
	Nuclear						✔
Water	Desalination plant maintenance				✔		
Waste	Recycling and waste management	✔	✔				
Construction	Schemes for upskilling across construction sector occupations					✔	
	Technology installers				✔		
	System mechanics		✔				
Services	Eco-design					✔	
	Energy auditing		✔				
	Carbon trading						✔
Restructuring/retraining							
Extractive industries	Oil shale mining			✔			
Process industries	Chemical technician	✔	✔				
Manufacture	Shipbuilding to wind turbine manufacture (diversification)						✔
Power	Solar energy entrepreneurs	✔			✔		
	Power technology			✔			
Transport	Low-carbon vehicles		✔			✔	✔

CHAPTER 3

Approaches to anticipating skills needs

Member States' frameworks for identifying future skills needs are well established and tend to be organised around formal qualification or sectoral training systems. Green skills identification is not an integrated aspect of these systems and is mostly made ad hoc at subnational level. Regional or local authorities, sectoral agencies and even companies themselves are usually the first to identify green skills needs but they often lack coordination and formal methods for anticipating skills needs.

3.1. Tools and institutional frameworks

General identification of skills needs in most Member States as the basis for skills responses need to improve. This improvement relates as much to environmentally-driven skills needs as to the economy generally.

In Denmark, Germany and France, there are well-established institutional frameworks for reflecting changes in skills needs in education and training responses. This framework combines quantitative forecasting, qualitative needs assessments and formal and informal dialogue with education and training providers. These frameworks tended to be built around qualification systems and established sectoral activity and rely on important contributions from the social partners. This is especially strong in support of the German apprenticeship system.

In France, use of observatories to forecast occupational changes, based on cooperation between various players in the labour market, is perhaps one of the most well-developed systems. The new plan for mobilising green jobs includes establishment of a new observatory for emerging environmental professions. France has also introduced the *licence pro*, which licenses vocational training provision based on well-defined needs assessments that require regular four-year reviews and updates, to ensure direct feedback from industry of their needs to training providers.

The UK is instituting a new system for identifying skills needs and their articulation as the basis for education and training responses (Box 7). This is focused on regional scale using regional development agencies with sector skills councils to understand better the needs of industry. The UK established the UK Commission for Employment and Skills to undertake an annual strategic skills audit with a clear mandate to identify what green skills employers in priority sectors require.

Box 7. **Reconfiguring the UK skills response system**

In April 2010, the system for skills development in the UK went through a major change when the Learning and Skills Council ceased to exist and responsibility for education, learning and skills for under-18s was transferred to local authorities and the new skills funding agency became responsible for adult learning and skills policy. The agency is responsible for ensuring a network of training providers, such as further education colleges and training institutions, is available to meet skill needs across England. Priorities for funding will be determined by regional skills strategies, developed by regional development agencies, sector skills councils and local authorities. This will support active industrial policy through allocating public funds to sectors and markets.

Under the new system, the UK Commission for Employment and Skills will produce annually a national strategic skills audit. The audit will forecast and identify skills needs in 25 sectors, including in-depth case studies of the sectors identified in the government's new industry, new jobs strategy. The audit will inform development of a 'strategic skills strategy' specifically to target skills gaps and shortages in low-carbon emerging industries. The strategy will be used by the new skills funding agency and skills agencies in devolved administrations to commission effective skills provision that meet national and regional sector priorities.

Estonia, where the framework for skills identification and development is still at an early stage, relies to a great extent on industry to identify and provide the skills needed for green jobs where occupations have not been identified in national strategies as important for greening the Estonian economy and training is provided through the formal education and training system.

3.2. Anticipating green skill needs as the basis for skills responses

Anticipating green-skills needs tends to be made on an ad hoc basis, mainly by regional bodies and industry, usually on a small scale and related to a specific occupation.

Experience from the selected countries is that even where there are well-established institutional systems, there is still reliance on initiatives at regional/local and sectoral/company levels. Even in France, identifying specific skill needs in the building sector and related responses tended to be ad hoc and led to several uncoordinated programmes and initiatives.

Member States other than France with its new mobilisation plan, do not appear to have undertaken formal skills anticipation or occupational forecasting of green jobs – with little or no formal, national-level quantitative model-based projections. Most approaches tend to be far less formal, consisting of employer surveys and various stakeholder consultations about skills, deficiencies and skills gaps.

Box 8. **Working together to analyse skills needs for the renewable energy sector**

In the UK, eight sector bodies (AssetSkills, Cogent, ConstructionSkills, EU Skills, Lantra, SEMTA, SummitSkills and ECITB) have worked together to deliver a renewable energy skills strategy, with funding from the Department of Energy and Climate Change to support central coordination, and in-kind contributions from sector bodies. The project will deliver a skills analysis for this emerging sector, covering specialist, transferable and cross-sector skills, including a supply side and gap analysis. The whole supply chain is scoped, including research and development, development and planning, design and maintenance, construction and installation, operation and maintenance. The steering group includes representatives from sector bodies, as well as from government departments across the UK. The project was due to be completed in June 2010.

The UK government launched a consultation exercise in March 2010 setting out the government's views on key skills-related priorities and challenges to be met if the country is to successfully enable workers and businesses to take advantage of the opportunities in the key sectors for reducing carbon emissions, and to embed the necessary skills across all sectors to move the UK to a low-carbon and resource-efficient economy. The consultation exercise seeks views on the priorities, challenges and gaps identified and seeks to explore how businesses can have better incentives provided to them and be encouraged to respond so they have the necessary skills at all levels. The exercise also looks at how the education and skills system can respond so that it is strongly focused on the needs of businesses. It should close in June 2010, with the government reporting on the outcomes in Autumn 2010.

CHAPTER 4

Responses to skills needs

Green skills responses vary across Member States' education and training systems. Regional bodies are often responsible for key tasks in national skills strategies, including identification and provision of skills. Where skills development tends to take place in the formal education system, there is focus on developing new higher level education and vocational training courses. Where formal skills response systems are unable to provide the necessary training, a mix of planned and ad hoc measures involving local authorities, sectoral agents and companies have been observed.

4.1. Skills responses to greening occupations within existing education and training systems

The nature of skills development responses related to green jobs depends in large part on the previous development of skills responses to environmentally-driven changes in competences within formal skills response systems. In addition to formal education and VET systems, sectoral bodies and trade unions often provide upskilling programmes for specific occupations where there is an immediate need for new green skills.

In Denmark, Germany and Estonia particularly, skills development responses are characterised predominantly by academic and VET courses, apprenticeships and other initiatives embedded in the formal education system.

In Germany, integration of environmental aspects has already strongly influenced the German education and training system in recent years. Environmental protection was included in both dual vocational training and university education and new initial training courses and university studies were introduced and degrees with environmental specialisations were added. Companies generally expect training to be provided by the public education and training system. This explains why there are very few additional or alternative initiatives to this 'dominant' public system. Industry does play a role in reorganising university courses, closely cooperating with training providers.

Further, as Germany has been involved in developing green technologies for several decades, training activities left the initial – more company-related – phase a long time ago. Training for green jobs is a well-established area of public vocational training.

In Denmark, the VET system is a sound basis for the responses required. Some changes are suggested however, to upper secondary VET to reflect better changes in required learning outcomes in relation to the environment. The relevance of the current system is in part a reflection of the continuing evolution of the system to environmentally-driven competences and growth in green occupations.

In addition, labour-market programmes based on continuing adult education for skilled and unskilled workers have played a major role in smoothing structural change and greening processes since they are highly responsive to changing needs. Further changes as a result of continuing environmental investment in skill requirements can be reflected in future revisions of VET curricula and qualifications. Greening occupations in construction is a good example of a strategic skills response framing future changes in VET provision.

In Estonia, developing the education and training system as part of broader restructuring and modernisation of the State, brings with it new capacity to manage greening industry. However, absence of previous experience in responding to changes in environment-related competences suggests that translating national provisions into the specific requirements of the greening process may take considerable effort and resources to 'finetune'.

In Spain, the autonomous regional structure means that skills responses tend to have a stronger regional character. Combined with clear demands from the renewable energy and water sectors, well-developed responses have been formulated, established as part of vocational training systems or in management post-graduate programmes. Several initiatives have been instigated to secure the dual aims of diminishing the problem of water scarcity and decreasing dependency on energy imports. Growth of the water and renewable energy sectors have largely been fostered through national and regional funding for training schemes for unemployed and SME workers. Many of these schemes are publicly funded but provided by external trainers (Box 9).

In France, there are also recognised systems for updating skills responses using the VET system on the back of changes in 'mentions' or components of specified occupations that reflect new or changing competences. This updating of occupations can be seen especially in agriculture and energy. However, the process particularly for initial education and training can be drawn out over several years, reducing the responsiveness to changing needs.

Inability of the system to respond fast enough to demand for changes in construction sector qualifications, to reflect better energy efficiency considerations, is an example of the problem.

Box 9. **Training solar energy entrepreneurs through the green hiring programme in Spain**

The green hiring programme (*Emplea Verde*) aims to create 1 000 new green companies, provide skills training for 50 000 workers and improve employment and the environment by creating strategic links between the public and private sectors. With a budget of EUR 44.1 million for 2007-13, the green hiring programme subsidises projects that train and improve the environmental abilities of the self-employed and SME workers.

The Biodiversity Foundation and the Telecommunications Installations Businessmen Association (FENIE) obtained a grant through this scheme to provide skills training in solar energy technologies for electric installers in the construction sector. The programme develops a comprehensive set of skills for all phases related to start up of solar energy projects, from technical design and orientation of solar panels to administrative, managerial and other entrepreneurial skills supporting creation of new photovoltaic energy companies, and helping electric installation companies diversify into solar energy.

Experience in France also highlighted a major increase in demand for new competences and revised qualifications, and not enough teachers trained to the revised standards.

Responsiveness of continuing training provision is higher, reflected in development of new training courses with 5 000 places for occupations in the building sector to improve competences on energy efficiency.

In the UK, transition to a new system is taking place for integrating identification of skills needs with investment in, and specification of, VET provision and design of curricula and qualifications. Introduction of the new system in April 2010 will require time to establish itself; however, integration of regional development agencies charged with promoting economic development into the system should improve translation of needs into responses. Since regional development agencies are charged in part with coordinating investment programmes in low-carbon industries, there should, in theory at least, be a clear framework for responding to the skills needs arising from climate change related industrial change.

Box 10. **Furthering ecodesign in France**

Ecodesign aims at reducing the environmental impact of products throughout their life cycle and is one of the key priorities of national sustainable development strategy. It involves actors across the product cycle in design, manufacturing, marketing, retail and final consumption. A range of legislative and regulatory incentives for promoting ecodesign exist, including the French integrated product policy and the EU Directive 2005/32/EC, and companies are increasingly adopting an ecodesign approach in product design and services to anticipate market developments.

The vocational licence in ecodesign, energy and environment was created at Nancy University to address industry needs, stemming from increasing end-user expectations related to environment and sustainable development in the initial design phase of industrial products. The qualification is designed to have a broad scope in terms of competences, and applies to a wide range of job profiles, such as project managers, consultants, waste managers and public authority officers. The licence is now widely recognised by businesses and companies asking for a second vocational licence dedicated to ecodesign based on a similar structure but focused on SMEs.

4.2. Regional/local and sectoral/company responses to greening occupations

Established skills response systems are not always able to respond to new skills needs. Often the scale or pace of change is such that ad hoc initiatives are required, driven by the urgent needs of companies and industries, and requiring local and/or sectoral responses.

Regions are increasingly important actors in identifying skills needs and organising provision of training related to green jobs. This can be seen especially in Spain, France and the UK, and to a lesser extent in the other Member States. Autonomous regions in Spain have been proactive in identifying skills needs for new green occupations and greening existing occupations. In particular, Extremadura and Navarre have both been cited as

'front-runners' and are regularly approached for advice on development of training responses. Navarre's experience in organising major expansion of training provision for renewable sectors is noteworthy (Box 11).

Box 11. Skills response for renewable energy production in Navarre region

Since 1994, when there was no renewable energy production in Navarre, the region has expanded its electricity production to 65% with a target of 100% of electricity from renewable sources in the coming years. Navarre has been able to cover the jobs needed for this new occupation, easing the rapid expansion of renewable energy production in the region in the past 15 years. The regional government cooperated with the Cenifer Foundation to develop workforce training and to ensure its large-scale roll out.

Company responses are also important, especially where evolving new occupations with significant changes in the number and level of competences are required. The range of company initiatives in the renewable sector, especially in wind energy (onshore and offshore) and solar thermal energy, in response to very high technology and production expansion, indicates the need for corporate leadership supported by regional and local (and sometimes national) investment to design and deliver the required training.

The response does not deal with fundamental skill shortages and lags identified in the underlying labour market for derivatives but rather focuses on upskilling several occupations including traders and brokers in oil, gas and energy, trading desk managers, technical and financial staff in companies holding emission certificates, lawyers, accountants, auditors and senior managers who need to understand compliance with emissions regulations.

Box 12. Upskilling workers in the financial services sector for carbon trading

In response to the skills needs identified by the Financial Services Skills Council in the financial services sector the European climate exchange has provided a suite of education and training activities, including practical skills on understanding trading tools, functioning of carbon markets and applying knowledge directly to different professions in carbon trading.

4.3. Skills responses in green restructuring

Green restructuring is ad hoc with responses designed case by case, even where there are strategic policy frameworks.

Compared to systems for responding to greening occupations, experience in the countries examined is that restructuring responses are far more ad hoc, being opportunistic responses to new market demands reflected in changing skills requirements.

This means that responses are largely case specific and built around regeneration efforts of particular regions/localities or sectors/companies (Box 13). Even where there are national strategies, for example the vehicles sector, there is still reliance on regional or company level initiatives to design skills responses.

Experience to-date in the selected Member States is that the scale of green restructuring is not large, with current initiatives focused on automotive and shipbuilding sectors.

Box 13. **Reskilling workers in the power sector in Estonia**

In Estonia, changes in the energy sector have been rapid over the past 15 years creating new challenges for in-service training. New skills needs have partially occurred as a result of market changes and structural change stemming from EU and national strategies and regulations.

Eesti Energia AS (EE) is a State-owned company engaged in the production, sale and transmission of electric and thermal power. Achieving their strategic aims of reducing CO_2 emissions from energy production requires large-scale transformation of production methods and management regime. This has created a need for several new occupations, including operators and managers in wind and hydro plant, heat coproduction, fluidised bed combustion, energy auditing, as well as technology developers and managers.

In-service training is provided in these areas covering practically all groups of personnel. Courses are delivered in six thematic modules over a six- or 12-month period. The programme consists of lectures, excursions and seminars.

CHAPTER 5

Conclusions and recommendations

Existing systems to identify and provide skills, in the Member States investigated in this report, could be improved to incorporate strategic measures for developing green competences and supporting transition to a low-carbon economy. Experience from France and the newly instituted UK system will provide valuable lessons for national green skills strategies but due to the highly differentiated skills response systems across the EU each Member State will have to develop a distinctive approach. Best practices have been identified in this report which will be relevant across a range of institutional settings and governmental levels.

5.1. Conclusions

5.1.1. Environmental strategies and skills responses

Environmental strategies are well developed in most Member States and have a long history of driving better regulation, higher standards and investment. These strategies have been updated for climate change; with new policies and targets for reducing greenhouse gas emissions and climate adaptation plans.

This in turn has prompted an almost universal focus on the energy sector (especially renewables) and on energy using activities and energy efficiency, especially in buildings and transport. Germany, Spain, France and the UK introduced specific green stimulus packages as part of responses to the economic crisis. These packages reinforced climate change related priorities. They also promoted a measure of green restructuring, investing in traditional sectors capable of responding to demand for low-carbon products, with major investment in the vehicles sector.

However, while environmental and climate change strategies acknowledge the need for skills to enable producers to respond to policy drivers, there are no strategic skills responses for the environment except for the French plan for mobilising green jobs. There are, however, a range of sector or regional

schemes in most Member States designed to assist with defining particular subsets of skill needs and to develop responses, such as:

(a) the Danish industry trade committee is currently developing a range of VET labour-market training courses directly aligned to climate-friendly and energy-efficient industry;
(b) in Spain, social partners such as business associations, foundations, trade unions or private training centres, form an integral part of skills identification and training;
(c) in France, regional plans for vocational training development define medium-term objectives for VET, targeting young people and adults to ensure vocational development;
(d) in the UK, professional bodies are active in identifying skills needs and developing skills responses and trade groups are directly involved in developing qualifications for their sectors;
(e) in Germany, the Federal Association of Wind Energy, the employment agency in Husum, the Chamber of Industry and Commerce and local manufacturers and operators of wind energy facilities are working together on a centre for renewable energy.

Only in Estonia are sectoral and regional skills initiatives absent.

5.1.2. Environmental skill needs

Green restructuring generates demand for new skills as existing producers reorientate activities towards new markets and products. The most prominent examples are in the automotive sector and in shipbuilding, responding to low-carbon demands for hybrid vehicles and offshore investment in wind and tidal energy, respectively. Generally, skills needs are reflected in demand for additional competences of existing workers.

Greening occupations also raises demand for new competences. While this is especially significant in the energy sector as a result of major investment and expansion in renewables and energy management subsectors (giving rise to new occupations), the main need is to revise and upgrade the skills of existing workers. This is the case even where there have been major increases in demand, such as workers for insulating and renovating buildings to improve energy efficiency.

These new environmentally-driven competences relate to new technologies (such as solar thermal power or new vehicle power trains, waste management, desalination and oil shale processing). They also relate to new management requirements because of the changes in production methods and adoption of new business models (with emphasis on added value services).

Skills needs are also compounded by general weaknesses in the labour force and in particular the lack of interest in science and engineering, leading to a deficit in available technical skills.

5.1.3. Anticipating skills needs

All Member States have some form of system for forecasting future skills needs and occupational change as the basis for State-driven investment in new qualifications and related education and training provision. These systems employ a mix of quantitative and qualitative assessment of labour market and occupational changes, supported by contributions from employers and trades unions. Systems in Germany and France are especially well developed, reflecting, at least in part, particular engagement of social partners. These systems have previously reflected past changes in environmentally-driven competences, leading to new qualifications and courses and changes to established curricula. To the extent that the pace of change allows, these systems might continue to reflect and animate the need for new skills responses.

However, existing systems for forecasting occupational change and framing education and training responses are not without difficulties. The UK, for example, decided to establish a new system in April 2010. This will have particular focus on establishing skills demands as a result of investment in low-carbon industries. In France, the new mobilisation plan seeks to increase already well-developed systems by introducing a new observatory for green skills with related infrastructure.

To the extent that existing systems need to be revised or expanded, the role of social partners is likely to be important in establishing the necessary analysis and subsequent qualification and training reform. An illustration is the important role of trade committees and councils in Denmark in defining changes in competence requirements and promoting changes in the vocational and education training system.

5.1.4. Developing skills responses

Existing systems allow gradual adjustment to qualifications and curricula in response to changing demands, including those driven by investment in low-carbon goods and services. Some case studies in the selected Member States reflect this process in operation.

However, where the scale or pace of change in demand for new environmentally-driven skills outstrips the capacity of the existing system, then more immediate and specific initiatives are required. This is a common form of response in the Member States examined. These initiatives tend to be

driven by specific company or sector demands and encourage local or regionally supported investment in education and training provision.

For green restructuring, where businesses have responded to new market opportunities by refocusing or diversifying their activities, and where investment requires new competences, then skills responses are highly company specific.

5.2. Recommendations

5.2.1. Strategic responses

In France and potentially in the UK continuing greening of occupations has been addressed. However, the absence of such strategy in other Member States may not be a major problem given emphasis on managing the demand for green competencies within the general system for anticipating and responding to new skill needs. However, absence of such a strategy may not be a major problem given the emphasis on managing demand for green competences in the general system for anticipating and responding to new skills needs.

This partly reflects general integration of these competences across industry and the workforce (as part of broader requirements for improved resource efficiency) which would be most efficiently made in the existing system, and would not be met by particular sectoral responses; where the pace of change or scale of demand is such, this tends to be well defined and discrete, enabling direct targeted responses.

There have been concerns about the lack of preparedness of policy-makers to the demand for new skills as part of greening the economy. This stems from problems where demand for skills has grown strongly and adequate education and training responses have been lacking. However, this is to some extent being addressed by specific sectoral initiatives, which in any case provide a quicker response than relying on national or regional systems for meeting new skills demand.

Further mapping of demand for and nature of environmentally-driven competences is a common requirement across Member States to minimise the risks of policy failure and could be linked to green strategies.

5.2.2. Anticipating skills needs

Weaknesses of formal national systems for forecasting and adjusting to occupational change in terms of accuracy and timing are acknowledged across Member States. This general weakness is however thrown into particular light when there are major and rapid changes in competences and skills needs.

Previously, the moderate pace and scale of emerging environmentally-driven skills needs enabled existing systems to map and recognise new competences and promote changes to qualifications and curricula. Recent evidence has, however, shown that transition to a low-carbon economy is triggering a need for new skills at a pace and scale that highlight the weaknesses in current systems, and especially the time to reformulate qualifications and course content.

There is a balance to be struck between improving present systems for anticipating skills needs and developing specific responses for climate change related pressures on skills. Where resource efficiency improvement is an economy-wide requirement, then improvements in current systems are needed. Where there are clear priority sectors (energy, transport, construction) new initiatives are likely to be required.

5.2.3. Supporting skills responses

The need for improvements in the capacity of existing education, training and qualification systems to respond to environmentally-driven skills needs is broadly acknowledged in all Member States. Particular focus for improvement tended to be on IVET, rather than continuing adult education or higher education. Case studies in national reports provide good evidence of progress being made to secure these improvements and could serve as good examples.

A particular feature in Germany, France and the UK, lack of interest in science and engineering and shortage of technical skills, has a particular impact in climate change driven skills because of strong technological focus. National responses to this shortage will have particular benefits in climate change polices.

The need for these improvements is partly reflected in strong regional- or sectoral-led initiatives that have had to be developed in the interim. These initiatives also provide potential examples for other sectors and regions concerned about lack of progress in responding to skill needs; recognising the strong institutional frameworks in which they were developed. The general importance of joint public-private partnerships in these initiatives is, however, easily transferable.

The role of lifelong learning in contributing to a broader skills response is acknowledged, especially in Denmark and Germany, to avoid overreliance on workplace-based training, and to acknowledge the need to improve general environmental awareness. Skills shortages might also be limited by exploring how environmental education and training measures and approaches (including pilot projects) can be used to reduce the level of students dropping out of school early and to improve the career prospects of youths from immigrant backgrounds.

List of abbreviations

EU	European Union
CVET	continuing vocational education and training
DE	Germany
DK	Denmark
EE	Estonia
FR	France
IVET	initial vocational education and training
LCEA	low carbon economic area
STEM	science, technology, engineering and mathematics
TVET	technical and vocational education and training
UK	United Kingdom
VET	vocational education and training

References

Bird, J.; Lawton, K. (2009). *The future's green: jobs and the UK low-carbon transition.* London: ippr – Institute for Public Policy Research.

BIS (2010). *Meeting the low carbon skills challenge: a consultation on equipping people with the skills to take advantage of opportunities in the low carbon and resource efficient economy.* London: Department for Business Innovation and Skills (URN 10/849).

Brøndum & Fliess (2009). *Erhvervs- og efteruddannelser i et cleantechperspektiv*. Copenhagen: Danish Ministry of Education.

BVET (2009). *Skills for sustainability - Second edition*. New South Wales Board of Vocational Education and Training – New South Wales Department of Education and Training.

Estonian strategy for competitiveness 2009-2011: *overview and updates to the Estonian action plan for growth and jobs 2008-2011*. Tallinn: The State Chancellery of the Republic of Estonia.

EurActive.com (2010). *Europe 2020: green growth and jobs?* 24 February 2010. Available from Internet: http://www.euractiv.com/en/priorities/europe-2020-green-growth-and-jobs-linksdossier-280116 [cited 31.5.2010].

European Commission (2010). *Communication from the Commission: Europe 2020: a European strategy for smart, sustainable and inclusive growth.* Luxembourg: Publications Office (COM(2010 2020 final).

ILO (2010). *Skills for green jobs: a global view.* Geneva: ILO.

Innovas (2009). *Low carbon and environmental goods and services: an industry analysis*. For UK Department for Business, Enterprise and Regulatory Reform. Winsford: John Sharp, Innovas Solutions Ltd.

Laboratory Demographic Change et al. (2009). *Jointly tackling demographic change in Europe.* Berlin: Econsense.

Le Grenelle Environnement (2009). *Rapport final du comité de filière énergies renouvelables*. Paris: Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer.

Ministère de l'Éducation Nationale (forthcoming). *Développement durable, gestion de l'énergie: évolutions et conséquences sur l'offre de diplômes.*

Pollin, R.; et al. (2009). *The economic benefits of investing in clean energy: how the economic stimulus program and new legislation can boost US economic growth and employment.* Amherst: PERI – Political Economy Research Institute, University of Massachusetts.

The UK low carbon transition plan: national strategy for climate and energy. (2009). Norwich: TSO – the Stationery Office.

UNEP et al. (2008). *Green jobs: towards decent work in a sustainable, low-carbon world.* Nairobi: UNEP.

ANNEX 1

Summary of key findings in Denmark

Environmental challenges, priorities and skills response strategies

Environmental challenges and priorities

Current focus on climate change and the impact on restructuring and subsequent changes in occupational profiles is, to some extent, a continuation of long-term policy priorities. Most sectors have experienced greening of existing occupations over the past 30 years, often driven by regulations and based on existing technologies. Recent policies to move more rapidly towards a low-carbon economy are introducing further refinements to occupations, and emergence of novel 'cleantech' technologies – a much broader notion than a green focus – is leading to technology convergence, often complemented by new business models and partnerships and driven by the market. Overall, this regreening of the economy (which refers to the fact that the green focus in energy policy is not a new phenomenon) is likely to entail greening of existing occupations, emergence of new green occupations and green restructuring of certain sectors.

The main priorities concern energy efficiency, renewable energy and R&D support into clean technologies (cleantech).

The response strategy – General environment strategy

The government has a strategy focus on green growth, namely efforts to mitigate the effects of climate change go hand in hand with economic growth and job creation in green growth industries reflected in the government's climate and energy policy: the energy agreement (2008-11); and the long-term prioritised research agenda for public research investment 'research 2015'.

Measures to increase the capacity of renewable energy focus on wind energy, biomass and biogas. Priorities and measures for energy reductions and energy efficiency focus on transport, construction and retrofitting/ renovating existing buildings, energy technology and cleantech solutions. Specific measures on reducing greenhouse gas emissions have also been set out for a range of industry sectors as well as for transport (such as

promoting greener vehicles) and building and construction sectors (such as a 2009 strategy focused on reduction of energy consumption in buildings).

Green employment represented a key priority in the late 1990s, reflected by a new law in 1997 on a pool for green employment which aimed to create new and enduring green jobs.

Green response to the current economic crisis

Denmark did not use its national growth stimulus packages as a means to ease green restructuring of the economy, so stimulus initiatives do not entail very wide green measures. However, the third stimulus package did target the construction sector with priority grants for renovation/retrofitting and improving energy efficiency in homes.

To stimulate alignment of efforts to mitigate the effects of climate change with growth and innovation policies, the government developed a business climate strategy (October 2009). Framework conditions for industry enable proactive market behaviour to exploit market opportunities as advanced global suppliers or first movers in emerging markets.

The skills development strategy in response to greening

To date, no overall skills response strategy has been developed, as part of a coherent policy response to climate change and environmental degradation. Individual strategies occasionally state that greening the economy and/or priorities on climate change may or will impact future skills requirements.

The long-term green focus in policy is already reflected in the educational sector. Various IVET, CVET and tertiary programmes have been adjusted over the years to match demand for skills and knowledge in green technologies and aligned to ongoing restructuring. For example, there is already a green occupational component in the outcome and competence-based goals for specific VET qualification in IVET as well as in CVET. Examples of such a green occupational component include: energy generation and reuse of energy, waste management, construction, facility management, transportation and agriculture.

New qualifications have been developed to comply with increased focus on energy reduction and energy efficiency and to exploit technologies that can be used to optimise and monitor energy consumption. A characteristic feature of these qualifications is that they are usually driven by joint demand and supply side initiatives. Examples include cooling technician and building service technician occupations.

The strategy ‘Denmark out of the crisis’, developed by the Danish growth council committee and endorsed by the current government, calls for specific

measures in education and training and continuing training to stimulate job creation by exploiting green technologies further. It also recognises that insufficient professional awareness of existing opportunities for energy efficient solutions forms a barrier to increased demand. To improve this, it recommends a green component be integrated into different VET programmes and further education is needed for workforces in different trades, advisers in the building and construction sector, and employees in maritime sectors.

Emerging skill requirements

Green structural change

Restructuring is a gradual and ongoing phenomenon that in industrial terms goes back at least 30 years. Jobs in manufacturing and process industries have declined (such as metal, shipyards and food processing industries) whereas there has been an increase in service jobs, and in service intensity in production.

The steel cluster in southern Jutland is an example of a successful and gradual restructuring process that led to the steel cluster becoming a global player in the process industry value chain. Low-value routine work has been outsourced or automated, leaving high-value work in Denmark.

The closure of the Lindoe shipyard is a particularly interesting case on green structural change, as stakeholders have turned to offshore renewable energy as a means of creating new jobs for the Lindoe workforce (case study).

Closure of MAN Diesel's production of engines in the small town of Frederikshavn (23 000 people) had a large impact on the machinery sector and local area. The 540 persons laid off so far include mostly skilled workers (72%) and low-qualified workers (27%). Restructuring of the site is primarily the result of the effects of the financial crisis. MAN Diesel specialises in marine engines, so the company was badly affected by decreasing orders and cancellations of orders by the shipbuilding industry (case study).

New skills

Emerging industries are cleantech, energy efficiency services and energy generation (new occupations include wind energy operator (case study) and manager in renewable energy) and emerging occupations have been identified in cleantech companies.

However, a sectoral approach to analyse greening of occupations is likely to be insufficient because it will not capture job creation opportunities from the

occupational convergence between analytical skills service elements and technological skills elements.

Business models are also changing. For example, Grundfos Pumps have become increasingly service-oriented in its fundamental business and value-added proposition to the extent that it may not even be selling pumps to some clients in the near future, offering services instead. This trend to a shift in service offers as technology production and supply is increasingly offshored is expected to increase.

To exploit fully renewable energy sources with different properties, there is an emerging need for technicians who possess interdisciplinary knowledge about different sources and who are able to manage and provide consultancy services in renewable energy implementation projects (case study: manager in renewable energy).

Skills gaps in the wind turbine sector comprise knowledge and competences related to production, assembly and maintenance of wind turbines. Workers must be capable of functioning in a global market where language and broad knowledge around wind turbine technology is essential. Many wind turbine companies have traditionally been forced to train their own employees to ensure they fit the job profile (case study: wind turbine operator).

Greening existing occupations

Some emerging occupations arising from cleantech and the energy sector are 'hybrid' occupations, for example agricultural meteorologists, solar installers, bio-energy technicians, energy assessors, green accountants and inspectors of energy efficiency.

The strategy for reducing energy consumption in buildings focuses on building renovation and installation of energy efficient solutions for new and existing buildings. The government believes that this drive will require new green skills and knowledge for all people involved in the construction sector – from engineers and architects to electricians and construction workers, namely at different qualification levels. Energy efficient renovation could create 5 000 new jobs (case study: greening existing occupations in construction).

Marine technicians are responsible for implementing and handling machines and technologies to reduce emissions. Tightening regulations and increased efficiency efforts are driving investment in new technologies. The shipping industry has taken various initiatives aimed at reducing CO_2. Core competences of marine technicians are to be modified to take account of these developments (case study: marine technician).

Approaches to anticipating skills needs

Green restructuring

No major coherent initiatives have been taken as yet to analyse labour-market consequences and identify the (re)training needs in the wake of greening the economy and green restructuring of industries.

At Lindoe shipyard, local municipal authorities have formal responsibility for identifying skills needs in relation to Lindoe's employees as part of public employment services.

Municipal authorities conducted a series of counselling sessions and job search courses onsite at MAN Diesel. These contributed to skills needs identification. A range of activities were also conducted relating to the maritime and energy sectors. The agenda focused on how to switch from industrial production to services in the sector and how such a switch would likely change demand for skills.

A shift towards service-oriented professions is evident in the MAN case study, where maritime and energy efficiency sectors may become the lifeline for redundant workers.

New skills

According to an industry analysis, there appears to be no justification for developing completely new training programmes targeting cleantech, existing qualifications need modification to match emerging skills needs.

In the renewables sector, skills analysis was organised in a public-private partnership project led by Siemens, IWAL (International Wind Power Academy Lolland), DTU (Technical University of Denmark) and the vocational academy CELF backed financially by the Ministry of Education and the Region of Zealand. Of all responding companies, 95% experienced an increasing need and skills gaps for project managers with competences across different renewable energy sources.

In the wind turbine sector, skills gaps were identified by a project led by representatives from the Federation of Danish Industry and the unskilled workers employees' organisation 3F. The specifics of the requested training programme were identified by surveying wind turbine companies, in particular Vestas and Siemens, who dominate the industry and represent most employees in the industry.

Greening existing occupations

The strategy for reducing energy consumption in buildings states that existing educational programmes should be revised in accordance with the overall strategy to ensure that all future employees have solid basic skills on energy efficient construction. In October 2009, an interministerial committee established a working group with members from relevant business organisations, education institutions and public authorities, to assess thoroughly the skills requirements/needs for different occupations. The outcome of the process will be an action plan that describes existing supply and skills initiatives for the sector (value chain) and presents new initiatives and recommendations.

Faced with the apparent skills gap in the marine technician area, a network of educational institutions and local companies in the Frederikshavn area entered into strategic dialogue on skills needs and suggestions to ensure adequate skills supply as well as ideas and guidelines for the educational response. Identification of the skills needs was thus mainly supply-driven locally, but in cooperation with demand-side representatives.

Responses to skill needs

Green restructuring

Lindoe Offshore Renewable Centre (LORC) was established in January 2010 as a knowledge, innovation and education centre for green technologies and jobs. The plan includes an application for a subsidy from the European Globalisation Adjustment Fund but this is not yet guaranteed so it is too early to say what the outcome will be. More importantly, the actual skills response about offshore renewable energy is still under planning. A similar centre exists in southern Denmark which could create competitive tensions for jobs.

The Frederikshavn municipality prioritised two sectors with potential to create new employment opportunities: maritime and energy efficiency sectors. The municipality hopes that implementation of new environmental regulations will turn into business opportunities. Municipal authorities have prepared new training modules in cooperation with social partners covering both priority sectors although they have yet to be implemented, primarily because the financing package of EUR 8 million is not yet in place. The municipality is awaiting a grant from the European Globalisation Adjustment Fund.

New skills

Adapting curricula for gradual greening of existing occupations started in the 1980s and 1990s. Labour-market programmes (adult continuing training programmes for unskilled and skilled workers) played a major structural and restructuring role as they are very responsive and adaptive mechanisms to changes in the labour market (a key factor is the short duration of programmes, which enable people to move quickly into new job functions in the labour market).

Studies have found that existing VET qualifications represent a solid foundation for providing competences for emerging occupations in cleantech.

However, revisions to a range of outcome-based competence goals in several upper secondary VET programmes have been suggested, including for auto mechanics; technical insulation; electro technician; supply technician; cooling technician; plastics technician; metal technician; process technician; wind technician; industry technician; industry operator; industry electrician; electrician; and automation technician.

The manager in the renewable energy case study provides good feedback mechanisms between the education/training system and business. The identified occupational profile builds on skills and knowledge elements in existing VET qualifications. However, assessment showed the need for a programme that would supplement existing qualifications. A new local/regional tailored tertiary qualification was developed in cooperation with industry and the public sector. The intention is to make it applicable to national needs.

A proposal was sent for preapproval to the Confederation of Danish Industry and to public authorities for a formal accreditation process before approval by the Ministry of Education. Training is expected to commence in 2011.

In response to the wind-turbine skills need, a new upper secondary vocational programme leading to a formal VET qualification as a skilled wind turbine operator has been developed, in cooperation with relevant schools and vocational colleges. The programme is now offered by four vocational colleges. The first students completing the programme are set to enter the job market in 2011-12. Whether the response adequately reflects the need of the industry will depend on the willingness and ability of companies to offer apprenticeships to new students and later employ these young people in job profiles that take full advantage of what they have learned. Currently, companies are not hiring new employees due to the recession and have proved reluctant to take on new apprentices.

Greening existing occupations

Technological developments, for example in non-fossil fuels, cleantech, and energy optimisation in process industry and manufacturing, will probably lead to further revision of VET qualifications and development of new qualifications.

Various skills initiatives have been taken at various levels to adjust to greening occupations in the construction sector, namely changes of content and requirements in occupations as responses to innovation, new solutions and approaches, and regulation related to energy efficiency. Current skills gaps analysis being undertaken is likely to lead to new interventions. Overall, this response represents the only example of a coherent skills response that forms part of a wider strategy on greening the economy and/or priorities of climate change.

In response to changing requirements in the occupational field of marine technicians, an initiative was taken to establish a new educational programme in energy and environmental skills for marine technicians (as well as a completely new training school) at the vocational college Martec in northern Jutland. However, it is still too early to assess the effectiveness of the skills response. So far no students have yet completed the programme. The first marine technicians specialised in energy and environmental issues are set to enter the job market within the next two or three years.

Conclusions

Main greening shifts in economies and labour markets

At least three green shifts are observable. The first concerns greening existing occupations. Rather than a shift per se, it represents continuation of a long-term development. The second shift relates to creation of entirely new occupational profiles not yet covered by education supply (such as cleantech). The third concerns innovation whereby the technological competence base is being used to create new business services, such as that highlighted by Grundfos. Overall, the greatest job potential is likely to be found in the energy sector and in cross-sectoral themes such as energy efficiency.

Despite these positive developments, there are concerns that workers laid off in the latest recession, particularly the lowly qualified, could end up in structural unemployment. Unions argue that the government needs to be more proactive to ensure that Denmark's potential first-mover advantage in alternative energy – particularly wind energy – is used systemically to stimulate job creation through coordinated employment, skills upgrading, and innovation policies. For

example, there are no indications that the Lindoe innovation initiative (case study) will be accompanied by structural measures to ensure that the right skills are available to turn innovation advance into sustainable job creation.

Diversification of existing companies is also critical – the Danish Metalworkers' Union (*Dansk Metal*) and the Union for Unskilled Workers (3F) have called for actions which can stimulate job creation in cleantech and other 'green areas' with growth opportunities – Dansk Metal developed specific recommendations which according to their estimates would create up to 50 000 new jobs in the energy sector.

Skills implications and development – New and changing skills needs by sector/occupation

The educational sector has a strong basis for meeting renewed global and national focus on energy efficiency and renewable energy in existing occupations. However, there is debate on whether the right education programmes and CVET measures are in place to harvest fully the potential from, for example, cleantech and disruptive and innovative changes in business models now occurring and do not follow the traditional sector logic (illustrated by the case study of pump manufacturer Grundfos moving into more service-oriented sales).

Scope and capacity of Member States/regional skills forecasting and VET systems to anticipate and respond

Very little information (statistics, analyses, etc.) currently exists on the consequences greening the economy have on occupational structures and skills requirements. Lack of data is confirmed through interviews with Director Generals for IVET and TVET.

Labour-market organisations called for actions to stimulate job creation in the energy sector, the major growth area in Denmark.

Good practice lessons in relation to identifying, anticipating, and responding to skills needs

Trade committees and respective councils monitor occupational changes and may call for development or adaptation of IVET qualifications and CVET certificates. Trade committees undertake studies on skills anticipation for a 'family of occupations' within IVET and CVET. They also carry out cross-sectoral studies to analyse the impact of technological convergence (for example cleantech) or on changes in particular work functions that may also be cross-occupational.

Currently, 13 CVET competence centres connect providers of CVET and basic adult education, and are responsible for anticipating and monitoring skills changes locally. Linked to this development, the Danish Technological Institute is currently preparing a guidebook of methods for anticipating skills needs.

The 'flexicurity' model, combined with high CVET participation rates, explains the success of the Danish economy prior to the crisis, and that processes of restructuring have been ongoing and supplemented by a high absorptive capacity in labour markets.

The Ministry of Education took various initiatives to integrate climate and energy topics in the existing curriculum, from compulsory school to higher education. The aim is to ensure that the climate agenda is not only covered in a focused and coherent manner but that it also stimulates climate-conscious behaviour and encourages more young people to choose a science education after compulsory education.

Recommendations

Since sectoral approaches to skills anticipation may not fully capture the industry dynamics, which may be driven by technological convergence, disruptive changes in business models or repositioning of value chains, there is a need for cooperation at European level to analyse further which methods are best suited to capture these skills changes.

ANNEX 2

Summary of key findings in Germany

Environmental challenges, priorities and skills response strategies

Environmental challenges

Broadening earlier environmental protection measures, German priorities on climate protection have come to the fore over the past 10 years, with a key goal of reducing greenhouse gas emissions. The challenge of achieving a huge decline in greenhouse gas emissions implies focus on energy efficiency and cleaner power production than previous policies. It also means that industrial restructuring will be necessary and environmental considerations increasingly influence both technological innovations and people's lifestyles. Investments will support employment growth and lead to 500 000 additional jobs in environmental protection by 2020 and 800 000 by 2030.

However, a key challenge is that Germany suffers from demographic changes which negatively affect the number of young people enrolling in VET.

The response strategy

For decades, environmental protection has been at the centre of public policy development. Combining legislation and incremental awareness influenced restructuring of economic sectors and occupational competences. From the outset, policies on environmental protection have not only been perceived as a step towards better living conditions, but also as a mechanism to develop market opportunities for domestic suppliers of environmental technologies and services. The roll out of environmental policies has therefore been used to create new jobs and support economic growth. The environmental technology and services sector is now one of Germany's major economic sectors, employing 1.8 million people in 2006 (4.5% of the labour force).

Green response to the current economic crisis

The federal government introduced two economic stimulus packages, in November 2008 and January 2009, together worth around EUR 100 billion. The proportion of the stimuli packages on green investments was around 13%

– one of the highest in the EU, even though focus was not primarily on green issues. Both recovery packages focused on promoting energy efficiency. A reconstruction loan offering another EUR 2.5 billion credit for energy-efficient building renovations and energy efficiency was also promoted by a higher tax deduction for craft services for maintaining and modernising buildings. Both measures should safeguard, and perhaps stimulate, new job creation.

Skills development strategy in response to greening

Environmental technology firms are now well established and often market leaders. Continuous investment in R&D of new products and processes helps Germany to maintain its competitive advantage as well as an appropriate supply of qualified workers (particularly those with technical focus). Indeed, beside demand for their products, qualified personnel are the single most important factor in determining a firm's location.

Greening the economy has thus been associated with significant impacts on occupational profiles and formal vocational training. Retraining across the economy in response to green restructuring is mainly focused on the education and training system, where technical qualification training courses are offered and new study courses and further training with environmentally-relevant subjects have been developed. The range of continuing vocational training courses related to environmental protection is now substantial. This is mostly due to the continuing vocational training regulation (*Fortbildungsordnung*) being renewed, which makes it a priority to integrate environmental protection issues.

In contrast, given their limited scale, initiatives by firms are seen as marginal. However, training centres for in-company training or integration of green modules supplementary to formal training programmes are being developed. Three skills responses in the case studies were initiated by companies (Q-Cells, Siemens Wind Power and BMW).

Skill needs in the environmental sector have mainly been covered by creating formal training courses within the system of dual training and university training. This follows a long tradition of German industries organising dual training rather than company-based continuing training.

Greening existing occupations has affected a very wide range of occupations. Clearly, however, the extent to which environmental issues are integrated differs widely according to job type.

Low graduation rates in recent years in mathematics, engineering and natural sciences have created a shortage of highly-qualified engineers and technicians of around 165 000 in 2006. According to firms, skills shortages

were already limiting growth of the environmental sector. However, the economic downturn has reduced labour shortages and environmental industries are now more easily able to fill recent job vacancies. The largest problem for the environmental sector remains availability of engineers, since graduation rates have also been low in recent years and near-term prospects have not changed. Moreover, fewer school graduates are applying for apprenticeships. While such shortages can hardly be avoided in boom periods, education and training policies have to follow a medium or long-term path. It will therefore be important to find the right balance between short-term adjustments and long-term accumulation of human capital.

Emerging skill requirements

Green structural change

It is difficult to find any incidence of occupations or occupational profiles completely disappearing as a result of 'greening' the economy. This is mainly a result of the education system, which trains apprentices and students for flexible employment in the labour market.

New skills

Across the economy, all occupations have integrated environmental protection to a certain extent in recent years. Environmental protection always represents an additional qualification integrated into existing training.

Pursuing a continuing vocational training course provides students with the opportunity to build up gradually their training competences and receive additional specialist certificates or higher degrees, which will enable them to develop in their chosen vocation. In this way, for example, a sewage foreman can train and build on completed initial vocational training.

Solar manufacturer Q-Cells faced a lack of suitable job applications for open vacancies in recent years. Additionally, dual training courses did not exist either for renewable energy or for solar techniques and there was no solar industry drive to establish a national training programme.

Initial vocational training on renewable energy does not yet exist and the number of students on corresponding university studies is still marginal. Technicians employed by Siemens Wind Power are usually electronic technicians or mechanic graduates. However, the high safety and technical standards of Siemens' wind turbines requires constant training on safety and technical developments.

New or modernised occupations at the level of dual apprenticeship programmes arise due to revisions in training regulations of an existing occupation or integration of a new training regulation. Between 1996 and 2009, 82 occupations were created and 219 occupations modernised.

In terms of greening, four new dual apprenticeship trainings were established from the existing provider and disposer training in 2002, namely:

(a) recycling and waste management technician (*Fachkraft für Kreislauf- und Abfallwirtschaft*; Case study 6);
(b) water supply engineering technician (*Fachkraft für Wasserversorgungstechnik*);
(c) sewage engineering technician (*Fachkraft für Abwassertechnik*);
(d) pipe, sewer and industrial service technician (*Fachkraft für Rohr-, Kanal- und Industrieservice*).

Training rates for the renewable energy sector – the ratio between apprentices and total employees within a company – lies at around 5 %, compared to an average of 6.5 % across all sectors. Renewable energy firms more often than not recruit qualified workers rather than offer dual training courses. This implies a pull from other sectors.

At the dual apprenticeship training level, environmental protection has been integrated in all initial vocational training regulations and, therefore, greening of the whole dual vocational training can be observed. A good example of greening an existing occupation as a result of technological change is solar installation technicians. There is a need for skilled craftsmen to install these systems, especially in private households. The target group are craftsmen, plant mechanics for sanitary, heating and air conditioning and electronics, who learn the required competences through continued vocational training. In this way, craftsmen who previously only worked on fossil-fuel based systems are retraining for low-carbon systems (see below).

Greening existing occupations

As the waste management sector became more complex and technically sophisticated, a trade in special areas was needed to help prevent facility breakdowns and to ensure air pollution emission regulations were being met. While the former vocational training course provided general training, increased complexity and technological changes brought about by change in waste management law, required greater specialisation as well as intensive training in customer-orientation and service-orientation to meet the increasingly professional nature of the industry.

To illustrate skills adaptation as a consequence of new legislation (the EU energy performance in building directive) a case study on energy consultants was included. According to legislation, landlords and others who sell buildings and homes require an energy certificate that defines the energy needs of the building. Only a designated group of specialists who have completed continuing training and become an energy consultant may issue an energy performance certificate.

For occupations outside the environmental sector, integration focuses on basic knowledge in waste recycling and energy conservation. The companies nevertheless are free to extent the environmental knowledge of their apprentices according to their needs.

Approaches to anticipating skills needs

Green restructuring

Low-carbon hybrid propulsion is a growing trend in the car industry. Car manufacturer BMW, for example, recently included two hybrid cars in its product portfolio, the X6 and its 7 series. Cars are equipped with both a combustion engine and additional electric motors and energy storage devices to reduce both fuel consumption and greenhouse gas emissions. Using up to 400 volts in hybrid systems creates obvious health and safety issues, which require technicians to have good overall technical knowledge of hybrid technologies. This means motor vehicle mechatronics technicians need to develop new skills. Indeed, due to legislation, only trained electricians or mechatronics technicians who have acquired the relevant knowledge may carry out work on hybrid cars.

Training regulations for chemical technicians and four other trades in the chemical industry were revised in 2002, as the concept of responsible care was introduced. This means that apprentices continuously receive training in work safety, health and environmental protection over the whole training period to increase their awareness of these subjects. Integrating this concept into dual apprenticeship training in this sector guarantees its implementation and its internalisation at all stages of work.

New skills

There is a perceived business need and actual gap in the training market for business environment courses. The university believes firms that do not fully integrate environmental protection into their operations (particularly in light of energy and carbon cost considerations) will suffer competitive and cost

disadvantages.

Solar manufacturers such as Q-Cells have experienced a shortage of solar technicians with the range of requisite skills to guarantee production levels and growth targets for the solar industry.

As wind turbine technologies have become more specific and complex, special training for adapting qualifications were identified by the industry.

Greening existing occupations

New and stricter waste disposal laws implemented in the 1990s coupled with more technically sophisticated waste technologies have required significant new technical and environmental skills training in the waste sector.

Revision to the 2003 training regulation for central-heating and ventilation required more focus on service-oriented training as well as use of sustainable energy inputs.

The Energy Savings Act 2007 requires specialists to be trained who can evaluate energy use and greenhouse gas emissions from buildings.

Responses to skill needs

Green restructuring

BMW decided in 2009 to meet the hybrid vehicle mechatronics skills gap by integrating this training as a new training module directly into its dual apprenticeship. This means all motor vehicle mechatronics technicians who complete their training at BMW will be qualified to work with all hybrid cars. This also provides flexible training to enable technicians to change firms. The module has now been integrated into the dual apprenticeship programme for apprentices at other BMW production plants in Regensburg and Dingolfing. From 2010, all BMW production plants in Germany will include the new training module. Around 100 apprentices per year receive this training (Case study 1).

As a result of the responsible care programme, the chemical industry has adjusted all its working processes to be intrinsically cleaner and more energy efficient (Case study 2).

New skills

In terms of new occupations, two new university degree courses are outlined in case studies:

(a) to meet the technical requirements of solar cell production, a course on solar techniques was recently established at the University of Applied

Sciences in Köthen (Saxony-Anhalt) in cooperation with solar cell manufacturers, but primarily by solar manufacturing giant Q-Cells (Case study 3) teaching a wide range of required disciplines and integrated specialist technical and production knowledge of photovoltaic from Q-Cells' solar cell production lines;

(b) green business management (Case study 4) was established at the private University of Applied Sciences BiTS (Business and Information Technology School) in Iserlohn (North Rhine-Westphalia).

Another study outlines the new Siemens wind power training centre, designed to improve training of its own personnel and customers to improve health, safety, technical performance and perceived high quality in the marketplace of the overall Siemens wind power brand. The course contents were designed to have precise objectives to promote successful execution of service activities (Case study 5).

Further greening of occupations might occur in the following fields:

(a) agricultural occupations that commit to organic farming;
(b) traffic occupations that support environmentally-friendly mobility;
(c) energy occupations that focus on renewable energy and energy conservation;
(d) manufacturing occupations that produce products from recycled materials;
(e) chemical occupations that use biodegradable substances;
(f) motor vehicle occupations that invent alternative propulsion technologies.

Greening existing occupations

In terms of greening existing occupations, two case studies on initial vocational training are presented:

(a) plant mechanic for sanitary, heating and air conditioning (Case study 7) – training has become more service-oriented as customer relations became more important in recent years. Knowledge of use of sustainable energy input was part of the revision;
(b) waste management and recycling technician – established to meet the requirements of an increasing technical need in the waste sector (Case study 6). However, companies still complain about the low number of apprentices on the course as demand for apprentices is sometimes higher than supply.

The third case study in this section is on energy consultants, with the main focus on energy performance certificates in buildings driven by new legislation and thus defining a very clear skills and training requirement for consultants (Case study 8).

Conclusions

Main 'greening' shifts in economies and labour markets – General nature of change in Member States (drivers and impacts) – Implications for structural change and sunset industries

A key finding is that rather than creating new, specific green occupations, many occupations and training curricula have been adjusted and refined to take account of the skills needs of increasingly green aspects of mainstream industry and business, as well as eco-industries. The skills response has followed an integrated approach. Focus on an integrative approach rather than on a specialised occupation guarantees flexible use of skilled workers and better job opportunities.

To improve green skills provision, further integration for non-environmental occupations needs to be pursued and there needs to be a higher occupational specialisation for the environmental sector.

Overall, while the aim of this study relied on a mainly demand-driven adaptation of training, as discussed, this does not really apply to the German VET system.

Skills implications and development – New and changing skills needs by sector/occupation

An important finding of the study is that most workers' occupations have been modified to take account of environmental considerations, in line with the overall German objective of greening the economy. While new occupations have emerged, their relevance is small compared to the great number of existing occupations which have been modified.

There are sector image issues especially in the areas of waste, sewage and sanitary, heat and air conditioning where apprentice numbers are low, leading to problems recruiting apprentices in craft businesses.

Pace of change in defining new and emerging skills needs

Modernisation of dual apprenticeship training or establishment of new apprenticeship training programmes is decided in consensus and thus takes time, which decelerates the pace of change. The continuing vocational training system on the other hand can, and does react flexibly to changes in demand for skill needs and was first to adapt to new skills needs.

Universities recently established new courses in response to new demands. The changes, however, posed fewer problems than in the dual vocation training system where adaptations took longer.

Scope and capacity of Member States/regional skills forecasting and VET systems to anticipate and respond

Cooperation between the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU), and the agencies responsible for education and training, particularly the Federal Ministry of Education and Research (BMBF) and the Federal Institute of Vocational Education and Training (BIBB) could be improved. The tripartite system is regulated at *Länder* level which decelerates cooperation, as 16 *Länder* governments have to be included in the process. The BMBF and BIBB are mainly responsible for the education and training system. The BMU can only offer learning and teaching materials, which include a lot of expert knowledge. Use of these materials should be guaranteed with better cooperation.

Good practice lessons in relation to identifying, anticipating, and responding to skills needs

According to the Vocational Training Act a specific skill need has to be identified in the economy for modernisation or establishment of a new training regulation.

In 2006, the Federal Environment Ministry started an educational initiative entitled 'Environment creates perspectives' in association with firms from environmental technologies/renewable energy sectors. As a result, 6 000 additional apprenticeships were created in 2009. The initiative aims to identify the apprenticeship trades, skills and competences required by the environmental sector.

BMW received the Innovation prize 2009 from the Federal Institute of Vocational Education and Training (BIBB) for the exemplary function of its hybrid training module, its close connection to the dual apprenticeship programme and its labour-market relevance.

Recommendations

For Member States skills forecasting approaches

It will be important to measure green skills and competences better, as well as being able to quantify green jobs more systematically to help shape training provision, particularly for higher-skilled jobs. Similarly, the job-creation effects of environmental expenditure could be refined further. In particular, the net effects of green investments are not adequately measured. There is some belief that, despite the overall supply side performing quite well, educational

policy underestimated the environmental sector's high growth and hence skills and labour needs, which has led to some skills shortages.

No skill identification or forecasting system exists which defines the need for green skills or green jobs. Further research is needed to ascertain demand for additional jobs or other training forms. For example, it may be useful to introduce two-year apprenticeship training programmes or apprenticeships in renewable energy. Evaluation of the adequacy, however, has not been conducted yet.

For Member States/regional VET systems

A publicly-financed lifelong learning system is needed to provide the skills demanded by labour markets rather than workplaces. Germany has long since been reluctant to develop such a lifelong learning system; nevertheless declining skills supply, caused by demographic changes, requires much greater emphasis on this area.

Skills shortages might be prevented by exploring how environmental education and training measures and approaches (including pilot projects) can be used to reduce both the level of students dropping out of school early and improve the career prospects of youth from immigrant backgrounds.

For employers

A higher level of occupational specialisation will be needed to improve the competitiveness of environmental goods and service suppliers. Supply of professionals will be pivotal to success particularly if future growth forecasts in the sector turn out to be correct, driving demand for skilled workers.

A higher level of knowledge integration of green competences will be needed for both application of environmental technologies and implementation of higher environmental standards in many non-environmental occupations. This is required to achieve the ambitious environmental protection goals of environmental policy.

For social partners

Social partners play an important role in forming training courses, both in dual and university training. They are active in shaping the content of new training programmes.

ANNEX 3

Summary of key findings in Estonia

Environmental challenges, priorities and skills response strategies

Environmental challenges and priorities

During the past two decades, Estonia went through fundamental political, social and economic restructuring. Greening the economy and the corresponding skills response have to be analysed in this context. Skills forecasting and training is mainly provided by different State departments. Skills responses are thus characterised by policy measures and reforms of the formal education system.

Priority sectors for greening the economy are energy, transport and construction. Key concerns are security of energy supply, environmental impact of energy production, energy prices, bringing down energy consumption of buildings, and sustainable transport. Renewable energy is important for development, along with the diminishing impact of oil shale energy production. Sectors with major greening potential include: oil shale industry; energy, gas and water supply; waste management; forestry, and agriculture.

Occupational structure has changed with the economic structure. In general, the share of professionals and service workers increased while the number of craft workers decreased more than the total number of employed. Sectoral employment is expected to stay at the current level. Most occupations belong to greening occupations.

The response strategy

To move towards a greener economy, the government has defined four major lines of action:

(a) efficiency of energy consumption;
(b) diversifying use of renewable energy;
(c) developing oil shale-based energy production – increasing efficiency and decreasing the environmental impact;

(d) decreasing the overall environmental impact of the economy and development of green entrepreneurship.

A raft of legislation has been adopted for energy, transport, agriculture, forestry, tourism, chemical industry, building materials industry and food industry sectors in line with the main policies for sustainable development, the Act on Sustainable Development (1995) and the national strategy on sustainable development (2005).

Response to the economic crisis

The key priorities identified in the action plan for growth and jobs 2008-11 are:

(a) adopting a conservative macroeconomic policy to keep public deficit within the limit of 3% of GDP, joining the euro area in 2011 and maintaining low public debt to sustain high investment levels and a favourable level of taxes in the medium and long term;
(b) raising the export potential of enterprises primarily by improving the general business environment to increase investment and productivity. The aim is to maintain the share of exports relative to GDP at its 2008 level, through support measures for export companies;
(c) developing skills by increasing financing of lifelong learning, ensuring more resources for continuing education and retraining activities and using the period of lower employment to raise the skills of 50 000 people by at least one European qualifications framework level;
(d) maintaining employment by improving the business environment and stimulating job creation, increasing public investment and providing additional subsidies to prevent long-term unemployment.

To support recovery of the labour market, the government has adopted an action plan for reducing unemployment (2009). The plan includes support for creating new jobs, measures for preventing inactivity, and improving additional training and retraining opportunities. Availability and flexibility of career counselling will be increased. In total, active labour-market measures will be financed by EEK 459 million in 2009 and EEK 618 million in 2010 in the framework of the programme 'Increasing the supply of qualified labour force'.

Skills development strategy in response to greening

Promoting green skills is part of environmental education. In 2005, the Minister for the Environment and the Minister for Education and Research signed a memorandum of cooperation establishing development of environmental education as a priority. The goal is to use the educational process to shape responsible citizens who value and care for the environment.

Priorities of the government in the coming years are to raise people's qualifications and their sense of security by making the education system more effective, by intensifying efforts to promote lifelong learning, by focusing on reducing withdrawals from school, by promoting science and technology as fields of study to help ensure competitiveness and by helping higher-risk groups to enter the labour market. Besides improving people's skills, the government is also hoping to encourage emigrant workers to return to Estonia.

New measures are also being prepared for supporting traditional industries, oriented towards implementation of new technologies and increasing productivity of enterprises, development of human capital and recruitment of leading development personnel and implementing professional design as a competitive advantage. Developing cooperation networks and clusters initiated by enterprises will be promoted.

Continuous and extended support will be provided to projects developing new competitive technologies, products, services and processes, for which export orientation and environmental sustainability are considered significant advantages. Based on the needs of many traditional sectors of the economy, support will be offered to projects that include testing and certifying, design and productivity management, which usually are smaller in size, and lower in risk, than those which focus on technology development.

Emerging skill requirements

Green structural change

The potential for green restructuring of the economy is most obvious in the following sectors of the national economy:

(a) agriculture (biomass, biofuel and bioenergy; organic farming);
(b) forestry (complex management of forests, applying new technologies, production of wood pellets);
(c) mining and quarrying (applying new technologies, water management in mines; remediation of open quarry territories);
(d) electricity, gas and water supply (application of environmentally-friendly technologies in energy production; thermal and/or power plants and boiler plants that use renewable energy sources; combined burning of renewable fuels, waste and oil shale; energy conservation in energy enterprises, electricity networks and heating pipelines; water management);
(e) manufacture of refined petroleum products, chemicals and chemical products (new technologies for producing motor fuels from oil shale and

renewable sources of energy, new technologies for producing chemicals from oil shale);
(f) manufacture of wood and wood products (complex use of timber; new technologies for timber modification);
(g) transport and supporting transport activities (sustainable transport);
(h) construction (new materials and technologies for construction and renovation; renovation of old heating pipelines in district heating networks; construction of passive houses);
(i) real estate and renting activities (energy certification and energy auditing in apartment buildings; renovation and reconstruction of apartment buildings);
(j) other economic activities, for example leisure and tourism.

At the moment, the labour market is characterised by a mismatch between employers' demands for qualifications, and the actual skill levels of the generally older, working-age population. Therefore, the knowledge and skills base of active workers need to be improved. Although labour force surveys and forecasts indicate some shift inside large groups of occupations, there is no evidence of occupations or trades becoming obsolete as a result of environmental degradation, climate change or environmental policies.

New skills and greening existing occupations

In November 2009, the Innove Foundation (Cedefop partner) organised the first seminar on the green economy in Estonia. Conclusions of this seminar indicate increasing demand for some groups of occupations and professions with specific technical skills related to a green economy, including:
(a) engineers, designers and researchers involved in green economy development;
(b) technicians capable of operating green technologies;
(c) architects, city and transport planners;
(d) consultants advising enterprises and consumers on applying new technologies;
(e) energy auditors and environmental impact assessors.

Among the engineers, designers and researchers driving technological change and innovation in the green economy, there are many new specialisations such as solar and fuel cell technologies. Nevertheless, it is difficult to predict which new green-collar jobs will be subject to highest demand during greening the economy. To date, experience of developing occupational standards for new green-collar occupations indicates that both technical skills related to new technologies, as well as generic skills such as team work, communication, learning and entrepreneurship, are important.

Developing and implementing new energy technologies in Estonia has implications for skills needs at two levels:

(a) developing and exporting new technologies in spearhead technology used in oil shale production;
(b) upgrading competences important for key technologies that play a key role in Estonia, such as biofuels.

Approaches to anticipating skills needs

Green restructuring

The Ministry of Economic Affairs and Communications (MEAC) has been preparing labour demand forecasts since 2003. Forecasts are updated annually. Forecasts are used by the Ministry of Education and Research (MER) as one input for preparing proposals for State-commissioned study places in IVET, higher education and adult education. Three components of labour demand are forecast: creation of new jobs; dropout from the labour market (mortality and retirement); and labour movement between different sectors of the national economy. Projections are made for 35 sectors of the economy and five aggregated occupational groups.

Three bodies advise the Minister for Education and Research on the need for State-commissioned study places:

(a) VET council;
(b) higher education council;
(c) adult education council.

Composition of these bodies is diverse, including different ministries and governmental agencies (MER, MSA, MEAC, ME), employers associations, trade unions and education providers. Thus, councils also provide a platform for social dialogue on skills development issues related to respective sectors of formal education. As a result of expert analysis and social dialogue, the State order for the respective institutions (VET institutions, professional higher education institutions, and universities) is prepared across fields of study and groups of study programmes (according to ISCED97), and are then approved by the Ministry of Education and Research (MER).

New skills and greening existing occupations

In 2006, the Ministry of Economic Affairs and Communications (MEAC) commissioned a study on Estonian energy technology strategy. This process brought together views of companies, research institutes, universities, and the

public sector in different energy-related industry segments. It was possible to define three key areas for development:

(a) development and improvement of the entire oil shale process;
(b) mapping, utilisation, and development of renewable sources of energy;
(c) study and development of new emerging sources of energy.

The following common horizontal objectives were also identified:

(a) reduction of energy consumption and improved energy efficiency;
(b) improved environmental sustainability;
(c) increased R&D investments and intellectual property rights value generation.

Development of the transmission network to improve efficiency and reliability, and the new challenges brought about by increasing use of wind power, are essential areas of particular importance to the environment. Heat production and distribution systems are areas with especially significant potential for efficiency gains. However, this will require investment in both improving existing, and developing new, infrastructure. Overall, while there is a good general level of knowledge and skills, there is no specialist area in which Estonia excels in the international arena.

Responses to skill needs

Green restructuring

To date, the main focus has been on updating the qualifications of the working-age population via vocational education supported with State funds.

The following initiatives were implemented during 2009 to improve availability of additional training and retraining:

(a) a personalised training voucher system for the unemployed as an additional option for labour-market training. Training vouchers enable the unemployed to find quickly a suitable additional training course based on individual needs (unemployment insurance fund);
(b) training vouchers for employers to raise the skills level of managers and employees (Enterprise Estonia);
(c) simplifying and shortening procedures for public procurement of labour market training to increase availability of active labour-market measures.

During 2008, a new initiative in financing adult education was approved, namely State financing of in-service training in vocational schools for working-age people. Offering free in-service training helps to update the knowledge of workers with low levels of education, reducing both the likelihood and

persistence of unemployment. Meanwhile, the share of adult education has increased in vocational schools.

Most recently, a new development plan for adult education 2009-13 was approved in September 2009. The strategy foresees considerable expansion in learning opportunities for adults, and initiatives for attracting more people to education and training. The main aims include overall improvement of skills and educational levels, and an increase in the numbers of adults participating in lifelong learning. A reduction in the share of people with no vocational education or professional specialisation, and creation of a high-quality training system to provide opportunities for people wishing to increase their qualification levels, are also high on the agenda.

New skills and greening existing occupations

To increase people's overall skills, several measures have been implemented in general, vocational, higher and adult education during 2007-08:

(a) 'modernisation of higher and vocational education curricula and matching higher education learning outcomes with labour-market needs. The principles of the APEL system (accrediting prior experiential learning) have been introduced;
(b) financial support measures to educational institutions to enable them to attract better foreign students at Master and PhD level to study in Estonia; encourage them to stay longer and forge ties with the Estonian labour market (especially in research and development work) after they finish their studies;
(c) launching the DoRa programme (programme for doctoral studies and internationalisation) to increase the quality and competitiveness of higher education [...];
(d) support for studies abroad for Estonian master level students to ensure availability of highly-qualified people;
(e) modernisation of the infrastructure (classrooms, learning equipment) of higher and vocational education institutions;
(f) raising the qualification of teachers in vocational and general education by developing a needs-based additional training system for teachers;
(g) [...]
(h) promoting science and technology study fields by increasing the importance of science subjects at basic and secondary school levels and by increasing freedom of choice for secondary school and vocational education students; developing curricula in technology and the natural sciences for non-formal education institutions;

(i) extension of additional training and retraining opportunities for adults through vocational education, higher vocational education and non-formal education institutions;
(j) further development of the system for career services based on the needs of society and the labour force.' (*Estonian strategy for competitiveness 2009-11*, 2009, p. 21-22).

Due to Estonia's socioeconomic structure skills anticipation and provision is almost entirely the responsibility of the government. This approach has been successful in providing publicly-funded training for several greening occupations (case studies: forestry and energy auditors). However, at company level several initiatives have been observed where firms are initiating skills forecasting and providing in-service training. These have been particularly effective in the energy sector (case studies: oil shale mining, Eesti Energia and ABB).

Conclusions

Main greening shifts in economies and labour markets – General nature of change in Member States (drivers and impacts)

During the past two decades, the economy has become much greener. Two major directions of development towards a greener economy can be identified:
(a) implementation of new cleaner technologies in many sectors of the economy;
(b) remediation of the results of Soviet heritage in the environment.

Some steps towards a greener economy happened automatically as a result of lower demand. For example, in the agriculture sector, privatisation and lower production levels have significantly decreased environmental pollution. Nevertheless, the sector has further greening potential, especially in organic farming and bioenergy production.

Support from EU structural Funds has played an extremely important role in implementing different projects towards greening the Estonian economy.

The government has defined four major lines of action to improve environmental friendliness of the economy:
(a) efficiency of energy consumption;
(b) diversifying use of renewable energy;
(c) development of oil shale-based energy production – increasing efficiency and decreasing the environmental impact;
(d) decreasing overall environmental impact of the economy and development of green entrepreneurship.

Restructuring the economy caused substantial changes to the structure of the labour market. The share of the primary sector, especially agriculture, decreased many times. The tertiary sector became more important; the secondary sector held its share. According to the forecast, the primary sector will also reduce its employment in the coming years. Growing economic activities are in the services sector and also in the manufacturing industry.

Skills implications and development – New and changing skills needs by sector/occupation

The occupational structure changed as did the economic structure. The share of professionals (ISCO 2-3) and service workers (ISCO 4-5) increased. We assume this trend will continue at a moderate pace. However, the number of craft workers (ISCO 6-8) has decreased more than the total number of employed. According to the forecast, the share of craft workers will stay at the current level.

Green restructuring of the national economy heavily depends on developing and implementing new technologies and changing people's attitudes. Therefore, the skills response to meet the challenges of green economic restructuring should include not only IVET and CVET, but also all levels of higher education and general education. Motivation among people to raise their skill levels and qualifications according to the changing needs of the labour market is one of the crucial factors for the forthcoming economic upswing.

Good practice lessons in relation to identifying, anticipating, and responding to skills needs

Effective delivery mechanisms are based on a combination of private initiatives, either individual or corporate, and State support. Impressive progress in developing adult education and training, including in-service training during the past five years, is a good example. According to several assessments, Estonia will move from the current economic crisis better prepared for the challenges of a green economy.

Recommendations

For Member States skills forecasting approaches

It is recommended to strengthen coordination mechanisms of sectoral and other mid-term strategies with the Estonian national strategy on sustainable development, 'Sustainable Estonia 21', and increase visibility of the strategic process. The government and parliament are invited to initiate preparation of a long-term lifelong learning strategy.

The national qualifications system is an interface between the labour market and the lifelong learning system. Developing modular occupational standards as prototypes for partial qualifications is recommended. So is development of a new generation of modular national curricula for VET to be better coordinated and based on a learning-outcomes approach.

For Member States/regional VET systems

State commissioning of study places should be regularly assessed and appropriate policy recommendations made. Implementation of national R&D programmes should be used to promote a culture of cooperation between stakeholders.

From this research, it follows that quantitative (State order for study places) and qualitative identification of skills needs (occupational standards, national curricula, school curricula) are separate activities. These two aspects of skills identification should move closer to each other.

As part of the above processes, functional mapping of competences in major sectors of the economy should become a regular activity. This will allow identification of competence profiles of occupations, as well as labour-market trends within a sector. Inclusion of partial qualifications in the national qualifications system will substantially increase flexibility of the system. Finally, qualitative skills need surveys should be incorporated into regular labour force surveys carried out by the Statistical Office of Estonia.

ANNEX 4

Summary of key findings in Spain

Environmental challenges, priorities and skills response strategies

Environmental challenges and priorities

The challenge of adapting to climate change in Spain is threefold: increases in temperature, decreases in precipitation and rising sea level. Global warming has serious effects on biodiversity affecting agriculture and livestock industries. Decreases in precipitation diminish water resources, with important consequences for agricultural production, forest density, soil erosion and fertility, as well as potential negative consequences for water supply in many cities. Economic development and population growth also affect efforts to mitigate climate change. Water problems are exacerbated by current urban growth and periodic droughts.

Priorities are, therefore, focused on energy security and solving the problem of water scarcity. Renewable energy production and desalination technologies have been developed extensively over the past decade. Energy and water strategies form the core of transition to a greener economy.

The response strategy

The policy response to the challenge of climate change is fostered at different administrative levels of the State: central government, autonomous communities and local councils, specific bodies for strategy on climate change response. The strategy comprises different laws, plans and decrees, and has links with policies and strategies in other fields.

Key environmental national strategies are the 2006 Spanish climate change and clean energy strategy (EECCEL), the 2007 Spanish national climate change adaptation plan (PNACC), and the 2007 Spanish sustainable development strategy (EEDS). Sectoral plans have also been implemented nationally for transport, pollution, water and energy. Several initiatives from the autonomous communities complement government strategies, with 'Agenda 21' at local council level.

Green response to the current economic crisis

In December 2008, the government launched a EUR 11 billion economic stimulus package, approximately 1% of GDP. The package included EUR 600 million on environmental projects and EUR 500 million on research and development. With funding for infrastructure projects and investment in the ailing automotive sector, it signals the importance placed by government on the green economy and its role in promoting growth and development. In response to the economic crisis, the government launched the Spanish economy and employment stimulation plan (Plan E) in early 2009 and consulted on a law of sustainable economy (LES) later that year.

Plan E is a comprehensive and extensive strategy containing short-term packages oriented towards introducing long-term reforms to the economy to move towards a more sustainable structure. It includes an important and comprehensive skills development strategy, from primary education to R&D projects at universities and research centres, which to some degree addresses the skills needs brought about by environmental policies.

The strategy is supported by a raft of measures to improve environmental sustainability, including funding for sustainable transport (Plan VIVE) and R&D in low-carbon vehicles (Movele project) as well as additional support for 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.

Skills development strategy in response to greening

Despite inclusion of several skills training responses in environmental policies, and progressive development of diverse environment-related programmes in the higher 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 and a recent symposium of environmental training in public administrations ([6]) found there has been a lack of strategic coordination of skills responses for greening the economy at different administrative levels. However, there are many interesting initiatives from public bodies that contribute to skills training (case study: Biodiversity Foundation and the Telecommunications Installations Businessmen Association). Public bodies also participate in skills training

([6]) *Jornadas técnicas sobre la formación ambiental en las administraciones públicas españolas,* held at the Instituto Navarro de Administración Pública in Pamplona, Navarra, on 3, 4 and 5 June 2009.

programmes designed by private-sector academies or associations, funding these programmes directly or through EU funding.

In Spain, the regions are responsible for managing active labour-market policies (ALMP), which include employment creation and occupational training for the unemployed. They also manage education policies including formal vocational training and tertiary studies. Though harmonised and coordinated at State level, they adapt employment and education strategies to their needs and strategic priorities. Regional approaches to the 'green jobs' agenda and associated skills requirements vary greatly but there are several environmental education plans in autonomous communities (case study: Cenifer Foundation).

Many non-public agents in the private sector or civil society are complementing the skills training offer for greening the economy. In the past decade, the green sector, especially the renewable energy sector, has grown rapidly, increasing demand for professionals that has developed a skills response from universities, certain public bodies and the private sector.

Emerging skill requirements

Green structural change

Green restructuring is mainly policy driven. Greening the economy started about 10 years ago with reform in energy policy and has been reinforced by policies aimed at dealing with the economic crisis. Greening strategy focuses on renewable energy but includes promotion of waste treatment and green management in public and private bodies. Due to the impact of the economic crisis on the construction sector a concerted effort to aid employees to diversify into renewables has been launched.

Green structural change involves several retraining needs. For many occupations in the construction sector the skills gap for renewables energy is small, for example 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.

New skills

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

broad groups: renewable energy, waste treatment, green management, and awareness. New skills training is needed in all the activities described below.

Many companies from engineering, electricity, or installation sectors have diversified their core activities to the renewable energy sector. Only half the renewable energy companies are specialised in renewable energy, while the other half perform additional activities. This means that new skills required are relatively easily acquired through retraining in skills related to renewables such as knowledge of technology systems, installation procedures, regulation, maintenance and management.

Waste management in Spain includes activities across urban waste management, dangerous waste management and recycling. New recycling and waste management approaches have been developed in response to increased urbanisation, population growth and development of the tourism industry while technological innovations involving mechanisation of tasks have changed the skills set for the sector. Greener waste management, which includes selective waste collection or recycling techniques, is expected to grow in coming years requiring additional jobs and skills training responses.

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 (in local councils).

Workers in environmental education and the environmental information sector have a key role in influencing the behaviour of consumers. Occupations related to environmental education and awareness have experienced considerable growth and diversification in recent years with more people acquiring skills for environmental training and awareness.

Greening existing occupations

In shifting to more environmentally responsible production methods, two different skills gaps have been identified. First, there is a capital greening gap which could be narrowed by increasing energy efficiency through capital substitution (generally involving technological change). Second, 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 for greening the economy. Thus, conceptual skills training responses, such as awareness campaigns, should continue and perhaps incorporate new training methods.

Greening occupations tend to be 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.

Approaches to anticipating skills needs

Skill needs for greening the economy are identified through several initiatives in public, private and mixed bodies, involving different methods. This study found five main methods of identification that apply across restructuring cases, new green jobs and greening existing jobs:

(a) worker demand;
(b) company demand;
(c) private academy marketing studies;
(d) public initiatives;
(e) comprehensive and organised studies at national or regional levels.

Worker demand played a key role in identifying skills needs in the solar energy sector, motivating organisation of several courses (case study: Proyecto Sol).

Company demand is clearly differentiated depending on company size. Large companies tend to identify needs in their own departments and provide skills training internally. In contrast, SMEs usually communicate skills gaps to regional bodies, training centres or corporate associations (case study: Fonama).

Marketing studies by private academies are entirely market driven. This identification procedure is, for example, used by the IIR training centre in its skills response for desalination plant maintenance and operation managers.

Initiatives from public bodies identify the skills gaps for greening the economy. Some are integrated into a certain skills development response, while in others consist of studies on skills needs.

Finally, there are regional and national skills studies, for example a comprehensive study undertaken by the Public Employment Service to identify occupations and skills needs in the renewable energy sector.

Responses to skill needs

Green restructuring

The skills training response needed for green structural change is carried out by several agents from public, private and mixed bodies, through multiple initiatives coming from different agents. Many local and regional governments are organising skills training in this context, for example programmes undertaken in the Basque country, Navarre or Extremadura.

Social partners, such as business associations, foundations, trade unions or private training centres also form part of skills responses for restructuring. These agents usually of design courses and monitor performance.

New skills

Sometimes skills training programmes are both public and private driven, as when an initiative is created by a private agent (an academy, or association), and funded by some public body (city councils, regional governments, EU funds). For the retraining needs of construction sector workers moving into renewable energy occupations, there are several initiatives, some coming from regional or local governments, which provide relevant retraining to become professionals in renewables.

Greening existing occupations

The education system is providing a growing range of courses related to green-collar occupations. These courses are either set in the vocational training system for technical occupations or in managerial postgraduate programmes at universities.

Courses for specific occupations have been fostered and financed both by public and private bodies, including regional and local governments, associations, foundations and trade unions. Private training centres have played an important role in this kind of skills response.

Skills responses in corporations are focused on specific skills needed for new green-collar occupations. Corporations identify the skills needed for their activities within their departments and the skills training response is internally organised.

Conclusions

With respect to: main greening shifts in economies and labour markets – General nature of change in Member States (drivers and impacts)

Main shifts in the economy relate to problems concerning the two basic resources of energy and water as well as waste treatment. Green activities, such as green management and awareness, have developed around these three core sectors. The greening strategy is policy driven with central government fostering the main greening shifts through regulatory changes and long-term programmes.

Energy and water development have achieved some important results. First, a huge increase in investments in renewable energy production and desalination has taken place, stimulating creation of new jobs. Second, there has been a shift in energy and water consumption patterns towards more sustainable trends. And finally, the growing influence of Spanish renewables and desalination companies in the global market shows technological development in these fields. These achievements indicate that the skills training response has achieved good results, because without the appropriate skills such green restructuring could not have taken place.

Implications for structural change and sunset industries

The core of Spanish energy strategy is based on energy efficiency and energy production from renewable sources. This strategy involves a shift from imports to national production and, therefore, has a positive impact on GDP. Hence, this greening shift creates employment and economic growth. Moreover, the shift requires additional labour, and thus skills, as integration and installation of renewable energy and energy efficiency technologies require considerably more labour than operation and maintenance tasks. New green production methods or diversification into renewables are possible in ailing construction and automotive industries.

Skills implications and development – New and changing skills needs by sector/occupation

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.

Pace of change in defining new and emerging skills needs

Considering high unemployment rates due to the economic crisis, it can be argued that this is the right time for greening. In Spain, the crisis is especially

severe in the construction sector, where many occupations have a high potential for training in renewable energy and energy efficiency. In fact, many occupations in the construction sector, such as electricians, installers or plumbers, can easily perform the tasks of green occupations such as solar photovoltaic or thermal energy installers.

Scope and capacity of Member States/regional skills forecasting and VET systems to anticipate and respond

There is no national coherent response but good examples at regional level, for example Navarre and Extremedura. National studies should be linked to design of the main greening strategies (one is currently being undertaken by the National Employment Service) and stronger public-private cooperation is recommended for anticipating future skills needs to avoid possible skills bottlenecks.

Good practice lessons in relation to identifying, anticipating, and responding to skills needs

Since 1994, when there was no renewable energy production in Navarre, the region has expanded its electricity production from renewables to 65% with a target of 100% of electricity from renewable sources in the coming years. Navarre has been able to cover the jobs needed for this new occupation, smoothing rapid expansion of renewable energy production in the region in the past 15 years. The regional government cooperated with Cenifer Foundation for training the workforce needed for this large-scale roll out.

Recommendations

For Member States skills forecasting approaches

Integrate skills studies with policy: identification of skills needs could be better forecasted with a positive effect on the timing of skills provision. A national comprehensive study of skills needs is currently being undertaken by the National Employment Service. It would have been positive if such a study was linked to design of the main green strategies (many conceived around a decade ago).

For Member States/regional VET systems

Stronger public-private cooperation is recommended for anticipating future skills needs to avoid possible skills bottlenecks.

ANNEX 5

Summary of key findings in France

Environmental challenges, priorities and skills response strategies

With a large proportion of its electricity derived from nuclear power, France has the advantage of a low-carbon power base, although France is now increasingly dependent on imported fossil fuels. Despite the nuclear power stance, France is still expected to exceed its Kyoto greenhouse gas target by 10% in 2010, due to increasing emissions from buildings and transport.

The main challenges and priorities are to reduce energy use by improving efficiency in buildings and transport, as well as to increase renewable energy generation.

The major challenges, set within the scope of energy policy, are to manage energy demand, extend the range of technological sources of production and supply, develop research in the energy sector, and guarantee provision of energy transportation and storage infrastructures adapted to consumption requirements.

The response strategy – General environmental strategy

General environmental strategy has two main dimensions:

(a) national adaptation strategy to climate change highlights the key priorities for adaptation: in particular, public security and health; social aspects, including inequality of risks, costs and opportunities and preservation of natural heritage. It focuses mainly on mitigation efforts;

(b) Grenelle Round Table, a major government initiative launched in 2007 to address energy efficiency improvements and a range of other environmental issues. In 2009, 13 measures were adopted, focusing on: built environment; planning; transport; energy; biodiversity; water; agriculture; R&D; risks, health and the environment; waste; governance, information and training; overseas territories.

France has committed to a 'factor four' reduction in greenhouse gases by 2050. Key measures to implement this goal include a bonus-malus tax system for CO_2 emissions from cars.

Key priorities:

(a) built environment sector: the number one priority in the fight against climate change by reducing energy use in both new and existing buildings. The building industry uses up to 70 million tonnes of oil equivalent, making it the biggest consumer of energy across all sectors of the economy. This energy consumption represents 25% of national emissions. All of these figures need to be reduced by 75% by 2050;
(b) developing renewable energies and materials is the key priority of energy policy.

Green response to the current economic crisis

The green new deal is based on:

(a) the 2009 budget amendment, which provided for a recovery package worth EUR 26 billion over two years, including EUR 10.5 billion of public investment (State, local authorities and public enterprise). The package also included help for the ailing automotive industry, with incentives to scrap older vehicles and buy new, more environmentally-friendly models. The climate-relevant portions of the plan amount to more than 20%, the highest in the EU;
(b) of these EUR 10.5 billion of public investments shared between the State (EUR 4 billion), public enterprise (EUR 4 billion) and local authorities (EUR 2.5 billion), EUR 1.1 billion in 2009 and 2010 (11%) are for speeding up implementation of the Grenelle Round Table through investment primarily in transport and buildings.

The skills development strategy in response to greening

Following the Grenelle Round Table, a fully-fledged skills development strategy has recently been launched with the mobilisation plan for green jobs ([7]) (September 2009), a plan to mobilise relevant sectors of the economy and regions to develop occupations for green growth. This represents a major effort in identifying the skills requirements and sectors, which should be focused on building a competitive green economy and fulfilling the economic and environmental potential of the Grenelle Round Table.

The objective is to adapt existing training programmes and qualifications and create new ones where necessary, in line with the 600 000 green jobs that the Grenelle Round Table could generate by 2020.

([7]) *Plan de mobilisation des territoires et des filières sur le développement des métiers de la croissance verte.*

This plan is articulated along four themes:

(a) identify the relevant occupations – this includes setting up a national observatory to understand the new professions and relevant fields and to quantify these;
(b) define training needs and set up training and qualification pathways – this will enable professional skills to be recognised;
(c) recruit sustainable development jobs – actions to help job-seekers meet the requirements of the numerous jobs currently on offer that cannot be taken up due to lack of skills;
(d) promote and develop professions for green growth – a national event on green professions will be organised for early 2010 during which the green growth plan will be detailed.

Emerging skill requirements

Green restructuring

Key impacts on the labour market:

(a) the sector consistently identified as having the highest potential in terms of job creation is the renewable energy sector – 200 000 jobs;
(b) together transport, the built environment and renewable energy are sectors which potentially could create the most jobs within the environmental economy by implementing the Grenelle measures (recognising most studies do not consider substitution effects and potential job losses in other sectors);
(c) estimates of job losses include 138 000 jobs in the conventional energy sector and 107 000 in the automobile industry (WWF study);
(d) in 2009, the automobile sector was characterised by important redundancies and suppression of almost all temporary jobs. It estimated that job losses related to decrease in production of heat engines could reach 8 000. However, job losses could be compensated by creating electric and hybrid vehicles (between 15 000 and 30 000 jobs by 2025-30). Low-carbon vehicles and clean technologies are very promising; however their diffusion will be slow and progressive, given that renewal of a fleet of vehicles takes about 15 years.

New skills

Regardless of the net volume of job creation, green growth will not generally be characterised by creation of new occupations but will contribute to evolution of existing occupations.

Where new occupations have been identified, they are mostly related to audit and consulting in the energy sector, protection of biodiversity, or eco-mobility. New occupations mostly concern highly-qualified jobs: occupations related to expertise linked to new technologies (measurement, metrology), or related to organisation and coordination: transport flow management; optimisation of logistic chains; managers of major building projects, etc. In addition, the *Conseil d'orientation pour l'emploi* identified occupations related to diagnosis, auditing and consulting (case study: energy performance experts):

(a) the most dynamic sector in creating new green occupations is the renewable energy sector;
(b) construction in the renewable energies (solar, wind, geothermal) (case study: renewable energies installers Qualit'EnR);
(c) waste sector: also a booming sector with new occupations such as waste prevention managers and operators in recycling industries (case study: waste operator).

Greening existing occupations

Existing occupations will become greener because:

(a) specific competences are currently lacking;
(b) some occupational tasks will necessitate more global approaches;
(c) sustainable development constraints will be increasingly considered.

Core competences of most existing occupations will not change fundamentally. Nevertheless, sustainable development will become a common 'backdrop' for all occupations and new competences will be necessary to adapt professional practices.

In the built environment sector for instance, each trade will have to integrate notions of sustainable development, but it is first and foremost articulation of the work undertaken by each building trade that will guarantee efficient construction. This should consider complementarities between building trades due to integration of technologies for renewable energies and energy efficiency. This is particularly true for the 260 000 craftsmen who now have to

work with eco-materials and integrate energy efficiency techniques into construction and maintenance of sustainable buildings (case study: FEE Bat).

New competences required include: knowledge of new technologies and technical solutions adapted to energy efficiency, cross-cutting knowledge of energy issues, understanding other occupations related to building renovation and counselling/advice to clients to adapt to new demands of the market.

Two sectors with the highest greening potential and representing high employment volumes are the built environment and agriculture sectors.

In agriculture, objectives set by Grenelle involve gradually moving to 20% organic production by 2012. New technical skills are needed for switching to organic farming, for example: techniques for reducing fertilisers and chemicals, and understanding requirements of environment-friendly objectives; the agricultural education system trains 172 000 pupils each year, 32 000 apprentices and 118 000 adults. An important effort to upgrade existing training programmes will be needed. In particular, training trainers (20 000 teachers in the agriculture school system) will be an important issue (case study: agriculture).

Approaches to anticipating skills needs

Green restructuring

France is characterised by a broad network of 'observatories' in occupational forecasting, which bring together various players in the labour market with the aim of reaching a common diagnosis. These research and monitoring centres most often work at national level, taking a sectoral (industry observatories) or regional view (regional industry observatories), and combining macroeconomic projections and quantitative surveys with qualitative information such as:

(a) **sectors**: since May 2004 law, every sector has to create an observatory for employment and training forecasts;
(b) **companies**: forward employment and skills management scheme, *Gestion prévisionnelle de l'emploi et des compétences* (GPEC), is mandatory in all companies with more than 300 employees and is designed to enable enterprises to anticipate their future skill needs;
(c) **regions**: given that powers are now decentralised and currently transferred to the specific CVET area, most tools used to determine and forecast training needs are found at regional level, for example regional training and employment observatories;

(d) **national level**: the general planning commission carries out studies to gauge developments in trade areas and qualifications. The development agreement for employment and skills (EDEC), developed by public authorities, helps to provide an overview of the economic, technological and social changes that a given sector might undergo. Social partners are involved.

New skills

Systematic forecasting of employment and skill needs is fully integrated into economic planning and is based on a range of institutions and experts. France has one of the most comprehensive ranges of tools in Europe.

Mechanisms described (sectoral and regional observatories, GPEC prospective studies carried out by branches) contribute to identifying new skills needs, in addition to identifying retraining needs and employment shifts.

Limitations: due to large numbers of stakeholders involved and the volume of their research production, tools and methodologies in occupational forecasting, lack of coherence and visibility has been highlighted.

Ministry level: identification of skills needs by overhauling existing qualifications and creating new qualifications: design of qualifications is increasingly characterised by an effort towards matching the needs of the labour market. The process for designing and modifying qualification standards takes place in consultation with social partners in the framework of specific committees (case study: waste recycling operator, to see how employers' representatives request creation of a new qualification).

Regional observatories (OREFs) have published several studies on green occupations. An increasing number of initiatives focus on green jobs and green growth.

Greening existing occupations

Creation of vocational licences (licences pro) ([8]) also illustrates how identification of skills needs by professionals on the ground feed back into the institutional decision-making process. The process for designing vocational licences aims to ensure that a qualification responds to the needs of the industry. A qualification is also overhauled every four years when ministerial authorisation has to be renewed (case study: ecodesign for more detailed analysis).

([8]) The vocational licence is a diploma equivalent to three years of post-Baccalaureate training. It was created in 1999.

Responses to skill needs

Green restructuring

Responses have been made by a range of stakeholders:

(a) in the **private sector**, CVT is managed by both enterprises and the social partners. Companies use tools such as training plans, *validation des aquis d'expérience* (recognition of experience and prior learning, giving the right to qualifications). Training plans have been carried out in car manufacturing companies such as Heuliez (conversion to production of electric vehicles), which restructured its assembly facility for heat engines in 2009 (case study: Heuliez);

(b) **regions**: fundamental actors in the training system define and implement regional vocational training policy of young and adult learners (2004 law). They are responsible for managing public funds dedicated to training delivered by AFPA ([9]), the national training providers of adult learning;

(c) **active support for redeployment/recovery plans**: the Poitou Charente region invested EUR 5 million in car manufacturer Heuliez to support training of employees for production of the new electric car (case study). Provence-Alpes-Cote-d'Azur region (PACA) financed training of employees at the Eiffel site (metallic construction) for a new wind turbine factory set up in 2008 (with a crucial role played by the regions in cushioning the effects of restructuring and implementing skills development programmes);

(d) **the role of training providers**: Association for Training in the Automobile Sector (ANFA) – in the current economic context affecting the automobile sector, ANFA is implementing accompanying measures to support workers and companies. The main objective is to raise the competence levels of the sector's staff;

(e) **national level**: the social investment fund (*Fonds d'investissement social*, FISO) will coordinate short-term and temporary anti-crisis measures with training measures aimed at increasing employability of the workforce affected.

([9]) *Association nationale pour la formation professionnelle des adultes*, the national training providers for adult learning.

New skills

Initial education and training: creation of new qualifications

In relation to green occupations, the Ministry of Education has so far adopted a prudent approach towards emergence of new occupations. They consider that there are today very few jobs purely based on new competences (such as renewable energies). Given rapid evolution of the sector, more time is needed to see how new standards and techniques will impact occupations in the built sector.

Requests for creating new qualifications, at BTS (higher technician's certificate) or DUT (university technological diploma) level, mostly concern the built sector.

Recent creation of licences pro (vocational licences) has played an important role in improving initial training provision. New vocational licences have been created in ecodesign for instance (case study). The number of training programmes specifically dedicated to ecodesign and number of enrolled students have steadily increased.

Overall, initial education is lagging behind requirements of the renewable energies sector. In particular, qualifications related to energy efficiency, wind power and installation of solar photovoltaic are lacking.

Provision of initial training in the renewable energies sector is however increasing, with more higher education qualifications specialised in renewable energies or integrating renewable energies modules in more traditional training programmes at all levels: DUT, BTS, licences, masters and engineering schools degrees.

CVET

Overall, continuing training in renewable energies is more advanced than initial training. While specific training courses focusing on renewable energies were rare in the early 2000s, the number of training programmes has increased (case study: Qualit'EnR).

A concern expressed by business representatives, training providers and public authorities is lack of coherence with increasing training programmes and absence of clear standards.

Greening existing occupations

Initial education and training – updating qualifications (overhaul) Over past years many qualifications have been overhauled ([10]) especially in agriculture. Adding new 'mentions' or components to existing qualifications can sometimes be a slow process. The French Federation of Electricians has worked on integrating a new mention 'renewable energies' into the existing 'Bac pro electrician' for the past three years; however, the objective to have the qualification updated by 2010 will not be reached.

Built environment sector: there is an urgent need to integrate new competences into qualification standards of the diploma delivered by the Ministry of Education. This concerns in particular qualifications at level III (BTS or DUT) in the construction sector. The priority for the built environment sector is to overhaul existing qualifications standards. Initial training for architects has been integrating sustainable development modules for several years now. The Ministry of Agriculture has started to redesign its qualifications to integrate green issues, in particular organic farming and phyto-protection, with good response, and needs are well addressed.

Continuing vocational education and training

Continuing training is generally adapting rapidly to the green economy. The wealth and diversity of CVET in the built environment sector: 5 000 training courses have been identified in 2009. They address diverse audiences, and include short and long training pathways.

Several important initiatives aim to bring new competences to professionals of the sector. A key initiative is the training scheme (case study: FEE Bat) in the built environment sector, which aims at training 50 000 professionals (entrepreneurs, craftsmen and employees) by 2010. A reason for the response of the profession is that companies have to react immediately to new emerging needs.

Key concern: important efforts in training trainers will be necessary to ensure coordination between different building trades and adaptation of services provided to new practices.

([10]) This is the case of BTS fluids, energy, environment which now replaces the former BTS technical equipments (since 1999). The DUT hygiene, security, environment, replaces the former DUT hygiene and security, to integrate a strong environment dimension to respond to new requirements of the labour market.

Conclusions

About main 'greening' shifts in economies and labour markets

Significant job creation in green sectors of the economy such as renewables and energy efficiency may be offset by changes in the automobile and conventional energy sectors that might be affected by job losses.

For most existing occupations, core competences will not change fundamentally. Skills needs for green growth are the following:

(a) for the whole labour market, transversal competences related to general awareness-raising of eco-activities, ecodesign, eco-citizenship, etc.;
(b) for most occupations, new skills needs related to new standards, new production processes (built sector, electro-mechanics, renewable energies) which means that occupations will evolve without changing core technical skill sets. Additional modules for core training standards will be needed;
(c) for some green occupations, very specific green skills in highly-specialised fields;
(d) for a minority of occupations, no new skills will be needed because occupations have already integrated sustainable development (waste, recycling) or limited impacts of green growth (such as catering).

Expectations for creating new jobs should not be exaggerated, as they are based on several assumptions (conditions to be met such as realisation of Grenelle objectives).

Skills implications and development

Overall, mechanisms for anticipating and identifying skills needs in France can be considered efficient. Sectoral, regional and national observatories and skills forecasting at company level, ensure that needs identified on the ground are considered by the education system. Regional level seems to be the most relevant for anticipating and planning training needs.

However, diversity of methodological approaches may mean that findings are not precisely comparable between one sector and another, or one area and another.

One key asset of the system is active participation of social partners in anticipation mechanisms of initial training, and in managing continuing training.

Skills response

Training provision is diversified and delivered by various actors: the national education system, agricultural education bodies, apprenticeship centres

(CFA), training centres managed by branches, network of commercial chambers, private sector, AFPA ([11]), etc.

Stakeholders highlighted relative flexibility and responsiveness of initial training to overhaul regularly qualifications through the CPC process ([12]). The bottom-up process, whereby requests from professional branches feed into the work of committees reviewing qualification and training standards, is considered effective.

Overall, existing qualifications and training pathways adequately cover the needs of professionals. In most cases, there is no need to create new qualifications, but a need for greening existing qualifications. Usually, the process has already started; however, it could be accelerated.

Main weaknesses of current training provision concern:

(a) lack of adaptation of current training provision to reach green growth objectives and address the needs of the labour market in particular in the built environment sector;
(b) mismatch between the types and levels of qualification needed by companies (surplus of overqualified graduates). Of job offers related to green jobs, 75% concern qualifications at upper secondary education levels;
(c) the process for overhauling existing qualifications and creating new ones is sometimes too slow;
(d) lack of visibility and coherence in provision of CVET, with increasing training programmes in certain sectors without established quality standards.

The most pressing issue concerns training trainers. The number of trainers and teachers who are able to train new techniques and are aware of sustainable development issues is clearly insufficient, in particular in the agriculture and built environment sector. There are concerns that in public spending cuts, in particular in the education sector, where some retiring staff are currently not replaced, the needs of teaching staff will not be addressed. This would be a major obstacle hampering skills development for transition to a green economy.

([11]) *Association nationale pour la formation professionnelle des adultes* [National association for adult vocational training].

([12]) *Commissions professionnelles consultatives* (define core occupational standards or activities and identify corresponding competences).

Skills anticipation

Good practice lessons in identifying, anticipating, and responding to skills needs:

(a) range of observatories (sectors and regions) seems to function well;

(b) support of regions to restructuring/revival plans is key for sectors such as automobile/set up of networks specifically focusing on green jobs (see Ile de France region TEE network);

(c) companies are making important efforts to train their employees, taking part voluntarily in training schemes especially in the built sector (FEE Bat) – FEE Bat considered as an exemplary training scheme by government and will be extended;

(d) feedback system of the Qualit'EnR training scheme (based on audits of work carried out by newly trained staff) considered as innovative and extremely efficient to ensure training programme updated/improved;

(e) Pôle emploi (national employment agency): recent efforts made by Pôle emploi to identify new occupations related to the green economy, quantify the volume of jobs they represent, and corresponding needs in skills and training (Le Grenelle Environnement, 2009, p. 18). Pôle emploi has mapped green growth occupations (p. 63-65). Results of the mapping have been considered in a report produced by sectoral committees;

(f) a fully-fledged skills development strategy is now being developed, following results of the work carried out by committees of the mobilisation plan for green jobs. As part of the next step of the mobilisation plan, MEEDDM ([13]) has announced the following measures:

  (i) inventory of green skills and green occupations: creation of a unique directory of qualifications for green occupations;

  (ii) creation of a national observatory under the responsibility of the Ministry of the Environment;

  (iii) revision of names of occupations to make them understandable and marketable.

([13]) *Ministère de l'Ecologie, de l'Energie, du Développement durable et de la Mer.* [Ministry of Ecology, Energy, Sustainable Development, and Sea].

Recommendations

For Member States skills forecasting approaches

Further research is needed to identify more precisely competences needed for green jobs, and to identify not only job creations but potential job losses. Improvements could include promoting wherever possible, a common methodological framework (especially for work of observatories, to improve cross-sectoral analyses and occupational mobility), and creating a synthesising procedure and/or space for exchanging and pooling information between all levels involved in forecasting studies.

Creating new observatories for green jobs, announced by the government, should improve data collection.

For Member States/regional VET systems

There is a need for IVET to integrate sustainable development issues into their training standards, rather than creating new qualifications. Many stakeholders warn against the risk of creating new qualifications entirely based on sustainable development or green skills that would be too narrow or poorly suited to the labour market. Sustainable development could be integrated as one of the core components of all technical and vocational training.

Provision of continuing training is a pressing issue. Less than 50% of young people find a first job that corresponds to their initial training. The number of workers to be trained, to reach green growth targets, is significant, particularly in the solar photovoltaic, water sanitation and built environment sectors.

Reaching these objectives will require additional efforts in training trainers. Priority should be in occupations where tensions are high on the labour market; however, sustainable development should be integrated into training plans of teaching staff (in particular for overhauled qualifications).

Quality labels, for example quality charters such as for training providers in the renewable sector should be developed further in other sectors, to avoid the risk of anarchy in developing continuing training programmes.

For employers

Efforts to improve the image of occupations related to green jobs, to make them more attractive (also in remuneration): most green and greening occupations correspond to low levels of qualifications, at the bottom of the salary scale (such as professional skills certificate, CAP), creating recruitment issues (waste sector).

Cooperation between building trades should be increased to develop transversal competences (joint training such as FEE Bat).

ANNEX 6

Summary of key findings in the UK

Environmental challenges, priorities and skills response strategies

Environmental challenges

The UK's main environmental priority is responding to the challenges of climate change, through reducing greenhouse gas emissions from key polluting sectors and adapting to the impacts of global warming. This includes developing strategies to reduce greenhouse gas emissions from energy, built environment, transport and food sectors in particular. Traditional environmental problems such as industrial pollution control, waste management, air/water quality, and flood defence are also encompassed within climate change strategy.

The response strategy

The 2008 Climate Change Act set binding targets for emissions. The 2009 low-carbon transition plan explained how these will be achieved. Acts covering energy and planning have been passed in the past two years to reduce carbon emissions, speed up new renewable infrastructure and smooth fast transition to a low-carbon economy. Food, transport and environment policies have also recognised low-carbon considerations. While these policies recognise skills gaps and shortages, this is usually through generalised statements rather than specific policy measures. For example, the UK low-carbon transition plan notes that 'the growing low-carbon industry in the UK can flourish only if workers have the right skills to meet the demands that businesses will face' (2009, p.129) and calls for development of courses and qualifications that reflect these skills (especially in renewable energy and nuclear power). There are almost 900 000 people employed in markets for low-carbon and environmental goods and services so it is already an important sector.

Green response to the current economic crisis

Low carbon industrial policy (2009) contains detailed proposals on how government will promote development of low-carbon business through

targeted industrial policy for the following sectors: offshore wind; wave and tidal power; civil nuclear power; ultra low-carbon vehicles; renewable construction materials; renewable chemicals; and, low-carbon manufacturing. These industries have had over GBP 400 million set aside in the 2009 budget specifically to aid their growth and development.

The green portion of the stimulus packages was GBP 3.3 billion – set out in the low-carbon investment fund – equivalent to 14.5% of the total stimulus and 0.22% of GDP. The fund supports skills development, mainly for higher-level skills, through funding for technology demonstration and R&D projects at higher education institutions and research institutes.

Skills development strategy in response to greening

The latest national skills strategy (2009) links to the industrial strategy and *New industries, new jobs* white paper to provide a skilled workforce for future economic growth. Actions announced cover basic and technical skills (such as apprenticeships, train to gain, university technical colleges). A new strategy for the higher education sector recognises a need to prioritise funding to growth industries. However, it is unclear how responsive the higher education funding council will be on this issue. Government has also introduced measures to promote take up of skills for green jobs (STEM skills) in compulsory education.

Devolved administrations have their own skills development mechanisms – although the sector skills council system is nationwide. Scottish strategy is more substantial than equivalent strategies in Wales and Northern Ireland.

Emerging skill requirements

Green structural change

The UK has experienced job losses in manufacturing, utilities and primary sectors, partly as a result of environmental pressures and regulations such as the EU emissions trading scheme. Working futures 2007 projections forecast that these losses will continue (although forecasts were made prior to the economic slowdown). Obsolete occupations/job losses have been predicted in the near future in coalmining, shipbuilding and high-polluting automotive sectors. Unequal geographical effects are also prevalent, with areas either losing or gaining jobs from transition to a low-carbon economy.

Structural change policies focused on increasing value-added activity, which in some cases contributed to a general shift in services, and enlargement of the financial services sector. Diversifying existing sectors into low-carbon industries

will provide a lifeline in many cases which will offset job losses – for example:
(a) shipbuilders, Harland and Wolff, have pursued a product diversification strategy enabling them to build components for wind turbines (case study);
(b) low-carbon vehicles, such as battery-powered, electric cars, offer an opportunity for the automotive industry to develop new cleaner products and create jobs (case study).

New skills
A forecast of an additional 400 000 new environmental/low-carbon jobs being created by 2015, although this is possibly overoptimistic. New green-collar occupations are forecast to be stimulated through economic and regulatory drivers in wind, wave and tidal, carbon capture and storage, and ultra low-carbon vehicles. The main skill needs are likely to be STEM disciplines and leadership.

Greening existing occupations
In a general sense, all jobs are greening to some extent. Specific occupations with strong environmental/greening dimensions include: low-carbon construction and energy efficiency, chemicals and industrial biotechnology, business and financial services, carbon markets, civil nuclear power, low-carbon aerospace, electronics and ICT.

Approaches to anticipating skills needs

Green restructuring
At policy level, machinery of government changes from April 2010 will alter the way skills are funded and identified. The Skills Funding Agency will be informed by sector skills councils and regional development agencies on skills needed and what training is funded. Local authorities will be responsible for learning for 16 to 18 year-olds. The system should (in theory) be more responsive to skills gaps and shortages. The UK Commission for Employment and Skills is responsible for coordinating sector skills councils and responding in particular to central government on 'priority industries' – including low-carbon industries.

In shipbuilding, while the skills required to construct new products for the wind industry are similar to those accrued for constructing ships and offshore platforms for the oil and gas industries, new challenges for engineers and designers and for flexibility of craft workers and labourers require a training response.

In the north-east of England, Nissan's car factory is shedding jobs and a new battery-assembly plant for Nissan's electric vehicles is creating new employment opportunities which require new skills to be developed among the existing workforce.

New skills and greening existing occupations

Sector skills councils are responsible for identifying sector skill needs through sector skills agreements and sector qualification strategies. Labour-market investigations are frequently used to build a picture of skills needs and gaps, for both existing and new sectors, including: working futures projections, national employer survey, labour force survey and surveys/consultations with employers/sector. This process has led to identification of a broad range of skills needs (case studies covering civil nuclear power, financial sector/carbon trading and environmental/land-based industries) but legislation also plays an important role. For example, changes in legislation will see smart energy meters being rolled out nationwide, creating demand for smart energy installers (case study).

The latest development is that the UK Commission for Employment and Skills is forecast to produce an annual report of skills needs across priority sectors which will mainly comprise those low-carbon sectors mentioned above (case studies covering emerging low-carbon sectors).

Responses to skill needs

Green restructuring

Harland and Wolff are retraining shipbuilding/oil rig workers for wind turbines through the company's own training structures and individual training plans.

Nissan and the regional development agency, One North East, are working in partnership to develop workforce skills for electronic vehicles and battery manufacturing. The regional development agency is leading the skills response with a: national training centre (technical skills), graduate placement programme (graduates) and R&D facilities (test track) for higher-level skills and knowledge.

New skills

Across the new and emerging wind, wave and tidal sectors, industry-led accords have been established with government to develop apprenticeships and career guidance (focusing on STEM) to stimulate and increase entry into

these sectors. These accords commit the power sector and skills bodies and education sector to train up to 60 000 entrants to the wind and marine energy industries by 2020.

In response to a shortage of training for smart energy meters, an employer-led response from British Gas is seeing five new training centres being developed to train new recruits for this massive undertaking. New employees will undergo a 23-week externally-accredited qualification training programme with a mixture of on and off-the-job training.

Greening existing occupations

The three greening responses show the significance of sector skills councils in easing delivery of skills responses across sectors:

(a) civil nuclear power – led by sector skills councils/employer-led through National Skills Academy, skills passport developed, foundation degrees to provide more high-level technical skills;
(b) environmental land-based – led by sector skills councils, development of diploma for 14 to 19 year-olds, tackles problem of not enough new entrants to workforce to replace ageing/retired workforce, creates career path, future workforce with greener skills;
(c) carbon trading – topping up skills for commodity traders, private provider/employer-led (no sector skills councils involvement) and training delivered through the European Climate Exchange.

Conclusions

Main greening shifts in economies and labour markets

In the UK the government's environmental strategies do not generally have a significant skills development component although the implications of structural change on skills overall are generally acknowledged.

Skills implications and development

The government's skills strategy does respond in general terms to the government's low-carbon industrial strategy in relation to both lower-level skills and investment in increasing opportunities for advanced technical and higher vocational levels in key sectors of the economy.

Within the system for developing skills responses, we should see skills strategies for sectors and subsectors of the workforce which reflect future forecasts of demand for labour and the skills required. We should also see

assessment of skills gaps and shortages over the next 10 years and the qualifications and skill sets that are priorities for public funding. As a consequence, key responses to green skills and green occupations should be found in the work of sector skills councils and the responses to their sector skills agreements.

Recommendations

For Member States skills forecasting approaches

It will be important that the UK Commission for Employment and Skills delivers on its role of coordinating sector skills councils and ensuring that cross-sectoral green skills are covered.

There is a need to improve the links between skills forecasting and funding of further education. The Skills Funding Agency, which comes into being in April 2010, will be responsible for this.

For Member States/regional VET systems

The key challenge to develop low-carbon sectors is the low level of STEM skills among the current workforce – as well as the future workforce. Improving take-up and achievement in STEM subjects and skills is needed across all education and training levels.

A better skills response is required in Wales and Scotland to ensure a full national response to greening the economy.

CEDEFOP | European Centre for the Development of Vocational Training

Skills for green jobs

EUROPEAN SYNTHESIS REPORT

Luxembourg:
Publications Office of the European Union

2010 – VI, 102 pp. – 17 x 24 cm
ISBN: 978-92-896-0660-8
ISSN: 1608-7089
doi: 10.2801/31554
Cat. No: TI-31-10-520-EN-C
3057 EN – Free of charge

EN

skills for green jobs

EUROPEAN SYNTHESIS REPORT

Green job creation has enormous potential and is crucial to ensuring smart, sustainable and inclusive growth. The case for government support to drive this forward is clear – industry cannot do it alone. Europe's policy-makers need to ensure that their support for skills and training matches the focus and ambition of their strategies for promoting investment in green innovation and infrastructure.

This European synthesis report on skills for green jobs brings together the findings from country reports covering Denmark, Germany, Estonia, Spain, France and the UK. Every single job can potentially become a green job; thus, understanding the environmental impact of an occupation needs to be mainstreamed into education and training systems. Case studies show that, although the need for new skills sometimes leads to the creation of new qualification standards, integration of sustainable development and environmental issues into existing qualifications becomes a massive process and may eventually concern all qualifications.

3057 EN – TI-31-10-520-EN-C

PRINTED ON PROCESS
CHLORINE-FREE RECYCLED PAPER (PCF)

CEDEFOP | European Centre for the Development of Vocational Training

Europe 123, 570 01 Thessaloniki (Pylea), GREECE
PO Box 22427, 551 02 Thessaloniki, GREECE
Tel. +30 2310490111, Fax +30 2310490020, E-mail: info@cedefop.europa.eu

visit our new portal www.cedefop.europa.eu

Publications Office

International Labour Office

ISBN 978-92-896-0660-8