

Skills for green jobs

Country report

United Kingdom

Preface

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

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

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

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NB:

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

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1. Introduction

Changes in technology, growing public awareness of climate change and depletion of environmental resources are encouraging the UK economy to become a low carbon economy. Set in the context of a global economic slowdown, the rise of new ‘green’ industries may kick-start economic growth. Regulatory change and policy shifts to reduce carbon emissions are a powerful incentive.

The growth of the low carbon economy inevitably affects demand for labour. There will be continuing job losses in carbon-intensive industries as demand for their products and services decline. However, new jobs are being created in industries producing low carbon goods and services, through cleaner production methods.

In essence, every job in the future will be a green job. Employment practices are currently changing across the board because firms are including environmental considerations in their decision-making. The transition to a low carbon economy is creating new jobs and changing existing occupations. New jobs demand a workforce equipped with new skills. Other workers need to be re-trained and re-skilled to adopt greener practices in their work.

This report presents a synopsis of the UK policy response to the environmental and economic pressures, an exposition of new occupations and an outline of early skills responses to the demand for new occupations and skills within the wider context of the vocational training system. Specific examples of skills responses by employers, regional and sectoral stakeholders are investigated in-depth in our case studies.

This study has attempted to categorise skills needs into the following categories:

- (a) (re)training needs due to structural change;
- (b) new green-collar occupations;
- (c) new types of skills and skills gaps because of greening of existing occupations.

For this study we undertook the following research:

- (a) reviewed relevant UK government policy documents including Acts of Parliament, White and Green Papers and research or positions papers from Government departments and devolved administrations in order to identify key drivers and actions in environmental policy and education and skills policy and the links being made between them at national level;
- (b) reviewed a wide range of research and publications, including grey literature, from other stakeholders, such as regional development agencies, sector skills councils, business and industry groups, non-governmental organisations, think-tanks, academic groups and trades unions which added to our understanding of skills needs and responses;
- (c) interviewed over the telephone selected stakeholders to capture information for the case studies and to discuss the development of strategies and actions in response to skills

needs. This included interviews of staff in sector skills councils, trade and employer organisations, key employers, regional development agencies and government agencies;

- (d) attended relevant workshops and events;
- (e) identified and mapped key sectors affected by the environmental challenges and key policy responses, including the eleven sectors named in the UK low carbon industrial strategy;
- (f) identified a long-list of potential skill responses case studies for further study. Seven case studies were selected to demonstrate skill responses in a range of sectors and level/type of response, and explored in-depth.

The main limitations of our analysis:

- (a) much of the research which has been the evidence base for skills strategies pre-dates some of the Government's key environmental strategies and legislation over the last two years;
- (b) we have drawn on reviews of systems and strategies as much as interviews with policy leads in Government;
- (c) we have not systematically assessed the work of regional development agencies and other regional bodies to support the skills requirements of specific sectors. We are aware that they do provide an important role and their investment has assisted in key sectors which is illustrated in several of the case studies;
- (d) the national catalogue of occupations, the UK Standard Industrial Classification of Economic Activities (SIC), was last revised in 2007 following a consultation process which began in 2002. The latest catalogue cannot therefore be used to identify new occupations. The next update to the catalogue will not be available within the next few years.

2. Policy context

2.1. Key challenges and priorities for the green economy

The UK's main environmental priority is responding to 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 the 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 encompassed within climate change strategy.

The green economy in the UK is already substantial. Almost 900,000 people work in the low carbon sector and its associated supply chain in the UK, in low carbon manufacturing and in green services such as consultancy or low carbon venture capital⁽¹⁾. Consumer demand for greener goods, manufactured through low carbon production methods, is increasing and offers growth opportunities for the green economy.

This has been recognised in government policy; the UK Low Carbon Industrial (LCI) Strategy identifies eleven industrial sectors which are delivering or will deliver low carbon goods and services: wind power, wave and tidal power, nuclear power, carbon capture and storage, low carbon vehicles, low carbon buildings and construction, low carbon aerospace, chemicals and industrial biotechnology, low carbon electronics, business and financial services and carbon markets. Government funding is being made available to support these sectors' development.

Low carbon sectors have been forecast to create up to 400,000 new jobs to bring the total workforce in them to 1.3 million by 2017 . Support measures to industry have been made available by the Government and they include developing strategies and mechanisms to ensure that there is a skilled workforce to enable this growth.

2.2. The response strategy

2.2.1. General environmental strategy

The UK's climate change strategy is underpinned by the Climate Change Act (2008). This introduced legally binding targets to cut greenhouse gas emissions by 80% by 2020. The order of priority in terms of cutting greenhouse gas emissions is as follows: power and heavy

⁽¹⁾ Low Carbon and Environmental Goods and Services: an industry analysis, Innovas for BERR, 2009

industry; transport; homes and communities; workplaces; and, farming, land and waste. Power is the key element of this planned emission reduction and should contribute over half the total required.

The UK Low Carbon Transition Plan (²) outlines the Government's strategy for achieving this reduction. Developing renewable energy is a major element of the strategy but also includes actions to improve energy efficiency of homes and workplaces, reducing emissions from transport and farming and developing a low carbon economy. The plan notes that 'the growing carbon industry in the UK can flourish only if workers have the right skills to meet the demands that businesses will face' and calls for the development of courses and qualifications that reflect these skills (especially in renewable energy and nuclear power).

2.2.1.1. *Energy*

'Together with the Climate Change and Planning Acts, the Energy Act will be central to delivering the right mix of targets, policies and regulation to achieve a diverse, low carbon energy mix' (³).

The UK targets to source 15% of its energy use from renewable energy by 2020. This forms the country's contribution to the target of 20% renewable energy across the EU. Meeting this target from a starting point of 1.3% in 2005 will be extremely challenging (⁴). The UK must invest considerably in new technology and infrastructure. The renewable energy mix will include offshore wind and wave, onshore wind, bio-energy, carbon capture and storage and heat micro-generation.

Two major market mechanisms to incentivise more sustainable behaviours have been put in place: the Renewables Obligation (RO) and the Renewable Transport Fuel Obligation (RTFO). The former requires electricity suppliers to source an increasing proportion of electricity from renewable sources. The target will rise to 10.4% by 2011-12 and then a further 1% annually thereafter. The RTFO is a similar requirement on transport fuel suppliers that 5% of all road vehicle fuel supplied will come from sustainable sources by 2010.

The 2008 Energy Act put forward measures to support achievement of the 2020 renewable targets. These include financial and legislative support for developing and deploying Carbon Capture and Storage technologies, strengthening the obligation on electricity suppliers to source an increasing proportion of their electricity from renewable sources, supporting the wind, heat and nuclear industries, and requiring the roll-out of smart meters across the national gas and electricity grids.

(²) The UK Low Carbon Transition Plan: National strategy for climate and energy, Department for Energy and Climate Change, 2009.

(³) Energy Act 2008 – Royal Assent Script.

(⁴) The EU's Target for Renewable Energy: 20% by 2020, European Union Committee, House of Lords, 2008.

Most recently, through the UK Low Carbon Transition Plan mentioned above and the UK Renewable Energy Strategy⁽⁵⁾, the policy focus has shifted to supporting the development of the renewable energy industries and supply chain, in line with the Low LCI Strategy, as well as securing renewable energy sources for heating and transportation.

In terms of skills, these strategies note the need for transferring existing Science, Technology, Engineering and Mathematics (STEM) skills from established industries which may be declining, such as offshore oil, into renewable activities such as offshore wind. The 2007 Energy White Paper states that the skills gaps and shortages should not threaten energy supplies in the UK in the next five years but acknowledges that forward planning on skills development is essential to meet future needs. It proposes that sector skills councils (SSCs) to report on skills gaps in the sector and take actions to address these.

2.2.1.2. Planning and the built environment

Planning and built environment policy forms the third major aspect of UK environmental policy. Some of the largest environmental impacts in the UK come from buildings and the potential carbon savings from improved construction and management are significant. The built environment is responsible for just under a half (45%) of the UK's carbon emissions: 27% from domestic buildings and 18% from non-domestic. Buildings make a significant contribution to the use of energy, materials and waste. The 'Building a Greener Future'⁽⁶⁾ policy statement introduced targets to achieve zero carbon emissions from buildings by 2016 for homes, 2018 for public buildings and 2019 for non-residential buildings. This has led to introductions of building regulations and programmes to make the design and construction of new buildings greener, facilitate the retro-fitting of old buildings (such as the Housing Growth Stimulus Programme delivered by the Government's Homes and Communities Agency⁽⁷⁾) and the introduction of community scale low-carbon energy microgeneration installations⁽⁸⁾.

The White Paper on 'Planning for a Sustainable Future'⁽⁹⁾ outlines the need for reform of the planning system to support the building of zero-carbon homes and offices, rationalising spatial development to reduce emissions from transport, improving public transport infrastructure and supporting the energy industry to meet the 15% renewable obligation. This has been reflected in revised planning guidance to local authorities. Following on from this, the 2008 Planning Act introduced a new system for approving major infrastructure of national importance. Such projects would include infrastructure relating to energy distribution, fossil

⁽⁵⁾ The UK Renewable Energy Strategy, Department of Energy and Climate change, 2009.

⁽⁶⁾ Building A Greener Future: Policy Statement, Department for Communities and Local Government, 2007.

⁽⁷⁾ http://www.homesandcommunities.co.uk/housing_stimulus.htm.

⁽⁸⁾ <http://www.homesandcommunities.co.uk/low-carbon-infrastructure>.

⁽⁹⁾ Planning for a Sustainable Future, White Paper, Department for Communities and Local Government, 2007.

fuels, nuclear power, renewable energy (e.g generating stations for wave, tidal and wind power), ports, rail and road networks, ports, aviation, water supply and treatment, and hazardous waste. This legislation allows Government to consider and approve such infrastructure of national importance more quickly than in the current system. It is expected that this will allow for a quicker transition to a low carbon economy.

At national and regional levels there has been significant consideration of the skills implications partly because of growth in demand for the built environment workforce and partly because of the recognised shortage of skills available to achieve environmental sustainability. Studies in 2007 (¹⁰) and 2009 (¹¹) for example have identified skills shortages among occupations such as, planners, architects, designers and engineers, and insufficient skills (awareness, knowledge and technical competence) among existing practitioners to drive forward the low carbon agenda. Career entrants are believed to have many of the skills lacking in existing practitioners but there have been insufficient numbers being trained and coming through. Skills such as whole life costing, appraising sustainable solutions, and sourcing low carbon products and building services are identified to be in short supply.

2.2.1.3. *Food*

In the UK, the combined food industry in the UK is responsible for seven million tonnes of carbon emissions a year (¹²) or 22% of emissions associated with all UK economic activity (¹³). The strategy for Sustainable Farming and Food (2002) introduced government actions to assist sustainable land management, respect for natural resources (soil, water, biodiversity) and reduce energy consumption and resource inputs and waste in the production of food. The launch of the Food 2030 strategy in early 2010 updates these policies, taking food security into account. There is a need to increase food production but to do so in a sustainable manner (¹⁴). Policy is not only targeted at food manufacturers (agriculture only accounts for 33% of the food chain's carbon footprint) but is even more important further down the supply chain in distribution, processing (including packaging) and retailing with their associated energy, water and waste implications. For example, the government has funded investment in anaerobic digestion demonstration projects to produce renewable energy and bio-fertilisers from organic waste (¹⁵).

In terms of skills, Food 2030 recognizes the need to improve the UK supply of STEM skills in its workforce to promote greener technological innovations in food, as well as the effective

(¹⁰) Mind the Skills Gap, The Skills We Need for Sustainable Communities, Academy for Sustainable Communities, 2007.

(¹¹) Research into Sustainable Development Advice and Training, GHK Consulting, South East England Regional Development Agency, 2009.

(¹²) Food Industry Sustainability Strategy, Department for Environment, Farming and Rural Affairs, 2006.

(¹³) Food Statistics Pocketbook, Department for Environment, Farming and Rural Affairs, 2009.

(¹⁴) Food 2030, Department for Environment, Food and Rural Affairs, 2010.

(¹⁵) The Future of Farming, Department for Environment, Farming and Rural Affairs, 2009.

adoption of sustainable practices by farmers, fishermen and other employees in the UK agri-businesses. It also calls for the development of a biotechnology and bioscience advance training partnership scheme between industry and higher and further education providers to provide high level training (masters, professional doctorates and continuous professional development).

2.2.1.4. *Transport*

Transport contributes to 23% of the UK domestic carbon dioxide (CO₂) emissions (¹⁶). Road transport (cars, vans and lorries) is responsible for 93% of these. To reduce emissions of CO₂ and other greenhouse gasses from transport, the government has set three goals in its 2007 Sustainable Transport Policy. These are:

- (a) putting a price on carbon by including the aviation sector in the emission trading schemes;
- (b) investing in the deployment of low-carbon technologies (such as electric cars and rail);
- (c) improving public transport and urban design to make it easier for people and business to make low carbon choices (such as public transport/cycling rather than carbon-emitting private vehicles).

These goals have important implications for workforce skills, although this need was not recognized in the policy papers.

To tackle road transport emissions and support the development of a low carbon automotive industry, the Ultra-Low Carbon Vehicles in the UK strategy was launched in 2009 (¹⁷). The government will invest £400 million in this strategy, through measures such as trials of electric and low carbon cars and vans, a subsidy for buyers of electric and plug-in cars and developing infrastructure to allow vehicles to be re-charged away from the driver's home. A new Office for Low Emission Vehicles was set up to support the operation of the strategy, including working with industry bodies, manufacturers, regional development agencies, trade unions and education providers to equip the workforce with appropriate skills.

2.2.1.5. *Environment*

Adapting to flooding and the risk of flooding has been an area of major interest in the UK, particularly because of the devastating impact of recent floods on affected communities. The government has responded with actions to support communities facing coastal erosion, such as property-level flood protection but also managing natural resources better to reduce the risk of flooding. Additionally, regulations have been put in place around water quality, waste

(¹⁶) Towards a Sustainable Transport System: Supporting Economic Growth in a Low Carbon World, Department for Transport, 2007.

(¹⁷) Ultra-Low Carbon Vehicles in the UK, HM Government, 2009.

and recycling management, air quality, biodiversity, land conservation and marine and fisheries to prevent and minimise environmental degradation (¹⁸).

The Department for the Environment, Farming and Rural Affairs (DEFRA) has also been funding the UK Climate Impacts Programme ‘to help organisations [and businesses] to assess how they might be affected by climate change’ (¹⁹). The programme offers a range of tools and resources (such as the Adaptation Wizard (²⁰)) to help businesses prepare for the impacts of climate change, including the training and skills implications such as gaining skills and knowledge around business planning, energy efficiency and insurance and risk assessment.

2.2.2. Green response to the current economic crisis

2.2.2.1. *Green stimulus*

In 2008 the UK government launched its £20bn recovery plan as part of the Pre-Budget report, equivalent to 1.4% of gross domestic product (GDP). The package included a modest (compared to other countries’ packages) ‘green stimulus’ of £535m, as well as other environmental spending commitments. The green stimulus focused on building energy efficiency, low carbon transport (railway and vehicles) and flood defence.

The green element of the stimulus package includes:

- (a) £100 million of new funding for Warm Front, a programme which will assist 60,000 low income households to cut their energy bills through insulation and more efficient heating systems such as new energy efficient boilers and radiators;
- (b) £60 million to provide 16,000 affordable housing units with energy efficiency and heating measures as part of an accelerated Decent Homes programme which is upgrading social housing;
- (c) £300 million to accelerate the delivery of up to 200 new carriages to expand capacity on the UK’s rail network;
- (d) £20 million of spending on flood defences, to deliver earlier protection for 27,000 homes;
- (e) £5 million of spending on British Waterways canal network infrastructure (²¹).

The ‘green stimulus’ did not allocate any additional public spending to renewables or other low-carbon power sources but extended the RO from 2027 to 2037 (²²). Funding allocated for

(¹⁸) <http://www.defra.gov.uk/environment/policy/index.htm>.

(¹⁹) UK Climate Impacts Programme, A changing climate for business, 2009.

(²⁰) UK Climate Impacts Programme. The UKCIP Adaptation Wizard v 2.0. UKCIP, Oxford, 2008.

(²¹) HM Government (2008) 2008 Pre-Budget Report.

(²²) Robins et al (2009) HSBC Report.

the RO, as well as the Carbon Emission Reduction targets, are expected to be worth around £1bn a year.

In 2009, the UK government introduced two new stimulus measures to supplement the lack of environmental policy related measures in the initial package (especially compared to other countries). These included a £2.3bn support package for the car industry in January 2009 (£1.3 billion in loans from the European Investment Bank and not included in the analysis below) and a £1.4bn low-carbon investment programme in the 2009 Budget. The latter included the £405 million Low Carbon Investment Fund which is part of the LCI Strategy (mentioned above).

Overall, the three stimulus packages amount to £22.7bn or 1.5% of GDP⁽²³⁾. The green portion of the stimulus packages is £3.3bn, equivalent to 14.5% of the total stimulus and 0.22% of GDP. A summary can be found in Table 1 below.

Table 1: Summary of green stimulus measures in the UK's stimulus packages measure

Activity	Cost (£ million)
Carbon Capture Storage (CCS) / Other	90
CCS research	60
Low Carbon Investment Fund – Nuclear	30
Energy Efficiency	575
Insulation in social housing through Decent Homes programme	100
Construction of new social housing with high energy efficiency	100
Low-cost loans for energy efficiency in small and medium businesses	100
Loans to install energy efficiency measures in public buildings	65
Decent Homes Programme	60
Warm Front	150
Low-Carbon Vehicles	1,355
Low Carbon Investment Fund – Ultra-low carbon vehicles	20
Loans and guarantees for low-carbon vehicles	1,000
Train to Gain for automotive industry	35
Scrapage scheme	300
Rail	300
Rail investments	300
Renewables	900
Low Carbon Investment Fund – Renewables	305
Offshore wind	525
Decentralized small-scale and community low-carbon energy	70
Transportation	5

⁽²³⁾ Reid (2009:15) Opportunity in a Time of Crisis: Stimulus Packages and the Green New Deal.

British Waterways	5
Other	80
Flood Defences	20
Low Carbon Investment Fund – Manufacturing	50
Waste infrastructure	10
Total	3,305

Source: Reid, 2009 (²⁴)

The Low Carbon Investment Fund is the main component of the green stimulus which supports skills development, mainly for higher level skills, through funding for technology demonstration and research and development projects at higher education institutions and research institutes. On technical skills, £35 million of additional funding (to the normal £65million) has been made available to provide training to workers in the automotive industry through the Train to Gain programme.

2.2.2.2. *Green industrial policy*

In response to the Stern Review on the Economics of Climate Change (²⁵) that called for the deployment of low carbon technologies for power, heat and transport, the Government set up a Commission on Environmental Markets and Economic Performance (CEMEP) in 2006 to make recommendations which would help the UK exploit economic opportunities in the transition to a low carbon economy. CEMEP undertook an examination of the UK's comparative advantage in new environmental technologies and recommended, among other things, that:

'Government Departments' and regulatory agencies' science and innovation strategies should not focus only on the use of science to support policy, but should address their role in inducing and rewarding private sector innovation that furthers the Government's environmental objectives' (²⁶).

In response to the economic recession, and following the CEMEP recommendation the Government has been engaged in developing an 'active industrial policy' which is particularly focused on industries which have the potential to grow in the transition to a low carbon economy. Thus, the 2009 White Paper 'New Industry, New Jobs' (²⁷) proposes to accelerate growth in areas where the UK has a potential comparative advantage by targeting interventions in these sectors; such as funding research and development, improving access to finance for start-ups, creating necessary infrastructure and investing in relevant technical and high-level skills. Targeting a particular area does not necessarily mean that it believes that

(²⁴) Reid (2009:15) Opportunity in a Time of Crisis: Stimulus Packages and the Green New Deal.

(²⁵) Stern Review: the economics of climate change, Stern et al, HM Treasury, 2006.

(²⁶) Commission on Environmental Markets and Economic Performance Report, 2007.

(²⁷) New Industry, New Jobs, Department of Business, Innovation and Skills, 2009.

sector is more important for UK growth than others but rather that the sector has ‘significant constrained potential and that Government can make a difference to the prospect of growth or high-value employment by removing barriers to the market’.

Building on the New Industry, New Jobs White Paper, the UK’s Low Carbon Industrial Strategy (²⁸) was announced later in 2009. It contains detailed proposals on how Government will facilitate the 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 will receive a total of £405 million set aside specifically in the 2009 Budget. Support measures include:

- (a) establishing Low Carbon Economic Areas (LCEAs); to accelerate economic growth in targeted geographical areas with advantages such as existing regional expertise, a skills base and business clustering. To date, the South West of England has been identified as the LCEA for marine energy and the North East of England for ultra-low carbon vehicles;
- (b) providing increasing support to research and development for business at early stages of innovation through funding for a Technology Strategy Board;
- (c) increasing access to finance for low carbon companies through the UK Innovation Investment Fund so that innovative low carbon concepts and technologies can become commercial products and services;
- (d) modernising the energy, water, waste, communication and transport infrastructure to make it ready for the low carbon transition, for example by facilitating the access of renewable energy sources (wind, combined heat and wave power) to the electricity grid and large-scale electrification of the rail track network.

The UK LCI strategy acknowledges that ‘Britain’s low carbon skills based will be a determining factor in our ability to attract low carbon investment, successfully commercialise low carbon technologies, and innovate within companies’. It proposes to support workforce skills in low carbon industries through the skills system and announces two subsequent skill strategies which outlined the Government’s proposed actions to achieve this. These are:

- (a) the 2009 National Skills Strategy to focus skills provision on sectoral skill needs in low carbon industries;
- (b) the 2009 Higher Education (HE) Strategy which reviews the future role of higher education and how the Government will support universities and low carbon sector employers to address higher level skills needs.

²⁸) The UK Low Carbon Industrial Strategy, Department of Business, Innovation and Skills, 2009.

2.2.2.3. *Responses from the devolved administrations*

While policy on energy and climate change is an issue which is dealt with at a UK level, the devolved administrations in Scotland, Wales and Northern Ireland have developed their own policies and strategies to contribute to the carbon emission targets, as well as on low carbon economic development, fuel poverty, energy efficiency, and environmental, agricultural and rural policy.

In Scotland, the Climate Change (Scotland) Act (²⁹) sets a target for reducing greenhouse gases in Scotland by 80% on 1990 levels by 2050, with an intermediate target of a 42% reduction by 2020. The targets will be delivered through greater electricity and heat supply through renewable sources, improving energy efficiency and reducing carbon emissions from transport, rural land use and waste.

The Scottish Government acknowledges the potential for economic growth for a low carbon economy in its 2009 Economic Recovery Plan (³⁰). Areas of green opportunities in the country include renewable energy, carbon capture and storage, energy efficiency and clean technologies. Scotland is the location of the majority of the UK oil and gas industry and the Scottish response has thus focused on supporting initiatives in energy efficiency and renewables.

In Wales, the One Wales – A progressive agenda for the government of Wales (³¹) sets out the commitment to reduce greenhouse gas emissions in areas of devolved competence by 3% each year until 2011. The Wales Assembly Government has also developed policy on renewable energy and energy efficiency, sustainable development, land use and food and fisheries. In renewable energy for example, the Wales Assembly Government plans to invest in wind, wave and tidal technology to produce all the electricity consumed in Wales by 2025.

In Northern Ireland, the Executive in its Programme for Government 2008-11 set out targets for reducing greenhouse gas emissions by 25% on 1990 levels by 2025 as well as committing to overall UK targets as laid out in the Climate Change Act. In terms of energy policy, the picture is more complicated in Northern Ireland as their power supply is partially linked to that of the Republic of Ireland. Nevertheless the Northern Ireland administration has its own targets on renewable energy.

(²⁹) Climate Change (Scotland) Act, Scottish Government, 2009.

(³⁰) Economic Recovery Plan, Scottish Government, 2009

(³¹) One Wales – A progressive agenda for the government of Wales, Welsh Assembly Government, 2009.

2.3. The skills development response to greening

The UK Government makes a significant and growing investment in adult skills which currently stands at over £5 billion a year. It has produced three skills strategies since 2003 (³²), demonstrating its increasing commitment to improving the technical and vocational skills of the workforce and aligning these with industry's needs. The most recent skills strategy in 2009, Skills for Growth (³³), underlines the continued importance that the Government attaches not only to the development of existing workforce skills but to the development of low, intermediate and higher level skills, and the strategic importance of these for economic recovery and growth.

The strategy highlights:

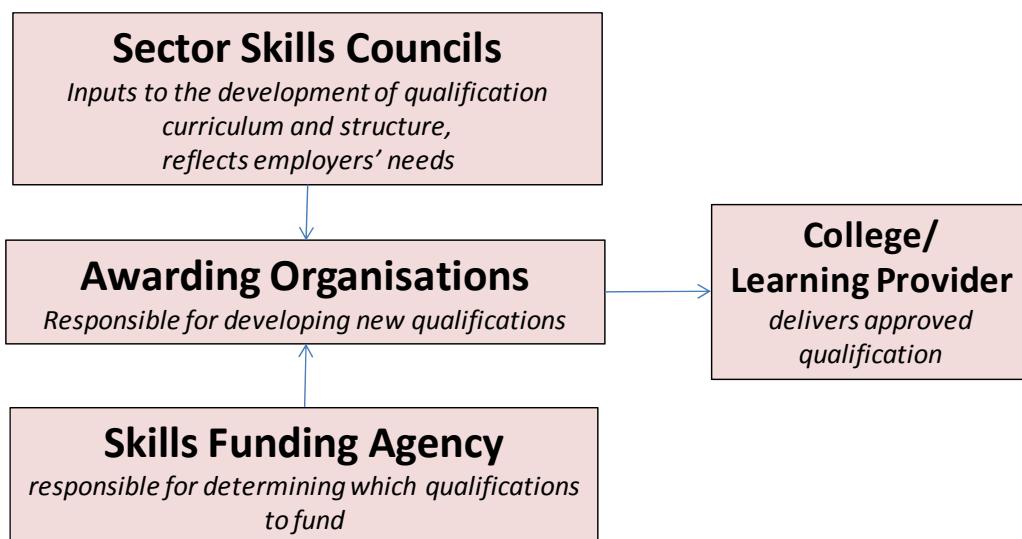
- (a) a continuing commitment to address the basic skills gaps of those in the workforce with £1 billion for Skills for Life training and the lack of vocational qualifications held by workers with £925 million for the Train to Gain programme (which provides training for people in work). The latter has grown considerably over five, to provide work based learning for employees without a level 2 qualification;
- (b) a continuing commitment to develop the workforce's technical and vocational skills with additional funding for 20,000 more apprenticeships in 2010-11 and an extra 35,000 places from 2011-12. Apprenticeship programmes have grown in number and spread over the last 10 years to draw more young people and adults into gaining recognised qualifications through work and college based learning;
- (c) the development and expansion of University Technical Colleges, foundation degrees and advanced apprenticeships to level 4 (35,000 more advanced apprenticeship places are to be created by 2011) to broaden opportunities for progression to advanced technical and vocational levels which are critical in many industries of the future;
- (d) the significance of nurturing new and higher skills in the key 'priority sectors' identified in the White Paper, New Industry, New Jobs, in particular life sciences, digital media and technology, advanced manufacturing, engineering, construction and low carbon products and energy. A budget of £100 million has been put aside to fund around 160,000 more training places at levels 2 and 3 in the industries. SSCs and RDAs are to work together to determine how these funds will be spent;
- (e) the on-going process of qualification reform in the UK which also impacts on the provision of qualifications for the transition to a low carbon economy. Qualification development is largely conducted by independent awarding organisations, but qualifications will only be eligible for public funding if they meet SSC requirements. SSCs all have in place Sector Qualification Strategies (SQS) which outline the content of

(³²) The first two strategies were '21st century skills – Realising our Potential, DCSF, 2003' and 'Skills: getting on in business, Getting on at Work, DCSF, 2005'.

(³³) Skills for Growth: The National Skills Strategy, Department for Business, Innovation and Skills, 2009.

qualifications for their sector. The SQS highlights the skills requirements of new and existing qualifications and provides a blueprint for Awarding Organisations to develop new qualifications, which must all receive SSC approval before being eligible for public funding.

Figure 1: Outline of the qualification development arrangements



In response to the economic downturn, additional funding has been allocated for 80,000 training places for recently unemployed or at risk of unemployment, training and skills support for 75,000 people who have been unemployed for longer than six months to undertake job-readiness training and to provide a guarantee of a job, work placement or training for young people aged 18 to 24 who have been unemployed for 12 months⁽³⁴⁾. This is in addition to the current offer and guarantees of training to the long term unemployed and those aged 16-18.

Significant machinery of government changes this year will have an impact on the delivery of adult skills provision from 2010 and beyond. These are designed to improve coordination, increase the influence of employers over what is provided and ‘switching more funding into the sectors and the markets where it can make a demonstrable difference in underwriting necessary skills development’⁽³⁵⁾.

From April 2010 the Learning and Skills Council (the body currently responsible for learning and skills and adult education for those aged over 16 except higher education) will cease to exist. Instead, responsibility for the education, learning and skills for those aged up to 18 years of age will rest with local authorities (in line with the intention to raise the age for

⁽³⁴⁾ Skills Investment Strategy 2010-11, Department for Business, Innovation and Skills, 2009.

⁽³⁵⁾ Skills for Growth: The National Skills Strategy, Department for Business, Innovation and Skills, 2009.

compulsory education and training to 18 by 2013), while adult learning and skills policy will be the responsibility of the new Skills Funding Agency (SFA). The key actors in the revised skills arrangements are:

Department for Business, Innovation and Skills (DBIS) is responsible for devising and overseeing implementation of policy across enterprise, innovation and skills⁽³⁶⁾. This includes the policy areas of universities and higher education, post-18 vocational skills, apprenticeships, science and innovation, trade and industry, business and regional economic development.

Regional Development Agencies (RDAs) are responsible for furthering economic development and regeneration in their regions. There are nine RDAs in England and they are tasked with identifying regional priorities for growth in their region, including identifying skills needs and assessing fitness of provision. They have led regional skills partnerships to coordinate the work of the SSCs, RDA and LSC. In the new arrangements, RDAs in England will have a key role in devising regional skills strategies⁽³⁷⁾, which will be integral to Single Integrated Regional Strategies (SIRS) covering economic, social, spatial and environmental objectives for each region⁽³⁸⁾. RDAs will work very closely with sector skills councils (SSCs) and local authorities/sub-regional bodies when developing the skills strategies for their region. It is envisaged that the SIRS will influence the SFA to ensure that regional skill priorities are reflected in the allocation of funding to providers.

Sector Skills Councils (SSCs) are employer-led, government-sponsored organisations overseeing the skills landscape in their sectors. There are 25 SSCs operating on a UK-wide basis covering different parts of the workforce, though mergers of some are planned. The purpose of the SSCs is to identify and reduce skills gaps and shortages in their sector, improve the skills of their sector's workforce, ensure the supply of skilled labour to the market, and improve the supply of learning provision to meet employer demand. To achieve these aims SSCs have been responsible for brokering Sector Skills Agreements between employers and providers, creating Sector Qualification Strategies and contributing to the development of National Occupational Standards, frameworks for Apprenticeships and new vocational qualifications to be included on the Qualifications and Credit Framework. Some SSCs have had sector skills agreements since 2005 and qualifications strategies have emerged from these arrangements and extensive consultations with employer and learning providers. The Skills for Growth strategy envisages a stronger role for SSCs from 2010, especially in targeting the skills needs industrial sectors with growth priorities, through working with RDAs to identify priorities, developing and approving new qualifications where these are

⁽³⁶⁾ This department was created in 2009 with the merger of the Department for Universities, Innovation and Skills (DIUS) and the Department for Business, Enterprise and Regulatory Reform (DBERR). Both historic departments and their publications are mentioned in this report.

⁽³⁷⁾ Skills Investment Strategy 2010-11, Department for Business, Innovation and Skills, 2009.

⁽³⁸⁾ London is an exception to this where the Mayor of London and the Greater London Authority assume these responsibilities.

critical for employers in specific sectors, and leading the development of National Skills Academies for their sector.

The UK Commission for Employment and Skills (UKCES) is responsible for overseeing and funding the SSCs and improving the employment and skills system. From 2010, UKCES will be responsible for delivering an annual National Skills Audit to identify skills gaps and shortages in the entire UK labour force. UKCES will also be responsible for coordinating SSCs' responses to skills needs in growth industries, especially in industries where they cover several SSCs' footprints (³⁹).

The Skills Funding Agency (SFA) will be responsible for allocating funding for post-18 education (except for higher education) and ensuring a network of training providers such as further education colleges and training institutions is available to meet needs across England. Priorities for funding will be determined by the regional skills strategies, developed by RDAs, SSCs and local authorities. This will make a contribution to supporting active industrial policy through allocating public funds to sectors and markets where they 'can make a demonstrable difference in supporting skills development that will help economic growth' (⁴⁰).

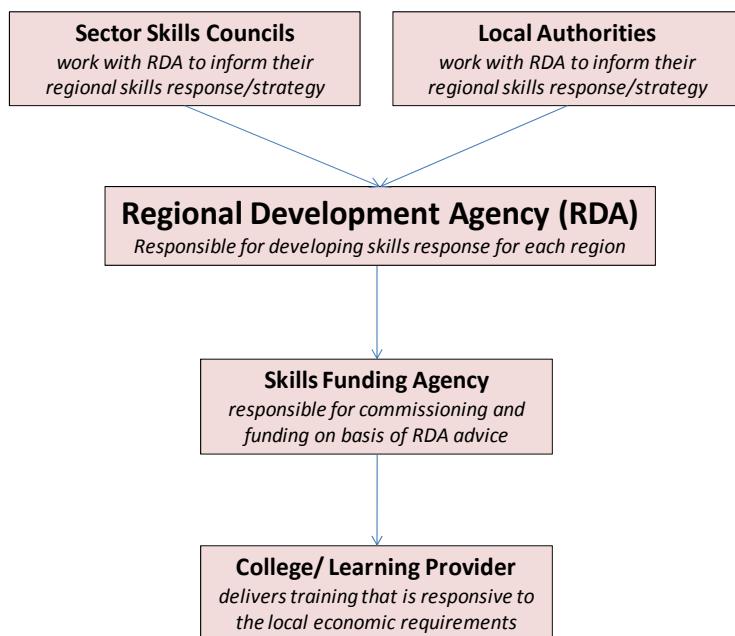
Local Authorities (LAs) will be given the responsibility for funding vocational education and training for young people between the ages of 16 and 18 (which currently lies with the Learning and Skills Council). This includes funding for Diplomas and some Apprenticeships.

Awarding Organisations are responsible for developing and updating accredited qualifications, which are developed in partnerships with SSCs or training providers. Learning for these accredited qualifications is delivered by providers (schools, colleges, private training providers). The SFA will make decisions about which qualifications will be publicly funded. This relationship is outlined in Figure 2 below.

(³⁹) Jobs of the Future, HM Government, 2009.

(⁴⁰) Skills for Growth: The National Skills Strategy, Department for Business, Innovation and Skills, 2009

Figure 2: Outline of new post-18 adult skills arrangements



Source: GHK

2.3.1. Higher education

For higher education, the Government's Higher Ambitions strategy⁽⁴¹⁾ sets out universities' important contribution towards the economic growth and development of higher level skills in the UK. Four key changes are proposed to facilitate universities' contribution to economic growth, including:

- (a) asking the Higher Education Funding Council for England (HEFCE) which funds university teaching to devise new funding incentives to respond to higher level skills needs, such as funding for degree courses in STEM subjects;
- (b) tasking universities, HEFCE and UKCES to work with SSCs and RDAs to identify and tackle areas where supply is not meeting demand, in particular in areas where the UK has a competitive advantage (financial services, biosciences, advanced manufacturing, low carbon, creative industries and higher education);
- (c) asking businesses to be active partners in working with universities to develop higher level qualifications that are fit for purpose;
- (d) reviewing the demand for and supply of postgraduate provision.

⁽⁴¹⁾ Higher Ambitions, Department for Business, Innovation and Skills, 2009.

The Higher Ambitions strategy also proposes ways to strengthen research capacity and its economic impact by increasing its concentration on what is considered world-class research; developing incentives to increasing the social and economic impact of research; and supporting stronger longer term links between business and universities.

2.3.2. Compulsory level education

For children and young people, the Department for Children, Schools and Families (DCSF) plays a key role in ensuring sustainability and environmental issues are embedded in compulsory education. The Department's Sustainable Development Action Plan (⁴²) states that the national curriculum should retain its specific references to sustainable development in the key areas of Geography, Science and Citizenship as well as being integrated across the whole curriculum. It also expects the curriculum to engage young people with three key questions: what are the biggest challenges facing our planet and how might they alter our future; how can I enjoy a good quality of life, without transferring problems to people in other parts of the world; and, how can I become an active global citizen and help look after the planet for future generations (⁴³).

Citizenship was introduced to the national curriculum in September 2002 and is a major route for delivering such learning. It includes a 'People and the Environment' unit (⁴⁴) which discusses issues such as waste management, wildlife conservation, road-building, creating new housing on a green field site or food production.

Science and Geography have always been important for delivering learning on environmental issues. The Geography curriculum places emphasis on ensuring young people understand the interrelated nature of the human and physical environments as well as climate change. The Science curriculum covers energy production. The DCSF and DECC have produced guidance for the teaching workforce to ensure their own knowledge is coherent and accurate in these areas.

As part of the reform of qualifications for young people aged between 14 and 19, the Government decided to introduce Diplomas as new alternative qualifications equivalent to GCSEs (⁴⁵). DCSF's Action Plan identifies this as a key way of delivering learning on sustainable issues. A Diploma requires young people to achieve appropriate levels in English and Maths, as well as having a more vocational element and a work experience component. They can be studied alongside GCSEs over two years and are available at levels 1, 2 or 3 to provide pathways to work as well as higher learning.

(⁴²) DCSF (2008), Brighter Futures – Greener Lives.

(⁴³) http://curriculum.qcda.gov.uk/uploads/Dimensions_global_and_sustainable_development_tcm8-14477.pdf#false.

(⁴⁴) <http://www.standards.dfes.gov.uk/schemes2/citizenship/cit021/?view=get> for more detail.

(⁴⁵) Department for Education and Skills (2005), 14-19 Education and Skills.

The SSC for the environmental and land-based sector, Lantra, has developed the Diploma in Environmental and Land-based studies in partnership with SSCs for related sectors (⁴⁶). It has been available from September 2009; the course content includes environmental science, working with plants and animals, and developing the sustainable environment.

The Diploma in Construction and the Built Environment was introduced a year earlier, in September 2008. Key elements of this curriculum include construction and building services (such as heating, ventilation and air conditioning), energy and utilities (such as electricity, gas and waste management), and the process and manufacturing industries (which include extractive industries and building products). The curriculum requires learners to examine the impact of climate change on the design of the built environment and on ways of minimising energy and water waste. There is also a Diploma in Science, to be launched in 2011, which will contain elements of the green skills agenda.

2.3.3. The devolved administrations

It is important to note that the skills landscape described above primarily refers to the situation in England. The devolved administrations in Scotland, Wales and Northern Ireland are responsible for education, training and lifelong learning in each nation. Industrial and energy policies are not fully devolved issues (UK legislation and strategies cover these). However, the devolved administrations have issued national delivery plans and strategies to address these as described in Section 2.3. Employment legislation is determined at UK government centrally and crucially, employer-facing skills bodies such as the SSCs and the UKCES and initiatives, such as the Skills Academies, operate on a national level.

The Scottish Government's Lifelong Learning Strategy in 2007 (⁴⁷) makes the links between engaging young people to acquire the skills needed for work with the skills needed to address weaknesses in Scotland's labour market. In particular it acknowledges concerns about the number of young people achieving intermediate level skills and basic skills for employment while skills shortages are constraining growth especially the availability of skilled scientists, technologists and engineers. 'More graduates and technicians are needed for industries in which Scotland operates at the leading edge', – including life sciences and energy, such as renewables.

The 2009 Scottish Economic Recovery Plan (⁴⁸) introduced a series of measures to support unemployed people to develop skills to gain employment while upskilling the existing workforce to help businesses improve their productivity. These measures include providing £16million for over 7,500 additional places for funded apprenticeships and targeted skills development programmes for employers considering making redundancies. Because of their

(⁴⁶) Construction Skills, Energy and Utility Skills, Improve and Skills Active.

(⁴⁷) Skills for Scotland: A Lifelong Skills Strategy, Scottish Government, 2007.

(⁴⁸) Economic Recovery Plan, Scottish Government, 2009.

potential for growth and contribution to economic development and employment, the Scottish Government has placed particular focus on vocational education and training in the following industries: universities, creative industries, energy, financial and businesses services, food and drink, life sciences and tourism through targeting funding to these sectors.

The Welsh Green Jobs Strategy (⁴⁹) outlines the Wales Assembly Government's approach to delivering their overall sustainability scheme One Wales: One Planet. In conjunction with SSCs, they are: 'Acting to identify the practical skills which will help to create a pool of 'renewables champions'. They will promote best practice in reducing household energy consumption to domestic consumers and small businesses and maximise local low carbon energy generation'. They are also focusing public spending in infrastructure, business support and skills on particular areas with the carbon economy sector being one of these (in particular, sustainable building technologies, opportunities arising from large scale renewables and other low carbon energy technologies, low carbon vehicles and climate change adaptations).

Success through Skills: the Skills Strategy for Northern Ireland (⁵⁰) was published by the Department of Learning and Skills of the Northern Ireland Executive in 2006. The strategy aims to improve understanding for the demand for skills, improve skills levels of the workforce, improve the quality and relevance of education and training and tackling skills barriers to employment and employment. It further outlines that the Northern Ireland Executive will work with employers, SSCs, education providers or sub-regional workforce development forums to achieve these aims. In terms of future skills needs, the department has recently undertaken future skills forecasting study (⁵¹). The study acknowledges the 'emergence of green jobs' as a factor which may influence future skill needs.

(⁴⁹) Capturing the Potential: A Green Jobs Strategy for Wales, Welsh Assembly Government, 2009.

(⁵⁰) Success through Skills: the Skills Strategy for Northern Ireland, Department of Learning and Skills, the Northern Ireland Executive.

(⁵¹) Forecasting Future Skill Needs in Northern Ireland, Department for Employment and Learning.

3. Anticipation and provision of skills

3.1. Green structural change and (re)training needs

This section outlines the skills and (re)training needs in response to greening of the UK economy. As the identification process and the agents involved in providing the skills response for green restructuring are identical to new and changing skills needs these are described in Section 3.2.

3.1.1. Green restructuring and its impact on the labour market

Changes in industrial sectors that are carbon dependent may result in job losses or may require the existing workforce to be retrained as their industries adapt to new requirements. As stated in the House of Commons Environmental Audit Committee second report on Green Jobs and Skills ‘job losses are not inevitable but the requirement for companies to be less carbon intensive is’⁽⁵²⁾. Certain areas in the UK are more dependent on jobs in carbon-intensive sectors than others and new jobs created may not be in the same locality so some communities may experience a net loss of jobs.

The ‘Working Futures 2007-17’ report, published in December 2008 offers the most comprehensive review of skills implications derived from technological change, changes in government policy and legislation and other socio-economic factors affecting the UK labour market. However, this ten-year projection was generated in the first half of 2008 – before the implications of the global financial crisis were understood. The uncertainty around the economy means that it is likely that the projection underestimates the effects of lower employment in 2009 and 2010. However, the projections do still take into account longer-terms trends in demand for skills unaffected by the economic cycle.

Regardless of these limitations to the Working Futures forecasts, Table 2 and Figure 3 indicate clear trends in employment across sectors. In the last 30 years, there have been considerably fewer jobs in manufacturing and the primary sector and utilities: one in five jobs was located in manufacturing in 1987 compared to one in ten 20 years later. Employment in business and other services, on the other hand, has increased by almost 3% a year since 1997 and is projected to continue growing (at a slower rate) up to 2017.

Environmental pressures have somewhat contributed to the decline of manufacturing, the primary sector and utilities – although by no means is it the major factor explaining this trend. For example, there is evidence that EU Emissions Trading Scheme has exposed five carbon

⁽⁵²⁾ House of Commons Environmental Audit Committee, Green Jobs and Skills, Second Report of Session 2008 – 2009, December 2009.

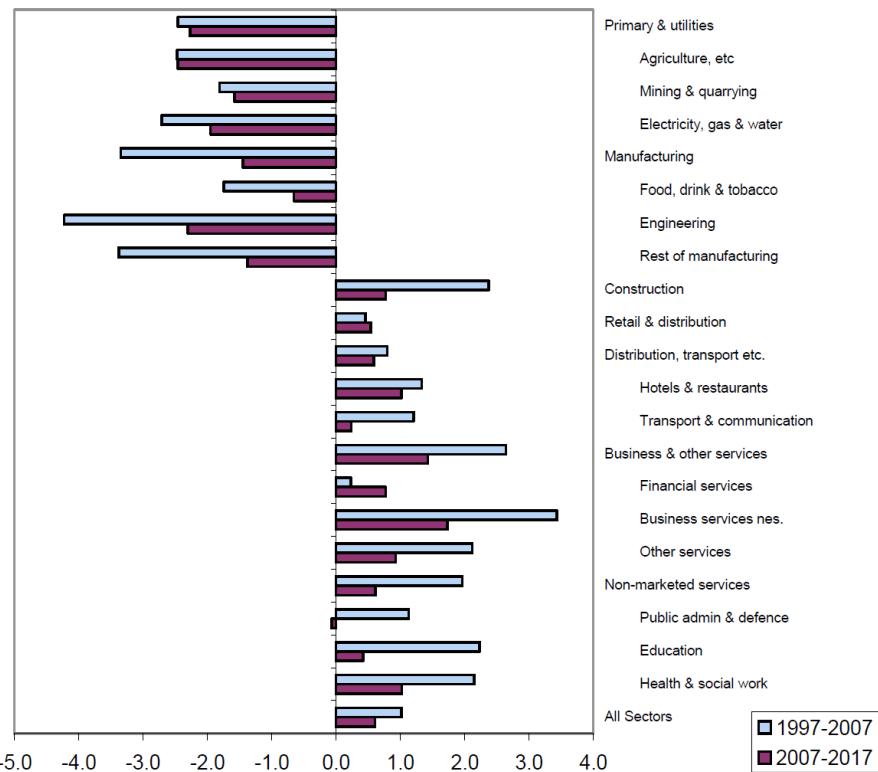
intensive industries (lime, precious metals, ceramic products, basic iron and steel, cement) to job losses more than other sectors not exposed to the scheme. More significantly trends can be explained by the growing demand for service sector employment, such as financial services, while much manufacturing has continued to lose its competitiveness with other countries.

Table 2: Employment (share of) by broad sector, 1987-2017 (%)

Broad sector	1987	1997	2007	2012	2017
Primary sector and utilities	4.2	2.9	2.0	1.8	1.5
Manufacturing	19.4	15.8	10.2	9.2	8.3
Construction	7.5	6.1	7.0	7.1	7.1
Distribution and transport	27.8	29.1	28.4	28.4	28.4
Business and other services	19.2	23.4	27.4	28.6	29.8
Non-marketed services	22.0	22.7	24.9	25.0	24.9
Total	100	100	100	100	100

Source: Working Futures 2007 – 2017, CE/IER estimates, CE projections MDM C81F9A

Figure 3: Trends in UK employment by sector (per cent per annum)



Source: Working Futures 2007-17, CE projections MDM C81F94

More detailed forecasts about be found in SSCs' sector skills agreements which are used in the sections below, though these also by and large pre-date the economic downturn.

Obsolete occupations/declining sectors

In 2008 the UK Coal Mining industry employed just over 6,000 workers⁽⁵³⁾ compared to a peak of 1,250,000 in the 1920s⁽⁵⁴⁾. Losses were heavily concentrated in specific areas, within 90% of jobs lost since the 1980s occurring in just 34 local authorities. Coal production in the UK peaked in the first half of the previous century as a result of mechanisation, industrialisation and the demands of the two world wars. Since the 1950s, the coal mining industry has been in decline. Reasons for the decline include the increasing scarcity of economic coal reserves, competition from cheaper energy sources such as oil, gas and nuclear and legislation such as the 1956 Clean Air Act which reduced demand for smoke burning fuel for domestic and industrial use. However, even the country's largest coal producer, UK Coal plc, has had to diversify into renewable energy through electricity generation from methane (a by-product of coal extraction) and wind farms⁽⁵⁵⁾. The industry may still be able to contribute to the UK's energy needs in the future if technologies such as clean coal and carbon capture and storage prove commercially viable. Since the mid-1990s, local communities affected by the decline of the coal industry have received funding for regeneration through the National Coalfields Programme. However, a 2008 report⁽⁵⁶⁾ on the programme has found that even though the investment has created more jobs in these areas, these jobs are not being taken up by ex-coalminers but by people moving or travelling to the areas. There is thus significant room for improving the employability and skills of the former coal industry workforce.

The UK Ship Building industry has been in decline since the 1950s from a position of market dominance over two centuries. Reasons for this decline include the increased competition from other countries such as Germany, Denmark, Sweden, Japan, South Korea and the US and the failure to adapt to newer, more efficient and technologically advanced production methods. The 1970s oil crises and higher prices in crude oil resulted in reduced demand for ships and forced many UK shipyards to wind down⁽⁵⁷⁾. British shipbuilding is now mainly concentrated in production of defence and leisure vessels or has had to diversify into other heavy industries such as oil and gas (constructing offshore platforms, oil rigs, floating production storage and offloading equipment, and drill-ships). Most recently, the sector has diversified into installations for offshore and onshore wind turbines and wave and tidal energy.

The Automotive Manufacturing sector in the UK underwent a period of significant restructuring in the 1990s. Peaking in the 1970s, car production dipped in the 1980s. Current

⁽⁵³⁾ The Coal Authority statistics, <http://www.coalpro.co.uk/index.shtml>.

⁽⁵⁴⁾ A Century of Change: Trends in UK statistics since 1900, House of Commons Research Paper, 1999.

⁽⁵⁵⁾ <http://www.ukcoal.com/re-the-company>.

⁽⁵⁶⁾ A mine of opportunities: Local authorities and the regeneration of the English coalfields, Audit Commission, 2008.

⁽⁵⁷⁾ British Shipbuilding 1950-1980: Trends and Developments with a case study of the Scott Lithgow Shipyard, Greenock, Economic History Society Conference Papers, 2006.

employment in sector is concentrated in companies that supply manufacturers (rather than being major vehicles manufacturers directly), small businesses (82% of employers) and niche markets such as luxury vehicles, motorsport and design engineering (⁵⁸). Most recently, the automotive industry globally has suffered because of falling volumes of car sales and profits (⁵⁹). Reduced consumer demand because of the economic slowdown and higher fuel prices have led to factory closures and associated job losses, including large UK employers such as Honda, Nissan, Jaguar Land Rover, Renault, Ford, Vauxhall and BMW. Diversification into low carbon vehicles, such as electric, hydrogen and hybrid, is an area of opportunity for the future of sector.

3.1.2. Case studies

3.1.2.1. *Harland & Wolff: ship building to wind turbines*

Harland & Wolff (H&W) is a long-standing heavy engineering company established in 1858 in Belfast. Its ship building operations were large and varied and included the construction of HMS Titanic. As demand for ocean liners declined with the emergence of the aviation industry and cheaper shipyards around the world reduced their competitiveness, the company diversified into offshore oil and gas markets (constructing offshore platforms, oil rigs, floating production storage and offloading equipment (FPSOs), and drill-ships). In 2002, using the skills and infrastructure from their ship building and offshore platform experience, H&W embarked on a further diversification strategy changing their name to Harland & Wolff Heavy Industries. While they continue to retain a foothold in the shipbuilding and offshore oil and gas markets, they now also produce a range of renewable energy products, such as turbines for offshore wind farms, wave and tidal energy devices, as well as decommissioning ships at the end of their lives in an environmentally sustainable manner.



(⁵⁸) Sector Skills Agreement – Electronics, Automotive and Aerospace Industries, SEMTA, 2006.

(⁵⁹) An Independent Report on the Future of the Automotive Industry in the UK, New Automotive Innovation and Growth Team (NAIGT) for DBERR, 2009.

A recently-won contract for the assembly of the Ormonde offshore wind farm off the Cumbrian Coast will be H&W's third wind farm contract in four years (after completing contracts on Barrow and Robin Rigg wind farms). H&W have also worked on the prototypes for two wave power generation turbines (this technology is at an early stage in comparison to wind energy turbines).

H&W's privatisation in the early 1980s led to a focus on the construction of bulk carriers and oil tankers to fixed designs. However shipyards in other parts of the world were able to undercut H&W on the price of these designs. The decline in H&W's traditional ship building markets continued through the 1990s; indicative of this was losing out to a French shipyard on the order for the new Queen Mary II in March 2000. The projects for the offshore oil and gas industry were insufficient to offset this decline so with the shipyard's order book empty, the management issued redundancy notices to the company's 1800 staff. The end result was that from September 2000, H&W began a major restructuring process to reduce the total workforce to 600.

An interview with a senior H&W manager revealed that the diversification strategy was a business decision to ensure such large scale redundancies were never again necessary: 'We didn't want to be so susceptible to the vagaries of the market ... if the ship building market goes quiet then we have renewables; if the renewables go quiet then we have ship building'.

Over the past decade, renewable energy and wind power, in particular, have grown to become a viable option for contributing to the UK's energy mix and with extensive Government backing at the national and European level, it will continue to grow. In the UK, the Renewables Obligation (RO), which requires electricity suppliers to supply a certain proportion of their electricity from renewable sources⁽⁶⁰⁾, is the key government mechanism for promoting renewable energy, a major element of the legally binding UK target to reduce greenhouse gas emissions by 80% below 1990 levels by 2050.

The Government has concluded that offshore wind is a major opportunity for the UK: '[the UK] is, and will remain for the foreseeable future, the largest single market for offshore wind in the world'⁽⁶¹⁾. A recent Strategic Economic Assessment of UK offshore energy carried out by the Government concluded that there is potential for 25GW of additional offshore generating capacity by 2020⁽⁶²⁾. As well as the policy and legislative framework, there is Government backing in the form of investment with up to £120 million earmarked for manufacturing facilities in the UK and for research and development. This is underpinned by changes to the statutory planning system which will provide a new system for consent for nationally important infrastructure projects, including offshore wind farms.

⁽⁶⁰⁾ In 2006-07, the proportion was 6.7% rising to 10.4% by 2011-12 and then 1% per year for following five years.

⁽⁶¹⁾ DBIS and DECC (2009), The UK Low Carbon Industrial Strategy.

⁽⁶²⁾ DECC (2009), A Prevailing Wind: Advancing UK Offshore Wind Deployment.

Importantly for H&W which has an international market, there is a growing European market for wind energy. In 2007, the European Commission agreed a target for 20% of the EU's energy consumption to come from renewable sources by 2020 (⁶³).

The development of the wave and tidal power industry is at an earlier stage. H&W's view is that: 'The wave and tidal team is at the stage that the wind energy team were ten years ago' (⁶⁴). However the Government included the industry in its Low Carbon Strategy (⁶⁵) and has plans in place to address the barriers to producing viable products.

Retraining needs and skills gaps/weaknesses

The diversification strategy that H&W has undertaken had to address skills needs. Viewed broadly, the skills required to construct the products required for the renewables market are not enormously different from the skills and experience they have accrued for the construction of ships and offshore platforms for the oil and gas industries: 'It [became] obvious that the core skills of a ship/rig builder are applicable to the renewables sector. Indeed, many of the same problems that arose, and were resolved, sometimes expensively, in the Oil and Gas sector as it moved offshore, are directly applicable to the renewables sector as it moved offshore' (⁶⁶). However there are new challenges for the engineers and designers and for the flexibility of the craft workers and labourers.

H&W currently have a core workforce of around 200 people. This can be broadly split into four levels:

- (a) management;
- (b) engineers/designers;
- (c) supervisors;
- (d) labourers/mechanical fitters.

At the management level, there has not been much retraining required. The task of organising and managing the workforce has remained much the same. Similarly, at the bottom two levels of H&W, the skills have remained broadly similar with only updates to certification required.

The main change has been at the engineer/designer level. While H&W retain a core of engineers which they call 'dyed in the wool ship builders' they also have a group of engineers and designers who have had to become far more flexible. This team have had to adapt to a new set of classification codes set by DNV (⁶⁷). However, the classifications for the design

(⁶³) DBIS and DECC (2009), The UK Low Carbon Industrial Strategy.

(⁶⁴) Interview with Sales & Marketing Manager, Harland and Wolff Heavy Industries

(⁶⁵) DBIS and DECC (2009), The UK Low Carbon Industrial Strategy.

(⁶⁶) Internal Harland & Wolff document.

(⁶⁷) DNV stands for Det Norske Veritas. It is an independent foundation set up in the 19th century whose core competency is to identify, assess and manage risk in the maritime environment. One of their key roles is to

and construction of offshore wind turbines and offshore oil and gas platforms are very similar (so similar, in fact, that the classifications for offshore wind constructions are viewed, simply, as a development of the existing offshore oil classifications) (⁶⁸).

The other major change which diversification has necessitated is ‘The workforce has had to become considerably more flexible ... the renewables projects have considerably fewer man hour requirements than ship building’ (⁶⁹). Their supervisors, labourers and fitters have to be able to move from a ship building project to a renewables project. This is not a major workforce challenge though; the tasks required from these workers, such as welding, are fairly generic and adaptable to different projects.

The skills response

The first notable aspect of H&W’s strategy for adapting their workforce to a more diverse business strategy was to cut numbers while developing options for expanding the workforce when a project requires extra skills and labour. H&W have employed three responses to ensure their workforce has the required skills for the new business strategy:

- (a) training/reskilling workers: in terms of the labour and skills required at the lower end of the workforce, H&W have fostered the required flexibility by ‘recruiting the very best labourers, foremen and fitters available, both in our core staff and the trade union pool over a long period of time’. However reskilling was required. Initially, they used the same equipment for the turbines as they did for building ships however, this was inefficient and impacted upon their tendering success. New equipment was purchased as a result. Labourers and fitters had to learn how to use new equipment; this training was provided and certified by the equipment’s manufacturers. The main mechanism for the delivery and organisation of this training is the company-wide training programme. Every employee at H&W has a training plan reviewed annually and training was allocated through this. This is also the mechanism used for allowing their engineers and designers to update their knowledge of the new DNV classifications. It is an ongoing process;
- (b) ensuring the supply chain is sufficiently skilled: when a larger project is being carried out H&W need to bring in extra skills and labour. They have a strong relationship with their trade union which acts as an employment agency with a pool of temporary workers who can often provide the craft skills required. The agreement with the trade union requires the labour to come from the local area in the first instance. Only if they cannot provide the required skills from the Belfast area, will the trade union provide labour from elsewhere. H&W ensure that the labour provided by the union is of a sufficient quality requesting only workers who have been certified to the required standards (H&W work

provide the specifications for offshore wind turbines. See www.dnv.com for more information (for example, DNV-OS-J201).

(⁶⁸) Interview with senior manager at Harland & Wolff..

(⁶⁹) Interview with senior manager at Harland & Wolff.

in a heavily regulated sector, mainly due to the safety implications; a great deal of importance is placed on individuals holding the required certification). On rare occasions, H&W know of a worker in the trade union with a required skill who has not got the relevant certification. When this happens, they will fund a training course for the worker;

- (c) recruiting new skills: for some projects, these measures might not be sufficient. In such cases, H&W have strong and long-standing links with a number of other engineering companies with greater experience in the renewables sector. They can sub-contract the required skills from these companies for the duration of the project. These relationships are managed through supplier agreements which state the number of workers and level of certification H&W require from their sub-contractors.

In summary, H&W value the business relationships they have with their union and sub-contractors. In most cases, the relationships go back to the beginning of the renewables diversification strategy and beyond. The majority of the workers that they draw in from the union pool or the sub-contractor list ‘have worked there before so there are few surprises’⁽⁷⁰⁾.

Assessment of the effectiveness and organisation of this response

The diversification strategy has secured the future of H&W. The company is profitable and stable, despite the difficulties which were apparent at the start of the 2000s. More recently, many heavy engineering companies have struggled because of the global economic downturn. This has impacted upon Harland and Wolff’s traditional markets as well and they have had a number of orders for ships delayed. However the company has remained stable enough to retain a sizeable core staff.

The company continues to evolve and has developed expertise in the wind energy sector. It has managed this through transferring skills derived from ship building and manufacturing offshore oil and gas equipment and adapting the workforce and their supply chain to produce wind turbines. In addition, they are at the prototype stage of two wave power generators. The market for such products is at a more immature stage than that of wind power. But by being at the forefront of the technology’s development, H&W will be in a strong position to succeed once the product reaches market.

3.1.2.2. *Low carbon electric vehicles in the North East England: Nissan and the North East low carbon economic areas*

The traditional, fuel-intensive automotive industry is in decline around the world. Fewer cars are being sold, leading to factory closures and job losses. Low carbon vehicles, such as battery-powered, electric cars, offer an opportunity for the automotive industry to develop new cleaner products. In the North East of England, Nissan’s car factory is shedding jobs. A

⁽⁷⁰⁾ Interview with senior manager at Harland & Wolff.

new battery-assembly plant for Nissan's electric vehicles is creating new employment opportunities which require new skills from the workforce. The North East regional development agency (ONE) is assisting in the response to the demand for a workforce skilled for the design and production of low carbon vehicles through three skills projects, aimed at factory workers, graduates and researchers.

The North East of England already has a strong base in the automotive sector. There are over 220 companies in the sector and the sector's supply chain which include manufacturing, research and development (R&D), specialist services such as design engineering and advanced performance engineering such as in motor sport. One Northeast⁽⁷¹⁾, the regional development agency for the region, estimates that over 26,000 people are employed in the sector which contributes £1bn to the regional GVA.

Nissan Motor Manufacturing UK in Sunderland, North East England, is the largest car manufacturing facility in the UK and the most productive (it produces more cars per worker) in Europe. One out of four cars manufactured in the UK are made at Nissan Sunderland. It is a major employer in the area, employing up to 4,900 workers directly and supporting many more in the supply chain. The Japanese company initially decided to locate there in 1984 to take advantage of the large and skilled labour force in the North East after the closure of many shipyards and the decline of the coal industry⁽⁷²⁾.

Today, the global automotive industry is in crisis which has resulted in falling volumes of car sales and profits in the industry⁽⁷³⁾. Reduced consumer demand due to the economic slowdown and higher fuel prices along with excess capacity in vehicle production have led to factory closures and associated job losses across the world. In the North East, Nissan announced in early 2009 that it would be shedding 1,200 jobs or approximately a quarter of the workforce⁽⁷⁴⁾.

With the 'traditional' fuel-intensive vehicles no longer appealing to as many consumers, there is an opportunity for the declining automotive sector to grow into low carbon vehicles. Consumers are becoming increasingly interested in low carbon vehicles because of greater environmental awareness, as well as financial incentives such as the high prices of fossil fuels and exemptions from congestion charges and lower vehicle excise duty and parking charges⁽⁷⁵⁾.

⁽⁷¹⁾ One Northeast is the Regional Development Agency (RDA) for the region charged with furthering economic growth, supporting employment and leading developments in skills relating to the growth objectives of the region.

⁽⁷²⁾ Nissan U.K.: a worker's paradox?, Thompson and Rehder, Business Horizons, 1995.

⁽⁷³⁾ An Independent Report on the Future of the Automotive Industry in the UK, New Automotive Innovation and Growth Team (NAIGT) for DBERR, 2009.

⁽⁷⁴⁾ <http://www.guardian.co.uk/money/2009/jan/10/nissan-job-cuts-sunderland-redundancies>.

⁽⁷⁵⁾ Identification of Expertise and Excellence in New Industry and New Jobs (NINJ) Industrial Technologies, GHK for DBIS, 2009.

The UK government has identified Ultra-Low Carbon Vehicles⁽⁷⁶⁾ (ULCVs) as an area of economic and job growth in its Low Carbon Industrial Strategy⁽⁷⁷⁾. The Department for Transport (DfT) is committed to decarbonise the UK transport system in part through facilitating the deployment of electric vehicles (EVs)⁽⁷⁸⁾. Measures to support ULCVs include:

- (a) a subsidy of £2,000 to £5,000 on the price of each LCV to kick-start initial consumer demand
- (b) grants to bus and coach operators (£30m in total) for the purchase of low carbon buses;
- (c) investment of up to £120million in research and development and demonstration projects to accelerate commercial production of low carbon vehicles;
- (d) purchasing low carbon and electric vans worth £20million for the public sector's fleet through the Low Carbon Vehicle Procurement Programme;
- (e) re-charging points for EVs made widely available in public places through the Plugged in Places initiatives which funds local authority investment in this infrastructure.

One Northeast estimates that the low carbon vehicle industry and the related supply chain could be worth £1bn to the region and sustain jobs, especially in manufacturing but also in services such as consultancy. The RDA recognizes that Nissan and the entire automotive industry make an important contribution to the economy and jobs in the region, and wishes to shield the labour market from the impact of restructuring by embracing LCVs.

The agency has worked to make the North East the UK's Low Carbon Economic Area (LCEA) specialising in ULCVs. LCEAs are part of the government's Low Carbon Industrial Strategy and aim to support development through clustering of industrial production and targeted investment in both capital and skills. The North East LCEA is led by One Northeast and includes Sunderland, South Tyneside and Easington – where much of the existing automotive industry is based. However, benefits will be felt beyond the LCEA designated areas through the supply chain. For example the chemical processing industry based in Middlesbrough will play an important role in developing chemical products to fuel battery powered vehicles.

The North East LCEA's skills response is analysed in greater detail below. Examples of the North East LCEA's capital investment activities are the following:

- (a) assess options for improving rail access for ULCVs by re-opening all or part of the Leamside Line to improve access to the Port of Tyne. This serves the dual purpose of

⁽⁷⁶⁾ Low carbon vehicles (LCV) may refer to hybrid electric vehicles or Ultra Low Carbon Electric Vehicles (ULCV) which produce zero emissions. The UK government's industrial strategy acknowledges that it does not have the comparative advantage to compete in hybrid vehicles and is thus focusing on ULCVs.

⁽⁷⁷⁾ The UK Low Carbon Industrial Strategy, HM Government, 2009.

⁽⁷⁸⁾ Ultra-low carbon cars: Next steps on delivering the £250 million consumer incentive programme for electric and plug-in hybrid cars, Department of Transport, 2009.

- boosting exports and imports to the area by improving transport infrastructure but also reduce the carbon footprint of the logistics chain;
- (b) pioneering the Plugged In Places national initiative by installing 750 charging points in a range of locations in the North East. These include supermarkets, shopping centres, public transport terminuses, hospitals, universities, public buildings and domestic and business premises. The first points are currently being installed in Newcastle and Gateshead. The Agency is working in partnership with major businesses to achieve this. Tesco, for example, the UK's largest supermarket chain, has agreed to install re-charging points in its car parks.

Industry Response by Nissan and others employers

Responding to global demand for low emission vehicles outlined above, Nissan have developed a zero emissions mass market programme. The Nissan Leaf model, the company's first mass market zero carbon vehicle, is expected to be made available in 2010. Nissan has chosen the Sunderland site for the creation of Nissan's Centre of Excellence for Battery Manufacturing (⁷⁹) to produce lithium-ion batteries for the Leaf and other electric vehicles for the European market. Nissan intends to invest £200million in the factory in the five years up to 2014, which will be able to produce 60,000 battery units per year. The facility is expected to directly create 350 new jobs and potentially many more in the supply chain.

The Sunderland site may also be chosen as the location for manufacturing and assembling the new electric Nissan Leaf potentially will create more jobs for the region – but this is pending on a decision by Nissan.

Other companies in the North East, beyond Nissan's supply chain, are already active in producing electric vehicles. Existing EV employers include:

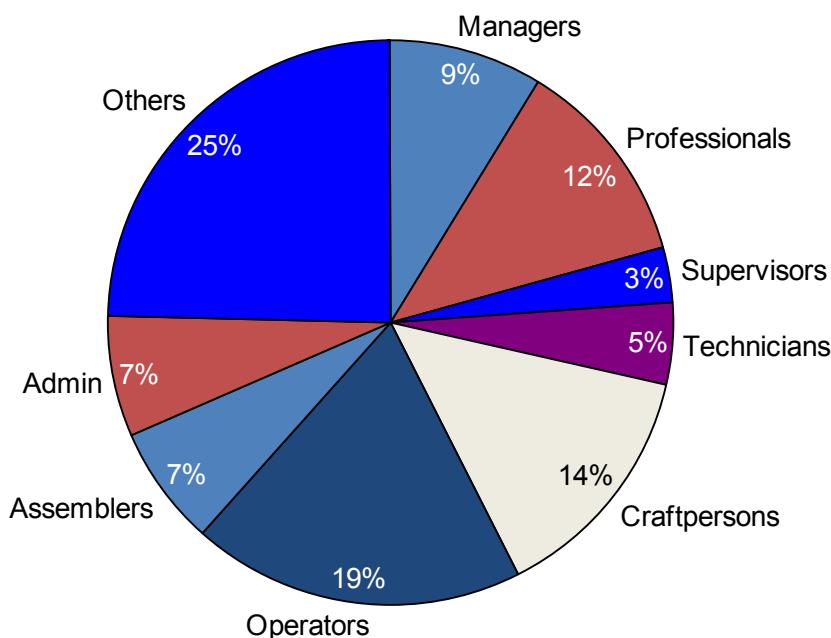
- (a) Smith Electric Vehicles, the largest manufacturer of road going commercial vehicles globally. The company has recently delivered electric trucks to enhance the logistics fleet of Coca Cola and AT&T in the USA as well as Royal Mail, DHL and Sainsbury's Online in the UK;
- (b) Elescoot, a Durham based manufacturer of electric scooters;
- (c) Avid Vehicles, a Northumberland engineering firm offering vehicle conversions to low carbon;
- (d) Future Transport Systems, a transport consultancy based in Newcastle specializing in integrating low carbon technology with existing infrastructure.

Occupations and skill shortages in the UK automotive sector

⁷⁹) http://www.nissanpress.co.uk/press_site/releases/environmental_issues/isu4_nbabb.shtml.

The occupational profile of the automotive industry in the UK is demonstrated in Figure 4 below. Technical roles (non-management) are occupied by 48% of the workforce and these skills are typically acquired through apprenticeship programmes jointly run by employers and further education colleges and (in the most) funded by the state. Employers believe that all skills types are in short supply, with technical skills cited by a higher proportion of employers as being difficult to find ⁽⁸⁰⁾.

Figure 4: Occupational profiles of the motor vehicle engineering sector



Source: Adapted from BMG research, 2007

Existing provision of education, training and R&D in the North East automotive industry

For the purposes of training workers for ‘traditional manufacturing’ operations, Gateshead College currently delivers Nissan’s apprenticeship programme at the college’s Skills Academy for Automotives and Logistics. Around 100 apprentices undertake the two year scheme each year. Apprentices study industry approved qualifications in a workplace environment. The Skills Academy facilities in the college simulate the Nissan production line and include a rolling road for vehicle testing, specialist welding facilities and a body and paint shop. The programme also includes block attendance at the Nissan factory to make apprentices ‘job ready’. Apprentices work with Nissan line managers and wear Nissan uniforms to fully represent the real working environment. The training course is supplemented with learning of key skills such as numeracy, literacy and information and

⁽⁸⁰⁾ The sector skills agreement for the motor industry, Automotive Skills, 2006.

communications technology (ICT). Learners work towards gaining one of the following qualifications:

- (a) NVQ in performing engineering operations;
- (b) NVQ in performing manufacturing operations;
- (c) NVQ Level 3 in engineered systems;
- (d) first diploma in engineering (maintenance);
- (e) national diploma in electrical and electrical engineering;
- (f) foundation degree in maintenance engineering.

The Skills Academy building and facilities is also used by companies in the Nissan supply chain. For example, Thyssen Krupps is a supplier for Nissan's Qashqai model and has spent £180,000 to send its apprentices on the Gateshead College 30 week course to give them the same qualifications as Nissan apprentices.

The table below indicates the centres for key research and development for the LCV in Higher Education Institutions located in the North East. These centres already enjoy strong links with industry through industrial sponsorship and placements.

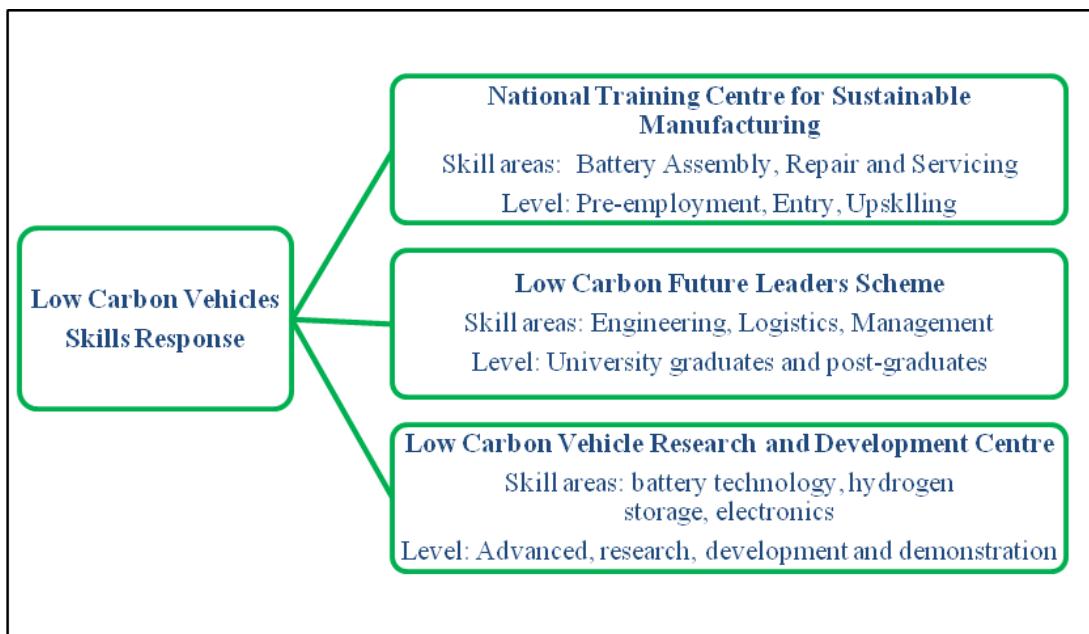
Table 3: Low carbon automotive research centres and areas in the North East

University – research centre	Research area
Newcastle University Centre for Advanced Electric Drives Transport Operations Research Group	Power electronics, control systems and the development of novel and energy efficient power drive trains Advanced technologies and behavioural research to facilitate changes in transport systems and infrastructure
Sunderland University Institute for Automotive and Manufacturing Advanced Practice	Economical conversion of conventional vehicles to hybrids
University of Durham Centre for Automotive Research	Brings together relevant expertise from Departments of Engineering, Mathematics & Physics to support the global motor industry

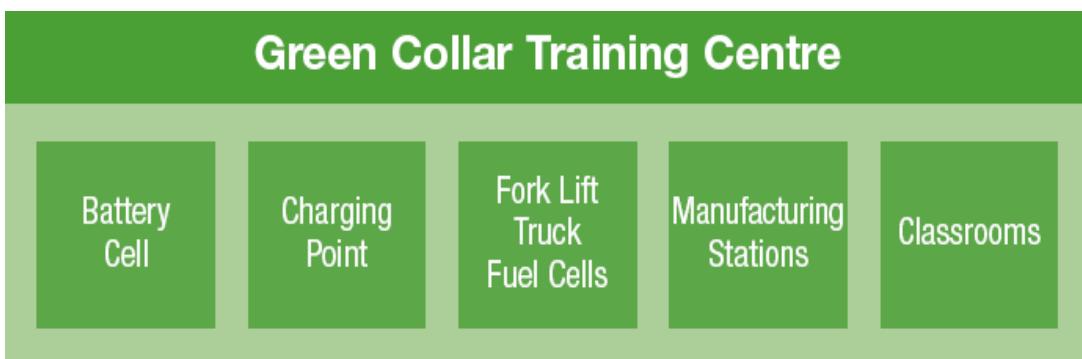
The Skills Response

One Northeast, through the LCEA, is leading the response to building a strong skills base for LCVs in cooperation with employers, trade unions, public and private training providers and research centres at university and industry level. The three skills initiatives, described below, targets all skills levels and different employer and employee needs.

Figure 5: Overview of skills responses for low carbon vehicles by the North East LCEA



The National Training Centre for Sustainable Manufacturing is a project between Gateshead College, Nissan Motors UK, the NA Group (a private-sector training provider) and One Northeast to build a state-of-art green collar training centre on a site adjacent to the Nissan car and battery plant. The centre will be equipped to train existing and future employers on all aspects of ULCV: from manufacture, right through to charging, storage and handling of batteries and fuel cells and vehicle maintenance.



It is expected that at least 60 businesses, including large manufacturers, supply chain and SMEs will access the centre to obtain training for their staff at apprentice and higher level. It is also envisaged that pre-employment programmes for the unemployed (described below) will help the region's unemployed workers gain the skills and qualifications to obtain a new green job.

Green Collar Pre Employment Training Course

The NA Group, a private training provider, is currently collaborating with Nissan to offer a Green Collar Pre Employment Training course aimed at unemployed people seeking employment in the automotive industry. The five-week course is fully funded by Jobcentre Plus. The learning programme includes a mixture of manufacturing techniques, health and safety, basic skills, such as maths and English, and environmental awareness. Course completers are then fast tracked on Nissan's selection process. The scheme is intended to offer training to 1000 unemployed people with the first 120 trainees starting training in November 2009. Nissan sees benefits in the scheme which makes potential applicants more 'job ready' after, potentially, a lengthy period away from the labour market.

One Northeast is working in collaboration with the region's universities to pilot the Low Carbon Future Leaders Graduate Placement scheme which places recent graduates on placements with low carbon vehicle employers. This is a national scheme announced in summer 2009 by the Department of Business, Innovation and Skills and will provide 1,500 funded placements for graduates in low carbon industries, including the low carbon vehicles in the North East. The Higher Education Funding Council for England (HEFCE) is currently developing plans to roll out the scheme by working with academic departments and career services in Higher Education Institutions. The example below demonstrates the benefits of the scheme for a LCV employer in the North East.

AVID Vehicles Ltd is an SME based in Northumberland, North East, employing 20 people in technical and engineering roles. The company has been working with existing vehicle manufacturers to offer conversion of vehicles from thermal engine to electric, hydrogen or fuel cell engine. It has a long history of working with One Northeast and the universities in the region – it has in the past provided industrial placements and sponsoring research. Encouraged by the success of these experiences, AVID was keen to participate in the Low Carbon Future Leader's scheme. So when Sunderland University put forward a suitable skilled engineering graduate for their placement in the supply chain and logistics they were very happy to take this up – especially as the 12 month placement is fully funded by the scheme. The graduate has been working at AVID for two months and is gaining valuable experience of the new industry while the company benefits by sourcing a suitable employee without having to incur the costs and risks of recruiting and training someone new.

LCEA North East's response to higher and advance level skill development and research is the creation of the National Low Carbon Vehicle Research and Development Centre in Sunderland. The centre will bring together five regional industry leads to undertake applied and fundamental research. Research projects will look at the whole spectrum of LCVs technology and use. Research area and lead academic partners are presented in the below.

Table 4: National low carbon vehicles research and development centre areas and lead academic partners

Research Area	Lead partners (University name – research department)
Advance battery technology	Newcastle University – School of Chemical Engineering and Advanced Materials
Electric motors and EV power electronics	Newcastle University – Design Unit and Gear Technology Centre Durham University – Centre for Automotive Research Northumbria University – Energy Systems Group
Hydrogen storage	Newcastle University – Sir Joseph Swan Institute for Energy Research
Telematics, ITS and safety	University of Sunderland – Institute of Automotive Manufacture and Advanced Practice Durham University – Centre for Communications Systems
Journey and navigation management	Newcastle University – Geomatics and Transport Operations Research Group

To enhance the research and development offer at the centre One Northeast is investing in an open access test track for available manufacturers and Higher Education researchers to allow demonstrations and trials of new technologies. The Agency has reached an agreement with Nissan to lease their existing medium speed test track and workshops for a period of 20 years. The lease and management plans for development of the site are already in place with the test track expected to open in Spring 2010. The multi-surface, two mile test track will provide facilities to spur innovation to LCEV beyond cars but to the whole range of vehicle manufacturers (e.g. scooters, logistic and commercial and trains) in the region.

Assessment of the effectiveness and organisation of this response

The skills initiatives taken forward by the North East Low Carbon Economic Area are all in planning or pilot phase. However, capital expenditure on facilities (training centre and the open access track) is secured and the facilities are on track to deliver training and research by 2011. The initiatives will not help just Nissan, but the whole LCV economy in the area.

Strong partnership between stakeholders in the region is the key strength of the response which means that skill initiatives address all levels of post-16 education: vocational, higher and highest. For the future, One Northeast is also looking into developing a Low Carbon Vehicle Resource Centre aimed at school-level education.

The market for low carbon vehicles is likely to grow significantly. Through investing in research and development, the North East hopes to gain the comparative advantage in the ULCV technologies.

Similarly, demand for associated skills will continue to rise. This includes high level skills and knowledge in fields such as automotive and chemical engineering and product design as well as intermediate skills in assembly, repair and servicing of batteries, vehicles, vehicle

parts and charging stations. Early acquisitions of these skills by the workforce in the North East through the initiatives described above are likely to aid the nascent low carbon vehicle industry and lessen the blow of job losses from the traditional, fuel-intensive automotive industry.

3.2. New and changing skill needs

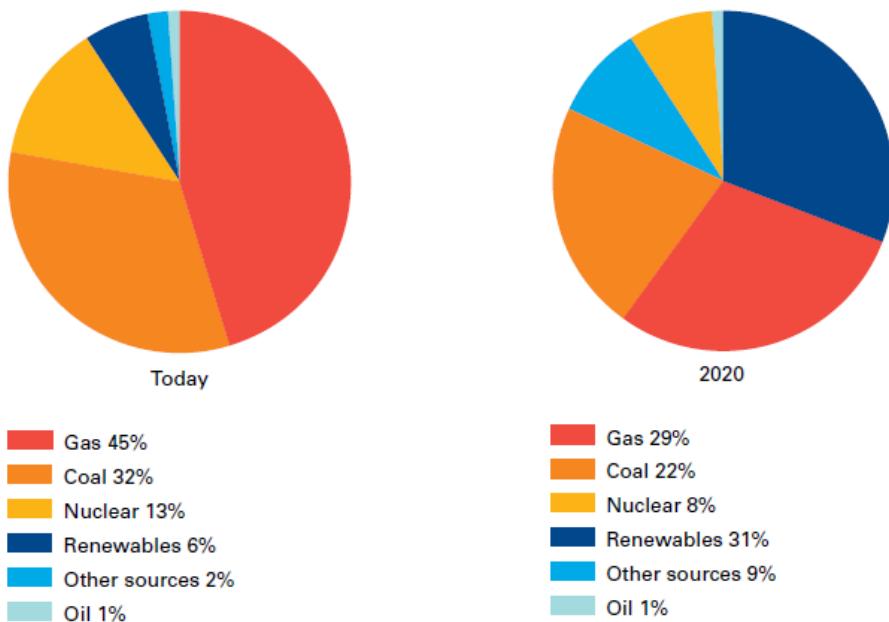
3.2.1. New green collar occupations

The UK Low Carbon Industrial Strategy has identified low carbon sectors which have the potential to generate economic growth and new jobs. Information regarding the growth trajectory of each sector, the current and forecasted occupational mix and potential skill needs is summarized below.

3.2.1.1. Offshore wind, wave and tidal power

Figure 6 shows that by 2020, approximately one-third of the UK's energy will have to come from renewable sources. The RO has been introduced which obliges energy companies to produce a certain amount of their energy from renewable sources. Since its introduction, use of renewable has tripled from less than 1.8% in 2002, to around 5.3% in 2009.

Figure 6: The UK's energy mix



Source: DECC UK Low Carbon Transition Plan, 2009

The wind wave and tidal power (WWT) sector will be a major element of this growth. Wind power, in particular, is seen as a vital means of meeting the UK's carbon reduction targets. By 2020, it is predicted that offshore wind will contribute 55% of the UK's renewable energy with 28% coming from onshore wind power.

Analysis (⁸¹) carried out for the British Wind Energy Association (BWEA) shows that even under the most pessimistic estimates, the combined workforce of the WWT industry will grow from approximately 4,800 full-time employees (FTEs) in 2009 to over 20,000 FTEs by 2020. Under the most dynamic model, this number will be closer to 60,000. This will be dominated by the wind energy workforce though in the wave and tidal industries it is estimated that there will be between 350 and 2,100 FTEs by 2020.

These jobs are likely to be highly skilled and requiring a range of engineering and project management skills already in short supply in the existing workforce. The UK is well placed geographically to take on a much expanded WWT sector (the shallow waters, long coastline and high winds are particularly well suited for offshore wind farms). In addition, the technology for producing and transporting the energy is largely in place. A key issue is getting sufficiently skilled and numerous individuals into the industry.

3.2.1.2. *Carbon capture and storage*

Coal is the most carbon intensive fossil fuel however but is widely used in the UK to produce energy (as evident in Figure 6 above). Six of the UK's nineteen coal power stations and three of the oil power stations are due to close by 2015, partly as a result of EU regulation on clean air. To compensate for these, new coal power stations may still be needed to contribute to the UK's energy mix. For this to happen in a relatively 'clean' way, carbon capture and storage (CCS) is seen as an important technology. It may have the ability to capture up to 90% of the carbon dioxide that would otherwise be emitted from fossil fuel power stations. Unfortunately, CCS has not yet been proven at the scale of a large power station. Indeed, the government has noted that, 'The critical next step [for CCS] is commercial scale demonstration. Each of the different stages of CCS – capture, transport and storage – has already been used successfully in other applications. CCS has never been applied at commercial scale as an end-to-end process on a power station – and this transition to commercial scale is the critical next step' (⁸²).

In 2007-08, CCS was still quite a minor industry, thought to employ around 4,500 people. However there are expectations of approximately 3.7% per annum growth until 2014-15 (⁸³). Despite the CCS technology and market being at an early stage in its development, the UK is one of just four countries committed to supporting a demonstration on a commercial scale.

(⁸¹) SQW Energy (2008), Today's Investment – tomorrow's asset: skills and employment in the Wind, Wave and Tidal sectors.

(⁸²) BIS (2009), Low Carbon Industrial Strategy.

(⁸³) Innovas (2009), Low Carbon and Environmental Goods and Services: an Industry analysis.

There have been some early estimates of how important the industry could become; AEA Technology⁽⁸⁴⁾ suggest that the value to the UK of coal power stations fitted or retrofitted with CCS technology could reach £1-2 billion per year. By 2030, the industry could sustain between 30,000 and 60,000 jobs. These figures are quite speculative at this stage given the early development of the technology.

If CCS under the sea bed proves to be viable, then it would benefit from a workforce with knowledge and skills of underwater engineering currently employed in offshore oil and gas drilling. Thus CCS offers an opportunity for restructuring the carbon-intensive oil industry mainly located in the North Sea off the coast of Scotland, through using the workforce's transferable skills.

3.2.1.3. *Ultra-Low Carbon Vehicles*

There are around 6,500 companies involved in the alternative fuel vehicle sub-sector with a market worth £12.6 billion in 2007/08 (out of a total Low Carbon Economic Goods and Services – LCEGS – market worth approximately £107 billion). This is expected to grow to £17.5 billion by 2014-15. The sub-sector employed approximately 105,000 people in 2007/08 (out of a total of 881,000 LCEGS employees)⁽⁸⁵⁾.

A key regulatory driver for the car industry is the EU's New Cars CO₂ Regulation⁽⁸⁶⁾. By specifying a stretching target of 130g/km CO₂ by 2015 and 95g/km by 2020, the Regulation is forcing strategic planning decisions on the industry and is consequently leading to investments to low carbon vehicle research and development.

The UK response has been to identify ultra-low carbon vehicles as an area of economic and job growth in its Low Carbon Industrial Strategy. Supporting measures include⁽⁸⁷⁾:

- (a) £250m to subsidize new electric vehicles or plug-in hybrids (providing £2,000-5,000 subsidy per vehicle);
- (b) grant funding of £30m (2009 to 2011) for bus and coach operators to purchase low carbon buses;
- (c) £140m allocation to the TSB Low Carbon Vehicle Innovation Platform;
- (d) funding for 150 low-emission and all-electric vans in public sector fleets.

There are many technologies which could play a part here however there is a widespread view that the market for ultra-low carbon vehicles will be dominated by plug-in hybrid electric and

⁽⁸⁴⁾ AEA Technology (2009), Future Value of Coal Carbon Abatement Technologies to UK Industry.

⁽⁸⁵⁾ Innovas (2009), Low Carbon and Environmental Goods and Services: an industry analysis.

⁽⁸⁶⁾ HMG, Ultra low carbon vehicles in the UK: the challenge, April 2009.

⁽⁸⁷⁾ Dft, Low carbon Transport: A Greener Future, July 2009.

all-electric vehicles in the future⁽⁸⁸⁾. From 2011, major vehicle manufacturers are announcing mainstream plug-in electrical models which will provide the impetus for the development of a charging network.

Across the automotive sector, skilled employees including managers, professionals, supervisors, technicians, craftspersons, operators and assemblers account for 68% of the total workforce. High level problem solving skills and technical diagnostic skills will be needed to meet these requirements. Early analysis suggests that the move towards ultra-low carbon vehicles workers will need to adapt to changes in technology. There will also be changes to the way in which motor vehicles are manufactured and maintained. Occupations such as repair technicians will therefore need to update their skills. Other skills, such as welding car bodies, can be transferred from manufacturing of traditional (diesel/petrol) automotives to the manufacturing of low carbon vehicles.

There are almost 900,000 people⁽⁸⁹⁾ employed in markets for low carbon and environmental goods and services in the UK according to a 2009 study by Innovas⁽⁹⁰⁾, distributed across 23 subsectors⁽⁹¹⁾. The report also forecasts that cumulative growth rate (CGR) in this market up to 2014-15 will be 45%. If this scenario is correct then by 2014-15 there will be 1,274,300 employees in these sectors. Table 5 below shows current and potential employment broken down by economic activity area.

However, the estimate of 400,000 new jobs is possibly overly optimistic⁽⁹²⁾. Studies looking at individual sectors (rather than all low carbon markets) have produced lower estimates while there is disagreement about the contribution of sectors where technologies are yet unproven, such as carbon capture and storage (CCS) and geothermal heat.

⁽⁸⁸⁾ DBIS (2009), The UK Low Carbon Industrial Strategy.

⁽⁸⁹⁾ Low Carbon and Environmental Goods and Services: an industry analysis, Innovas for BERR, 2009.

⁽⁹⁰⁾ The study by Innovas has used the new methodology of the full sector analysis model for profiling and forecasting market value and employment. This model involves identifying economic activities at the lowest possible level of analysis and then aggregated to improve convenience of reporting. It also adopts a wider view of the sectors by examining supply and value chain companies (this is usually overlooked by other methodologies). This “bottom up” approach identifies and uncovers much more activity than through SIC coding. A total of 2,490 discrete product groups were identified. Data for each group was analysed separately (rather than grouping data together) using econometric techniques and multiple sources and methods such as data triangulation.

⁽⁹¹⁾ A full list of the 23 sub-sectors and 96 sub sub-sectors identified is provided in Annex 2.

⁽⁹²⁾ The Future's Green: Jobs and the UK low-carbon transition, IPPR, October 2009.

Table 5: Employment in low carbon goods and services and forecasted growth

Sub-sector	Employed 2007-08	% CGR 2014-15	Potential employed 2014-15	Increase
Air pollution	8,900	19.67	10,700	1,800
Environmental consultancy	6,800	32.23	9,000	2,200
Environmental monitoring	1,400	32.31	1,900	500
Marine pollution control	900	36.88	1,200	300
Noise & vibration control	1,900	65.11	3,100	1,200
Contaminated land	7,900	27.08	10,000	2,100
Waste management	42,100	24.47	52,400	10,300
Water & waste water treatment	68,800	14.06	78,500	9,700
Recovery and recycling	53,700	28.2	68,800	15,100
Hydro	4,800	24.95	6,000	1,200
Wave & tidal	600	56.78	900	300
Biomass	45,800	49.9	68,700	22,900
Wind	87,500	79.22	156,800	69,300
Geothermal	75,800	51.89	115,100	39,300
Renewable consulting	4,400	24.98	5,500	1,100
Photovoltaic	38,000	66.55	63,300	25,300
Alternative fuels for vehicles	104,600	38.43	144,800	40,200
Alternative fuels	162,200	46.16	237,100	74,900
Additional energy sources	10,300	36.71	14,100	3,800
Carbon capture & storage	4,600	33.95	6,200	1,600
Carbon finance	21,800	62.21	35,400	13,600
Energy management	21,900	36.59	30,000	8,100
Building technologies	107,000	44.68	154,800	47,800
Total	881,300	45.35	1,274,300	393,000

Source: Adapted from Innovas 2009

‘Green jobs’ has previously referred to occupations preserving or improving environmental quality. The definition of ‘green jobs’ in UK policy literature and understanding has become much wider. We are ‘in transition to a low carbon economy’ which requires innovation that avoids emitting carbon dioxide and producing waste. This involves innovation and investment in new technologies, as well as the development of associated skills to design and manufacture low carbon products. As such, green jobs are to be found in industries that have traditionally contributed to carbon emissions (such as energy, automotives and fuels) but where there is potential for change.

The table below outlines how two industrial sectors in decline can be expected to restructure into low carbon processes or products, and the associated skills that need to be acquired by the workforce to achieve transition.

Table 6: Green jobs in high carbon sectors

Industry	Source of carbon	New low carbon process or product	New skill needs
Steel making	High embedded emissions in production process	Low carbon steel making	<ul style="list-style-type: none"> • design of low carbon steel production line • operation of new process
Petrol/diesel car production	Manufacturing of carbon dependent product	Electric vehicles	<ul style="list-style-type: none"> • design of new products • production of new product • maintenance and repair of new product

For many sectors it is matter of greening existing occupations. For example, the creation of a market for carbon emissions has required commodity traders traditionally trading in oil and energy market to gain knowledge of carbon emissions. Facilities (building services) and logistics managers (in all sectors) are also examples of occupations which need to understand the implications of their actions on the environment and how they can mitigate these.

UK stakeholders agree on the point that ‘low carbon skills are not just relevant to a small discrete group of jobs but applicable to the economy as a whole’⁽⁹³⁾. Compartmentalising occupations into restructuring, new and greening categories and addressing skills responses at these levels does not work. The 2008 Windsor Consultation on ‘Skills for a Sustainable Future’⁽⁹⁴⁾ convened by DIUS concluded that:

- (a) there is clear need for new skills in order to allow UK industry to capture market opportunities through developing sustainable solutions and new technologies;
- (b) environmental skills responses have focused on modifying existing education and training provision by adding green considerations as an afterthought;
- (c) skills required for the transition to a low carbon economy are needed in all industries and should not just be focused on the environmental goods and services industries, because they are needed in all vocational qualifications;
- (d) behavioural and cultural change is needed so that market leaders can drive changes through the application of regulations and contract requirements on their supply chains.

⁽⁹³⁾ John Edwards, former TUC chair, Aldersgate Group Conference, December 2009.

⁽⁹⁴⁾ Skills for a Sustainable Future: facing the challenge, Outcomes Note arising from Consultation at Windsor Castle, DIUS, 2008.

To inform the question of what exactly green skills are, Defra commissioned ProEnviro to undertake a review of evidence on green skills. The report identified nine groups of skills and 45 sub-groups. There are presented in Table 7 below while the third tier of skills is presented in Annex 3.

Table 7: Green skills checklist

Design skills	Eco-design Green manufacturing Materials specification Life cycle assessment/costing
Waste skills	Waste quantification and monitoring Waste process studies Waste management systems Waste minimisation Waste technologies
Energy skills	Energy minimisation Energy management systems Energy quantification and monitoring Energy costs and trading Renewable energy technologies Non-renewable technologies
Water skills	Water minimisation and re-use Water management systems Water quantification and monitoring
Buildings skills	Building energy management Integration of renewable energy Energy efficient construction Facilities management Calculating building energy efficiency and carbon ratings
Transport skills	Transport impact minimisation technologies Transport impact minimisation processes Transport management in business
Materials skills	Sourcing Procurement and selection Material use and impact quantification Management systems Impact and use minimisation
Financial skills	Investment models New/alternative financial models Quantification of climate change impacts Principles of low carbon and resource efficient economies Tools of low carbon and resource efficient economies
Management skills	Impact assessment Business planning Awareness raising Opportunities management Risk management Day to day management
Policy and planning skills	Built environment master planning and implementation Strategy development Strategy implementation

Source: ProEnviro, 2009 (⁹⁵)

As is evident in the table above, many of the skills required for the transition to a low carbon economy are not new. While some are technical skills which may be needed in a range of occupations and some sectors more than others, many are more generic skills (⁹⁶). These skills include leadership and management, communication, financial skills, sustainable procurement and communication skills. These are easily transferable across industries and are required throughout the whole workforce.

3.2.2. Greening existing occupations

The main ‘family’ of skills lacking in the UK workforce are Science, Technology, Engineering and Mathematics (STEM) (⁹⁷). Supply of these skills at all levels of the UK education and training systems have been historically weak.

‘The key to meeting the productivity challenge is skills... The traditional British deficit in technical skills is an important causal factor in our productivity gap.’ Department for Education and Skills, 2001 (⁹⁸).

STEM skills are fundamental for all ‘low carbon market’ jobs, especially at the design, development and implementation phase and are more relevant to technical occupations. They are crucial to the deployment and delivery of cleaner energy generation, as highlighted in the 2007 Energy White Paper (⁹⁹). The Stern Review (¹⁰⁰) suggests that the energy sector will need to expand 20-fold in the next 40 to 50 years in order to stabilise emissions and will require ‘new generations of engineers and scientists to work on energy-technology deployment’.

The shortage of workers in STEM occupations is evident in Table 8 which presents the Government’s recognised shortage occupations in the UK (used for migration purposes) identified by the Migration Advisory Committee (¹⁰¹).

(⁹⁵) Skills for a low carbon and resource efficient economy: A review of evidence, ProEnviro, 2008.

(⁹⁶) Skills for a low carbon and resource efficient economy: A review of evidence, ProEnviro, 2008.

(⁹⁷) Skills for a low carbon and resource efficient economy: A review of evidence, ProEnviro, 2008.

(⁹⁸) Meeting the Sector Skills and Productivity Challenge, DFES, 2001.

(⁹⁹) Meeting the Energy Challenge A White Paper on Energy, DBERR, 2007.

(¹⁰⁰) Stern Review: the economics of climate change, Stern et al, HM Treasury, 2006.

(¹⁰¹) Migration Advisory Committee Second review of the recommended shortage occupation lists for the UK and Scotland: Autumn 2009.

Table 8: Recommended UK shortage occupation list for Tier2 of the points based system, September 2009

Occupation Title	Job Titles included on the shortage occupation list
Production, works and maintenance managers	Project manager within the electricity transmission and distribution industry
Managers in mining and energy	Site manager, station manager, shift/group leader within the electricity transmission and distribution and the electricity generation industries
Civil engineers	Geotechnical engineer, geotechnical design engineer, geotechnical specialist, reservoir panel engineer, rock mechanics engineer, soil mechanics engineer, geomechanics engineer, tunnelling engineer, petroleum engineer, geoenvironmental engineer, contaminated land engineer, drilling engineer, completions engineer, fluids engineer, reservoir engineer, status resource engineer, offshore and subsea engineer, control and instrument engineer, process safety engineer, planning drilling engineer, subsurface engineer, project civil engineer in the electricity generation industry and contaminated land engineer
Mechanical Engineers	Mechanical engineer in the electricity transmission and distribution and the electricity generation industries
Physicists, geologists and meteorologists	Engineering geologist, hydrogeologist, geophysicist, geoscientist, geophysical specialist, engineering geophysicist, and engineering geomorphologist, nuclear medicine scientist and radiotherapy physicist
Electrical engineers	Electrical engineer in the oil and gas industry and power system engineer, control engineer, protection engineer, project control engineer, control and instrumentation engineer, assistant engineer, electrical engineer within the electricity transmission and distribution industry
Chemical engineers	All jobs
Design and development engineers	Design engineer within the electricity transmission and distribution industry
Production and process engineers	Plant process engineer within the electricity generation industry
Planning and quality control engineers	Planning/development engineer and quality, health, safety and environment engineer within the electricity transmission and distribution industry
Engineering professionals	Project engineer, proposals engineer within the electricity transmission and distribution industry
Secondary education teaching professionals	Secondary education teacher within the subjects of maths or science
Engineering technicians	Commissioning engineer
Science and engineering technicians	Production controller in the electricity generation industry
Welding trades	High integrity pipe welder
Metal working production and maintenance fitters	Licensed and military certifying engineer/inspector technician and airframe fitter
Line repairers and cable jointers	Overhead linesworker within the electricity transmission and distribution industry
Electrical/electronics engineers	Site supervisor within the electricity transmission and distribution industry

Source: Migration Advisory Committee Second review of the recommended shortage occupation lists for the UK and Scotland: Autumn 2009

The findings above reinforce GHK's study on sustainable development training in the South East England (¹⁰²) which found the following:

- (a) generic and technical skills lacking among existing practitioners;
- (b) specific occupations with shortage of career entrants – planning, engineers, building surveyors – though the economic downturn has reduced this;
- (c) specific technical skills around whole life costing, retrofitting buildings, sourcing sustainable/energy efficient building products and fittings.

3.2.2.1. Low carbon buildings and construction

The construction industry is a major part of the British economy with an annual output of £115 billion and employment for three million workers (¹⁰³).

The key driver for new skills requirements in low carbon buildings and construction is legislation (¹⁰⁴). Building and planning regulations require higher standards in sustainable construction, environmental impact assessment and energy efficiency of buildings. Improved awareness of clients, political pressures and corporate social responsibility are also contributing to the growth of greener practices in the sector (¹⁰⁵). Public sector clients in particular are increasingly requiring these through their procurement practices. Meanwhile, greener building technologies (windows, doors, materials, insulation and heat and monitoring and central systems) are becoming increasingly available and demanded by clients. To adapt to these changes the workforce is required to update its skills.

Designing and constructing new low carbon buildings is one element of the skills requirements in construction. As most of the 2050 building stock is already constructed, skills and knowledge for retro-fitting are also needed. Retro-fitting includes installing insulation and other measures to improve energy efficiency as well as adapting to climate change (e.g. increases in summer temperatures and flooding). Managing buildings and facilities is also crucial with existing occupations such as building services managers requiring updated knowledge and skills to take low carbon targets into their considerations. There is an identified gap in understanding and knowledge around the management of non-domestic buildings which are likely to have poor fabric, poor environmental controls and low levels of occupant energy awareness (¹⁰⁶).

(¹⁰²) Research into Sustainable Development Advice and Training, GHK Consulting, South East England Regional Development Agency, 2009.

(¹⁰³) DBIS (2009), The UK Low Carbon Industrial Strategy.

(¹⁰⁴) Build to Last: Reviewing Sustainable Construction, CITB-Construction Skills, 2004.

(¹⁰⁵) Research into Sustainable Development Advice and Training, GHK Consulting, South East England Regional Development Agency, 2009.

(¹⁰⁶) The UK's approach to the thermal refurbishment of non-domestic buildings, Kingspan, 2009.

3.2.2.2. *Chemicals and industrial biotechnology*

In the UK the chemicals sector has a turnover in excess of £60 billion and employs around 200,000 people with several hundred thousand jobs in associated industries. The UK is one of the world leaders in research capabilities (¹⁰⁷). As the sector adapts to a low carbon economy, chemicals and materials will be produced using Industrial Biotechnology (IB) rather than high carbon processes and petrochemicals.

IB sales are projected to grow by between five and 11% a year to between £4.4 billion and £11.8 billion per year by 2025. The Government established the IB Innovation and Growth Team (IB-IGT) in 2007 in order to provide strategic leadership and guide skills development on the issue. They recommended that the government needed to ‘ensure that the UK’s world leading science base in genomics, fermentation, biocatalysis, plant science, marine organisms and mycology is effectively developed and translated into IB applications.’

Research by Cogent, the SSC for the chemicals industry, identifies that leaders and managers will have a key role to play in leading their organisations through these changes. There is a greater emphasis being placed on ‘softer skills’ because of more stringent environment and health and safety requirements, the drive to reduce costs through more efficient operations and the push for higher quality outputs. Employers are recognising the importance of behavioural aspects of roles such as team work, problem solving and fault diagnosis to achieve low carbon targets (¹⁰⁸). Looking at skills gaps related to qualifications, Cogent have quantified a need to raise approximately 40,000 employees from level 2 to 3 (¹⁰⁹).

3.2.2.3. *Business services, financial services and the carbon markets*

Business and Financial Services are important contributors to the UK economy. Carbon Markets, created through international agreements such as the Kyoto Protocol, are providing a mechanism to set a price on CO₂ (and other greenhouse gases) and to offer a monetary incentive to businesses to reduce emissions. Financial and business services are mainly concentrated in the South East of England particularly in London – although there are pockets elsewhere in the country including a significant banking sector in Scotland.

Most roles in the sector will require some knowledge of greening. However, there are existing job roles where the emergence of the low carbon economy requires additional skills, such as:

- (a) commodity trader (now trading in carbon emissions);
- (b) commercial lawyer (offering legal advice projects with an environmental focus);
- (c) accountant/auditor (carbon auditor);

(¹⁰⁷) DBIS (2009), The UK Low Carbon Industrial Strategy.

(¹⁰⁸) Cogent, 2007: A Sector Skills Council Agreement for the Cogent Sector UK.

(¹⁰⁹) Cogent, 2006: A Gap Analysis for the Chemical Industry.

- (d) back-office / technical and financial (responsibility to comply with regulations);
- (e) venture capitalist (financing of clean technologies and carbon reducing projects).

There are some new green occupations created in the sector. These are expected to be roles such as Sustainability and Energy Manager or Climate Change Consultant either directly employed or obtained from specialist consultancies.

In the financial and business sector employers take responsibility for upskilling of the workforce in new products and practices (¹¹⁰). Employers provide training by in-house experts or source expertise from specialists, usually private sector training providers.

3.2.2.4. Low carbon electronics and ICT

There are 597,000 people employed in the ICT industry in Britain with a further 650,000 ICT professionals working in other industries. There are also 220,000 people involved in the design and production of electronic products working mostly in SMEs. It is a key sector to take account of. While ICT accounts for 2% of the global carbon footprint, it is vital in reducing the emissions from other sectors for example, through reducing communication and transport costs by using on-line technologies. The market in low carbon electronic design and plastic electronics has an enormous potential with many of the leading firms in the UK.

Higher level skills are focussed in the existing workforce and there is adequate provision for ‘digital’ technology research in England which generates sufficient number of new entrants to the industry. This is demonstrated by the overwhelming concentration of major ‘digital’ industry business European research and development centres in England and the continued key role of technology intensive UK owned businesses in designing and developing new and emerging digital technologies.

However, there has been a fall in the uptake of Computing degrees over the past five years in the UK. The number of UK resident applicants to Computing / Information Systems and Engineering courses delivered by UK universities has dropped by 50% over the period 2001-06 to 13,500 in 2006 (¹¹¹). Meanwhile, the demand for high level skills and qualifications can be expected to continue to rise and the proportion of workers in the sector who are graduates and with post graduate qualifications can be expected to rise. Demand growth for lower level skills is less certain, though creating pathways for lower skilled entrants to acquire higher level skills through vocational qualifications is being used to help to satisfy demand. Generic skills such as creativity and entrepreneurial skills (leadership and management training, international sales and marketing) are also required.

(¹¹⁰) Skills review: UK wholesale financial services, Financial Services Skills Council, 2007.

(¹¹¹) E-skills UK (2008) IT & Telecoms Insights 2008: Competitiveness of the UK IT & Telecoms Sector.

3.2.2.5. *Low carbon aerospace industry*

While it is estimated that aviation contributes only 2% of global CO₂ emissions, it is thought that there will be a fourfold increase by 2050 if this is left unchecked. Aviation is a vital industry for the UK with the second biggest aviation industry in the world in terms of employment and turnover (£20 billion in 2007).

There are few options available to the industry aside from the continuing efficiency gains in aircraft design which are driven, for the most part, by the increasing costs of aircraft fuel. However there are impediments to this happening quickly. Rigorous safety standards and testing and the long working life of aircraft, means the industry is characterised by high investment costs and long development timeframes. Coupled with this is the inherently international nature of the industry which creates difficulties in getting agreement on how to regulate it.

Occupations across the aerospace industry are expected to need changes to the skills required because of environmental issues, such as climate change, local air quality and noise pollution (¹¹²). This includes the design phase (airplane, turbines, fuel), to manufacturing as well as flight and ground operations to reduce the carbon intensity of the airport system through effective air traffic management. As such, occupations affected range from engineers, product designers, air traffic controllers, and airport managers as well as consumers of both business and leisure travel and travel agents.

The solutions for reducing the aviation industry's carbon emissions are rooted in technological developments which can be stimulated by government. The skills response linked to this is at an early stage. The SSC for manufacturing (SEMTA) is working alongside business and the National Skills Academy for Manufacturing to ensure that low carbon skills are being provided in sufficient numbers for the existing and current workforce.

In terms of higher level skills, the Technology Strategy Board is supporting research and development activities in the sector. For example, it has awarded £45million of funding to aircraft manufacturer Rolls-Royce to undertake research projects in collaboration with eight UK universities to develop lighter fans that reduce fuel consumption and affordable high temperature alloys to improve fuel efficiency.

3.2.2.6. *Civil nuclear power*

A recent Government White Paper (¹¹³) has put the issue of civil nuclear power back on the table because of the increasing cost of fossil fuels and rising CO₂ emissions. A new generation of nuclear power plants is a key factor in decarbonising the UK's power supply.

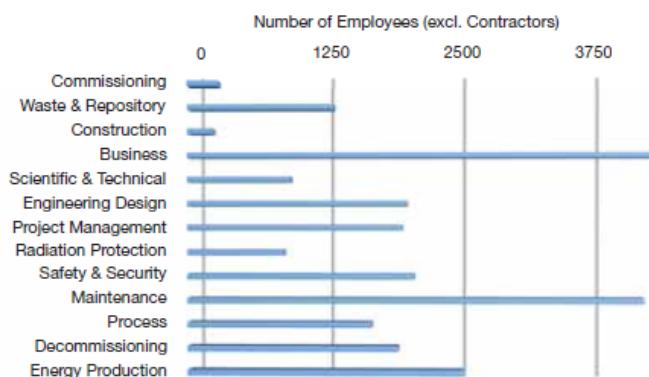
(¹¹²) www.omega.mmu.ac.uk.

(¹¹³) BERR, Meeting the Energy Challenge: a White Paper on Nuclear Power, January 2008.

All but one of Britain's existing nuclear power plants are reaching the end of their lives and are scheduled to be closed down by 2023.

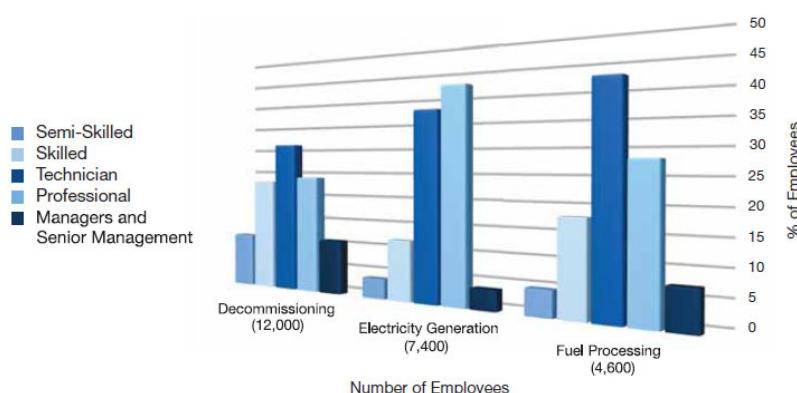
The civil nuclear workforce is estimated by Cogent, the SSC for science based industries, to employ approximately 44,000 people with 24,000 employed directly by the operating companies in electricity generation, decommissioning or fuel processing. The majority of the workforce is employed in the North West of England with significant employment in the South West and in Scotland. This is expected to increase very significantly as decommissioning takes hold and a new generation of nuclear power stations is built over the next ten years. To recruit such large numbers on top of a considerable skills gap because of the need to replace so many of the existing workforce over the same period is quite a challenge.

Figure 7: Civil nuclear employment by area of work (2009)



Source: Adapted from Cogent, 2009

Figure 8: Skill levels in the civil nuclear workforce



Source: Adapted from Cogent, 2009

Cogent is working in partnership with the Office for Nuclear Development, the National Skills Academy for Nuclear, the Nuclear Decommissioning Authority, the Engineering Construction Industry Training Board (ECITB) and ConstructionSkills (the SSC for construction) to develop a high level new nuclear skills and capability plan. This plan aims to detail the volume of different skills required and the necessary timeline to ensure new nuclear power plants can be built and begin generating electricity by 2018. It will include all skills involved in the design, engineering, construction, commissioning, operation and maintenance of a plant, including the supply chain. The OND is also working with Cogent to plan for future skills requirements. This will estimate the nuclear sector's skills requirements and current workforce numbers across all elements of the sector (including new build, decommissioning, existing operation of nuclear plants) over the next few decades.

3.2.3. Identification of skills needs

In the UK, SSCs are the organisations identifying skill requirements in their sectors to provide estimates of replacement demand, new entry demand, skills shortages and skills gaps and needs for re-skilling and up-skilling to meet sectoral needs and changes in the composition of the workforce. They do this through gathering labour market intelligence (LMI) through a combination of qualitative and quantitative data gathered through workforce studies of their sector and employer consultation. This includes analysis of national cross sector studies such as:

- (a) working futures – this study provides a 10 year projection of the future pattern of demand for UK skills as measured by occupation. The 2007 study made projections to 2017. It was commissioned by UKCES and used the Cambridge Econometrics Multi-Sectoral Dynamic Model. This methodology offers likely trends given a continuation of past patterns of behaviour and performance, rather than a precise forecast of what will inevitably happen. The study is used extensively by the SSCs to estimate future demand in their sectors. However, the sectoral footprint of some SSCs does not match the disaggregation available. It also only provides disaggregation up to 2-digit Standard Industrial Classification (SIC) rather than to individual occupational level;
- (b) the Labour Force Survey (LFS) – this study surveys a small sample of UK households to provide information on the characteristics of the UK workforce (persons aged 16 and over). It covers information on the current and past employment and economic activity as well as qualification level and past and ongoing training. It is conducted four times a year by the Office of National Statistics;
- (c) the Annual Business Inquiry (ABI) – A yearly survey of employers that collects information on employment (total numbers and cost of) and financial information from companies. Data can be disaggregated by sector and occupation and region;

- (d) the National Employer Skills Survey (NESS)⁽¹¹⁴⁾ – this survey provides detailed information on the incidence, extent and nature of skills problems facing employers, in terms of both recruitment and skill gaps within their existing workforce as well as expenditure and nature of training and human resource practices. It is conducted every 2 years since 2003 and thus allows for trends in the direction of skills gaps and shortages to be identified. The last published survey (2007) covered 79,000 (in 2007) employers in England drawn from the comprehensive Business Register. It is jointly commissioned by the LSC and UKCES and carried out by an external company.

Similar surveys cover employers in Scotland and Wales:

- (a) Future Skills Wales – is a research programme which generates mostly demand side information on sectoral skills needs in Wales through employer surveys. This and other information on skill needs is made available through the Welsh Learning and Skills Observatory interactive website;
- (b) Future Skills Scotland – this is a research programme led by Scottish Enterprise and Highlands and Islands Development Enterprise. It undertakes Scotland specific primary research, such as surveys and case-studies of employers in Scotland. It also produces a 10 year projection of skill gaps and shortages bringing together demand and supply side scenarios for the country using existing national datasets (Working Futures, LFS, ABI).

In addition to national sources, surveys and intelligence on skills is collected through targeted skills surveys by SSCs, professional bodies and private organisations. ConstructionSkills for example, the SSC for the construction industry, has set up a Future Skills Unit with a specific remit of collecting intelligence to undertake skills forecasting in the sector, focusing on renewables, zero carbon, low carbon, environment and technological change. An example of LMI from a private organisation is the Environmental Data Service¹ (ENDS) annual survey of employees of environmental consultancies covering careers, salaries and skills.

From 2010 and on an annual basis, the UKCES will be producing a National Strategic Skills Audit. The audit will use intelligence collected by the sources identified above and other contributions by SSCs to 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 the development a 'Strategic Skills Strategy' to specifically target skills gaps and shortages in low-carbon emerging industries. The strategy will be used by the newly-formed SFA and skills agencies in the devolved administrations to commission effective skills provision that meet national and regional sector priorities.

⁽¹¹⁴⁾ <http://researchtools.lsc.gov.uk/ness/home/home.asp>.

3.2.4. Skills response

The UK Government has outlined the measures that will ensure that their approach to skills is joined-up, employer-led and ultimately facilitates economic recovery and growth in its Skills for Growth Strategy. This broadly supports the Government's industrial strategy by committing resources to the development of priority sectors particularly low carbon, by ensuring that the workforce is adequately skilled to meet the demand for labour in these sectors⁽¹¹⁵⁾. The strategy also details how public funding is targeted at meeting needs common to all sectors as well as some priority sectors (which include life sciences, digital media, technology, advanced manufacturing and engineering construction). For example, more than £100m has been made available specifically for priority sectors which would fund 160,000 level 2 and 3 training places⁽¹¹⁶⁾.

The government has also:

- (a) expanded its commitment to supporting the retraining and upskilling of those who have been made redundant and been long term unemployed with additional places for training;
- (b) increased its funding for Apprenticeships which will enable sectors such as Nuclear to develop new apprenticeship qualifications;
- (c) targeting resources from European Social Fund 2007-13 projects which promote 'skills for climate change and sustainable development' (Department for Work and Pensions ESF Unit). These projects are aimed at both up-skilling the existing workforce to meet the greening demands. Birmingham Chamber of Commerce is leading one such project where it is working in partnership with local further education colleges to provide training to building managers and managers of SMEs on reducing carbon emissions of the existing building stock;
- (d) specified shortage occupations which include some arising from carbon reduction which migrants can fill from outside the EU.

More specific skills responses to industries growing and declining as a result of the government's environmental strategies and regulation are apparent in the work of SSCs, employer bodies, qualification bodies and major employers. In the UK's arrangements for responding to changing skills needs this should be expected.

The SSAs and SQSs of eight key SSCs indicate that some have so far responded more than others to the Government's environmental strategies.

⁽¹¹⁵⁾ BIS (2009) Skills for Growth.

⁽¹¹⁶⁾ BIS (2009) Skills for Growth.

3.2.4.1. Energy and utility skills (EU skills)

EU Skills' SSA published in 2009 states that: 'The main factors shaping the future of the sector relate to the transition towards a low carbon economy' (¹¹⁷). The core actions the sector needs to take to address this are: 'more emphasis on workforce planning, raising the profile of the industry, increasing the number of Apprentices, influencing the economic regulator where appropriate, focusing on technical upskilling and higher-level skills development and forecasting the skills needs for new and emerging technologies.'

Referring to specific industries within their footprint, for example Gas, the SSA discusses the expected re-skilling and 'greening' of current jobs: 'The gas engineer of the future may well be needed to install and maintain some of these micro-generation technologies, as they do the central heating boilers of today.'

3.2.4.2. Asset skills

The most recent update to the Asset Skills sector skills agreement (¹¹⁸) published in 2010 describes sustainability as having 'a significant impact on the Asset Skills industries, changing the required skills of staff working in this field'. The skills implications are outlined as: energy management, energy efficiency and certification, energy advice and support for carbon reduction measures and sustainable use of resources. It acknowledges that low carbon legislation at the UK and EU level has had a major impact on their footprint. For example, the European Performance of Buildings Directive, for example, has increased demand for Domestic, Commercial and Air Conditioning System Energy Assessors and Home Energy Advisers.

3.2.4.3. Lantra

Lantra's SSA makes very little mention of the impact of the Government's environmental strategies: 'Lantra fully supports the Government's regeneration and sustainable development strategies.' However the 2009 update (¹¹⁹) outlines significant progress and assimilation of government policies. The following new 'greening' competencies as a result of climate change are identified: managing the business in an environmentally responsible manner; using scarce resources such as water effectively and efficiently; limiting damaging impact of industry such as minimising nitrates in fertilisers; managing crops and landscapes to take account the changing weather; making efficient use of energy and waste; including considerations of biodiversity in business practices.

(¹¹⁷) EU Skills (2009), Sector Skills Assessment 2009.

(¹¹⁸) Asset Skills (2010), Sector Skills Assessment.

(¹¹⁹) Lantra (2009), A Skills Assessment for the Environmental and Land-based sector UK report.

3.2.4.4. Cogent

Cogent's SQS does not directly address the issues of greening existing jobs, restructuring the sector and of new green jobs across its footprint but does discuss these issues within its constituent industries. With regard to the petroleum industry, the SQS discusses the advent of biofuels and increased demand for renewable as 'creating the need for areas of new skills development' (¹²⁰). The SQS recognises the need for level 4 or 5 skills provision in compliance management to ensure targets are met.

A key conclusion of the sector skills agreement, published in 2006 is the introduction of skills passports to the sector. This is to aid flexibility in the workforce. In the nuclear sector, it may facilitate workers' movement between decommissioning to new build, for example.

3.2.4.5. Summitskills

Summitskills' SSA published in 2007 highlights renewable and environmental technologies as being a skills deficiency across the sector (¹²¹). The document calls for 'Urgent development of national occupational standards for environmental technologies to ensure that the skills are available across the sector to design, install, commission and maintain these new and emerging technologies so that the sector can compete in a global market against foreign competition'.

3.2.4.6. Construction Skills

In its SSA published in 2005 (¹²²), Construction Skills highlights sustainability as one of the key drivers for change in construction. They expect that because government is a client (the industry's largest) construction companies will have to build in a more sustainable manner due to sustainable procurement guidance.

3.2.4.7. Semta

Semta has SSAs for sub-sectors. The majority of the work was published in 2007. Government low carbon strategies are not reflected in the skills gaps identified. In the SSA for the Electronics, Automotive and Aerospace Industries, the new markets being opened up for hybrid, electric and alternatively fuelled vehicles are mentioned as an area of growth however, the skills requirements for this growth are not covered.

(¹²⁰) Cogent (2007), Sector Qualification Strategy, p. 28.

(¹²¹) Summitskills (2007), Sector Skills Agreement Stage 3: gap analysis and market testing.

(¹²²) Construction Skills (2005), Making the Case for Change.

3.2.4.8. Financial services

Financial Services Skills Council (FSSC) does not mention the impact of the Government's environmental strategy in either their SQS or SSA (¹²³).

We find that:

- (a) some SSCs have developed specific skills strategies for sectors and sub-sectors affected, such as LANTRA, Summitskills, Constructionskills and Cogent;
- (b) SSCs and other bodies have worked and are working together with trade and employer associations to develop skills strategies and qualifications. This is apparent in the work of the BWEA in the WWT sector and of Cogent in the chemical sector;
- (c) awarding organisations and SSCs are working closely together to reflect new NOS in all the new vocational qualifications that will have to comply with the QCF by September 2010. Many are taking this opportunity to ensure they take on board environmental requirements in their content and assessment as well as developing more relevant new qualifications;
- (d) skills academies established for many sectors are leading work to develop new qualifications such as the apprenticeship in the Nuclear sector and the Masters degree in leadership for the manufacturing sector. In 2010-11 £16m has been allocated to support the further development of Skills Academies (¹²⁴). There are now 14 National Skills Academies in operation and one in the planning phase. In addition to nuclear and manufacturing they exist for construction; financial services; materials, production and supply; and process industries;
- (e) RDAs are supporting various strands such as STEM skills and the development of higher level vocational qualifications and training centres for priority sectors in their region. In the North East of England, the RDA is assisting in setting up an LCEA for low carbon vehicles and the re-skilling of the workforce that is required;
- (f) a similar process is happening in Scotland and Wales;
- (g) employers, such as British Gas, are responding to regulatory changes to ensure their workforce can be re-trained and increased to respond to a change such as smart metering of domestic supplies of gas and electricity.

We have also found that:

- (a) the government has set up the Forum for Just Transition as part of the Low Carbon Transition Plan. The forum will advise on how the government can fairly distribute the cost and benefits of the transition to the low carbon economy through national, regional and local policy. The first meeting took place in December 2009 between government

(¹²³) This was also confirmed in an interview with the Research Manager at FSSC.

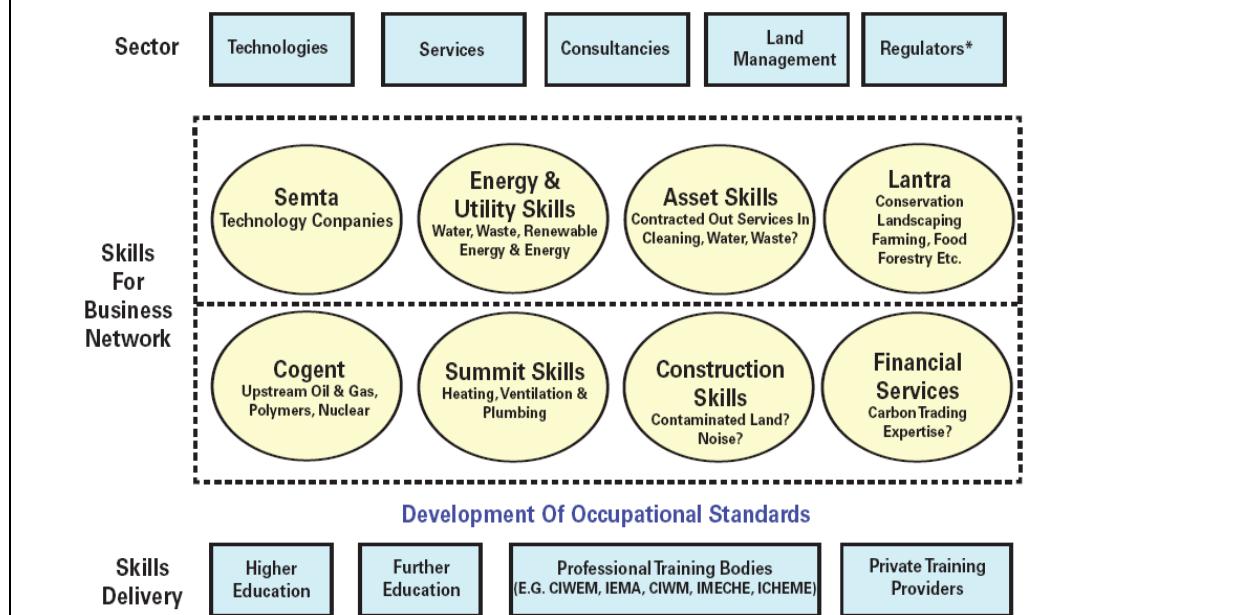
(¹²⁴) BIS (2009) Skills for Growth.

ministers and representatives of trade unions, industry groups and education and skills groups. The exact mechanisms by which recommendations, especially on skills and retraining needs related to restructuring, is not yet clear;

- (b) to develop a clear skills response for the low carbon industry (and recognising the overlapping responsibilities of SSCs in these areas), eight sector skills bodies are now working together in identifying skills needs in industries such as renewable energies (as detailed in below).

Skills bodies acting together on renewable energy

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



Source: Environmental innovation: bridging the gap between environmental necessity and economic opportunity, DTI 2006

- (c) because of the lack of coordination for renewable energy industries, the Office for Renewable Energy Deployment (ORED) has been charged with undertaking a comprehensive audit of skills for renewables and develop the National Skills Academy for Power. ORED is working with industry, SSCs, RDAs, local authorities to produce a coordinated response;

- (d) some sector skills bodies and trade groups, such as the Institute of the Motor Industry (IMI) and Construction Skills have set up an awarding organisation arm to directly develop qualifications for their sector that meet the green agenda. For example IMI Awards Limited have developed a qualification in hybrid technologies to respond to demand from particular car manufacturers;
- (e) professional bodies are also active in identifying skills needs and developing skills responses. For example, the Royal Institute for British Architects (RIBA) has set up a Sustainable Futures Group to inform its members (architects) about developments in sustainable building design. The group also feeds into updating curricula for architecture schools and continuing professional development (CPD), as well as professional standards to ensure that skills for designing low carbon buildings are disseminated into the occupation;
- (f) there are many organisations offering advice to businesses regarding improving their response to sustainability issues within specific sectors. These include:
 - (i) the Manufacturing Advisory Service; which offers advice to businesses on improving production efficiency and reducing waste (although does not offer greening advice directly);
 - (ii) National Industrial Symbiosis Programme, delivered on a regional basis and aims to improve cross sector resource efficiency commercial trading of materials, energy and water and sharing assets, logistics and expertise;
 - (iii) Forum for the Future, helps organisations to change their operations into low carbon ones;
 - (iv) Envirowise, offers advice to business on minimising waste and reducing environmental impact;
 - (v) the Commission for Architecture and the Built Environment works with architects, planners, designers, developers and clients offering guidance on sustainable development, public spaces and housing.

Even so some weaknesses in the response to the supply of and demand for skills and changes to skills arising from the environmental strategies have been raised by various bodies outside government and in research for RDAs and UKCES. This is primarily around:

- (a) the extent that universities have responded to changes in higher level skill needs and collaborated widely with employers. Change is slow. The Trade Union Council (TUC) states that if the UK is to reap the economic benefits from an early transition then ‘the time lag between new skills needs developing and the market responding to this demand must be shortened’⁽¹²⁵⁾. While a response can be evidenced in terms of universities providing higher level degree courses and units for employers, it is relatively small scale

⁽¹²⁵⁾ Unlocking Green Enterprise, A Low-Carbon Strategy for the UK Economy, Trade Union Congress, 2009.

in relation to the likely level of need⁽¹²⁶⁾. A report by the West Midlands Regional Observatory on environmental technologies, for example, had found that ‘the majority of businesses have no links with the region’s Higher Education Institutions’, although there are notable examples of firms working with specific universities. To some extent the Government’s strategy for higher education acknowledges this though more needs to be done;

- (b) the extent that employers recognise the need to reskill and adapt their workforce and that they are expected to fund this alongside the Government. Repeated surveys of employers find that the level of investment in training is often inadequate and dependent on public funding⁽¹²⁷⁾. The Sustainable Development Commission suggests appealing to the business needs of employers by not talking about low carbon but speaking about ‘resource efficiency’ to better make the business case. ‘Demand is not currently being articulated by employers and as a result the current skills delivery framework is ill equipped to anticipate and respond. Organisations do not have the right levels of understanding of skills requirements’ Pro Enviro, Defra 2009;
- (c) the Sustainable Development Commission⁽¹²⁸⁾ describes the 2009 Skills Strategy as ‘disappointing’ and not the step-change required to meet the needs of transition to the low-carbon economy. SSCs are not as active as they should be in addressing low carbon and energy efficiency skills are incorporating these considerations into their action plans and overall strategies⁽¹²⁹⁾. SSCs feel that ‘it is too early’ and do not have a full understanding of the skills required.

3.2.5. Case studies on new green collar occupations

3.2.5.1. British Gas smart energy meters

The UK Government has confirmed that electricity and gas suppliers will have to install smart meters into every UK home by 2020. Smart meters are the next generation of electricity and gas meters displaying real time information on the amount of energy being used in the home. This allows consumers to monitor their energy use more accurately, with the potential to reduce their bills and increase their energy efficiency. The aim of these changes is to reduce the carbon emissions of the UK’s built environment. In order to deliver on this requirement, British Gas, one of the UK’s leading gas suppliers, has created a new business sub-unit called British Gas Smart Energy to recruit and train 2,600 new employees to install and maintain the new meters and explain to their customers how to use them effectively.

⁽¹²⁶⁾ Research into Sustainable Development Advice and Training, GHK Consulting, South East England Regional Development Agency, 2009.

⁽¹²⁷⁾ National Employers Skills Survey, Learning and Skills Council, 2007.

⁽¹²⁸⁾ Comments made by Tess Gill, Commissioner for Work and Skills of the Sustainable Development Commission at the Aldersgate Group round table on 19th November 2009 at the House of Commons.

⁽¹²⁹⁾ Skills for a low carbon and resource efficient economy: A review of evidence, ProEnviro, 2008.

The UK Government's Energy White Paper (2007) laid out the Government's target to install smart meters to all domestic buildings by 2020. The Energy Act (2008)⁽¹³⁰⁾ gave the Government power to require gas and electricity suppliers to do this in every home (46 million meters in 27 million homes by 2020) by the end of 2020, at a rate of approximately 12,000 a day. Of this, British Gas will be installing approximately 17 million meters. The cost of installation is estimated to be about £15 a household (£7 billion in total). £10 of this will be recovered from savings made by the energy companies who no longer have to pay people to read the meters. The other £5 is likely to be picked up by consumers but the expectation is that they will save more than this through modified energy use.

After consultation on the approach for achieving smart meter installation by 2020, the Government set out its model in December 2009:

'Energy suppliers will be responsible for purchasing and installing meters and communications are coordinated centrally offers the best model for the UK's smart meter roll out ... the model combines strong incentives for energy suppliers to deliver a high quality service to their customers, with wide scope to simplify and improve industry processes, making it easier to switch between suppliers.'⁽¹³¹⁾

As the focus of this case study, this model has major implications for British Gas, as it puts the onus on the energy supplier to develop the required workforce in terms of recruitment and skills⁽¹³²⁾.

There are a number of factors driving this commitment.

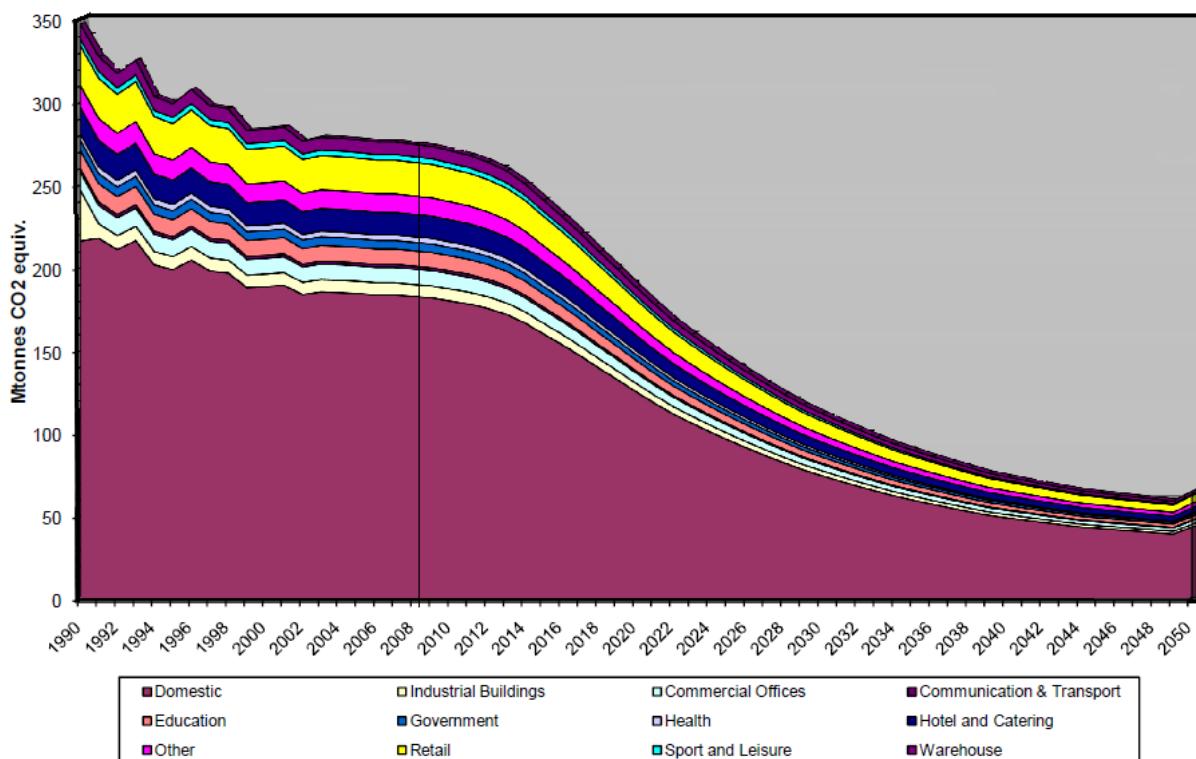
Figure 9 outlines the relative significance of the various component parts of the built environment to UK GHG emissions with housing representing approximately two-thirds of built environment emissions. If the UK is to meet its 80% reduction target by 2050, then domestic buildings will have to make a major contribution.

⁽¹³⁰⁾ The Energy Act (2008) provided enabling powers for a universal smart meter mandate. The Secretary of State was given the power to amend the supply and operating licence of any gas or electricity supplier to comply with future commitments made on smart meters.

⁽¹³¹⁾ DECC (2009), Towards a smarter future: Government response to the consultation on electricity and gas smart metering.

⁽¹³²⁾ At a recent presentation on green skills, the Managing Director of British Gas New Energy commented that given the prevailing policy environment and government commitments to carbon reduction targets, energy companies have very little choice but to adapt their business models. For British Gas to embrace the agenda fully, they require, and, it seems, are getting, governmental support in three areas: politically: broad acceptance of the wider agenda for the roll out of smart metering from across the political spectrum allows long term training and infrastructure planning. Regulatory: the framework of bodies regulating the industry must be in line with the political drivers. OFGEM's involvement in the management of the early stages of the implementation is confirmation of this. Fiscally: tax breaks and subsidies for green policies provide incentives (and confirm political commitment) for the major changes to the organisation's business model.

Figure 9: Built environment contribution to UK GHG emissions



Source: UK Green Building Council

The Government estimates that smart meters will deliver a net benefit to consumers of around £6 billion over twenty years⁽¹³³⁾. The Energy Retail Association (ERA), an organisation representing all of the major energy suppliers in the UK, has set out the benefits which consumers are likely to enjoy:

- (a) tariffs can be set flexibly relating to consumption at given time periods for example, cheaper rates would be available during the night when demand is low;
- (b) consumers will be able to switch between suppliers more easily;
- (c) consumers will be able to sell energy back to the national grid thereby encouraging and rewarding micro-generation;
- (d) consumers will be able to see the way they use energy more accurately and modify their behaviour accordingly⁽¹³⁴⁾. This will end the financial difficulties sometimes incurred through inaccurate estimations of bills.

⁽¹³³⁾ OFGEM (2009), Delivering Smart Meters: Factsheet 84. There is some debate over this figure though. Energy consultants McKinnon and Clarke have suggested that savings will be as little as £30 per household per year, with most of this coming from reduced usage. Savings of £120 per household per year should be passed on: accessed at <http://www.mckinnon-clarke.co.uk/content-page.php?press-release=1975>.

⁽¹³⁴⁾ See <http://www.energy-retail.org.uk/smartmeters.html>.

There are likely to be benefits for the energy producers as well:

- (e) the costs of servicing consumers will reduce as there will be a reduced need for meter readers;
- (f) there will be reductions in energy theft through the installation of smart tamper alarms;
- (g) network operators will be able to run the national grid more efficiently.

The impact assessment conducted for DECC in May 2009, confirms the importance of the Government in this policy:

‘Currently, suppliers are only likely to roll out smart meters to 20%-30% of the market where a commercial case exists. With Government intervention, smart meters can be extended to the rest of the market capturing the benefits of increased energy efficiency, improved consumer experience, energy network benefits and the ability to respond to future energy market and policy developments’⁽¹³⁵⁾.

The energy industry, described very broadly, has been supportive of the Government’s policy. The ERA, for example, fully supports the approach that the Government has opted to implement. The energy industry regulator in the UK, OFGEM has created a new business unit, ‘OFGEM e-serve’, to manage and administer a range of environmental programmes including the smart meter implementation programme.

While all energy companies have begun to prepare for the installation of smart meters to some extent, British Gas was the first of the UK’s ‘big six’ energy suppliers⁽¹³⁶⁾ to announce measures preparing for the implementation of smart energy meters.

British Gas’s response

The Government have outlined the importance of labour force planning in the implementation of the smart meter programme. Respondents to the consultation pointed out that ‘planning was important to ensure that sufficient numbers of trained workers were available to facilitate installation and/or that consideration should be given to re-training [those workers] once the peak installation period had passed’⁽¹³⁷⁾. Other training issues outlined by the government include ensuring that workers displaced by the introduction of smart meter technology be retrained and redeployed; that the installation should be carried out by those already engaged in the industry; and, importantly for British Gas, that a directly employed workforce is preferable to a sub-contracted one.

⁽¹³⁵⁾ Baringa Partners (2009), Impact Assessment of a GB-wide smart meter roll-out for the domestic sector.

⁽¹³⁶⁾ The other five are: NPower, EDF Energy, Scottish Power, Scottish and Southern Energy and E.on.

⁽¹³⁷⁾ DECC (2009), Towards a smarter future: Government response to the consultation on electricity and gas smart metering.

British Gas plans to take on 2,600 new staff by 2012 (although 900 of the roles will be taken by transferees from other metering organisations) to install these smart meters. 2,100 of the jobs will be engineers working in the field; the remainder will be for support staff (400 jobs) and management (130 jobs).

The new staff will be trained in five British Gas training centres across the UK (Leicester, Dartford, Thatcham, Hamilton and Leeds) at a total cost of £30 million to British Gas. These training centres have facilities which can offer practical workshops and simulations of situations that engineers will face in the field. Two of them are accredited as centres of vocational excellence by the Government.

New job roles and skills

To undertake the responsibilities given to them by the Government to install smart meters in all of their homes, British Gas have set up a new business unit: ‘British Gas Smart Energy’. A number of new roles have been created to carry out the installations. The Smart Energy Expert is the core role for installing and advising customers on smart meters. Smart Energy managers will have responsibility for managing a team of up to 25 field-based Smart Energy Experts.

For the Smart Energy Experts, new employees will undergo a 23 week externally accredited qualification training programme with a mixture of on and off-the-job training. The core training will ensure new employees achieve the industry standard qualification to work on gas supplies, equipment and meters ⁽¹³⁸⁾. Trainees work towards either Gas Safe Accreditation CCN1 (Core Gas Safety Certificate) or CMA2 as well as either MET1 (Gas meters) or MET2 (electricity meters) to be able to install and service domestic meters. Recruits who hold these valid qualifications will not need to retake them.

All recruits to the Smart Energy Expert role will have to undergo accredited training to acquire the customer service skills necessary and ability to explain to consumers the environmental and economic benefits of having a smart meter. This will ensure they can:

- (a) advise customers on the range of tariffs available, such as time-of-use tariffs, which reward customers for using energy at off-peak times;
- (b) give advice on measures that could cut energy use, such as insulation;
- (c) help customers learn about ways of generating their own energy;
- (d) provide advice to customers on the installation and maintenance of low-carbon micro-generation technologies.

⁽¹³⁸⁾ To work on gas installations and appliances in the UK, employees have to be registered with CORGI (Gas Safety Register) and hold valid and relevant ACS gas qualifications which are renewable every five years.

Assessment of the effectiveness and organisation of this response

The British Gas response to the requirements they have to install smart meters into all of their homes is well-developed. They have acknowledged that given the carbon emission reduction targets that are law in the UK, they have to adapt their business model. They have developed an extensive training programme to increase their workforce and re-skill existing employees in the new roles needed over the next ten years.

3.2.5.2. *British wind energy association skills accord*

The wind energy industry has experienced a period of rapid international growth which is forecast to continue as the cost of wind energy falls and the need to tackle CO₂ emissions grows in importance.

In the UK, there is likely to be a particularly large increase in demand for wind energy (both offshore and onshore) over the coming years because of the significance of wind energy in the Government's Energy Strategy and the need to hit targets for carbon reduction set in legislation. However there is evidence that skills shortages across the supply chain may inhibit the growth of this industry in the UK.

This case study examines the response of the British Wind and Marine Energy Association (BWEA), which is the trade association for the UK wind and marine renewables industry. In October 2009, the first Wind and Marine Energy Skills Accords were signed which committed business leaders from the UK power sector and leading figures from skills bodies and the education sector to train up to 60,000 entrants to the wind and marine energy industries by 2020.

The development of the wind, wave and tidal (WWT) energy industry is closely related to Government policy. The Renewables Obligation (RO) is the government's main mechanism for supporting the generation of non-fossil fuel electricity. It requires electricity suppliers to provide a certain proportion of their electricity from renewable sources ⁽¹³⁹⁾. The RO is a key part of the UK's actions for carbon emissions reduction included in the Climate Change Act 2008. This legislation committed the UK to legally binding targets of reducing carbon emissions by 80% against a 1990 baseline by 2050. Increasing the use of renewable energy is one method of reaching this target.

Large scale wind power is the only renewable electricity generation technology that can generate electricity on a large scale. By 2020, it is predicted that offshore wind will contribute 55% of the UK's renewable energy and onshore wind 28%. Offshore wind, therefore, is the key growth area. The UK has physical advantages in this with a long coastline, shallow waters and high average wind speeds. The Government claims that the UK is: 'and will

⁽¹³⁹⁾ In 2006-07, the proportion was 6.7% rising to 10.4% by 2011-12 and then 1% per year for following five years.

remain for the foreseeable future, the largest single market for offshore wind in the world' (¹⁴⁰). A recent Strategic Economic Assessment of English and Welsh territorial waters concluded that there is potential for some 25GW of additional offshore generating capacity .

Analysts have projected changes to the labour market for the wind, wave and tidal (WWT) industry from 2008 until 2020. There are currently 4,800 full-time employees (FTEs) working across a range of functions in the sector. Three outcomes for the WWT (¹⁴¹) sector in 2020 have been modelled: slow growth, solid progress and dynamic model (¹⁴²). See Table 9 below. Even under the most pessimistic estimates the industry should require a substantial increase in numbers of workers over the next decade; equivalent to 740% growth.

Table 9: Workforce forecasts (numbers of workers) (¹⁴³)

Year	Sub sector	Slow growth	Solid progress	Dynamic
2014	Wind, wave & tidal	12,000	14,500	18,000
2020	Wind	23,100	35,900	56,900
	Wave & tidal	350	1,600	2,100

Source: adapted from SQW Energy (¹⁴⁴)

Skills gaps/weaknesses

The WWT industry faces a number of barriers to gaining the workforce potentially demanded over the next decade:

- (a) a large proportion of the engineering workforce (relative to the remainder of the economy) is nearing retirement (43% of the engineering workforce is aged 45-64 in comparison to 38% in other sectors) (¹⁴⁵). The engineering sector, which is likely to be a key source of recruitment for the WWT industry, will have to replace much of the existing workforce.

(¹⁴⁰) DBIS (2009), The UK Low Carbon Industrial Strategy, p. 7.

(¹⁴¹) This case study focuses on the entire wind and marine energy workforce however wind makes up the vast majority of this and is therefore the dominant aspect of the skills response.

(¹⁴²) Slow growth is based upon assumptions of a lack of support for WWT energy and most manufacturing and skills remaining based outside the UK. Solid progress (or base case) assumes clear political support and an almost self-supplying manufacturing industry and limited export. The dynamic model assumes political support for ambitious targets, and the export of offshore expertise and wind turbine components.

(¹⁴³) The majority of growth before 2014 is anticipated to take place in the wind sector which is why there is no split for 2014.

(¹⁴⁴) SQW Energy (2008), Today's Investment – tomorrow's asset: skills and employment in the Wind, Wave and Tidal sectors.

(¹⁴⁵) SEMTA (2008), Engineering Skills Balance Sheet.

- (b) there is likely to be competition for individuals with skills suitable to the WWT industry from other related sectors. Analysis produced by SSCs⁽¹⁴⁶⁾ for similar areas of the workforce (Semta – Science, engineering, manufacturing and marine; EU Skills – electricity, gas, waste water; Cogent – oil and gas, nuclear, polymer; Construction Skills – engineering and construction)⁽¹⁴⁷⁾ shows that all these related SSCs anticipate an increase in demand within their current planning cycles (up to 2014) with EU Skills (the relevant SSC for the WWT industry) actually predicting the smallest of these increases. Therefore, the market for individuals with these skills will be very competitive;
- (c) the UK has a long term skills shortage in ‘STEM’ subjects from school leavers. This feeds into the university system with the number of graduates in engineering, for example, likely to remain static for the next twelve years⁽¹⁴⁸⁾;
- (d) the Government has identified that the offshore wind industry suffers from a characteristic common to other emerging low carbon technologies, that of knowledge spillover. In emerging industries, dominated by small and medium enterprises (SMEs), there can be a tendency for companies to underinvest in research and development for fear that workers may change companies taking knowledge with them⁽¹⁴⁹⁾;
- (e) finally, the power industry in general faces a problem with public perception. A study conducted for EU Skills showed that 44% of respondents thought of the electricity industry as ‘not at all desirable’ to work in⁽¹⁵⁰⁾.

BWEA have also commissioned work which highlights specific skills gaps. One of the key findings of the Bain Report⁽¹⁵¹⁾ was that ‘the labour market projections suggest that ... between 10,000-20,000 construction, installation and O&M staff will be needed to support the British Wind Energy Industry by 2020. The evidence presented highlighted technician training as a key skills gap’⁽¹⁵²⁾.

⁽¹⁴⁶⁾ Sector skills councils are employer-led government agencies which aim to address the skills gaps of the sector which they represent. They conduct regular labour market research to keep the knowledge base up to date as well as developing and approving qualifications and acting as a strategic lead for learning and skills in their sector. EU Skills represents the energy and utility sector as a whole which includes the renewables workforce.

⁽¹⁴⁷⁾ A coalition of SSCs was formed recently called the Renewable Energy Skills Group. As well as the four SSCs mentioned here, AssetSkills (facilities management, housing, property, planning, cleaning and parking), ECITB (Engineering Construction Industry Training Board), Lantra (environmental and land-based sector), SummitSkills (building services engineering) are members.

⁽¹⁴⁸⁾ Bains & Company (2008), A closer look at the development of wind, wave & tidal energy in the UK.

⁽¹⁴⁹⁾ DBIS (2009), The UK Low Carbon Industrial Strategy, p. 21.

⁽¹⁵⁰⁾ EU Skills (2008), Public attitudes to Electricity Industry and the careers it offers.

⁽¹⁵¹⁾ Bain and Company (2008), A closer look at the development of wind, wave & tidal energy in the UK

⁽¹⁵²⁾ <http://www.bwea.com/jobs/skills/apprenticeships.html>.

Existing provision of education/training for the occupation

Research (¹⁵³) produced for BWEA outlines around fifty relevant courses being run at present in the UK. Providers range from universities to private providers. There are a variety of different types of courses too including full time undergraduate and postgraduate vocational (e.g. a Bachelors in Mechanical Engineering with Renewable Energy), vocational qualifications (such as an NVQ in Fabrication and Welding Engineering) and part-time, short courses (for example a Diploma for Wind Turbine Technicians).

However, the current range of qualifications is insufficient. Employers at the BWEA summit in October 2009 (at which the Skills Accords were signed) agreed that a major gap in provision was a National Renewable Energy Apprenticeship programme (¹⁵⁴). EU Skills made the case for such a qualification in their 2008 response to the Energy White Paper which recognised the importance of a qualification which is capable of leading to a Foundation Degree (¹⁵⁵): ‘There is an absence of clear up-skilling and re-skilling pathways for those with the ambition to work in this area of the renewable energy sector’ (¹⁵⁶).

There is a general agreement, which the Renewable Energy Skills Group presented to the House of Commons Environment Audit committee, that current provision is insufficient: ‘Too many educational institutions are focussed on courses that are easier and more cost effective to deliver, leaving energy-related sectors short of training places’ (¹⁵⁷). These weaknesses in progression routes, the specific demand for an Apprenticeship programme from the industry and the predicted increase in demand generally as well as at the specific technician level, form the basis of BWEA’s skills accords.

The skills response

As the trade and professional body for the UK wind and marine renewables industry, BWEA promotes the use of WWT energy in the UK and conducts a wide range of research including looking at the workforce challenges facing the industry in the coming years. BWEA also acts as a focal point for its membership which is drawn from across the industry and in this latter role it convened a ‘Skills Summit’ in October 2009.

The Summit brought together corporate bodies (including major wind turbine manufacturers, such as Siemens), energy suppliers (including e.on and Scottish Power), skills bodies (including EU Skills) and qualifications bodies (such as City & Guilds) from across the

(¹⁵³) SQW Energy (2008), Today’s Investment – tomorrow’s asset: skills and employment in the Wind, Wave and Tidal sectors.

(¹⁵⁴) Apprenticeships are a qualification which combine learning in the workplace with vocational and key skills study. They are a means of learners earning money while they study and increasing their employability.

(¹⁵⁵) EU Skills (2008), Energy Skills – Opportunity and Challenge: A report to government by the sector skills council responsible for energy.

(¹⁵⁶) <http://www.bwea.com/jobs/skills/apprenticeships.html>.

(¹⁵⁷) Evidence submitted to the House of Commons Environmental Audit Committee (2008-09 session).

industry with the chief goal of signing two Sector Skills Accords (the UK's first). The Accords, which were drafted over a period of consultation with key stakeholders in the sector (¹⁵⁸), are not meant to be legally binding documents and focus on broad statements of intent rather than specific targets. Their significance lies in the leaders of key government and industry bodies who have signed them.

The Renewable Energy Apprenticeship Programme Accord (REAP) sets out the strategy to address the shortage of qualified and experienced wind energy technicians through developing a new apprenticeship programme for the sector.

EU Skills has formed a working group with some key employers to produce an occupational functional map of the renewable energy industry. Their goal is to more accurately describe where 'wind energy technicians' fit within the industry and develop National Occupational Standards (NOS) for the wind energy technician. This describes the skills and abilities that someone filling such a role should have, including the qualifications they need. From this point the next steps are:

- (a) the design and delivery of a large scale wind energy service technician apprenticeship programme from 2010;
- (b) the design and delivery of a broader Renewable Energy Apprenticeship Programme for the future;
- (c) making a commitment to the health, safety and wellbeing of everyone training and working in the industry.

The aim is to get the first cohort of learners to start on this new programme in 2010 while the government has increased its funding for Apprenticeships.

The Renewable Energy Careers and STEM Guidance Accord sets out 'a long term strategy to address the shortage of Professional Engineers available to wind and marine energy business' (¹⁵⁹). The two key aspects are:

- (a) school and educational outreach initiatives which focus on harnessing the enthusiasm many young people have for environmental issues to increase learners choosing STEM subjects at all stages of education;
- (b) providing clearer careers guidance on the pathways into renewable energy industries.

The Accords link closely to overall Government strategy. Increasing the number of STEM graduates for the WWT and other sectors has been a long term goal for the Government. In addition, the Government has invested heavily in increasing numbers of apprenticeships in the UK and is committed to further growth of 20,000 places in 2010-11.

(¹⁵⁸) The signatories were senior figures within the organisation which lends the Accords greater influence (source: interview with Skills and Education Policy Officer at BWEA).

(¹⁵⁹) BWEA 31 (2009), Skills Summit.

Assessment of the effectiveness and organisation of this response

BWEA have successfully built a case, backed up by strong research, which describes the likely increase in the WWT industry's workforce up to 2020. As an industry owned and managed body they are close to the needs of their members. The Accords have brought together the membership and the government organisations which need to work together to make changes in qualifications, attract learners and provide public funding. This is seen as their real strength (¹⁶⁰). Taken together, the Accords represent a coherent response to the workforce issues outlined in the research aiming to address specific skills gaps identified through labour market research, and the more general shortage of engineering skills in the sector in the coming decade.

3.2.6. Case studies on greening existing occupations

3.2.6.1. Emissions trading and financing in London

London is the leading global financial centre (¹⁶¹) and has emerged as the leading centre for carbon trading globally (¹⁶²). The emissions trading market is still in its infancy but is developing rapidly. As the market grows so does the workforce which has to acquire additional knowledge and skills to reap the opportunities from the new market.

The Kyoto Protocol ratified in 2007 committed 175 countries to reducing emissions of greenhouse gases, primarily carbon dioxide, in recognition that human activity leading to these emissions is a major cause of global warming (¹⁶³). The protocol establishes a common denominator for all greenhouse gasses in metric tonnes of carbon dioxide equivalent. Countries with developed or transition economies are committed to reducing collective emissions to 5% below 1990 levels by 2012.

The EU has signed the treaty as a single body and created the EU Emissions Trading Scheme (ETS) in 2005 as a mechanism to achieve its emission reduction goal. The EU ETS has created a market in carbon emissions operating on a 'cap and trade' basis. This means that each company receives a capped allocation of emissions. It can then purchase additional allocations if it emits more than its allowance, or sell or "bank" for the future any allocations that were not used. Carbon emissions have thus become formalised assets that can be bought, sold and included on a balance sheet. This mechanism has created a market in EU Allowances (EUAs).

(¹⁶⁰) Interview with senior manager at BWEA.

(¹⁶¹) The Global Financial Centre Index, 6th Edition, City of London, 2009.

(¹⁶²) Based on research by Oxford Economics cited in Prospectus for London, the Low Carbon Capital, Ernst & Young for the LDA, 2009.

(¹⁶³) Climate Change 2007: Synthesis Report, Intergovernmental Panel on Climate Change, 2007.

To help developing countries to grow sustainably, venture capital companies can invest in Clean Development Mechanism (CDM) projects. These create additional emission reductions, beyond "business-as-usual" and are certified by the UN. The investor can then trade the emissions reductions produced in the emissions trading market⁽¹⁶⁴⁾. This mechanism has created a market in Certified Emissions Reductions (CERs).

Sectors currently covered in the EU ETS include energy production and heavy industries (ferrous metal, cement, ceramics, brick, glass, pulp and paper). Aviation is expected to be included in the next phase of the ETS from 2012. The emissions market is therefore closely linked to the oil, gas, coal and weather derivatives markets , for example the price and availability of coal influences the demand for emissions. This close relationship is reflected in job roles created by the new commodities market. In effect, a 'carbon trader' is not a new occupation but instead is an oil/energy/gas trader who now deals in emissions⁽¹⁶⁵⁾.

London has built on its position as a global financial centre to establish a lead position in the European carbon trading market. London is the home of the European Climate Exchange (ECX), a marketplace for trading carbon emissions of futures and options of EUAs and CERs. ECX dominates emission derivative volumes with more than 95% of all exchange activity traded directly through this marketplace⁽¹⁶⁶⁾. London is the location of the two leading verification agencies for certifying emissions, several trading desks (where traders and brokers operate), investment banks, commercial law firms (which offer legal advice on regulatory compliance) and CDM project developers (venture capitalists). According to research by Ernst & Young⁽¹⁶⁷⁾ the share of carbon market jobs/activities located in London is as follows:

- (a) 75% of all carbon market trading desks globally;
- (b) 40% of all CDM buyers globally;
- (c) 80% of all carbon market brokering firms;
- (d) 31 clean technology companies backed by private venture capital;
- (e) 200 lawyers engaged in low carbon projects;
- (f) 17 universities and 80 academic departments focusing on climate change and renewables (271 researchers in the energy and environmental sector).

Figure 10 below illustrates the dominance of the London region in the UK carbon finance market as it shows that only 3% of value is generated outside the region.

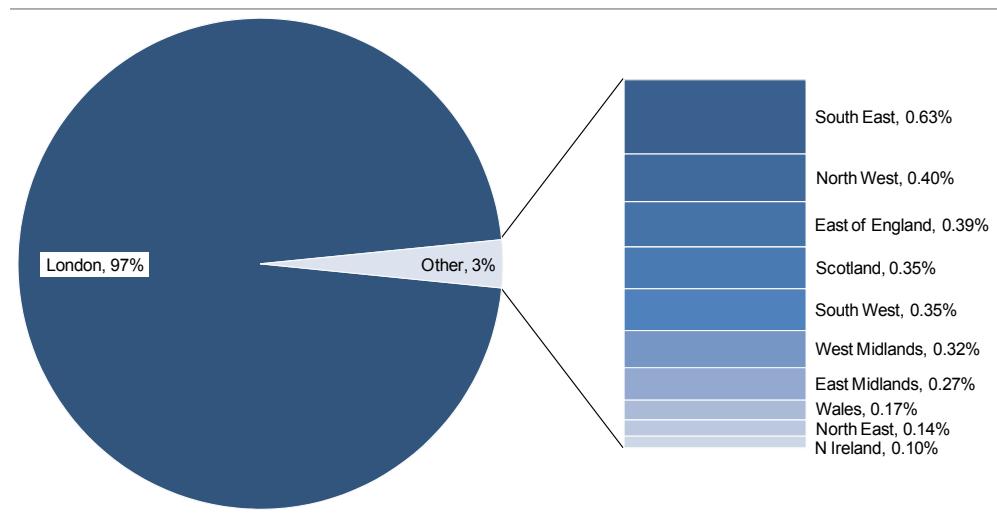
⁽¹⁶⁴⁾ The emissions trading market: risks and challenges, Financial Services Authority, 2008.

⁽¹⁶⁵⁾ <http://www.guardian.co.uk/environment/2009/nov/29/carbon-trading-market-copenhagen-summit>.

⁽¹⁶⁶⁾ Climate Exchange plc, Interim Statement for the six months ended 30 June 2009.

⁽¹⁶⁷⁾ Prospectus for London, the Low Carbon Capital, Ernst & Young for the LDA, 2009.

Figure 10: Carbon finance market value by UK region, 2007-08



Source: Adapted from information by Innovas 2009

The table below provides an overview of occupations in the financial sector which are 'greening' because of the new market in emissions trading.

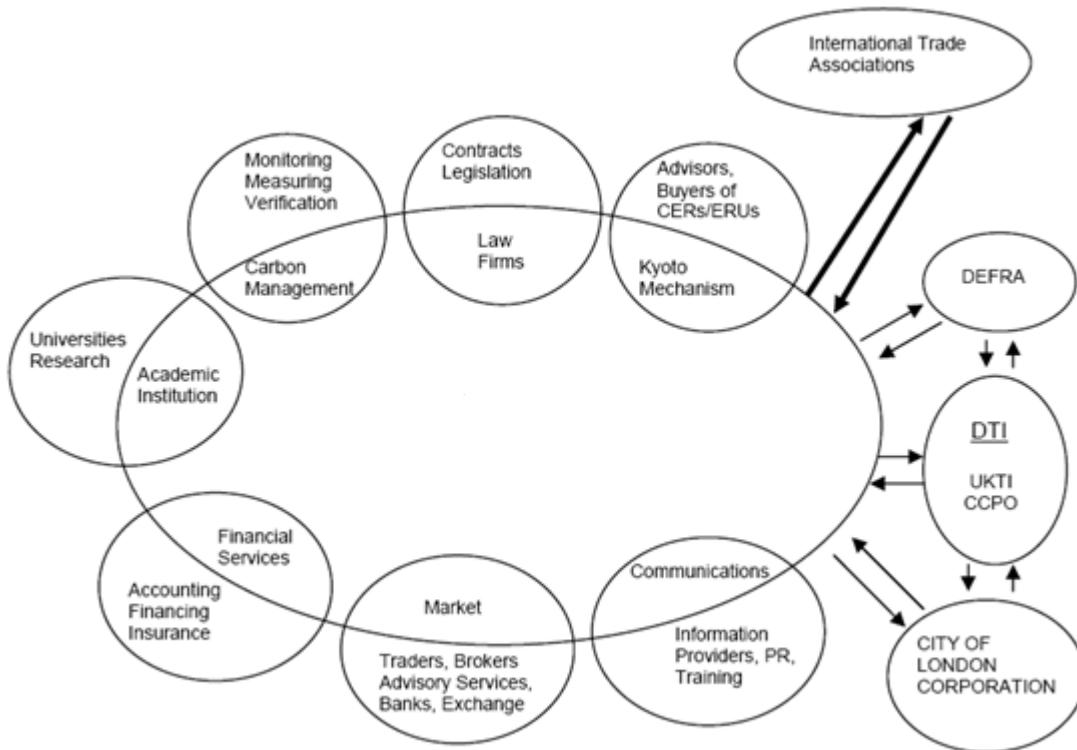
Table 10: Occupations in the financial sector

Existing Occupation	Greener Occupation
Commodity trader/broker	Emissions trader/broker
Commercial lawyer	Environmental lawyer
Accountant/auditor	Carbon auditor (to assist with carbon forecasting, carbon balance sheet accounting and management) ⁽¹⁾
Technical and financial staff in companies	Technical and financial staff in companies emitting greenhouse gases (responsible for complying with EU ETS regulations)
Venture capitalist (financier)	CDM project investor (financier)

⁽¹⁾ Evidence to the Environmental Audit Select Committee from the Association of Chartered Certified Accountants (ACCA), UK Parliament, May 2009

This is by no means a complete list: the carbon finance sector is still very new and defining what the sector actually comprises is difficult in itself. There is scope for including several other occupations. An illustration of the diverse occupations influencing and benefiting from carbon trading and financing in London is presented in Figure 11.

Figure 11: Actors in the London carbon financing market in 2006



Source: CEAG (¹⁶⁸)

Most UK literature concerning future job projections in green and greening sectors has focused around ‘new green collar’ jobs emerging from new technologies, usually in the science, engineering and construction sector. Nonetheless, the UK Low Carbon Industrial Strategy (¹⁶⁹) identifies business and financial services and carbon markets as areas of growth opportunity for the UK economy. A 2008 report for the Department of Trade and Industry (¹⁷⁰) identified a comparative advantage for the UK in carbon finance in major export markets.

The 2009 Innovas report (¹⁷¹) has found the market value of the carbon finance sector to be £5.2bn for 2007-08 and represented 4.9% of the low carbon and environmental goods and services market. Figure 10 below shows the growth rate forecast up to 2014-15, taking into account the effects of the current economic slowdown. The cumulative growth rate for the period is just over 60% which would result in a market value of £8.4bn in 2014-15 (an increase of £3.2bn from 2007-08).

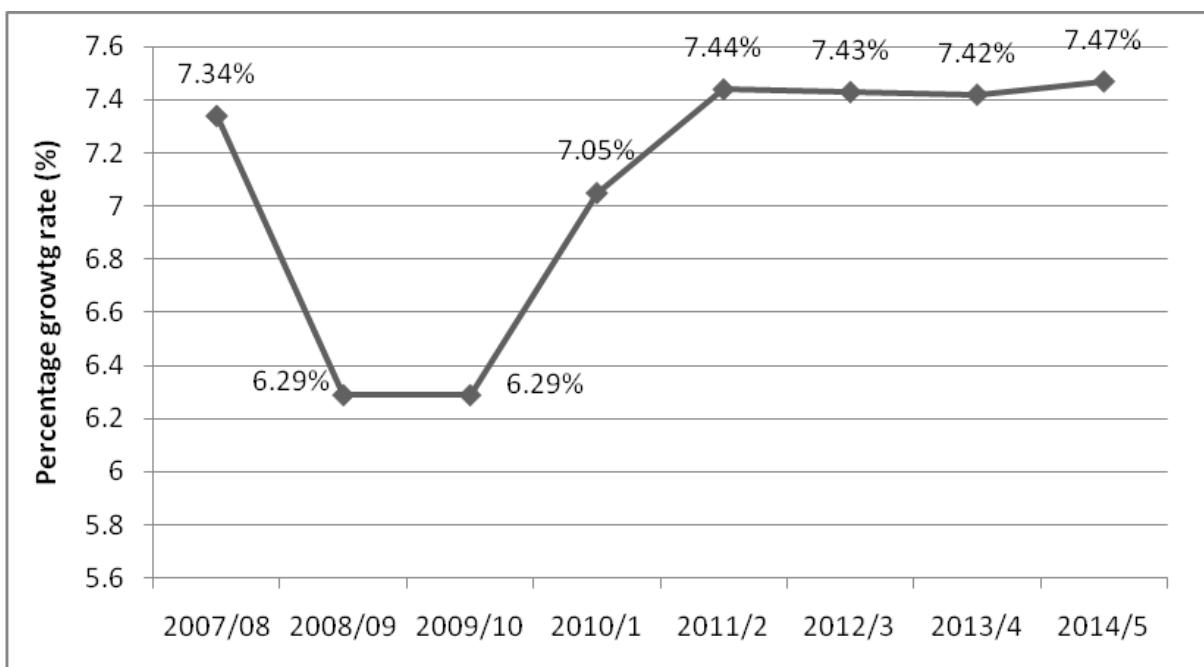
(¹⁶⁸) Emissions Trading and the City of London, CEAG, 2006.

(¹⁶⁹) The UK Low Carbon Industrial Strategy, DBIS, 2009.

(¹⁷⁰) Market opportunities in environmental goods and services, renewable energy, carbon finance and CATs, SQW Consulting, DTI, 2008.

(¹⁷¹) Low Carbon and Environmental Goods and Services: an industry analysis, Innovas for BERR, 2009.

Figure 12: Carbon finance forecast growth rates, 2007-08 – 2014-15



Source: Innovas, 2009

In terms of employment, Innovas 2009 has estimated that the carbon finance sector employed over 21,500 staff in 2,500 companies in 2007-08. Based on the forecast market growth rate, it is estimated that 13,600 new jobs will be created by 2014-15, bringing the total workforce to 35,400.

Skills gaps/weaknesses

Although the market for emissions trading is very new, trading in commodities and derivatives is not. Carbon emissions and future carbon emissions are thus bought, sold and exchanged in much the same way as oil, gas, power and coal. Therefore, trading of carbon emissions should not be seen as a new green collar occupation but as a ‘greening occupation’ – a financial broker who once traded fossil fuels is now trading future carbon emissions. Green jobs created in the financial services sector require a base of relevant skills necessary to the existing occupation (i.e. regardless of the green element) and, additionally, specialised knowledge specific to the new green market. This can be described as ‘topping up’⁽¹⁷²⁾ of existing skills with supplementary skills in order to perform the new job role.

Identification of skills needs

The Financial Services Skills Council (FSSC) is the sector skills body for the financial services sector in the UK. It is employer-led and is charged with identifying skills gaps and

⁽¹⁷²⁾ The Future's Green: Jobs and the UK low-carbon transition, IPPR, October 2009.

shortages in the sector's workforce. Skills needs are identified through a rolling programme of research, including surveys of employers. The skill needs emerging from the carbon emissions market have not yet been captured by FSSC research because of the small size and its relative newness⁽¹⁷³⁾. As identified previously, the emission market has not created any new occupations. However, the skills gaps and shortages identified for the wholesale financial services sector as a whole are particularly pertinent to the carbon financing and trading sector.

Overall, UK financial services employers face skill shortages in quantitative skills, business/management techniques and compliance skills among back office (IT) staff⁽¹⁷⁴⁾. Within quantitative skills, there is an acute shortage of quantitative developers and risk modellers within derivatives. Occupations where skill lags⁽¹⁷⁵⁾ have been identified are:

- (a) derivatives;
- (b) prime brokerage;
- (c) commodities;
- (d) electronic trading;
- (e) proprietary trading;
- (f) emerging markets;
- (g) risk management;
- (h) risk and actuarial modelling.

All these areas are related to the emissions trading market and may be a risk for both firms and exchanges. The Financial Services Authority, the regulator for the sector, has identified the lack of skilled specialists in commodities as a major challenge⁽¹⁷⁶⁾.

Existing provision of education/training in the Financial Service industry

An undergraduate degree (in any subject) is essential for recruitment to the industry with 25% of entrants holding a postgraduate degree. Many employers expect new recruits to hold specialist degrees or PhDs. Graduates in mathematics, economics, engineering and computer science are a popular source of talent, especially for roles requiring quantitative analysis and modelling. UK firms also heavily recruit graduates from outside the UK (from Germany, Eastern Europe and the Far East). Employers cite the superior numeracy and quantitative skills of non-UK graduates as the primary reason for their recruitment.

⁽¹⁷³⁾ From interviews with the FSSC for the purpose of this research.

⁽¹⁷⁴⁾ Skills review: UK wholesale financial services, Financial Services Skills Council, 2007.

⁽¹⁷⁵⁾ Skill lags are defined by the FSSC as "the periods of time between the introduction of a new product or business practice that necessitates a new skillset for a certain role and the emergence and diffusion of appropriate skills among the workforce".

⁽¹⁷⁶⁾ Growth in commodity investment: risk and challenges for commodity market participants, FSA, 2007.

Continuous professional development and training in the wholesale financial sector is mainly conducted in-house⁽¹⁷⁷⁾. This could include specialist technical training, coaching and mentoring, team working and training covering regulatory topics related to the firm's needs. Employers make the decision to use external providers (both private and academic institutions) when there is no internal expertise in the firm, depending on how relevant, specific and commercially sensitive the training is. Thus decisions about vocational education and training are made at an employer level, especially around acquiring new expertise and knowledge such as around the emissions market.

The skills response – industry-led

The European Climate Exchange has responded to the demand for 'top up' sector specific knowledge by providing a suite of education and training activities though a dedicated training arm. The ECX training offer includes:

Activity provided	Description	Skills	Module content
Seminars (off-the shelf)	Intensive training courses Eight core modules two days Cost: £1,200 + VAT per participant	Practical skills on functioning of carbon trading market Actual application of knowledge by profession In-depth understanding of trading tools	Principles of carbon trading Understanding the EU emissions trading scheme (EU ETS) Understanding the UN clean development mechanism (CDM) Knowledge of currencies in the carbon market carbon price drivers
In-house (tailored)	Employer can design course suited to needs Selection from eight core modules two hours to two days Cost: variable	As above, dependent on employer choices	Trading tools and strategies Who is trading and how? Voluntary markets and carbon offsetting
Trading software training	Aimed at traders already trading ECX products Group or individual In-house (face to face) External (face to face) By telephone (trader at office desk)	Improve skills of WebICE software Update knowledge on upgrades and new functions	Save inactive orders Deal report aggregations RTD and DDE Excel links (to allow live trading from an Excel sheet connected to WebICE real-time prices) Tear-off floating windows New order/deal tabs Formula trader Market maker order-entry windows Good-till-cancel (GTC) your orders (orders will be saved in one's order book until they are filled)

⁽¹⁷⁷⁾ Skills review: UK wholesale financial services, FSSC, 2007.

These education activities designed for individuals and businesses who have an interest in entering the carbon market or are already involved but wish to ‘top up’ their knowledge and skills. Individuals may attend the seminars in order to develop a specialisation in the industry or expand their business into a new market.

The training is aimed at the following occupations:

- (a) traders and brokers in oil, gas and energy (new and experienced);
- (b) trading desks managers;
- (c) technical and finance stuff in companies holding emission certificates;
- (d) lawyers;
- (e) accountants/auditors;
- (f) senior managers who need to understand compliance with emissions regulations.

Course providers have had significant interest in the training provided from a variety of occupations and occupational levels. The course supposes existing understanding of financial markets. It is not aimed at upskilling the workforce on a mass scale: as indicated above, the majority of firms in the sector conduct training in-house.

Assessment of the effectiveness and organisation of this response

The market is still in its infancy and the shape of the EU ETS beyond 2012 is not yet formalised. London's position as a carbon trading centre may be threatened by development of trading schemes in Tokyo and Australia/New Zealand. It may be further threatened if the USA abandons its policy preference for a taxation based system and enters into a Kyoto-style ‘cap and trade’ policy. This will create a very significant US market in emissions which may dwarf the European market and shift innovation, global funds and jobs away from London.

These uncertainties mean that the effect on future jobs and skills needs is difficult to ascertain. Financial sector businesses are keen to invest in training if this gives them a competitive advantage and thus private sector initiatives such as the ECX training arm are well suited to the market. They offer flexibility and a specialised response to demand from current employers.

The response does not deal with the fundamental skill shortages and lags identified in the underlying labour market for derivatives. Nonetheless, it is not designed to do so. Instead it has achieved the upskilling of a number of workers.

3.2.6.2. *National skills academy for nuclear*

Since the opening of the UK and the world’s first commercial nuclear power station in 1956, civil nuclear power has remained a strategically important and often controversial policy area for government. Up until 1995, the UK constructed sixteen nuclear power stations but

concerns over safety and waste disposal brought this to an end. In the past few years, nuclear power has re-emerged, primarily as a response to the UK's climate change targets and concerns over the security of the country's energy supply.

The likely construction of new nuclear power stations, their operation as well as the decommissioning of existing nuclear power stations presents a major workforce challenge for the industry and the Government. One of the responses has been the creation of a National Skills Academy for Nuclear in January 2008, which addresses specific skills and workforce needs in the sector so that the UK can 'Create, develop and promote world class skills and career pathways to support a sustainable future for the UK nuclear industry'.

The re-emergence of nuclear power as a viable option for the future supply of energy in the UK has been developing over a number of years. The Government repeatedly brought the issue back onto the agenda in a series of policy papers (¹⁷⁸) despite public and pressure group opposition before committing firmly to building a significant number of new stations in 2006 (¹⁷⁹). The Government has confirmed a commitment to this policy because of:

- (a) energy security: a major concern for the Government in recent years has been securing reliable sources of energy. Traditionally, the UK has sourced most of its energy needs from domestic sources (coal and then North Sea oil and gas). In the future, the UK will have to rely more on importing oil and gas which can be subject to price volatility and international conflict (as seen with the instability of oil prices in summer 2008). Relative to this, imported uranium for the development of the UK's nuclear industry is seen as a more secure option;
- (b) energy policy: the UK government has set targets for reducing carbon emissions by 2020 and 2050. As outlined in the 2008 Energy White Paper, 'The Government believes it is in the public interest that new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources'. Over the next two decades, it is expected that about one third of the country's oil and coal power stations will be closed with low carbon alternatives required to fill this gap.

Contributory drivers (¹⁸⁰), include a likely increase in demand for electricity (with a growing economy, population and use of electric vehicles); the fact that a nuclear power station produces more energy from one station fired by other sources, such as coal; and that while there are significant costs in the building and decommissioning phases over the lifetime of a nuclear power station, the fuel is cheaper than other sources (¹⁸¹).

(¹⁷⁸) Performance and Innovation Unit (2002), The Energy Review; DTI (2003), Energy White Paper: Our energy future – creating a low carbon economy; DTI (2006), The Energy Challenge Energy Review Report 2006.

(¹⁷⁹) BERR (2008), Meeting the Energy Challenge: A white paper on nuclear power.

(¹⁸⁰) Cogent (2009), Power People: The Civil Nuclear Workforce 2009-25.

(¹⁸¹) Nuclear Energy Agency, OECD (2008), Nuclear Energy Outlook 2008.

As a result, the Government stated that ‘it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to open up construction of new nuclear power stations’⁽¹⁸²⁾. To enable this, the Government has proposed processes to remove planning delays on large energy projects and ten sites for new build stations⁽¹⁸³⁾. Energy companies have announced that they intend to develop 16GW of new nuclear generation capacity by the end of 2025⁽¹⁸⁴⁾.

The civil nuclear power workforce today stands at 44,000 with 24,000 of these directly employed by the nuclear power operators in electricity generation (7,500), decommissioning (12,000) and fuel processing (4,500). The remainder is in the direct supply chain of the civil nuclear industry.

Each of these areas of activity requires a distinctive set of occupations. The labour force challenge of the coming decades, as articulated by Cogent, the SSC for nuclear, will be ‘in planning between expansion in decommissioning, medium term contraction in energy production and long term expansion in new-build commissioning and operation’⁽¹⁸⁵⁾. Cogent’s analysis identifies three key drivers for change in the workforce in the coming decades:

- (a) a workforce with large numbers nearing retirement age driving demand for larger numbers of entrants with higher level skills (level four and above). As shown in Figure 13, the civil nuclear workforce is closer to retirement age than the rest of the UK workforce at each skill level; approximately 50% of the directly employed workforce will have retired by 2025. As would be expected, the highest numbers of retirements are at the more senior levels: managers and senior management (nearly 70% retiring by 2025); and professional (approximately 55% retiring by 2025). This loss of experience and skills is exacerbated by the fact that the nuclear industry has a higher than average skill level. Recruitment into the industry, therefore, will have to be at a high level of skill. Such recruits are likely to be university graduates or those with previous experience in a related area.

⁽¹⁸²⁾ BERR (2008), Meeting the Energy Challenge.

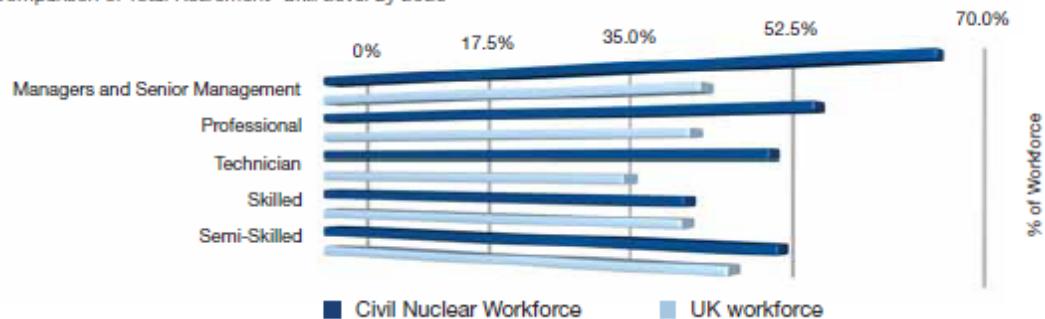
⁽¹⁸³⁾ DECC (2009), Draft National Policy Statement for Nuclear Power Generation (EN-6).

⁽¹⁸⁴⁾ www.centrica.co.uk/index.asp?pageid=217&newsid=1783; www.edfenergy.com/media-centre/press-news/EDF_Energy_welcomes_Government_announcement_on_nuclear_sites.shtml; <http://pressreleases.eon-uk.com/blogs/eonukpressreleases/archive/2009/04/29/1382.aspx>; www.scottishpower.com/PressReleases_1948.htm.

⁽¹⁸⁵⁾ National Skills Academy for Nuclear (2009), Five Year Business Plan: Supporting the 2020 Vision for the UK Nuclear Industry.

Figure 13: Civil nuclear workforce 2009-25

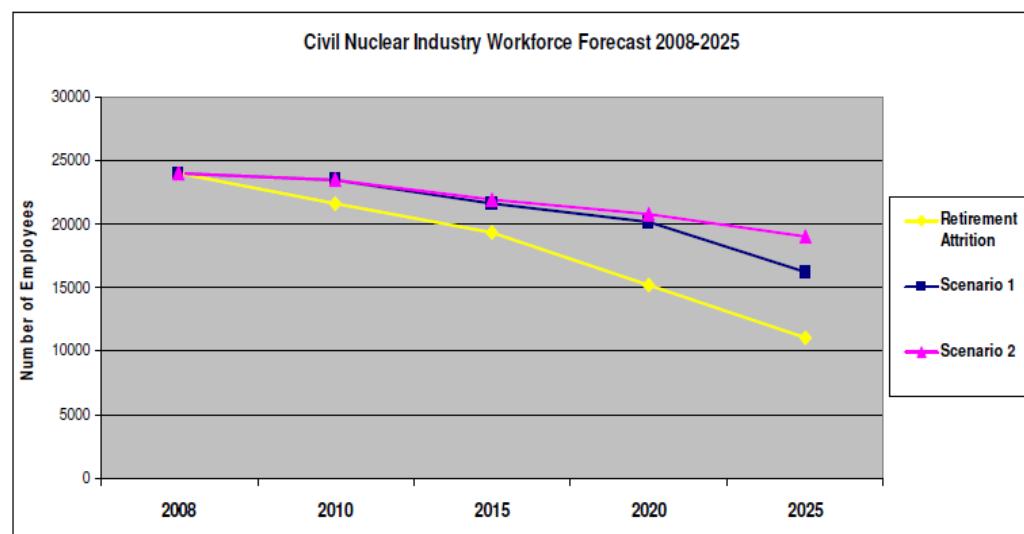
Comparison of Total Retirement- Skill Level by 2025



Source: Cogent, Power People: The civil nuclear workforce 2009-25

When this retirement attrition is plotted against two scenarios which describe the potential changes in workforce demand in the sector in the coming years (Figure 14), it is clear that even under the more modest reduction in Scenario 1, new entrants to the industry will be required. Scenario 2⁽¹⁸⁶⁾, which is more likely at present given government policy over recent years, shows an even greater shortfall.

Figure 14: Civil nuclear workforce forecast 2009-25⁽¹⁸⁷⁾



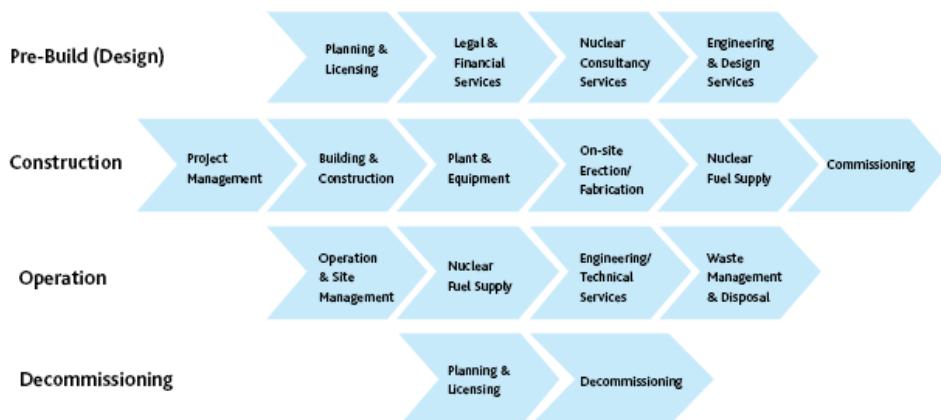
Source: Cogent, Power People: The civil nuclear workforce 2009 – 2025

⁽¹⁸⁶⁾ Scenario 1 models four new pressurised water reactor units (the latest design of nuclear power stations) coming online in eighteen month intervals from 2017; scenario 2 models eight new units coming online at twelve month intervals from 2017 with the four of the existing fleet of power stations being extended for five years.

⁽¹⁸⁷⁾ Figure 14 plots those directly employed by the industry, not contractors.

- (b) a shift in skills to decommissioning. The skills required to support nuclear power need to go beyond the operating lifetimes of the stations in handling used fuels as well as remediating the sites of the stations. This will increase in importance over the coming years. By 2011, all the Magnox power stations (the original model used with the UK's first two power stations) will be in decommissioning while the Advanced Gas-cooled Reactors are set to close in the mid-2020s (apart from Sizewell B). As a result, decommissioning activity will grow until 2015 with estimates suggesting that 6,000 more workers needing decommissioning-specific qualifications by 2012 (¹⁸⁸);
- (c) demand for skills to construct and operate new nuclear power stations. The forecasts on what new construction might do to workforce demand remain imprecise. Cogent have modelled a new build and construction workforce for each new pressurised water reactor (PWR) at 5,000 per PWR. Government goals of constructing ten new PWRs will therefore have a major impact on the workforce requirements for the industry. Skills will be required across the supply chain (Figure 15). Given that the last nuclear power plant to be built in the UK was constructed between 1988 and 1995, UK design and construction skills have eroded leading to a reliance on non-UK companies.

Figure 15: Supply chain



Source: NAMTEC, The Supply Chain for a UK Nuclear New Build Programme, February 2009

The nuclear industry faces a challenging few years. On one hand they have to replace the skills and experience that will retire in the coming years (about 5% per year until 2025) (¹⁸⁹). Ensuring the workforce is capable of decommissioning the existing group of nuclear power stations as well as building those new ones which get approved will be vital. Encouraging new entrants to the industry as well as increasing the flexibility of the workforce in moving from one set of operations to another is one way in which to address these challenges.

(¹⁸⁸) Cogent et al (2008), Energy Skills – Opportunity and Challenge.

(¹⁸⁹) Cogent (2009), Power People: The Civil Nuclear Workforce 2009-25

The skills response

The National Skills Academy network is one element of a number of policies aimed at addressing the UK's skills needs in the immediate future. The intention to have a National Skills Academy for each vocational area was originally announced in 2005 (¹⁹⁰). The policy has developed to a point where there are fourteen academies operating in diverse areas of the economy where there is an identified need for greater coordination between employers, learning providers and government funders to address skills gaps.

A key feature of the Academies is that they are employer-led meaning the key employers in the sector are engaged in managing and deciding the strategic direction of the Academies. The relevant SSC is closely engaged as well as providing accurate labour market data and links with Government. The Academies produce a range of products and services aimed at addressing particular skills issues in the sector as well as acting as a leader for addressing the skills needs in their sector.

Each Academy is structured differently. Some have a site and campus, others less of a physical presence with a focus on developing teaching and qualifications in the sector and working with key learning providers across the country. These might be housed in the offices of the SSC or a key employer in the sector. This latter model is how the National Skills Academy for Nuclear is managed. In the nuclear sector the Academy will:

- (a) develop the capacity and capability of the UK nuclear workforce through attracting new entrants and enabling the current workforce to progress in the industry;
- (b) develop the network of learning providers to deliver the training and qualifications needed to produce a workforce of sufficient quality for the industry;
- (c) become an influential organisation within the sector so that it can be an effective driver for the skills agenda across the nuclear industry.

The Government created the National Skills Academy for Nuclear as part of its role of facilitating private sector involvement in the future of the industry. The organisation's unique selling point is that '[We are] employer-led ... our Board is made of twenty employers, with a number of regionally-based working groups' (¹⁹¹). This industry lead is more strategic. At the launch, the majority of the Academy's funding came from government (primarily the Learning and Skills Council) however a three year business plan was agreed which stated that from 2011 onwards the Academy was to be fully sustainable and industry funded.

The Academy describes itself as 'a lean organisation'. It has a small staff with a head office in Cumbria in North West England (where 50% of the workforce is located). Other small regional offices are located near other centres of the nuclear industry.

(¹⁹⁰) DfES (2005), 14-19 Education and Skills.

(¹⁹¹) Interview with a senior manager for the National Skills Academy for Nuclear.

The organisation has built partnerships with key industry agencies (Nuclear Decommissioning Authority, Office for Nuclear Development), learning and skills agencies (the National Skills Academy Network, LSC, Cogent and other related sector skills councils), the relevant government departments (DBIS and DECC) and with the major private sector organisations from the sector (EDF, British Energy, Arriva and Westinghouse) in order to maximise its influence.

Since its inception, the Academy has produced (and will continue to do so) an array of services and products demanded by the industry's employers which include Energy Foresight, a programme to encourage the uptake of Science, Technology, Engineering and Mathematics (STEM) at school, qualifications designed to facilitate entry into the industry from non-nuclear sectors, and a scheme to enable nuclear supply chain companies to access funding to take on apprenticeships.

Its most important activity at present , the Nuclear Skills Passport (underpinned by the Nuclear Industry Training Framework)⁽¹⁹²⁾ is expected to facilitate movement within the sector (between companies for example) and encourage greater flexibility in the workforce. It comprises five elements:

- (a) the development of nationally recognised skills, competencies and training standards for the nuclear industry;
- (b) a learner database that provides a registry of retraining records for individual passport holders;
- (c) datasets that describe job roles, nationally recognised industry training standards and the Skills Academy assured provider network;
- (d) benchmarking and signposting tools to support upskilling – skills gap are able to be plotted against job context role profiles with signposting to training provision;
- (e) a reporting suite that generates statistics at industry, regional and corporate levels.

Training received by an employee in one setting will not have to be repeated if they move company. The end result, the Academy believes, is: 'As one area of the sector is diminishing [for example fuel processing as the existing fleet is closed] the Passport will ensure individuals remain competitive in a changing labour market ... A more transferable and flexible workforce will be formed that can close the skills gap in all sub-sectors of the industry' ⁽¹⁹³⁾. Other benefits of the skills passport include:

⁽¹⁹²⁾ This will be a database of nationally recognised and industry-led training relevant to the nuclear industry. Each part of the training will then be assigned a credit and level value based on the qualifications and credit framework (QCF). The Framework will also formalise the different job contexts within the industry (there will be thirteen including, for example, Decommissioning Operations, Energy Production Operations and Safety and Security); each context will have five roles (from operations level up to senior management).

⁽¹⁹³⁾ <http://www.nuclear.nsacademy.co.uk/products-and-services/skills-academy-products-and-services/nuclear-skills-passport>.

- (a) reduced training costs in the sector; there will be one standard for each activity meaning so if an individual moves company or site, they will not have to retrain;
- (b) the image of the sector will be enhanced by nuclear employers demonstrating that they value and invest in staff training;
- (c) local people will be retained and developed within the industry enhancing the socio-economic impact of nuclear power stations;
- (d) career paths will be able to be plotted more clearly. After analysing where an individual's skills gaps lie, relevant training courses will be signposted.

The proof of the industry's enthusiasm for the Passport is that it will be classed as 'highly desirable' in supply chain tenders: 'It will become a key differentiator in contractor selection'.

Another key goal of the Academy is to increase the number of new entrants to the industry. Three of the methods for achieving this are:

- (a) the Award for Nuclear Industry Awareness. This is a level 2 qualification which provides an introduction to the industry for apprentices, graduates and others who are new to the nuclear workforce. It is available as a classroom-based course or as an e-learning training package;
- (b) the Academy has developed a number of Foundation degrees which are at level 5. These have been developed with the specific aim of attracting students interested in a science or technology career who could apply their skills in a nuclear setting. Those validated so far include foundation degrees in Decommissioning, Nuclear Project Leadership, and Nuclear Related Technology, where demand will increase in future years. The curricula have been developed to encourage learners to progress to full degrees and beyond;
- (c) as well as these activities, the Academy has developed the Energy Foresight programme which aims to increase the uptake of STEM subjects at school. It is delivered within science lessons at Key Stage 4 and is supported by materials produced by the Academy including films, student activity sheets and teacher notes, as well as a supporting website.

Assessment of the effectiveness and organisation of this response

The importance of the National Skills Academy for Nuclear lies as much in the strategic intent from the Government and industry than the range of products and services it has developed. The Academy has worked on products which focus on attracting new entrants to the industry and increasing workers' ability to move around within the industry to address potential shortages in skills in particular parts of the sector, for example decommissioning.

The Academy has heavy involvement by industry and this will grow as they take on the funding responsibilities. This is a vital aspect of the Academy's future as the nuclear sector is dominated by quite a small number of large and influential companies. The products are at a very early stage in their implementation (the Passport and Nuclear Industry Training

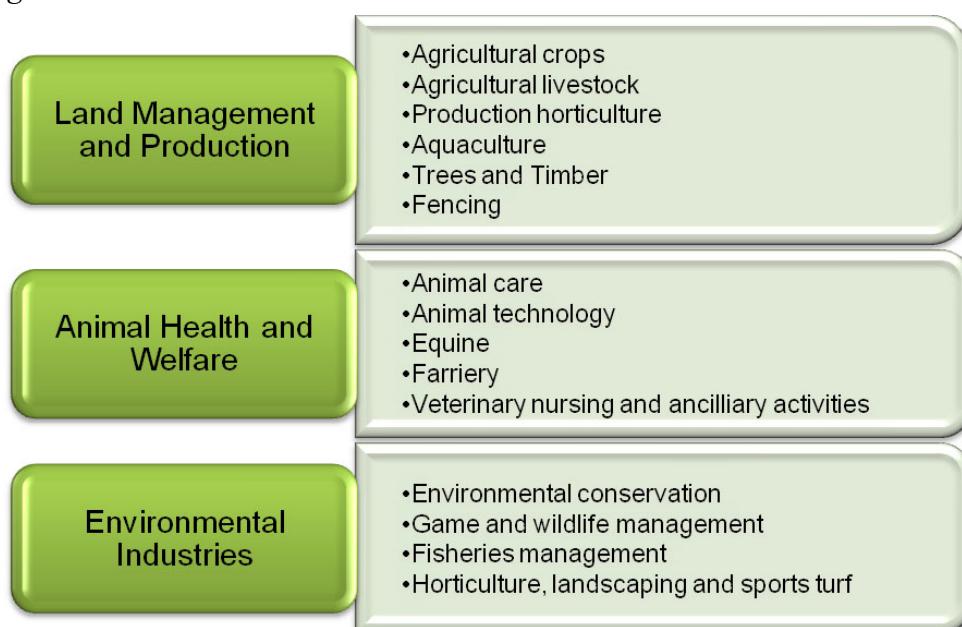
Framework will be rolled out throughout 2010) and so it is too early for evaluative assessments to have taken place.

The operational plan for 2010⁽¹⁹⁴⁾ includes commitments to develop two new training facilities: the Engineering Centre in Scotland and the South West Energy Centre and an upgrade for the Springfields Apprentice centre in the North West of England. The Academy has plans to increase its private sector membership during 2010 to ensure the sector is fully represented. There will also be further focus on Higher Education with a Certificate of Nuclear Professionalism being developed during the year.

3.2.6.3. *Case study on the environmental and land-based sector*

The Environmental and Land-based Sector (ELBS) in the UK has an important role in achieving environmental strategy objectives such as reducing greenhouse gas emission, managing biodiversity, mitigating climate change and providing energy through biomass. The sector, which broadly comprises the 15 industries outlined in Figure 16 below, is also an important source of jobs, particularly in rural areas. However, the sector's workforce is not growing. Employers cannot recruit sufficient new entrants to meet their needs and there are needs of higher level skills because of technological and environmental changes. Lantra, the sector skills council (SSC) for the sector, has developed the Diploma in Environmental and Land-based Studies (DELBS) for young people aged 14 to 19, in order to provide the sector with better and greener-skilled potential new entrants.

Figure 16: Industries within the environment and land-based sector



⁽¹⁹⁴⁾ NSAN (2010), Operational Plan: January – December 2010.

The UK environmental and land-based sector employs around 4% of all employment in the UK (¹⁹⁵). It is also estimated that there are around half a million regular volunteers, who are particularly active in the environmental conservation and animal health industries (¹⁹⁶). Overall, the sector makes up one in 10 of all businesses in the UK. They are predominantly (96%) micro-businesses employing fewer than 10 employees. Businesses in the sector are mainly located in Northern Ireland (23% of all), Wales (16%), Scotland (13%) and the South West of England (14%) while a smaller proportion is located in London (1%) and the South East (6%). Businesses in this sector make up a considerable contribution to the economy of rural areas (although there are some industries in the sector such as horticulture, landscaping and sport turf that are located in urban areas).

The largest labour market problem faced by the sector is the replacement of older workers. As indicated in Figure 17 below, the workforce has more workers aged 55 and over (26%) compared to the UK workforce as a whole (16%). The problem is particularly evident in Wales, Scotland and Northern Ireland.

Figure 17: Environmental and land-based sector workforce age band distribution



Source: Labour Force Survey 2008 and Lantra 2009

The sector is further characterised by high self-employment (42% are self-employed compared for 13% across all sectors). Furthermore, 64% of the workforce in the sector is

(¹⁹⁵) Office for National Statistics Labour Force Survey Q1-3 2008 and other sources cited in A Skills Assessment for the Environmental and Land-based Sector UK Report, Lantra, October 2009.

(¹⁹⁶) Information from data by the National Council for Voluntary Organisations 2009 cited in A Skills Assessment for the Environmental and Land-based Sector UK Report, Lantra, October 2009.

male compared to 54% across all sectors. In terms of ethnicity, White British make up the majority of the workforce (98.9%) compared with 91.2%.

According to the Working Futures 2007-17 (¹⁹⁷) projections, employment levels in the ELB have declined by 24% between 1997 and 2007, compared to a rise of 11% across the whole economy. Machinery and technology continue to replace labour in this sector. Meanwhile, in the last 10 years incomes in the sector have dropped due to a drop in agricultural product prices and subsidies. The removal of EU Common Agricultural Policy subsidies for production has made smaller farms less viable while outbreaks of disease (such as Foot and Mouth, Blue Tongue, Avian Flu) have reduced demand for rural products and services.

Further drops in employment are forecast for the period to 2017 due to the following factors:

- (a) small farms are closing or consolidating into large farms which are more likely to substitute labour with machinery;
- (b) the rural economy is diversifying from food production to other activities such as leisure and tourism;
- (c) further lower demand and lower prices of agricultural products.

There will be high levels of replacement demand despite the forecasted overall drop in employment. Working Futures forecasts that 110,000 new entrants will be needed in the sector up to 2017. Lantra believes even more will be needed as the Working Futures study does not include all the sector's industries listed above (¹⁹⁸).

Environmental and Land-based occupations are becoming increasingly professionalised and technology-reliant. This is particularly the case in larger farms. As such, more jobs in the sector are already becoming increasingly skilled with the share of high-skilled occupations in the sector rising to 20% in 2007 from 16% in 1997. The Working Futures forecasts that this share will rise to 23% by 2017 (¹⁹⁹).

The sector is a substantial contributor to greenhouse gases: agriculture alone contributes to 1% of carbon dioxide, 30% of methane and 60% of nitrous oxide emissions. As identified by the Stern Review (²⁰⁰), agriculture contributes more than the manufacturing and transport sectors.

Managing the natural environment appropriately is particularly important for mitigating the impacts of climate change through carbon sequestration (²⁰¹). In the transition to a low carbon

(¹⁹⁷) Working Futures 2007 – 2017, Institute of Employment Research, UKCES, 2008.

(¹⁹⁸) Skills Priorities for the Environmental and Land-based Sector, Lantra, 2009.

(¹⁹⁹) Working Futures 2007 – 2017, Institute of Employment Research, UKCES, 2008.

(²⁰⁰) Stern Review: The economics of climate change, Stern et al, HM Treasury, 2006.

(²⁰¹) Carbon sequestration is the biological, chemical and physical process to natural removal of carbon from the atmosphere by the soil, sea, water and plants.

economy the sector will be a key source for renewable fuel in the UK. The three main sources of biomass are forest management, agriculture/energy crops and biodegradable waste (including food and farm waste). Around 30% of renewable energy may come from bioenergy for heat and power according the UK Renewable Energy Strategy (this rises to up to 50% if transport biofuels are included).

Occupations in the environment and land-based industries require the following new ‘greening’ competencies as a result of climate change (²⁰²):

- (a) managing the business in an environmentally responsible manner – need to respond to consumer and public demand as well as regulation;
- (b) using scarce resources such as water effectively and efficiently;
- (c) limiting damaging impact of industry such as minimising nitrates in fertilisers;
- (d) managing crops and landscapes to take account the changing weather;
- (e) making efficient use of energy and waste;
- (f) including considerations of biodiversity in business practices.

Skills gaps/weaknesses

Recruiting suitable employees is the main problem for employers and Lantra has stated that ‘the sector is experiencing a critical shortage of skilled workers’ (²⁰³). Just over six out of ten (61%) workplaces in the sector have reported difficulties in recruiting staff, according to the latest National Employer Skills Survey (²⁰⁴). This is considerably higher than for all employers in the UK at 52%. Although employers do report skills gap in the existing workforce, this is less of a problem than recruiting new entrants.

The main shortages are for skilled trade occupations, qualified to Level 3. Job specific technical skills are most sought by employers. These significantly vary across industries and job roles in the sector. Examples of such technical skills needed are ‘operating machinery’, ‘driving tractors’ and ‘caring for and handling animals’.

Other than technical skills, generic skills such as ‘problem solving’, ‘team work’ and ‘communications’ are also in demand. Business skills such as ‘management’, ‘finance’ and ‘marketing’ are also seen as important according to the survey. This is not surprising because of the scale of micro-businesses (and associated self-employment) in the sector.

Identification of skills needs

⁽²⁰²⁾ A Skills Assessment for the Environmental and Land-Based Sector UK Report, Lantra, 2009.

⁽²⁰³⁾ Skills Priorities for the Environmental and Land-based Sector, Lantra, 2009.

⁽²⁰⁴⁾ National Employers Skills Survey. Learning and Skills Council. 2007.

Skills needs for in ELBS are identified by Lantra, relevant the sector skills council. Lantra produced a Sector Skills Agreement (SSA) in 2007. This led to the Sector Qualifications Strategy (²⁰⁵) which identified actions to be taken to improve the provision of skills and meet employers' needs. These are:

- (a) ensuring job profiles are current and up to date and approved by the relevant industries;
- (b) ensuring National Occupational Standards are fit for purpose to provide unit and credit development;
- (c) creating flexible, unitised programmes of learning;
- (d) facilitate entry into the sector for adults and young people;
- (e) facilitate workforce and professional development;
- (f) recognising qualifications and training, whether accredited or not, through Lantra's Online Competence Framework;
- (g) influencing funding to meet sector requirements;
- (h) providing qualifications and training that provide clear progression routes.

The development of the Diploma in Environmental and Land-based Studies, as explained below, fulfilled several of these aims.

In order to draw the SSA, Lantra established an evidence base from labour market intelligence such as national statistics, surveys and forecasts, as well as its own employer skills surveys targeted to specific industries and consultations with employers and stakeholders. This evidence base was updated in 2009 to include the most recent information.

The skills response

In response to the requirements to improve the skills of the workforce at the point of entry to the labour market, Lantra has developed The Diploma in Environmental and Land-based Studies (DELBS) for young people aged between 14 and 19 to raise the profile of the sector and to raise the profile of the sector and to increase the supply of work-ready entrants.

'Ultimately, the Diploma will result in a strengthening of the sector workforce, its competitiveness and professionalism'. Line of Learning Statement, DELBS, 2007

The specialist diploma is an alternative route to achieving qualifications and gaining practical work experience for young people at the end of compulsory education in England (²⁰⁶). The other qualifications routes available to this age group in are:

(²⁰⁵) The Environmental and Land-based Sector Sector Qualification Strategy, Lantra, 2007.

(²⁰⁶) The devolved administrations in Scotland, Wales and Northern Ireland are also reforming the educational offer for 14-19 year olds. The Welsh Assembly Government Department for Education Welsh Language

- (i) general qualifications such as GCSEs and A-Levels;
- (ii) apprenticeships for 16 to 18 year olds;
- (iii) foundation Learning (vocational learning with functional and personal skills).

While general qualifications and apprenticeships are well-established routes, the Diploma is entirely new and has been developed from scratch. It is part of wider programme of reform, initiated in 2005, to make 14-19 education and training more flexible and suited to the needs of learners, employers and the UK economy as a whole.

Diplomas offer a learner a mixture of applied and theoretical subject-based learning, blended with generic learning in functional skills, an independent research project and work experience. There are currently 10 different Diplomas on offer, with a total of 17 to be offered by 2013. The make-up of a diploma is outlined below:

Table 11: Components of the 14 to 19 diploma

The 14 – 19 diploma		
Principal Learning Core knowledge, understanding and skills related to the sector	Generic Learning Functional skills (English, Maths and ICT) Personal, learning and thinking skills Project (independent research skills) Work experience (minimum 10 days)	Additional and Specialist Learning Further learning from the sector (specialisation) OR Learning from a different sector (broader knowledge and skills)

Each Diploma has been developed by a Development Partnership led by an SSC. As the SSC for the sector, lantra led the development partnership for the DELBS. Other partners included six other SSCs (covering the inter-related sectors of food and drink manufacture, active leisure, hospitality and tourism, construction and electricity, gas and waste management and water industries), schools, further and higher education providers, qualification awarding bodies and employers and employer organisations.

The DELBS development partnership commenced operation in early 2006 and undertook a series of evidence gathering exercises to inform the design of the diploma. These included consultations at public events, on-line virtual consultations and use of survey data from the work around the SSA. The design of DELBS was outlined in the Line of Learning Statement issued in 2007 (²⁰⁷).

and Culture, for example, is currently piloting the 14-19 work-based learning pathways and the Welsh Baccalaureate.

(²⁰⁷) Diploma in Environmental and Land-based Studies: Line of Learning Statement, Lantra, 2007.

The ELBS Diploma is being piloted during the academic year 2009-10. Diplomas are delivered by ‘partnerships’ of schools, colleges and employers, rather than through a single school or training provider. Currently, 56 partnerships across England are participating in the first pilot year. For the next academic year (2010-11) 123 partnerships have been approved to deliver the qualification with availability in all partnerships planned for 2013.

The Diploma is available at three different levels, to appeal to those aged 14-16 as well as 16-19 year olds. In response to the ‘greening’ nature of occupations in the ELBS, managing the environment sustainably is a key feature of the learning curriculum. The principal learning units and other information about each level of the Diploma are outlined in the table below.

Table 12: Level of diplomas

Guided Learning Hours	Level 1	Level 2	Level 3
	600 hours	800 hours	1,080 hours
Age Group	14-16	14-16	16-19
Equivalence	Broadly equivalent to 4 to 5 GCSEs	Broadly equivalent to 5 to 6 GCSEs	Broadly equivalent to 3 GCE A levels
Principal Learning Units	Natural environment ELBS production, systems and service Introduction to working in the ELBS Working with plants and animals Impacts on the environment	Environment influences upon ecosystems and production zones Working in ELBS organisations Plant nutrition, growth and breeding Animal nutrition, growth and breeding Plants and animals and their role in society Importance of a sustainable environment to society Environmental monitoring Sources and uses of energy	Ecology of the natural environment Management of natural resources and resources for production Business and enterprise in the ELBS Applied plant and animal science Plants, animals and humans Plants and animals – safe working practices and relevant legislation Sustainable development of resources Global impacts and the ELBS Research methods, skills and environmental analysis Environment, waste and pollution

Assessment of the effectiveness and organisation of this response

Data about take-up and learner characteristics is not yet available; statistics about participation and achievement for the 2009-10 academic year are expected in November 2010.

It is difficult to judge impact of the Diploma on the ELBS at this point due to lack of data. At face value, the introduction of this route for young people has achieved the following:

- (a) promoted the wider sector (rather than just ‘agriculture’) as a career choice for young people;
- (b) offers a career pathway into the sector, into either employment or further learning and training;
- (c) updated the curriculum to respond to identified employer needs in higher-level technical skills, generic skills and business skills;
- (d) updated the existing curriculum for 14-19 year olds to include knowledge and skills suitable to greening occupations.

The success of the specific ELBS diploma largely relies on the success of the diploma route in the education system as a whole. Again it is premature to make a judgement on this as no learner has yet to complete a two-year diploma programme.

4. Conclusions

In the UK the Government's environmental strategies do not generally have a significant skills development component though the implications are generally acknowledged at this level. As a consequence there does not appear to be a national policy strategy to meet skills needs arising from the required changes in policy and regulation.

However, what we find is that:

- (a) 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 the investment in increasing opportunities for advanced technical and higher vocational levels in key sectors of the economy;
- (b) it is embedded in the national curriculum as well as Diploma, GCSE and Apprenticeship choices for young people aged 14-19;
- (c) Government departments with responsibilities for specific policy areas, such as the built environment and renewable energy, have through their agencies ensured that skills needs and shortages are researched and addressed in key areas to deliver environmental strategies;
- (d) regions are expected to have skills strategies which are joined up to regional economic strategies. The machinery of government changes should strengthen this;
- (e) government then acted to improve the coordination of skills responses in sectors such as renewable energy and led the debate in its Windsor Consultation.

Within the UK's system for developing skills responses we should expect to see skills strategies for sectors and sub-sectors of the workforce which reflect on future forecasts of demand for labour and the skills required. We should also expect to 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, the key responses to green skills and green occupations should be found in the work of the SSCs and the responses to their sector skills agreements.

We find that:

- (a) there are skills strategies which cover all the key sectors affected by the environmental agenda which would reflect on this in their forecasts though most pre-date the Government's key environmental strategies and are not always at a level of detail to address all the low carbon employment sectors;
- (b) many but not all SSCs have sectoral or sub-sectoral strategies in place or in the making for low carbon employment sectors which are based on assessments of future workforce needs. For many, such as WWT and Nuclear, the significant skills challenges are well recognised;

- (c) regional skills strategies that reflect the challenges and we see thus the engagement of RDAs in supporting skills development in priority areas of the economy;
- (d) strategies are being devised by third parties funded by government.

From these we have identified considerable responses to the challenges in many of the low carbon employment sectors as well as the high carbon sectors where jobs are declining or changing significantly.

The government has:

- (a) changed systems so that SSCs are guided by UKCES and so that SSCs representing employers have a key role in approving qualifications and funding priorities;
- (b) regulated in some sectors so that employers have to develop staff with new skills and meet some of the challenges of reducing carbon emissions, such as the smart meter legislation which requires energy companies to install them by 2020;
- (c) continued to support and recently bolstered its funding for training people who have been long term unemployed as well as providing immediate training for those about to be made redundant;
- (d) continued to raise public funding for lower level skills training and apprenticeships which should provide the impetus for providing more workers with technician skills in many low carbon employment sectors;
- (e) focused some of its economic downturn funding towards key sectors affected by its environmental strategies which should increase employer demand for skilled labour;
- (f) reiterated its commitment to skills academies and higher level apprenticeships in key sectors.

Within sectors we see that:

- (a) skills academies have been established and are making a difference to the pace of development in nuclear and manufacturing;
- (b) qualifications are being reformed and revised through the re-designation of all vocational qualifications within the QCF and diploma qualifications for those aged 14-19 which have integrated skills and knowledge needed to meet the Government's environmental strategies;
- (c) qualification pathways, such as apprenticeships and foundation degrees, are being developed to address existing and likely skills shortages in sectors such as nuclear, wind power and low carbon vehicles;
- (d) RDAs are guiding and leading interventions in STEM and higher level skills across priority industries in their region.

Employers are retraining and re-skilling employees as we see in the Nissan, Harland and Wolff, British Gas and carbon trading case studies and they are recruiting apprentices and increasing demand for skills required.

There are some concerns. We find that not all the key sectors have up to date skills strategies as far as we can tell. Progress is possibly hampered by the need for coordination between SSCs to cover some low carbon employment sectors and to obtain intelligence for relatively small sub-sectors.

Among the key agencies there are concerns that:

- (a) the funding response in higher and further education is slow though there are now clear mechanisms for employer skills needs for vocational level qualifications to be developed, approved and funded relatively quickly in further education;
- (b) the government's funding focus is on qualifications not necessarily the skills employers need but are reluctant to fund;
- (c) universities are not as enterprising in meeting needs of employers for qualification level training as the professional bodies and private training providers are in meeting non-qualification level training (for example in carbon trading);
- (d) STEM response may well be inadequate;
- (e) employer demand for skills often needs to be stimulated;
- (f) the economic stimulus package and the qualification reform process may have been missed opportunities for green skills.

5. Recommendations

The key challenge to the development of the low carbon sectors is the low levels of STEM skills among the workforce and future workforce. Improving take-up and achievement in STEM subjects and skills is needed across all education and training levels. This would include:

- (a) greater funding and continuing initiatives for targeted support and promotion of STEM in compulsory level education, starting at early-years learning and continuing to 18;
- (b) early promotion of STEM careers (including in low carbon occupations) through clear progression pathways;
- (c) incentives for take-up of STEM subjects at university, such as a £1000 'golden carrot' for each student enrolling on a STEM degree proposed by the Confederation of British Industry (²⁰⁸).

We have found that the coordination between employers' and future industry skills needs and the funded provision for skills and training can be improved. The machinery of government changes in April 2010 will introduce mechanisms to address this, at least in further education. Further improvements can arise from:

- (a) ensuring that UKCES delivers on the role of coordinating SSCs, including specifically coordinating the identification and response to skill needs for green jobs, such as when SSCs need to work together when occupations/industries transcend sectoral footprints;
- (b) improving recognition and understanding of the 14-19 Diploma as a valid learning and skilling option by employers as well as by universities, schools, parents and young people;
- (c) ensuring that every environmental or industrial policy announcement recognises employment and skills implications and works within the skills funding mechanisms to address them;
- (d) enhancing the link between funding and green skills needs at higher education, such as through improving coordination between SSCs, RDAs and HEFCE;
- (e) improving coordination between central Government and the devolved administrations' learning and skills agencies to address the skills needs arising for the UK Low Carbon Industrial strategy.

In the future, every job will be a green job. Understanding of the environmental impact of an occupation needs to be mainstreamed in education and training. As such we recommend that:

- (a) every new apprenticeship to have a low carbon element (as is the case in Australia);
- (b) introduce requirements for green skills training through major government procurement.

²⁰⁸ <http://www.cbi.org.uk/pdf/NEILBENTLEYSPEECHATIPRSEMINARONGREEN%20JOBS.pdf>.

Annexes

Annex 1: Sector skill councils

List of UK Sector Skill Councils

Sector Skill Council	Industry Footprint
Asset Skills	Property, housing, cleaning and facilities management
Cogent	Chemicals and pharmaceuticals, nuclear, oil and gas, petroleum and polymers
ConstructionSkills	Built Environment – development and maintenance
Creative & Cultural Skills	Arts, cultural heritage and craft and design
e-skills UK	Business and information technology
Energy & Utility Skills	Electricity and renewables, gas, waste management and water industries
Financial Services Skills Council	Financial services, accountancy and finance
GoSkills	Passenger Transport
Government Skills	Central Government
Improve Ltd	Food and drink manufacturing and processing
Institute of the Motor Industry (IMI)	Retail Motor Industry
Lantra	Environment and land-based
Lifelong Learning UK	Community learning and development, further education, higher education, libraries, archives and information services, work-based learning and development
People 1st	Hospitality, leisure, travel and tourism sector
Proskills UK	Process and manufacturing sector
SEMTA	Science, engineering and manufacturing technologies
Skillfast-UK	Fashion and textiles
Skills for Care and Development	Social care, children and young people
Skills for Health	Health
Skills for Justice	Policing & law enforcement, youth justice, custodial care, community justice, courts service, prosecution service and forensic science
Skills for Logistics	Logistics
SkillsActive	Active leisure and learning
Skillset	Audio visual industries
Skillsmart Retail	Retail
SummitSkills	Building services engineering

Annex 2: Low carbon and environmental sectors and activities

Sector	Activity
Air Pollution	<ul style="list-style-type: none"> • Dust & Particulate Control • Indoor Air Quality • Industrial Ambient (Workplace) Air control • Industrial Emission control • Industrial/Mobile Source Emission Control • Process Engineering Air Pollution
Environmental Consultancy and Related Services	<ul style="list-style-type: none"> • Specialist Consultancy to the Environmental Sector • Training & Education • Manpower and Executive recruitment • Management Services in the Environmental Sector
Environmental Monitoring, Instrumentation and Analysis	<ul style="list-style-type: none"> • Environmental Monitoring • Instrumentation Equipment & Software • Environmental Analysis
Marine Pollution Control	<ul style="list-style-type: none"> • Marine Pollution Specialist Consulting & Training • Marine Pollution Abatement • Technologies, Research & Development
Noise & Vibration control	<ul style="list-style-type: none"> • Noise Abatement • Noise & Vibration Consultancy, Training & Education Services • Technologies, Research & Development
Contaminated Land Reclamation & Remediation	<ul style="list-style-type: none"> • Remediation & Land Reclamation • Decommissioning of Nuclear Sites
Waste Management	<ul style="list-style-type: none"> • Construction & Operation of Waste Treatment Facilities • Equipment For Waste Treatment • Technologies, Research & Development • Consultancy, Training and Education
Water Supply and Waste water Treatment	<ul style="list-style-type: none"> • Water Treatment and Distribution • Consulting, Education & Training • Technology, Research & Development • Engineering •
Recovery and Recycling	<ul style="list-style-type: none"> • Waste Collection • Engineering & Equipment • Consultancy, Training and Education • Technologies, Research & Development • Textiles Feed Stock Processing • Composting Feed Stock Processing • Paper Feed Stock Processing • Automobile Recycling • Wood Stock Processing • Oil Stock Processing • Electronics & Related Stock Processing • Household Electrical Goods Stock Processing • Plastics Stock Processing • Rubber Products Stock Processing • Coal Combustion Products Stock Processing • Glass Stock Processing • Construction and Demolition Debris Stock Processing • Metals Recycling Stock Processing
Hydro	<ul style="list-style-type: none"> • Turbines • Electricity Supply • Dams & Structures • Pumping & Lubrication
Wave & Tidal	<ul style="list-style-type: none"> • Ebb & Flood

	<ul style="list-style-type: none"> • Pumps & Equipment • Two Basin Schemes • Turbine and Generation • Assessment and Measurement • Other General services
Biomass	<ul style="list-style-type: none"> • Education and Technical Consulting • Manufacturing Of Boilers and Related Systems • Boilers and related Systems • Biomass Furnace Systems • Biomass Energy Systems
Wind	<ul style="list-style-type: none"> • Wind Farm Systems • Large Wind turbine • Small Wind Turbine
Geothermal	<ul style="list-style-type: none"> • Whole Systems Manufacture • Consulting & Related Services • Manufacture and Supply of Specialist Equipment • Suppliers of systems • Component design & Research
Renewable Consulting	<ul style="list-style-type: none"> • Renewable Energy General Consultancy
Photovoltaic	<ul style="list-style-type: none"> • Systems & Equipment • Photovoltaic Cells • Other Related Equipment and chemicals • Chemicals • Research & Development
Alternative Fuel Vehicle	<ul style="list-style-type: none"> • Alternative Fuels (main Stream) for Vehicles Only • Other Fuels and Vehicles
Alternative Fuels	<ul style="list-style-type: none"> • Main Stream fuels • Batteries • Other Fuels • Nuclear Power
Additional Energy Sources	<ul style="list-style-type: none"> • Additional Energy Sources Under Development
Carbon Capture & Storage	<ul style="list-style-type: none"> • Carbon Capture & Storage
Carbon Finance	<ul style="list-style-type: none"> • Carbon Finance
Energy Management	<ul style="list-style-type: none"> • Energy Saving Lighting Equipment • Energy Saving Heating & Ventilation Equipment • Energy Saving electrical Equipment • Gas Supply • Consulting, Education & Training • Technologies, Research & Development
Building Technologies	<ul style="list-style-type: none"> • Windows • Doors • Insulation and Heat Retention Materials • Monitoring and Control Systems

Source: Adapted from Innovas 2009

Annex 3: Green skills checklist

	Tier 1	Tier 2	Tier 3
1	Design Skills	Eco-Design	Design for Disassembly, Design For Recyclability, Design for the Environment, Design for Effective Energy Use, Legislation and Regulatory Compliance
		Green Manufacturing	Legislation and Regulatory Compliance, Integration of Process Waste
		Materials Specification	
		Life Cycle Assessment/Costing	
2	Waste Skills	Waste Quantification and Monitoring	Waste Production Calculations, Mass Balance, Waste Audit
		Waste Process Studies	Material/Substance Flow Analysis, Resource Utilisation Mapping, Life Cycle Assessment
		Waste Management Systems	Objective Setting, Legislative and Regulatory Compliance, Collection Systems, Segregation, Waste Cycle Management, 3R Implementation (Reduce, Reuse, Recycle), Hazardous Waste Management, Landfill Requirements, Communications/Implementation Campaigns
		Waste Minimisation	Industrial Symbiosis, Integration of Process Waste
		Waste Technologies	Recycling, Waste to Energy
3	Energy Skills	Energy Minimisation	Energy Reduction Programmes, Heat Recover and Re-Use, Energy Efficient Technologies, Energy Efficient Practices, Communications/Implementation Campaigns, Enhanced Capital Allowance Technologies and Scheme
		Energy Management Systems	Objective Setting, Legislative and Regulatory Compliance, Energy Base Loads and Variable Loads, Energy Audit, Energy Review, Communications/Implementation Campaigns
		Energy Quantification and Monitoring	Monitoring Targeting and Reporting, Use of Half Hourly Data, Use of Sub Meters, Computer Based Data Logging and Energy Management Systems, Energy Data Manipulation Software Systems
		Energy Costs and Trading	Energy Markets and Pricing, Carbon Trading Schemes, Climate Change Levy Agreements, Energy Price Trends, Enhanced Capital Allowances, Peak Oil and Impact on Energy Supplies and Prices
		Renewable Energy Technologies	Solar, Wind, Biomass, CHP, Photovoltaic, Ground Source Heat Pump, Air Source Heat Pump, Hydro, Hydrogen, Fuel Cell, Integration into Energy Supply
		Non-Renewable Technologies	Nuclear, Incineration with Energy Recovery, Clean Fossil Fuel Technologies, Carbon Sequestration, Waste to Energy
4	Water Skills	Water Minimisation and Re-Use	Grey Water, Water Harvesting, Waste Water Recovery, Recycling, Cascading, Waste Water Recovery, Effluent Treatment, Sludge/Slurry Dewatering, Leak Detection
		Water Management Systems	Objective Setting, Legislative and Regulatory Compliance, Water Audit, Water Consumption Review, Communications/Implementation Campaigns
		Water Quantification and Monitoring	Sub-Metering, Data Collection, Water Use Calculations
5	Buildings Skills	Building Energy Management	Monitoring Targeting and Reporting, Use of Half Hourly Data, Use of Sub Meters, Computer Based Data Logging and Energy Management Systems, Energy Data Manipulation Software Systems, Building Energy Assessment

		Integration of Renewable Energy	Photovoltaic, Solar, Wind Turbines, Combined Heat and Power, Fuel Cell
		Energy Efficient Construction	Insulation (Cavity Wall, Loft, Paperwork), Regulatory Compliance (Part L), Passive Heating, Building Regulations
		Facilities Management	Building Energy Management Systems, Management and Maintenance of Water, Waste Management
		Calculating Building Energy Efficiency and Carbon Ratings	U Value Calculations, Building Energy Assessment, Carbon Rating
6	Transport Skills	Transport Impact Minimisation Technologies	Hybrid Vehicles, Biodiesel, Electric Vehicles, Fuel Efficient Vehicles
		Transport Impact Minimisation Processes	Alternative Transport Strategies, Communication/Implementation Campaigns, Car Sharing Schemes, Public Transport Planning, Public Transport Implementation, Cycle Network Planning, Cycle Network Implementation, Transport Modelling
		Transport Management in Business	Transport Modelling, Route Planning and Management, Distribution and Collection Systems
7	Materials Skills	Sourcing	Sources of Low Energy Materials, Sources of Low Mileage Materials, Recyclates (Secondary Materials), Energy Efficient Raw Material Extraction, Industrial Symbiosis, Transport Mileage
		Procurement and Selection	Use and Properties of Low Energy Materials. Use and Properties of Recyclates, Industrial Symbiosis, Low Carbon and Resource Efficient Procurement, Cost Impact of Climate Change on Material Procurement
		Material Use and Impact Quantification	Material Usage Calculations, Life Cycle Assessment and Costing
		Management Systems	Material Use Planning, Material Flow Process Design and Implementation, Energy Efficient Process Design and Implementation
		Impact and Use Minimisation	Life Cycle Assessment and Costing, Energy Efficient Process Implementation, Material Flows Analysis
8	Financial skills	Investment Models	Energy Technologies Investment Models, Carbon Derivatives Investment Models, Calculation of Payback/Return on Investment
		New/Alternative Financial Models	Carbon Trading, EU Emissions Trading Scheme, UK Emissions Trading Scheme, Enhanced Capital Allowances
		Quantification of Climate Change Impacts	Impact Assessment of Climate Change of Business Finances, Impact of Climate Change on Materials Availability and Cost, Carbon Neutrality and Associated Cost/Opportunities (Costs of Doing Nothing), Risk/Opportunity Assessment Models for Adaptation and Mitigation, Insurance Risks/Opportunities of a Low Carbon Economy
		Principles of Low Carbon and Resource Efficient Economies	Polluter Pays Principle, Externalities
		Tools of Low Carbon and Resource Efficient Economies	Climate Change Levy Agreements, Enhanced Capital Allowance, Cost Benefit Analysis, Low Carbon and Resource Efficient Procurement
9	Management Skills	Impact Assessment	Energy Use Calculations, Water Use Calculations, Waste Production Calculations, Carbon Footprinting Calculations, Emissions Measurement
		Business Planning	RE Planning, Low Carbon Planning, Integration of RE and Low Carbon into Business Planning Cycles, Climate Change Risks, Climate Change Adaptation and Mitigation Responses (As Part of Business Risk Management), Understanding Low Carbon and Resource Efficiency Skills Requirements and Long Term Planning
		Awareness Raising	Communication/Implementation Campaigns

		Opportunities Management	Identification of Low Carbon and Resource Efficiency Opportunities, Cost Benefit Analysis
		Risk Management	Identification of Low Carbon and Resource Scarcity Risks, Cost Benefit Analysis
		Day to Day Management	Low Carbon and Resource Efficient Procurement, Integration of Low Carbon and Resource Efficiency Skills, Due Diligence, Management Systems, Low Carbon and Resource Efficiency Skills Requirements for Recruitment
10	Policy and Planning Skills	Built Environment Master Planning and Implementation	Low Carbon Spatial Planning, Zero Waste Planning, Resource Efficient Planning, Low Carbon and Resource Efficient Urban Design, Building Regulations, Public Transport Planning and Implementation, Cycle Network Planning and Implementation
		Strategy Development	Impact Assessment and Modelling, Principles of Low Carbon and Resource Efficiency
		Strategy Implementation	Understanding of Skills Needs for HR Managers, Low Carbon and Resource Efficient Material Sourcing and Procurement, Awareness Raising/Communications Skills

Source: Pro Enviro, Skills for a low carbon and resource efficient economy (LCREE), Report for Defra, 2009

Acronyms and definitions

ABI	Annual Business Inquiry
BWEA	British Wind Energy Association
CDM	Clean Development Mechanism
CEMEP	Commission on Environmental Markets and Economic Performance
CER	Certified Emissions Reduction
CGR	Cumulative Growth Rate
DBIS	Department for Business, Innovation and Skills
DCSF	Department for Children, Schools and Families
DEFRA	Department for the Environment, Farming and Rural Affairs
DELBS	Diploma in Environmental and Land-based Studies
DfT	Department for Transport
ECITB	Engineering Construction Industry Training Board
ECX	European Climate Exchange
ELBS	Environmental and Land-based Sector
ENDS	Environmental Data Service
ERA	Energy Retail Association
ETS	Emissions Trading Scheme
EU	European Union
EUAs	EU Allowances (
EV	Electric Vehicles
FSSC	Financial Services Skills Council
GDP	Gross Domestic Product
HE	Higher Education

HEFCE	Higher Education Funding Council for England
H&W	Harland & Wolff
IB	Industrial Biotechnology
IB-IGT	IB Innovation and Growth Team
ICT	Information and Communications Technology
IMI	Institute of the Motor Industry
LA	Local Authority
LCI	Low Carbon Industrial
LCEAs	Low Carbon Economic Areas
LCEGS	Low Carbon Economic Goods and Services
LFS	Labour Force Survey
NESS	National Employer Skills Survey
NOS	National Occupational Standards
ONE	North East regional Development Agency
ORED	Office for Renewable Energy Deployment
PWR	Pressurised Water Reactor
R&D	Research and Development
RDA	Regional Development Agency
REAP	Renewable Energy Apprenticeship Programme
RO	Renewables Obligation
RTFO	Renewable Transport Fuel Obligation
SEMTA	SSC for manufacturing
SFA	Skills Funding Agency
SIC	Standard Industrial Classification

SIRS	Single Integrated Regional Strategies
SQS	Sector Qualification Strategies
SSA	Sector Skills Agreement
SSC	sector skills council
STEM	Science, Technology, Engineering and Mathematics
TUC	Trade Union Council
UKCES	UK Commission for Employment and Skills
ULCV	Ultra-Low Carbon Vehicles
WWT	Wind, Wave and Tidal

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