



Education and Culture DG

Lifelong Learning Programme



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GT VET

**Greening Technical VET – Sustainable Training
Module for the European Steel Industry**



Industry Driven Analysis of Job Requirements

National Report

The UK Green Skills Agenda

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Introduction

This report provides an overview of the UK green skills agenda, encompassing Government legislation, strategy and policy initiatives. The drive towards green jobs and skills is emanating from a range of directions, including legislation to reduce carbon emissions; public sector investment into, and promotion of, more sustainable technologies, material and ways of living; companies adopting environmental policies and potential market opportunities afforded by renewable energy. Moreover, the drive was given added impetus by the economic crisis that began in 2008, and the stimulus package that was announced in the UK by way of response. This ‘green stimulus’ strongly emphasised the concept of ‘green jobs’ as a way of recovering from the recession. Speaking in March 2009, the then Prime Minister, Gordon Brown, stated that moving to a low-carbon economy would create 400,000 new jobs over the next eight years, in industries such as renewable energy (CLES, 2010). Indeed, since late 2008, there has been a raft of national policy papers issued by central government aiming to boost awareness of the low carbon economy and how it will develop green industries and skills.

There is some debate as to what actually constitutes a ‘green job’ or a ‘green skill’. According to a study by UNEP (2008) on green jobs, these are “jobs in the environmental sector and/or jobs requiring specific environment-related skills”. The report predicts that green employment will be affected in at least four ways:

1. Additional jobs will be created in some areas, like in the manufacturing of pollution control devices which are added to existing production equipment;

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2. Substitution of some employment, for example due to shifting from fossil fuels to renewable energy sources, or from truck manufacturing to rail car manufacturing, or from land filling and waste incineration to recycling;
3. Particular jobs may be eliminated without direct substitution, like in the situation that the use of certain packaging materials are discouraged or are forbidden and an end is put on their production.
4. Many existing jobs (i.e. plumbers, electricians, metal workers, and construction workers) may be altered due to the greening of day-to-day skill sets, work methods and profiles.

It is this latter sense of the 'greening of existing jobs and skill profiles' that will be the focus of this report, given the project remit.

This report will be structured in the following way. It will begin with a discussion of environmental legislation, strategy and policy in general terms. Any explicit implications for green skills will be identified. Subsequently, the report will outline the strategies and policies that have been launched with the specific aim of creating green jobs and cultivating green skills. These will be presented in a chronological order. Finally, the report culminates in an overview of research into green skills, which has been conducted so as to deepen understanding of the skill requirements in any transformation to a low carbon, resource efficient economy and further to influence governmental policy in such directions.

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1 Environmental Legislation, Strategy and Policy

This section outlines the major and salient developments in environmental policy, the institutional framework, legislation and strategy, in chronological order, before specifically discussing the ‘green skills’ agenda, which has followed from attempts to move towards a ‘low carbon economy’. A ‘low carbon economy’ can be defined as “one that causes less carbon emissions whilst remaining profitable and functional via the use of new technologies and practices, and the formation of new ‘green’ industries and jobs themselves” (CLES, 2010).

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.

A major policy shift has also been signalled by the reorganisation of departments that now includes a Department of Energy and Climate Change (DECC), which took over an environmental and energy remit from the Department for Food, Environment and Rural Affairs (DEFRA).

1.1 The Stern Review

The Stern Review of 2006 (HM Treasury, 2006) was the first substantial appraisal of the potential effects of climate change and global warming on the global economy. The review described climate change as ‘the greatest market failure the world has ever seen.’ Stern argued that an investment of 1% of global GDP into averting further damage to the environment would be necessary in order to avoid the estimated

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losses of 20% of global GDP that will occur if nothing is done. Amongst suggested actions, Stern advocated the use of environmental taxes as tools to reduce carbon emissions and pollution. As such, it is clear that the Stern Review not only considers the economy a victim of climate change, but also part of the solution.

1.2 The Establishment of CEMEP

In response to the Stern Review on the Economics of Climate Change 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, so as 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.’

Significantly, for the purposes of this report, CEMEP noted that one in three firms in the environmental sector is being hampered by a shortage of skilled staff (CEMEP, 2007). If specialist, ‘green-collar’ skills are in short supply, it can be inferred that the general ‘greening’ of skills across existing jobs will also be impeded.

In response to the economic recession, and following the CEMEP recommendation, the then-Government engaged in market-interventions aimed at developing an ‘active industrial policy’ which particularly focused on industries with the potential to

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grow in the transition to a low carbon economy.¹ The aim was 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. The targeting of a particular area implied that the sector has ‘significant constrained potential and that the Government can make a difference to the prospect of growth or high-value employment by removing barriers to the market’.

1.3 The Climate Change Act 2008

In response to the Stern Review, and the progression of the environmental lobby into mainstream policy and national consciousness, the Climate Change Bill was proposed to Parliament in November 2007 as a government blueprint for tackling climate change and modifying the UK into a low carbon economy. The key points of the bill included:

¹ The previous Government’s ‘industrial activism’ policy was first advocated by Lord Mandelson in December 2008. The policy aimed to bring together different strands of government policy so as to ensure low-carbon companies had access to the right infrastructure, skilled workers and research and development capacity. It was argued that “policy should be activist in the sense that it recognises that government can and must complement market dynamics to get the best outcomes for the economy.” The active intervention was mainly focused on the development of off-shore wind energy. However, the Environmental Audit Committee (2009) argued that many areas of the economy, identified as requiring investment if the carbon reduction targets are to be met (such as carbon capture and storage technology, nuclear power, biofuels), were not receiving an adequate share of the government stimulus.

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1. A target-driven approach for the reduction of carbon dioxide emissions. Such targets would be legally-binding.
2. The composition of legally binding government reports to be produced at least every 5 years on current and predicted impacts of climate change and on policy for adapting to climate change (including a new system of five-year carbon budgets, set at least 15 years ahead, to provide clarity on the UK's pathway towards its key targets);
3. The establishment of a new statutory body, the Committee on Climate Change, where the remit would be the provision of independent expert advice and guidance on achieving targets and staying within carbon budgets. Annual reports are to be produced for Parliament, setting out the UK's progress towards targets and budgets;
4. Proposed new powers for Government so as to enable the easier implementation of policies to cut emissions.

The Bill became law as the Climate Change Act was passed on 26 November 2008. This enactment marked the beginning of the legal obligation to 'improve carbon management and help the transition towards a low carbon economy in the UK'. The Act also identifies the UK's intention to demonstrate strong leadership in this direction internationally. These are the two key aims of the Act (DECC, 2011).

Significantly, the Act is the world's first long-term legally binding framework aimed at tackling the dangers of climate change. It sets out a legally-binding target for an 80% reduction in carbon emissions by 2050. To this end, emissions are to be reduced by 34% by 2020 – both targets use 1990 levels as a baseline. In order to

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achieve these diminutions, the Act created the world's first carbon budgets, which are 'caps on the total quantity of greenhouse emissions emitted in the UK over a specified time' (DECC, 2011). The carbon budgeting system caps emissions over five-year periods, with three budgets set at a time. The first three budgets were set in May 2009, and run for the periods 2008-12; 2013-17 and 2018-22. These budgets will purportedly help to keep the country stay on track for the 2050 goal.

1.4 The Low Carbon Transition Plan

The Government published the 'Low Carbon Transition Plan' on the 15th of July 2009.² The Plan outlined the policies and proposals deemed necessary to meet the budgets. This included a goal of cutting emissions from the power sector and heavy industry by 22% on 2008 levels by 2020. Under the plans, by 2020, 40% of the UK's electricity is to come from low-carbon sources as a result of producing around 30% of electricity from renewables by substantially increasing the requirement for electricity suppliers to sell renewable electricity, capturing and storing emissions from coal power stations as well as the building of new nuclear power stations.

Moreover, the aim is to cut emissions from homes through, amongst other measures, investing £3.2 billion in helping to make homes more energy-efficient. In addition, other goals are:

- the cutting of industrial emissions by 13% on 2008 levels by 2020 through including high-carbon industries in the EU Emissions Trading System, which will save around 500m tonnes of carbon dioxide a year across the EU by 2020;

² A Renewable Energy Strategy and a Low Carbon Transport Plan, in addition to the Low carbon Industrial Strategy, were launched alongside the Low Carbon Transition Plan.

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- the creation of 1.2m jobs in the low-carbon industry, worth £3 trillion, by the middle of the next decade, by investing in research and development of new low-carbon technologies; and
 - the investment of £120m in offshore wind, and an additional £60m in marine energy (*The Guardian*, 2009).

Also outlined were plans for transport (including reducing the price of hybrid cars, providing an infrastructure of electric car charging points, cutting CO2 emissions from new cars by 2015) and farming (focusing on landfill and forestation, amongst other things).

1.5 The Low Carbon Industrial Strategy

In July 2009, the UK Government published its 'Low Carbon Industrial Strategy' (BERR, 2009). The ethos of the strategy is encapsulated in a statement contained therein, which argues that:

‘Tackling climate change is about more than just averting environmental disaster. It can create a better kind of society and a stronger, more sustainable economy’.

The document outlined the government’s strategic view of Britain’s low carbon strengths and opportunities, and detailed proposals for how the Government will facilitate the development of low carbon business through targeted industrial policy for the following sectors:

- offshore wind;

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- wave and tidal power;
 - civil nuclear power;
 - ultra low carbon vehicles;
 - renewable construction materials;
 - renewable chemicals; and,
 - low carbon manufacturing.

These industries received a total of £405 million set aside specifically in the 2009 Budget (see below). Support measures included:

- the establishment of Low Carbon Economic Areas (LCEAs), comprised of partnership of regional and sub-regional bodies, led by Regional Development Agencies in conjunction with relevant local authorities and Local Strategic Partnerships. The LCEAs aim to accelerate economic growth in targeted geographical areas that have 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;
- the provision of increased support to research and development for business at early stages of innovation through funding for a Technology Strategy Board;
- increased 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;

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- the modernisation of 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.

Significantly for the purposes of this report, the UK LCI strategy acknowledged 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:

- the 2009 National Skills Strategy to focus skills provision on sectoral skill needs in low carbon industries;
- 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.³

1.6 The Green Fiscal Stimulus (the ‘Green New Deal’)

Essentially, the Low Carbon Industrial Strategy and the enhanced funding allocation for green sectors in the 2009 Budget can be seen as part of the ‘green fiscal stimu-

³ In furtherance of this, the 2010 Budget announced an additional 20,000 full, part time and foundation higher education places, with priority given to areas identified in New Industry, New Jobs and the national skills audit that will best support growth, including STEM. These will be funded from a £270m Higher Education Modernisation Fund, available in 2010-11 and administered through HEFCE (HM Government, 2010) .

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lus' launched by Gordon Brown's Government (first alluded to in the 2008 Pre-Budget Report, when £20billion – equivalent to 1.4% of GDP - was committed to a recovery plan). This green 'industrial activism' was thus aimed, in part, at mitigating the impact of the economic recession of 2008/09, and so the 2009 Budget allocated funding to low-carbon industries and 'advanced green manufacturing'.

This green package was worth one-sixth of the total economic stimulus package, created by the Budget. The package included a modest (compared to other countries' packages) 'green stimulus' of £535m, as well as other environmental spending commitments.⁴ The initial green stimulus focused on building energy efficiency, low carbon transport (railway and vehicles) and flood defence. The other 'green elements' included the provision of £50 million extra for the Technology Strategy Board to expand its work with business in developing innovation and new technologies (see *Low Carbon Industrial Strategy* above); £375 million to help households and businesses with energy and resource efficiency; £90 million more to fund engineering and design studies for Carbon Capture and Storage (CCS).

The 'green stimulus' did not allocate any additional public spending to renewables or other low-carbon power sources, but the Renewables Obligation was extended from 2027 to 2037.⁵

Later 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

⁴ The amount allocated was criticised as being insufficient by the Environmental Audit Committee, the Environmental Industries Commission (who advocated a stimulus of £45 billion), the TUC (who supported a package of £25billion) and the Sustainable Development Commission, which recommended that a package in the region of £30billion was required.

⁵ The Renewables Obligation 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.

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the car industry in January 2009 (£1.3 billion in loans from the European Investment Bank and not included in the table 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 Low Carbon Industrial Strategy (mentioned above).

A summary of all the green measures in the UK's stimulus packages is laid out in the table below.

Table 1: Summary of green stimulus measures in the UK's stimulus packages measure (Reid, 2009: 15).

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

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Low-Carbon Vehicles	1,355
Low Carbon Investment Fund – Ultra-low carbon vehicles	20
Loans and guarantees for low-carbon vehicles	1000
Train to Gain for automotive industry	35
Scrappage 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
British Waterways	5
Other	80
Flood Defences	20
Low Carbon Investment Fund – Manufacturing	50
Waste infrastructure	10
Total	3,305

The final total then was £3,305 billion (the three stimulus packages eventually added up to £22.7 billion, some 1.5% of GDP (Reid, 2009). The green portion of was equivalent to 14.5% of the total stimulus and 0.22% of GDP.

1.6 Other Policy Initiatives

Two significant Government-initiatives, aimed at encouraging businesses to become more resource and energy efficient, are the Carbon Reduction Commitment Energy Efficiency scheme, which entered into force in 2010 and the government-funded Carbon Trust. It is intended that the Scheme will stimulate improved energy efficiency in large business and public sector organisations, which are responsible for around 10% of UK emissions. The Carbon Trust exists to provide a range of support to help businesses understand the opportunities and risks of climate change, and to embed low-carbon as a strategic priority. The Environmental Audit Committee (2009) recommends that, despite these endeavours, further effort is required to mainstream green skills across industry and develop the confidence at board level and below to manage carbon reduction in business.

2 Environmental/Green Skills Policy

This section outlines the green skills response of the UK Government. Until recently, environmental skills training has not been a high priority within the UK (ECORYS, 2009). Rather, the primary focus of skills strategy over the past ten to fifteen years has instead been the addressing of basic and core skills deficiencies (English, maths and IT). More recent foci include making the demand-led system (i.e. stimulating employer demand for skills) a reality, as well as addressing gaps at intermediate skills levels, through the expansion of Apprenticeships and the reform of qualifications system. The environmental skills agenda only really emerged and began to gain ground as a skills policy priority from about 2008 onwards (ECORYS, 2009).

Since this time, a number of policy documents were issued by central government, aimed at stimulating awareness of the need for a low carbon economy, as well as a

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statement of intent as to how government plans to develop green industries and skills.

2.1 Environmental Audit Committee

The Environmental Audit Committee is appointed by the House of Commons and exists so as to consider the extent to which policies and programmes of government and non-governmental public bodies contribute to environmental protection and sustainable development. Moreover, the Committee audits their performance against targets that may be set for them and to report on such findings to the House of Commons (Environmental Audit Committee, 2009).

In April 2009, the Committee announced an Inquiry into green jobs and skills policies (Environmental Audit Committee, 2009). The Inquiry gathered evidence from a range of public and private stakeholders, including large employers, industry skills bodies, governmental agencies, environmental and energy organisations, policy research institutes, trade unions and others. The aim of the Inquiry was to encourage government to invest in the low carbon sector and concomitantly, to boost employment in environmental industries, so as to help mitigate the effects of the recession. The Inquiry also sought to identify the nature of the jobs that might be created in green industries as a result of the green fiscal stimulus; the skills base for the UK environmental industries; as well as to evaluate the effectiveness of extant government policies.

All stakeholders agreed that harmonising terms of reference for low carbon jobs and skills was an urgent priority. The evidence presented to the Committee indicated that the green skills gap represents a major barrier to UK success in environmental markets.

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Moreover, and of particular salience, the Inquiry identified that the Low Carbon Industrial Strategy was actively targeting the renewable energy sector, but that it was not effectively address the necessary transition across the whole economy. The Committee highlighted the pressing need for the development of a more general green skills set, required to provide the entire economy with vital resource efficiency and leadership skills, essential for the transformation of the economy as it moves towards more sustainable patterns of production and consumption.

Significantly, the Inquiry argued that an exclusive reliance on the market to address skills gaps was, and is, responsible for delaying the transition to a green economy. The demand-led approach to skills is identified as deficient due to employers' inability to effectively articulate their needs to the skills delivery bodies (i.e. the Sector Skills Councils) as well as these latter being unable to accurately forecast where demand for new skills will emerge. As research commissioned by DEFRA found, demand for environmental skills "is not being articulated by many employers and as a result the current 'demand-led' skills delivery framework is ill equipped to anticipate and respond."⁶

The Inquiry thus recommended that a more strategic and targeted approach to skills would be required in order to solve both these problems. It argued that future governmental skill strategy should prioritise the skills necessary to impel the whole economy through the low carbon transition, namely the skills in the sectors highlighted by the Committee on Climate Change and the Low Carbon Industrial Strategy as

⁶ Similarly, the TUC argues that relying on the market to identify skills gaps is causing delays in moving towards a green economy; the TUC thus argues for the urgent development of an active skills strategy as it believes that the current level of skills training capacity is inadequate to meet the needs of a low-carbon, resource-efficient economy. Furthermore, the SDC also argues that there is a lack of appropriate demand for some of the skills that are required for the low carbon transition.

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being important in the low-carbon transition and moreover, that low-carbon skills should be integrated through the whole skills delivery system to encourage behavioural change across the entire economy.

Furthermore, it recommended that a body to ‘take ownership of’ and lead the green skills agenda must be found/established, so as to coordinate the delivery of green skills across all sectors, thereby ‘mainstreaming’ green skills. The Inquiry argued that there was (and is) little evidence of ownership of the low-carbon skills agenda within the extant skills system. Both CEMEP (2009) and the SDC envisaged a leadership role for the UK Commission on Employment and Skills (UKCES), the body set up to see that employment and skills systems contribute to the highest levels of productivity. However, the Government decided that other priorities, such as the simplification of the entire skills system, should take precedence and that it would not be desirable to divert effort from the core mission of UKCES. Moreover, UKCES responded that it did not have the capacity to take on such a role and it still does not participate in the meetings on the subject (Environmental Audit Committee, 2009).

As part of the House of Commons’ response to the Audit Committee’s Inquiry, the Government of the time reported that a Strategic Advisory Group of leading edge employers was formed to help Government develop the skills contribution for the Low Carbon Industrial Strategy of 2009 (Environmental Audit Committee, 2010). Moreover, a high Level cross-Government Forum was established in order to align skills policy thinking for the *Low Carbon Industrial Strategy*. That group was enlarged so as to include a wider range of Government departments and strategic skills partners, with a view to producing a Government-wide consultation document on the Low Carbon and Resource Efficient Skills Strategy in the spring of 2010 (see below). Employers were to be the primary audience for this consultation, which was to form

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the basis of a skills strategy to be launched later in that year (this has yet to be released by the current Coalition Government). The consultation was to focus on identifying priority skills actions and overcoming barriers to progress in each of the emerging low carbon ‘sectors’. Leadership of the cross- Government group was jointly provided by BIS and DECC.

Finally, the Government responded that a number of Sector Skills Councils and other sector bodies were working collaboratively, so as to provide leadership on different aspects of the low carbon skills agenda, or within specific low carbon sectors. For instance, all SSCs had come together under the joint leadership of Cogent and Energy & Utility Skills in order to coordinate the alignment of low carbon skills initiatives across the economy and the SSC network. Moreover, 11 SSCs and 1 ITB had formed a steering group to deliver a Low Carbon Cluster Report to inform the UK Commission’s first Strategic Skills Audit (see *National Skills Strategy* below).

2.2 The BERR (2009b) ‘Green Jobs, Green Skills’ Report

This report was published in the aftermath of the economic crisis of 2008/09 and identifies the ‘transition to low carbon and the green revolution’ as significant global trends which present ‘significant opportunities for British businesses (BERR, 2009b). The Government of the time committed to ‘improving the skills of [the British] people and adapting [those skills] to the needs of a modern economy (2009: 3). The report outlines a Government strategy of greater ‘industrial activism’, aimed at securing sustainable international competitiveness for UK businesses and people, and an enhanced role for Government in creating the frameworks within which successful businesses are created, developed and thrive therein. One strand of building such ‘frameworks’ identified within the report is the targeting of certain kinds of public poli-

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cy measures (including tailored skills strategies) towards ‘growth areas of the economy’, which of course encompasses ‘green’, low carbon aspects.

2.3 The National Skills Strategy

Environmental and low carbon skills featured strongly amongst the Government priorities outlined in the 2009 Skill Strategy (BERR, 2009c). In this strategy document, the Government committed to further invest in skills for the sectors on which future growth and jobs depend.⁷ The Strategy, then, identified the need for urgent action in low carbon and resource efficiency which ‘defy sector boundaries entirely, requiring a cross-cutting approach’, thereby explicitly recognising the economic importance of low carbon sectors for future growth.

The Strategy also outlined plans for the new Skills Funding Agency to become more selective in the skills training it funds, so as to focus on identified potential high growth sectors. The Skill Funding Agency was operational from the 1st of April 2010, and is responsible for funding post-19 learning in England. It will purportedly direct public funding quickly and efficiently to colleges and training organisations, in response to individual and employer demand. National skills priorities identified by the UK Commission, and those set out in the regional strategies, will be agreed by BIS and confirmed in the annual ministerial *Skills Investment Strategy*, against which the SFA will fund colleges and training organisations (HM Government, 2010).

Furthermore, it highlights the new role of the employer-led UK Commission for Employment and Skills in producing an Annual Strategic Skills Audit. Such Audits are to review evidence of current skill mismatches (in co-operation with the Sector Skills Councils and Regional Development Agencies) and on this basis, identify current

⁷ Other areas identified as qualifying for increased funding include life sciences, digital media and technology, advanced manufacturing, and engineering construction.

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and future skill needs and priorities.⁸ The data can thus be used to help individuals, employers and training providers make informed decisions. The first National Skills Audit, which was due in March 2010, was to provide a comprehensive assessment of current and future gaps in low-carbon skills. It was intended that these results could form the basis for any future development of the green skills strategy. Indeed, in the House of Commons' response to the Environmental Audit Committee Inquiry, the then-Government stated that its' BIS/DECC consultation on a Low Carbon and Resource Efficient Skills Strategy would build on the Audit by exploring each of the low carbon sectors in more detail, drawing out skills priorities and barriers to progress. This analysis was then to inform a full Low Carbon and Resource Efficient Skills Strategy to be released late in 2010, so as to accelerate priority skills solutions in those sectors where growth is strongest.

Other measures introduced under the Skills for Growth Strategy include:

- Placing a new emphasis on skilled technician and associate professional skills at Levels 3 and 4. From September 2010, funds within available budgets were to be prioritised so as to boost advanced and higher apprenticeship opportunities for 19-30 year olds through the provision of an additional 35,000 places over the next 2 years. The National Apprenticeship Service (NAS) has highlighted the renewable energy sector as one of its priorities for Apprenticeship development, and is reviewing the role of Apprenticeships in providing the skills for resource efficiency and low carbon. Sector Skills Councils (SSCs) are purported to be already working with their employers to develop new

⁸ Alongside the National Skills Audit, Regional Development Agencies are to develop their first regional skills priorities statements for 2010/11 with their regional and sub-regional partners, including those in the Low Carbon Economic Areas. These statements are living documents and will be continually refined to take account of developments including the national priorities identified in the UK Commission's audit.

frameworks to support the low carbon agenda, for example in the wind energy and waste management sectors (HM Government, 2010);

- Co-investing with employers to build capacity in low carbon skills. The Government launched a competitive prospectus for a new Joint Investment Programme (JIP). Under this initiative, the Skills Funding Agency will seek expressions of interest and match fund selected proposals from Industry Training Boards and SSCs, so as to tackle specific technical skills needs in areas key to economic recovery. Low carbon proposals are expected to feature strongly among the bids. The Programme will promote skills solutions cutting across traditional sector boundaries, with an emphasis on organisations working collaboratively, and on replicating emerging best practice across sectors and regions;
- Further support collective employer action on skills through the formation of National Skills Academies (NSAs). Fifteen have already been established, including the NSA for Nuclear, and the newly launched NSA for Power. These skills academies exist to enable employers to drive and shape the design and delivery of training and qualifications in their sectors. Other NSAs are proposed, including one covering Green Building Services in the Housing Energy Management sector, and another covering the emerging Biotechnology and Composites sectors;
- Actions to reduce the development time for new occupational standards and qualifications, from the existing twelve months to six.⁹

⁹ The wind energy sector provides a good example of accelerated development of new national occupational standards, Apprenticeship frameworks and foundation degree programmes. This has been achieved through the creation of a voluntary Skills Accord, comprised of employer and supply-side coalitions.

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- Disseminating best practice in low carbon skills delivery across the further education sector through a new Learning and Skills Improvement Service, as part of a wider support programme.

2.4 The 2010 'Meeting the Low Carbon Skills Challenge' Consultation

This consultation was run jointly by the Department for Business, Innovation and Skills and the Department for Energy and Climate Change. It was issued on the 31st March 2010, with responses due by the 23rd June 2010 (HM Government, 2010). The consultation set out the Government's views on the key skills-related priorities and challenges which it stated must be met, in order to achieve the following:

1. Enable British workers and businesses to take advantage of the opportunities in the sectors key to reducing carbon emissions;
2. Embed the necessary skills across all sectors to move the UK to a low carbon and resource efficient economy.

The consultation was issued so as to seek views on:

- the priorities, challenges and gaps identified by the Government;
- on how businesses can best be incentivised and encouraged to respond so that they have the skills they need at all levels; and
- on how the education and skills system can respond so that it is strongly focused on the needs articulated by businesses.

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Within the consultation document, the Government identified five key challenges for both employers and the skills system:

- The delivery of significantly higher volumes of generic science, technology, engineering and mathematics (STEM) skills at all levels;
- The rapid development and delivery of the specialist skills solutions that will be needed for emerging sectors and technologies;
- Ensuring that more young people and adults are interested in low carbon careers and hence, in acquiring apposite skills and qualifications;
- The stimulation of employer demand for and investment in low carbon skills;
- The replication of the good practice occurring in each of the above categories, within and between emerging sectors.

Within the document, the Government acknowledges that many of the skills needed to make the transition to a low carbon economy will not be new. The importance of fundamental Science, Technology, Engineering and Mathematics (STEM) skills will be needed at all levels, both in key energy and advanced manufacturing sectors as well as more widely across the economy, so as to lower carbon emissions and make better use of all resources.¹⁰ The consultation document thus outlined the actions

¹⁰ 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. For example, they are crucial to the deployment and delivery of cleaner energy generation, as highlighted in the 2007 Energy White Paper. The Stern Review 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

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that the then-Government had put in place so as to improve access to, and uptake of, STEM qualifications.¹¹

However, although it is recognised that in some sectors, much of what needs to be done will build upon existing STEM-based skill sets, it is also acknowledged that there will be sectors in which completely new skills are needed, and for which new qualifications will need to be developed. As such, the document states that the skills system needs to be able to respond rapidly and flexibly to these demands, with action necessary at local, regional and national levels, not just by educational institutions but also by the SSCs, businesses and individuals.

Three key sectors are identified as requiring ‘major cross-sector efforts’ to meet the predicted escalation in demands for skills: the power (wind and nuclear) industry, the construction industry and the transport sector. Within the consultation document, the Government identified that the power industry will need to recruit apprentices and graduates (particularly those with STEM skills) in large numbers, so as to meet tar-

deployment’. In light of such predictions, it is significant that the main ‘family’ of skills lacking in the UK workforce are those of Science, Technology, Engineering and Mathematics (STEM) (ProEnviro, 2009). Supply of these skills at all levels of the UK education and training systems have been historically weak (DES, 2001).

¹¹ In March 2006, the ‘Science and Innovation Investment Framework 2004 – 2014: Next Steps’ was published. This announced a number of ambitions to increase both the number of young people studying science and mathematics at A level, and the number of physics, chemistry and mathematics teachers

In response, a ten-year STEM programme was developed, jointly led by the Department for Children, Schools and Families (DCSF) and the Department of Business Innovation and Skills (BIS), to educate the next generation of scientists and mathematicians. Actions include improving engagement through a more flexible secondary curriculum for mathematics and science; improving the quality of teaching and learning by making available high quality continuing professional development through the network of Science Learning Centres, and the establishment of the National Centre for Excellence in the Teaching of Mathematics; introducing a new Science Diploma from 2011 (Advanced Level from 2012), responding to demand from employers and Higher Education for young people with the combination of theoretical knowledge and practical scientific skills they need to succeed; increasing the number of STEM Ambassadors to support pupils, teachers and schools; and encouraging young people to consider the relevance of STEM to their lives and career prospects through the Science and Society Strategy and the ‘Science: So what? So everything’ campaign. More recently, the Coalition Government has launched StemNet, the Big Bang Fair and the National Science and Engineering Competition (DECC, 2010).

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gets for de-carbonisation. The Government had already established National Skills Academies for Nuclear and for Power, and outlines other measures, such as industry bodies working together so as to develop new qualifications such as the Wind Turbine Service Technician Apprenticeship. In this sector, the consultation sought to identify the best ways to further accelerate skills development in the power sector.

Within the wind and nuclear energy sectors, the Government identifies a clear need for technician level skills. To this end, the Government committed to:

1. Co-fund the delivery of up to 1,000 apprenticeships per year to support de-commissioning and new-build in the nuclear energy sector;
2. Co-fund the delivery of up to 2,500 apprenticeships in the emerging wind energy sector, in line with the sector's ambition for the size of its workforce in 2017.

For the construction/building sector, the Government at the time predicted that there will be a strong demand for skills in three areas:

- adaption of existing housing stock,
- renewable building methods, and
- the construction of zero carbon homes.

The Government anticipated that the required skills will be mainly at graduate level; those needed to develop, manufacture and implement new technologies, and to enhance existing practical construction skills for installing new adaptation and mitigation technologies. The consultation identifies that the skills system is beginning to address this, through the updating of National Occupational Standards, amongst

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other measures. However, the precise identification of skill needs within this sector was acknowledged in the consultation to be a major challenge facing the Government. Thus, one aim of the consultation was to ascertain whether extant initiatives would be sufficient to realise Government ambitions.

Within the transport sector, the transition to ultra-low carbon vehicles and the development of new fuel efficient aircraft is expected to require the manufacturing and maintenance workforces to adapt their skill sets to the demands of changing technology. It is anticipated in the consultation that STEM graduates will be in high demand. The consultation thus sought an improved understanding as to how the transport sector should work with the skills system, in order to anticipate and respond to these demands.

Beyond the three key sectors, the consultation aimed to review the skills needed to decarbonise the UK's entire manufacturing and process industry supply chains and moreover, to make the most efficient use of resources, reduce waste and minimise carbon emissions. The document identifies that Industry and manufacturing are directly responsible, collectively, for some 14% of total UK carbon emissions. Of specific relevance here, the consultation briefly refers to the need for the decarbonisation of the UK's important traditional heavy industrial base. This will be underpinned by decarbonising the power sector and by the introduction of new technologies such as Combined Heat and Power, and Carbon Capture and Storage in cement, iron and steel manufacturing, as well as direct energy efficiency measures.

Moreover, advanced manufacturing is discussed. The opportunities creating demand for new and evolving skills of key importance are identified as:

- Development and use of new raw materials, including bio-composites;

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- New types of manufactured product, such as those taking plastic electronics and silicon electronics approaches;
 - New industries such as chemical production through industrial biotechnology;
 - Extraction of recyclable materials for reuse and recovery and life cycle assessments;
 - Application of lean manufacturing methods;
 - Redesign of existing products with a focus on resource efficiency and a cradle to cradle approach, in which materials are continually recycled;
 - In product design, so that products use fewer resources in manufacture, have lower impact in use, and are easily recycled;
 - Energy minimisation by integrating waste recycling to energy;
 - Improved supply chain management;
 - IT that replaces goods and services with virtual equivalents and provides technology to enable energy efficiency.

The actions to increase the provision of STEM qualified employees are acknowledged as key to delivering the skills needed for these new opportunities. A primary role for SSCs, in conjunction with industry, in identifying developing skills needs, is highlighted.

Within the consultation document, the prediction is made that that a wide range of cross-cutting skills will be needed, many of which will combine traditional professional disciplines with emerging industrial applications, such as composites. It is anticipated that STEM qualifications will again be pivotal, as will specialist skills. The consultation thus sought to gain better understanding of these skills needs.

There is also an explicit recognition that, even within a decarbonised society, the UK will need to continue to adapt to a changing climate, and thus the knowledge and

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skills to achieve this, will need to be embedded across the economy. The need for adaptation will provide opportunities for businesses, both in terms of providing solutions and services in the UK and in exporting their expertise abroad.

In sum, the Government states in the consultation document that it was aiming to:

- Ensure that employer skills needs in areas defined as key to economic growth would be clearly identified and articulated, and prioritised within the skills funding system;
- Develop new funding incentives to enable universities to respond to the needs of areas key to future economic growth;
- Co-invest in collective employer action so as to tackle skills needs in new and emerging markets;
- Speed up the development of new and updated qualifications to reflect new and changing jobs;
- Stimulate joint action between business and skills partners, regionally and locally, on new skills needs as well as replicating the good practice emerging in specific areas and industries;
- Exploit the power of public procurement to drive up demand for skills and Apprenticeships through the supply chain;¹²

¹² The public sector spends an estimated £220 billion each year on public procurement. The stated Government ambition in the consultation was to support 20,000 apprenticeships over the next three years through public procurement, with the expectation that many of these apprenticeship places to be in low carbon skill areas. This will be done by working with procurers and key suppliers in sectors with large environmental im-

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- Promote dialogue between regulators, regulated industries and Sector Skills Councils in order to drive up demand for skills;
- Work with national, regional and local bodies, trade unions, business organisations, and third sector bodies so as to ensure that the transition to a low carbon economy does not unduly penalise those working in high carbon sectors.

2.5 The 2010 Government Response to the Consultation on ‘Meeting the Low Carbon Skills Challenge’

The Department for Energy and Climate Change published the Coalition Government’s response to the consultation in December 2010 (DECC, 2010). The consultation received a total of 114 responses, with the majority of responses being from training providers, SSCs and those with an interest in the skills delivery framework (businesses, unions, green groups). There were also responses from professional organisations, trade associations and private individuals.

The document essentially reiterates the original Government aims of the consultation at the outset. It then goes on to highlight that the Coalition Government recognises the importance of skills as a driver in creating a low carbon, resource efficient economy (LCREE) and states that the consultation response on the skills aspect of the LCREE should be seen in the context of the wider Coalition Government reforms to

pacts and developing sustainable purchasing specifications as part of the Government Buying Standards (Buy Sustainable Quick Wins), developed by Defra. Additionally, the Government was in the process of developing materials as part of a National Training Programme in Sustainable Procurement with local authorities. The Government aim in this was to support the development of specialised modules on “carbon and energy efficiency” to help budget holders and procurers better understand at which points in the procurement cycle their decisions can make a difference in creating and supporting markets for lower carbon goods and services.

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the skills and education systems, as set out in the ‘Skills for Sustainable Growth’ strategy, launched in November 2010 (BI, 2010a - see below).

The keys themes raised by consultees are summarised as follows:

- The need for a more flexible and responsive skills delivery system which better reflects current and future business needs. However, it is also noted that new low carbon businesses can be poor at articulating their skills needs, and that we will need to find better ways to inform and stimulate demand if we are to have the skilled workforce we need in the numbers required;
- The need for more flexible qualifications which support work-based learning. It is clear that many see continuous career development as key to a more flexible and productive workforce, particularly where new combinations of skills are needed. Businesses and employees must understand that skills development is a continuous process, requiring co-investment; and
- The need for more support and promotion of STEM skills to improve the STEM skills pipeline.

Of particular salience for the purposes of this report is the response to Question 21: What actions should be taken to ensure that individuals working in carbon intensive industries have the skills to make the transition to a low carbon, resource efficient economy?

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Respondents identified re-skilling (i.e. preparing existing employees for LCRE business practices) as important. There was support for extending training support to the over-25s. A strong multi-disciplinary skills basis was considered key in facilitating skills transfer throughout an individual's career. Clear incentives to train would be needed. In addition, consultees recognised that public/private investment would be necessary to develop conversion courses.

Respondents also stated a belief that the education and training system needs to be more closely aligned with the needs of the economy. It was acknowledged that there is insufficient recognition across the supply chain of the need for low carbon or resource efficiency skills, meaning that there was likely to be a case for government intervention. The incorporation of resource efficiency models into business and management training courses was identified as necessary action. Government contracts and procurement were also highlighted as important in stimulating capacity for low carbon and resource efficiency skills. The sharing of best practice, through dissemination of case studies, was identified as important.

In the Response, the Government commits to working with all key partners, including employer organisations, so as to support employer action in stimulating learner and employer demand and to tackle skills gaps. In addressing the particular needs of individuals working in carbon intensive, manufacturing industries and service sectors, the Government pledges to extend accessibility to adult apprenticeships and re-skilling of the existing workforce in this area. It is highlighted that industry has an important role to play in ensuring that its skill needs are met, through brokering the introduction of clear professional standards or occupational licensing for job roles that have low carbon and resource efficient skills requirements. Within such standards, the Government wishes industry to consider how they can put Apprenticeships at the centre of any new proposals.

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2.6 *'Skills for Sustainable Growth' Strategy*

This strategy is identified as providing the context for the Response to the LCRE Consultation. However, despite its title, there is only one explicit reference to the development of low carbon skills within the strategy document.

The strategy was launched in November 2010 and ostensibly sets out the Government's strategy for radical reform of the skills system (BIS, 2010a). The strategy sets out the Coalition Government's proposals for the establishment of "a skills system where responsibility for quality and investment is shared between Government, employers and learners and where training and qualifications "are designed and valued by business", thereby providing a foundation for further learning. This should be placed in context of a 25% reduction in the FE budget (BIS, 2010b).

There is to be an expansion in the numbers of adult Apprenticeships available by 2014-15, by up to 75,000. This is predicted to lead to more than 200,000 people starting an Apprenticeship each year. In order to fund this growth, investment in Apprenticeships is to be increased by up to £250 million over the spending review period. There will be investment of £605 million in 2011–12 and an indicative budget of £648 million in 2012–13.

Moreover, the Government seeks to qualitatively improve the programme. Apprenticeships are to be 'reshaped', so that technician level – Level 3 – becomes the level to which learners and employers aspire. To widen access, there will be clear progression routes into Level 3 Apprenticeships, and routes from Level 3 Apprenticeships to higher level skills, including Level 4 Apprenticeships or Higher Education.

Alongside Apprenticeships, the Government intends that there will be a wider and more flexible system of vocational qualifications. The Qualifications and Credit

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Framework will allow individuals and employers to access units of training that meet their specific needs. Sector Skills Councils will act for businesses in regularly updating national occupational standards, and qualification awarding bodies are expected to take these standards into account as they update and introduce their vocational qualifications.

Employers are to be supported in the efforts to tackle skill shortages. The Government pledges to work with groups of employers to explore how new professional standards can drive competitiveness in their industry. Moreover, a new Growth and Innovation Fund will be established, so as to support employers in raising skills in their sectors as well as promote better development and deployment of workplace knowledge and skills. The strategy states that this may include the co-funding of training programmes in new or rapidly changing parts of the economy, including those which arise in the transition to a low-carbon economy.

The Coalition Government states that the skills system must move away from a “culture of bureaucratic central planning and regulatory control” and micromanagement from the centre. As such, central targets for the number and types of qualifications will be abolished, so that colleges “can be more responsive to the needs of employers and learners.” According to the strategy, this will result in a more flexible and responsive supply side, where providers will be able to supply the type and volume of training that is needed in their local area.

3 Research/Evidence-base pertaining to Green Skills in the UK

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Alongside the raft of policy development, research aimed at the identification of the low carbon skill sets needed for both existing and future green jobs and industries and with a view to influencing policy has been conducted (indeed, some of the proposals are reflected in the 2010 Government Consultation and in the Environmental Audit Committee recommendations). However, in a comprehensive review of the research/evidence base on green skills available, Pro Enviro (2009) reported that overall, the evidence base on LCREE skills is weak, with available research focused on high level and general comments.

A range of cross cutting themes can be identified from a review of the extant literature (and indeed, some of these are reflected in Governmental strategy and policy documents). These include (SWO, 2010):

- The problems of reskilling associated with an ageing workforce.
- The need for increased promotion and uptake of STEM subjects.
- The need for general management and leadership skills, a common deficiency across UK organisations (Bird and Lawton, 2009).
- The role of government procurement in encouraging low carbon and resource efficiency.
- Latent demand from employers, which is, however, not being clearly articulated. The current skills delivery system (being demand-led) is thus deemed ill-equipped to anticipate and respond (e.g. ProEnviro, 2009).
- The need to 'green' existing jobs, rather than focus on the creation of completely new jobs with radically different skill sets.

This section will provide a succinct overview of the key findings and recommendations of four principal reports into low carbon skills in the UK, those of ProEnviro

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(2009), the IPPR (Bird and Lawton, 2009), the Aldersgate Group, the Windsor Consultation (2008) and the Sector Skills Council Cluster Group report.

3.1 The ProEnviro Report (2009)

The ProEnviro Report was commissioned by DEFRA and constitutes a comprehensive review of extant literature available at the time of publication, as well as primary research with relevant stakeholders. This latter included interviews with personnel from twelve priority SSCs and twenty-three private and public sector bodies, including training providers and professional bodies.

The intention of the ProEnviro report was to undertake a wide ranging, high level review of current and relevant evidence relating to the skills implications of the transition to a low carbon and resource efficient economy (LCREE). This project was the first attempt to combine extant research with stakeholder views on skills for a low carbon and resource efficient economy. The specific objectives were:

1. To develop an overview of the generic and specific skills requirements for a low carbon and resource efficient economy (LCREE).
2. To develop an overview of a wide range of stakeholders understanding and awareness, as well as the demand for, generic and specific skills requirements for a LCREE.
3. To identify gaps in evidence and recommend priority areas for future research which will move the LCREE agenda forward.

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In terms of the review of the extant research base, a number of gaps were identified in the ProEnviro report. The researchers found a bias towards low carbon and energy issues and much less work on resource efficiency issues. Moreover, the report identifies that a majority of the extant research operates at a high level of abstraction, with only a vague focus on more in-depth specific skills requirements. The Pro-Enviro researchers argue that this indicates a lack of clarity in the research mission and an inability to progress to the level of actually specifying skills requirements and concrete actions that will promote LCREE and its skills requirements.

Pro-Enviro proposed a draft two-tier checklist of green skills, as detailed below, so as to clarify the skills area of importance for a Low Carbon and Resource Efficient Economy (LCREE). The checklist defined the scope and range of both generic and sector specific skills areas and was used as a project aide and a tool for gathering opinions and comments.

The checklist was drawn up from a review of the literature and used during the subsequent consultation process in order to help consultees understand the potential scope of skills and think more clearly about them in their responses. The checklist also formed a baseline from which to assess the nature and depth of consultees' understanding and awareness of the skills requirements for LCREEs, so as to facilitate their provision of intelligence on the gaps in generic and specific skills provision and evidence.

Pro-Enviro's green skills checklist

Tier 1	Tier 2
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<p>Design Skills</p>	<p>Eco-Design</p> <p>Green Manufacturing</p> <p>Materials Specification</p> <p>Life Cycle Assessment/Costing</p>
<p>Waste Skills</p>	<p>Waste Quantification and Monitoring</p> <p>Waste Process Studies</p> <p>Waste Management Systems</p> <p>Waste Minimisation</p> <p>Waste technologies</p>
<p>Energy Skills</p>	<p>Energy Minimisation</p> <p>Energy Management Systems</p> <p>Energy Costs and Trading</p> <p>Renewable Energy Technologies</p> <p>Non-Renewable Technologies</p>
<p>Water Skills</p>	<p>Water Minimisation and Re-Use</p> <p>Water Management Systems</p> <p>Water Quantification and Monitoring</p>
<p>Building Skills</p>	<p>Building Energy Management</p> <p>Integration of Renewable Energy</p> <p>Energy Efficient Construction</p>

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	<p>Facilities Management</p> <p>Calculating Building Energy Efficiency and Carbon Ratings</p>
Transport Skills	<p>Transport Impact Minimisation Technologies</p> <p>Transport Impact Minimisation Processes</p> <p>Transport Management in Business</p>
Material Skills	<p>Sourcing</p> <p>Procurement and Selection</p> <p>Material Use and Impact Quantification</p> <p>Management Systems</p> <p>Impact and Use Minimisation</p>
Financial Skills	<p>Investment Models</p> <p>New/Alternative Financial Models</p> <p>Quantification of Climate Change Impacts</p> <p>Principles of Low Carbon and Resource Efficient Economies</p> <p>Tools of Low Carbon and Resource Efficient Economies</p>
Management Skills	<p>Impact Assessment</p>

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	Business Planning Awareness Raising Opportunities Management Risk Management Day to Day Management
Policy/Planning Skills	Built Environment Master Planning and Implementation Strategy Development Strategy Implementation

The key findings of the ProEnviro report were as follows:

- *Latent Employer Demand*

There was evidence of a latent demand for LCREE skills – 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 the skills requirements and implications of a LCREE and consequently of the importance and potential benefits of integration of LCREE skills into their businesses. ProEnviro argues that businesses will only demand LCREE training, when a clear business case is made. The consultants categorise this situation as a classic ‘Catch 22’ – understanding and awareness are the key to stimulating demand for skills but in a demand led skills delivery system, an expression of demand is required

from the organisations for the skills delivery sector (especially SSCs) to respond to. It can be surmised that this situation is set to worsen, given the focus of the current Coalition Government, who intend to abolish centralised planning in the skills system in an attempt to further embed a purely demand-led mechanism.

- *Priority Skills*

The research identified a range of priority generic (cross-sector) and sector-specific skills as priorities for the achievement of a successful LCREE. As has been discussed previously, many of the identified skills are not new, they are simply skills that already exist whose availability needs to be increased or which need to be applied in new situations or adapted with further training to a LCREE context specifically in mind. There is a need to identify these transferable skills as well as the mechanisms for their transfer.

The most important generic skills highlighted were leadership and management skills, necessary in order to effectively further the LCREE agenda (e.g. communicating the LCREE message and strategic business planning which includes the LCREE agenda); sustainable procurement; and STEM (Science, Technology, Engineering and Mathematics) skills in general. These last have been strongly emphasised in the Government's policy.

- *Integration of Skills*

In sum, ProEnviro recommend that LCREE skills need to be considered by, and integrated into, the whole of the skills delivery system.

Along with the targeting of specific skills gaps, the Institute of Environmental Management and Assessment (IEMA) believes that mainstreaming environmental knowledge and skills across all sectors will be essential to achieving a low carbon economy. ProEnviro propose that that integration of LCREE skills into all training taken by companies is the key to mainstreaming LCREE understanding, knowledge, skills and thinking. Several consultees mentioned that these skills have to become core to an organisation's function. Indeed, LCREE has traditionally been seen as a skill set that is separate to the core work of the company and the written evidence reviewed does not demonstrate a high level of integration of LCREE skills needs into current organisational priorities. In many progressive organisations, LCREE actions are taking place but these are not necessarily being integrated into the general management practices of these organisations on a widespread basis.

A key factor highlighted as increasing integration of LCREE and associated skills into organisational priorities is an enlightened and aware director who will push these skills issues forwards. In addition, levels of understanding and awareness amongst staff will impact on ability to integrate LCREE skills requirements and practices into organisational priorities.

In 2008, Lantra, the Sector Skills Council (SSC) for the environmental and land based sector, commissioned IEMA to undertake research into existing National Occupational Standards (NOS), training and qualifications in relation to environment and sustainability. A key finding of this research was the lack

of a clear structure and framework for environmental and sustainability skills. Lantra and IEMA thus called for a mainstreaming of green skills, supported by the EIC, and that all existing Sectors Skills Councils should develop programmes relevant for green jobs. The ProEnviro report, a year later, found that integration of some LCREE skills into qualifications and National Occupational Standards has started to take place, but the authors emphasise that this has occurred in a limited capacity, and there is still much to be done.

- o *Skills Demand Drivers and Obstacles*

The ProEnviro report identified the drivers and obstacles to the stimulation of LCREE skills demand.

In terms of drivers, the general consensus amongst participants was that most organisations will be driven to take action if this is required by legislation or if there is a clear business case (such as cost savings or increased competitiveness) to justify it. The clear business case is not currently fully appreciated. It is considered that, at the moment, levels of demand for LCREE skills are lower than could be expected. This is because a significant proportion of the total potential demand for LCREE skills is latent. Organisations do not have the right levels of understanding of the importance, and the potential benefits, of integration of LCREE skills into their businesses. Only when these links and a clear business case are made will businesses demand LCREE training (see above – *Latent Employer Demand*). This is problematic in a demand-led skills system.

Various pieces of legislation and actions have started to impact on demand for, and subsequent integration of, aspects of LCREE and associated skills. But, there has been no co-ordinated overall systematic discussion or action to stimulate demand for LCREE and consequently the optimal way to achieve this is unclear, leaving a significant proportion of latent demand unrealised.

Supply chain pressures were also commonly cited as an important driver and are likely to play an increasing role in encouraging down-stream demand.

The obstacles to skills demand identified were as follows. Some stakeholders considered that low levels of awareness and leadership are leading to a short-termist approach from policy and decision makers within government, the public sector, the skills provision sector and businesses. Organisations find it difficult to plan ahead because they do not know what the future policy drivers will be.

Moreover, LCREE skills are not being comprehensively promoted by professional bodies that influence the perception of their members' skills requirements, for example through Continued Professional Development (CPD) activities.

- *National Capacity and Capability to Meet Skills Needs*

On the basis of their research, Pro Enviro consider it unlikely that current levels of skills training capacity will be sufficient to meet demands in the event of increased conversion of latent demand into actual demand, though further evidence based work and forecasting are recommended to quantify this.

Their findings also highlighted that there may be a shortage of trainers in the marketplace – a factor which will significantly impact on delivery.

Moreover, many of the stakeholders who participated in the research highlighted that a high proportion of the 2020 workforce are already in work. These people, at all levels, will need to be upskilled whilst within their existing jobs. There must be an effective way of reaching this group with appropriate qualifications and policies that support re-skilling and upskilling in a modular way. Many stakeholders felt that the current skills delivery infrastructure is not well suited to reaching and upskilling those already in the workforce. Those already in work require shorter specialist and background courses/modules and vocational training material which are often not available (or not available in sizeable quantities). Funding mechanisms are geared to delivery of longer term qualifications and do not support these shorter courses. In addition the practical methods of delivery are important to successful upskilling – with the private sector more flexible and able to respond to employers' requirements better (e.g. the provision of on-site training).

The skills delivery system and funding has been focussed on lower level skills. This does not maximise support of the LCREE agenda as LCREE skills have been cited as mainly being level 3 and above as well as at higher levels. In addition, there is a reported mis-match between the funding system for Higher Education and the skills required for a LCREE.

Skills brokerage (and subsequent delivery) is reliant on well informed business advisors under the Business Support Simplification Programme. Not all business advisors are sufficiently knowledgeable about LCREE to identify is-

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sues and broker relevant support/training. It is recommended that business advisors should receive specific LCREE training.

3.2 The IPPR Report (Bird and Lawton, 2009)

This report was based on a review of the extant literature, in addition to primary data gathered through a survey, supplemented by qualitative interviews with thirty nine ‘green’ employers.

The research found that it is currently unclear what the UK’s specific skill needs for the emerging low carbon economy, actually are. Their data suggests that employers in the Low Carbon sector currently have two major skills problems:

1. Management skills which is regularly identified as a general weakness in UK firms
2. Technical, job-specific skills, but not limited to STEM skills.

No evidence found that new low-carbon jobs would require completely new types of skills sets among the workforce. Instead, the IPPR identified four broad types of skill shortages:

- Specific skills shortages requiring substantial investment in training and development (eg high integrity pipe welders and civil engineers)
- Skills gaps that could be addressed by ‘topping up’ existing workforce skills (e.g. training electricians to work on roofs so that they can install solar panels) (see table below)

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- Generic skills gaps that apply across the UK economy (eg management and leadership skills)
- Generic green skills (ie a broad understanding of the changes needed for businesses to reduce their emissions that will be needed by all employees across the economy)

Table 1: Top-up training for low-carbon jobs

Current Job	Core Training Needed	New Low-carbon Skills Needed	New Low-carbon Job
Electrician	Apprenticeship, BTEC, NVQ/SVQ	Working on roofs; Solar panel fitting	Solar PV Fitter
Offshore oil/gas/wind maintenance technician	Apprenticeship, BTEC, NVQ/SVQ	Offshore wind technology	Offshore maintenance technician
Aerospace Technician	Apprenticeship, BTEC, NVQ/SVQ	Technology-specific knowledge	Wind turbine technician
Architect	Undergraduate or Master's degree; work experience	Energy efficiency and zero-carbon knowledge	Zero-carbon Architect
City Trader	Undergraduate	Carbon literacy; Understanding of carbon trading	Carbon trader

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		schemes	
Facilities Manager	No specific qualifications	Sustainability and energy management issues	Low carbon facilities manager

The IPPR's research identified a number of problems with existing skills policy with respect to the above:

1. The focus on employer demand can be problematic when it comes to low carbon skills because it can be difficult for employers to identify future skill needs. This concurs with the ProEnviro evidence.
2. Funding for adult skills is often inflexible and does not always respond to employers' needs
3. Skills funding, especially in England, is spread across the economy, with little attempt to target support where it can have the greatest impact.

Thus, an employer-led skills system in the context of the transition to a LCE is found to be deficient. The IPPR recommends that there is a need for government to play a more active role in setting the direction. This increased activism should include developing national skills strategies which reflect the specific priorities for economic development of each of the four nations of the UK (again, it should be noted here that the Coalition Government has stated that it will be moving away from such intervention and will be abolishing central planning and targets in the skills system); ensuring that a central agency, such as the UKCES, has oversight of emerging and fu-

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ture skills needs (as recommended by the Environmental Audit Committee), and is responsible for ensuring that these are reflected in the commissioning process for workplace training; and a greater responsibility among SSCs for delivering cross-sector skills, including the skills that all workers and employers will need to transform their workplaces into LC workplaces.

The report also recommends that public subsidies for workplace training should reflect broad strategic economic priorities rather than being spread evenly across all sectors, as is currently the case. A more flexible and relevant system of subsidies for training is also needed, including funding to ‘top up’ core skills, targeted at small businesses, and funding for LC re-skilling.

Finally, employers need a stable and significant demand for LC skills before they will invest in training or articulate a demand for publicly-subsidised training. A credible routemap for the low carbon transition would help. Public procurement should also be used to stimulate demand for LC skills (identified in the previous Government’s LCREE skills consultation).

3.3 The Aldersgate Group

The Aldersgate Group (2009a) also undertook an analysis of the skill sets that will be required in a green economy. They considered that there would be a particular need for communications skills and education in STEM subjects for qualified engineers, craft technicians across disciplines, project managers and employees at all levels.

The Group found that, although some entirely new jobs will be created requiring special training arrangements, in many jobs there are similarities between existing and

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low carbon skill sets. They recommended that more rapid progress could be achieved in developing training courses to enhance current skills and ensure that existing employees are not left behind by newly qualified (i.e. the upskilling and re-skilling of the existing workforce are important areas for policy and action.

According to the Aldersgate Group, the current government classification for a 'green job' is ill defined and will become increasingly irrelevant as the low carbon transformation develops. They feel that 'new green jobs' do not recognise the Government's ambition to transform the whole economy so that, over time, almost every occupation could be described as 'green'. The Aldersgate Group believes that there is little advantage in arguing whether a particular job is 'green'; the aim should be to accomplish a transition that brings widespread economic and social benefits.

Key Aldersgate recommendations include:

- All major environmental policies (like the CRC) should be accompanied by a skills strategy.
- Sufficient investment for training should be provided, especially for the enhancement of existing skills, rather than the creation of new ones.
- Training institutions need strategic leadership to ensure all sectors of the economy have their skills developed in generic issues such as: environmental skills, resource efficiency, energy efficiency and dematerialisation of products.
- The Government should mobilise business engagement by providing initial funding to alter long-term business practices and support in-house training programmes.
- As with the recommendations from other pieces of research, it is proposed that public procurement could have a substantial impact on the growth of envi-

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ronmental markets, therefore, effective sustainable procurement skills and policies must be developed.

The Aldersgate Group also recommend active government and supply side interventions, so as to help the low-carbon transition through the provision of supporting infrastructure in finance, skills and resource efficiency, the reduction of risk in low carbon investment risk through the provision of government guarantees, the mobilisation of private sector capital flows and the setting up a Green Infrastructure Bank. These recommendations were echoed in a separate report by the Group looking specifically at the financing of low carbon initiatives (2009b).

The active skills policy advocated by the Group need to include both top-down and bottom-up approaches, aimed at developing:

- new and enhanced existing skill sets in the environmental sector,
- resource efficiency skills across the economy, and
- higher level skills to adapt to new technologies and business models.
- Generic sustainability skills should be required training in every profession, including champions responsible for driving through reform and engaging the workforce.

Fundamental and existing skills should incorporate additional knowledge and techniques to be relevant to emerging skill requirements. Funding must match the real life needs of businesses and their employees, designing shorter courses to build on existing skill sets, new 'add-on' modules for adult apprentices and creation of regional centres of excellence to provide training (as proposed by the ProEnviro report).

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The Group highlighted how Government policy drives environmental markets which in turn, affects the demand for low carbon skills in the UK. Government should also mobilise businesses to engage with environmental issues and low carbon skills, subsidise initial training programmes and adopt best practice. In addition, the Group recognises that businesses, trade unions and civil society have a key role to play in addressing sustainability issues and taking advantage of emerging opportunities.

3.4. The Windsor Group (2008) 'Skills for a Sustainable Future'

The 2008 Windsor Consultation on 'Skills for a Sustainable Future' convened by DIUS, and involving a number of prominent employers, concluded that:

- there is clear need for new skills in order to allow UK industry to capture market opportunities through developing sustainable solutions and new technologies;
- environmental skills responses have focused on modifying existing education and training provision by adding green considerations as an afterthought;
- 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;
- 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.

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3.5. The Sector Skills Councils Low Carbon Cluster Report

More recently, a grouping of SSCs have produced a cluster report on low carbon (Low Carbon Cluster, 2009). The report is the product of collaboration between 11 SSCs and one statutory industry training body that, between them, are responsible for much of the low carbon cluster. The partners involved were Lantra, Cogent, SEMTA, GoSkills, SummitSkills, ProSkills, Skills for Logistics, Asset Skills, EU Skills, ECITB, SkillFast UK and Construction UK.

The report includes:

1. An overview of the strategic context and drivers behind the development of low carbon industries.
2. The current skills issues facing the development of low carbon industries.
3. The anticipated future skills demand and supply issues, including the identification of skills mismatches.

The context for the report is that, internationally, the global market for low carbon and environment goods and services is already worth an estimated £3 trillion annually. This is forecast to grow by almost 50% to £4.3 trillion between now and 2015. This report concludes that the rapid growth offers UK firms a significant opportunity to gain access to new markets for their goods and services, and in so doing support highly paid 'green' jobs in manufacturing and services in the UK.

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The potential of the green agenda to support new jobs is already apparent, with an estimated 880,000 people in the UK already working directly in the low carbon cluster and its supply chain. This growth is also forecast to continue, with the UK low carbon environmental goods and services market predicted to grow by over 4% per annum up to 2014/15.

The report looks at the drivers of change, which include:

- Legally binding targets;
- De-coupling economic growth from emissions;
- The 'green' economic potential;
- First mover advantage;
- Greater energy security;
- Resource efficiency;
- Correcting market failure;
- Low carbon economic areas;
- New industrial activism; and
- Emerging and nascent technologies.

The Cluster Report also sets out, in relation to eighteen individual sectors of the economy, associated with the transformation to low carbon, the factors driving the demand for skills both now and in the future; the extent to which the supply of skills meets current demand; and likely future demand. The report covers decarbonising the power industry (large-scale renewable power generation, development of new nuclear energy capacity, energy from waste and carbon capture and retrofitting carbon capture); decarbonising industry (improved energy efficiency, reduced emissions and waste, the use of alternative fuels, low carbon processing) and decarbonising the transport sector (low carbon , fuel efficiency, air traffic management, hybrid vehi-

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cles); and decarbonising buildings (retrofitting existing buildings for energy efficiency, zero-carbon buildings).

The section on decarbonising industry is of most relevance for the purposes of this report. This is split into sub-sections, and includes an identification of the key skills challenges for improving energy efficiency and the reduction of emissions and waste within industry.

In this section, a key challenge identified is the need to develop skills in the manufacturing of instrumentation for measuring, monitoring and controlling emission and waste generation. In addition to the skills needed to implement efficient waste disposal, most modern manufacturing industries will need to develop the design and manufacturing processes to make material and energy use more efficient, minimise waste and reduce the time taken to get a new product from the design stage through to manufacture and sale. The need for technical skills such as mathematical modelling, rapid prototyping and computer simulation which take into account the sustainability agenda is a growing area for development.

It is likely that graduates of the future will need some multi-disciplinary understanding of a range of high-level skills, from high temperature metal processing to chemical manufacturing, and also roles may emerge for people with a background and understanding of alternative sources of power generation such as battery and low carbon fuels.

Low carbon practices are being built into the industrial process, but it takes detailed knowledge of processes, products and materials to achieve this. This means current skills needs tend to be at higher levels, specifically around: management and leader-

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ship; process control and improvement; materials, supply chain, and product design. These will require higher-level STEM skills, in particular knowledge of materials, mechanics, and engineering.

4 Conclusions

This report has reviewed the major pieces of environmental legislation, strategy and policy in place in the UK. Any explicit implications for green skills emanating from these prescriptions were identified. Subsequently, the report outlined the strategies and policies that have been launched with the specific aim of creating green jobs and cultivating green skills. The green skills for green jobs has been increasingly emphasised in recent years. This emphasis is being impelled both by the growing raft of environmental legislation, aimed at effecting the transition to a low carbon, resource efficient economy, as well as the green fiscal stimulus, initiated by way of response to the economic crisis and viewed as a mechanism for boosting economic growth, jobs and skills.

The green skills agenda was given heightened attention through the 2010 Government Consultation. The consultation was issued so as to seek views on:

- the priorities, challenges and gaps identified by the Government;
- on how businesses can best be incentivised and encouraged to respond so that they have the skills they need at all levels; and
- on how the education and skills system can respond so that it is strongly focused on the needs articulated by businesses.

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The original intention was to use the findings to develop a specific and explicitly articulated green skills strategy. However, the change of Government in May 2010 has meant that such plans appear to have been stalled. DECC issued a response to the consultation in October 2010 and states that the response is to be seen in the context of the Coalition Government's 'Skills for Sustainable Development Strategy.' It should be noted that, despite its title, there is only one explicit reference to the development of low carbon skills within the strategy document. The strategy, launched in November 2010, sets out the Government's strategy for radical reform of the skills system (BIS, 2010a). The proposals should be placed in context of a 25% reduction in the FE budget (BIS, 2010b). Principally, the Government intends to expand the numbers of adult Apprenticeships available by 2014-15, by up to 75,000, as well as make qualitative improvements to the apprenticeship programme. The demand-led system is to be given a further boost, when centralised planning and targets within the skills system are abolished.

The increased focus on a demand-led skills system runs counter to recommendations made in a series of research reports conducted by a number of influential bodies, reviewed above. A number of cross-cutting themes were identified, namely:

- The problems of reskilling associated with an ageing workforce.
- The need for increased promotion and uptake of STEM subjects.
- The need for general management and leadership skills, a common deficiency across UK organisations (Bird and Lawton, 2009).
- The role of government procurement in encouraging low carbon and resource efficiency.
- The need to 'green' existing jobs, rather than focus on the creation of completely new jobs with radically different skill sets.

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- Latent demand from employers, which is, however, not being clearly articulated. The current skills delivery system (being demand-led) is thus deemed ill-equipped to anticipate and respond (e.g. ProEnviro, 2009).

This final point is reiterated by all these bodies, which is highly significant in light of current Government plans to remove active state interventions and supply side initiatives. It can be inferred that this might prove detrimental to the incipient green skills agenda.

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