

Skills for a Low Carbon Economy



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Executive Summary

New jobs in low carbon products and services offer an important route out of recession. Large scale investment and employment creation in low carbon technology is essential if the Government's goals for carbon emission reductions are to be met and the UK is to play its part in stabilising the global climate.

Many commentators assume that such job creation is unproblematic, requiring only sufficient Government will to pull the right policy levers to make or incentivise the investment. Our analysis is different and focuses more on the human capital for systemic change. A low carbon economy will require changes in skills, knowledge and attitudes across a broad range of occupations. Re-skilling is therefore central to the project, not a minor detail. The twin urgent crises of the economy and the environment will only be addressed if the Government's commitment to prioritising education is renewed and refocused on the needs of a low carbon society.

Most attention to low carbon skills has been focussed on the science and technology of new low carbon technologies. These are important, but can be addressed relatively easily within the higher education sector and in high technology companies. There are three greater challenges.

Firstly, a low carbon infrastructure has implications for technical skills across the construction sector, particularly in building refurbishment, as well as in building management. A much greater emphasis is needed on providing the knowledge and upgrading the skills of this broad range of skilled workers.

Secondly, a transition to low carbon will involve a sustained change to integrate climate and energy awareness into decision making across business and the public sector. Despite the growth in public interest in climate change, most leaders and managers do not understand its implications for their own long term activities. Neither do their day to day support networks, for example in trade associations, finance and business advice.

Thirdly, there is an urgent need to create demand for these new skills. There is already evidence that skills training is not occurring at the required pace where there is a perception that the demand is not forthcoming. It will be sensible to concentrate on areas where existing Government plans have tough targets that require major investment, i.e. in low energy buildings, wind, biomass and waste management.

Clarity of goals is essential to provide certainty for skills investment, but probably insufficient. In all these areas direct public investment, with a provision that appropriate skills are in place or developed, can kick start the development in skills that is needed in the wider economy.

We examine the need for skills in four priority areas – low carbon buildings, wind energy, biomass and waste management. Whilst the sectors differ significantly, there is a common theme. The priority needs to be on technical skills development amongst skilled and semi-skilled workers, rather than the professions that are making progress on low carbon economy skills. The skills needs are geographically widely scattered, but predominantly in non professional occupations. There needs to be a clear link to the Government’s focus on education, but with a priority for practical skills – “lifelong learning for a low carbon economy”.

We recommend that:

1. Business Link advisors should be trained to identify carbon and natural resource management as an issue for all businesses and managers.
2. Government should ensure carbon literacy training for all senior civil servants and senior managers in the public sector.
3. For all targets within the broad agenda of the low carbon economy, Government and the Sector Skills Councils (SSCs) should systematically identify the employment and skills required.
4. The Construction and Summit Sector Skills Councils need to accept the centrality of low carbon buildings (new and refurbished) to the future skills agenda, review existing training in this context and incorporate low carbon refurbishment into the Sector Skills Agreements and National Occupation Standards across their sectors.
5. Communities and Local Government should ensure that all refurbishment contracts for social housing will only be open to contractors accredited to an approved low carbon building skills standard.
6. The Technology Strategy Board funded demonstration programmes recently announced should be used to develop low carbon refurbishment management skills.
7. Government plans to expand apprenticeships should include the technical skills required for a low carbon economy, which will be key growth areas for employment.
8. Further Education College courses in land management should give a higher priority to the biomass sector.
9. The Government and Local Authorities should develop a strategy for improving the skills and status of waste management operatives who act as the key interface with the public in developing a sustainable waste sector.

1. Introduction

The concept of a “Green New Deal” is now accepted wisdom across much of the political spectrum. It is clear that the scale of investment required in low carbon technology to stabilise the global greenhouse gas emissions is substantial. The Secretariat of the United Nations Framework Committee on Climate Change has estimated that \$350 billion annually will be needed globally¹ and the International Energy Agency has made similar estimates for the energy sector². They agree that, contrary to what many people envisage, the majority of this investment will be in buildings, vehicles and industry rather than upstream energy infrastructure.

If the UK is to be a world leader it will need to invest more than £10 billion annually, approximately 1% of GDP as recommended by The Stern Review³. The pressure to make clear the sources and mechanisms will increase as we approach the key decision point of Copenhagen in December 2009.

This analysis was valid before the economic downturn began, but the new economic situation adds urgency. It is unthinkable that any economic recovery should be based on the type of resource intensive activity that led to the global commodity crunch that triggered the financial crisis. New jobs will need to be in low carbon products and services. The low carbon economy therefore offers a key element of the route out of recession. Large scale investment in low carbon technology and services is essential if the Government’s goals for carbon emissions reductions are to be met.

The employment creation of such investment will be substantial. Estimates vary depending upon assumptions about elasticity of demand for employment, secondary effects, impacts on trade and other factors. We do not review those here. We simply note that most studies find that low carbon investment generates employment at approximately £30,000 to £50,000 per job year⁴, implying £10 billion annually is associated with 200,000 to 300,000 jobs.

Many commentators assume that such job creation is unproblematic, requiring only sufficient Government commitment to pull the right policy levers to make or incentivise the investment. The clarion call for a Green New Deal by the New Economics Foundation⁵ is a good example. We broadly agree with their

¹ UN Framework Convention on Climate Change Secretariat. Investment and Financial Flows to Address Climate Change. http://unfccc.int/resource/docs/publications/financial_flows.pdf

² International Energy Agency. Energy Technology Perspectives – Scenarios and Strategies to 2050. <http://www.iea.org/Textbase/techno/etp/index.asp>

³ HM Treasury. Stern review on the Economics of Climate Change. http://www.hm-treasury.gov.uk/sternreview_index.htm

⁴ Association for the Conservation of Energy. National and Local Employment Effects of Energy Efficiency Investment Programmes [http://www.ukace.org/publications/ACE_Research_%282000-04%29 - National and Local Employment Impacts of Energy Efficiency Investment Programmes %5BVolume 1 Summary Report%5Dhttp://www.ukace.org/index.php?option=com_content&task=view&id=219&Itemid=45](http://www.ukace.org/publications/ACE_Research_%282000-04%29_-_National_and_Local_Employment_Impacts_of_Energy_Efficiency_Investment_Programmes_%5BVolume_1_Summary_Report%5Dhttp://www.ukace.org/index.php?option=com_content&task=view&id=219&Itemid=45)

⁵ New Economics Foundation. A Green New Deal. http://www.neweconomics.org/gen/z_sys_publicationdetail.aspx?pid=258

objectives, but believe that the process not so straightforward. Our analysis is different in that it focuses more on the human capital for systemic change.

2. Skills and Training Priorities

A low carbon economy will require changes in skills, knowledge and attitudes across a broad range of occupations. Re-skilling is therefore central to the project, not a consequential minor detail. In this sense, the twin challenges of the urgent crisis in investment in the economy and the longer term (but increasingly urgent) restructuring to low carbon are challenges for education, training and skills. So they can only be addressed effectively by a government committed to prioritising education. This needs to be renewed, but also refocused on the needs of a low carbon society, i.e. that it is a lifelong learning challenge that will need to include a broad range of skilled and semi-skilled workers and not just an elite of low carbon professionals.

Most attention to low carbon skills has been focussed on the science and technology of new low carbon technologies. These are important, but can be addressed within the higher education sector and in high technology companies. The last ten years has seen a proliferation of postgraduate courses in areas such as environmental technology and renewable energy. They attract committed, intelligent students who will provide the leaders of the next generation of technologists and entrepreneurs. Almost by definition, these people are not the problem. There are some current shortages, but the key problems in re-skilling the workforce lie elsewhere.

We see three greater challenges:

- **Technical skills** for the broader workforce - in occupations where change to work practices is needed to deliver a low carbon economy.
- **Management knowledge and attitudes** to climate and low carbon across business and the public sector.
- Creating the **demand for low carbon skills** that generates the support for training.

2.1 Technical skills

A low carbon economy has implications for technical skills across much of the existing economy. It is **not** just a case of introducing a few new specialist 'green technologies'; buildings, vehicles, farms, waste and water management will all be significantly different, and therefore there are implications for hundreds of thousands of workers involved in constructing, maintaining and repairing this infrastructure. In many case wholesale re-skilling is not the objective. What is required is an understanding that low carbon approaches are inevitable, a

knowledge of what this implies and application of existing skills to the new agenda.

In the buildings sector alone, a move to low carbon refurbishment will fundamentally affect the work of insulation contractors and gas engineers, but will also need some changes in practice for general builders, plasterers, glaziers, carpenters, roofing contractors and plumbers, as well as the architects, surveyors, site managers, college lecturers and builders merchants who design and control their work processes.

Within the Sector Skills Councils (SSC), low carbon is therefore not just an issue for the Energy and Utility SSC, but will need fundamental changes in the work of the Construction and Summit SSCs. Currently neither the Sector Skills Agreements (SSA) nor the National Occupational Standards (NOS) place much emphasis on low carbon buildings, despite the centrality of this issue to the Government's goals. A complete review of all SSA and NOS will clearly take time, so it is a high priority that this work begins now.

2.2 Management attitudes and knowledge

The transition to a low carbon economy affects not only those technicians whose work directly affects energy infrastructure, but also everyone whose decisions affect energy use. As this includes energy use in buildings, transport, food and waste it includes almost every decision maker in the economy. So there is a need to integrate climate and energy awareness into decision making across business and the public sector. Every manager needs to be carbon literate and carbon aware; and every organisational leader needs to understand the importance of this agenda.

Despite the growth in public interest in climate change, most leaders and managers do not understand its implications for their own long term activities. There are some counter-examples in with high energy bills and/or high profile organisations CSR commitments, but these remain a small minority. The proper management of financial and human resources is widely recognised to be important; natural resource management needs the same status.

Securing such a far reaching change will not be easy. Training the trainers is probably the best place to start, recognising the role of trade bodies, professional associations, financial advisor, human resource professional and business advisors. Much of these lie outside the direct control of Government, but that does not mean Government has no influence. Services that are controlled or supported by Government (e.g. Business Link) should be trained to identify carbon and natural resource management as an issue for all businesses and managers. And Government should take a lead, for example by ensuring carbon literacy training for all senior civil servants.

2.3 Demand for low carbon skills

Training in both of the categories outline above will not take place without a firm belief that it is relevant, both amongst employers and the individuals receiving training. There is an urgent need to create demand for low carbon knowledge and skills, outside the (largely young and professional) groups where it already exists. Government exhortation to re-skill can only do so much, the reality of market demand is much stronger and the SSCs (rightly in our view) place emphasis on the perceived needs of employers.

There is currently a disconnect between some of the very ambitious goals of policy and the rate of investment and already evidence that one of the constraints is that skills training is not occurring at the required pace, because there is a perception that the demand is not sufficient. This does not mean Government is powerless; indeed it is the key agent of change in two ways.

Government targets set the envelope within which changes of the economy will take place. There are already ambitious targets in place. In addition to the overall CO₂ target, the targets for low energy buildings, renewable energy and landfill reduction imply major investments and employment opportunities. But in some of these cases there is a disconnect with the current skills agenda. Government, through the SSCs needs to put in place detailed assessments of the employment and skills required to deliver these targets and to fund or require the relevant training. There are good examples of where this has worked (see Annex 1 “Training gas engineers for condensing boilers”) which provide lessons for the future

Government, nationally or locally, has direct control or influence over some low carbon investment, for example in public buildings, social housing and waste collection. In many cases these markets are sufficiently large to provide a niche in which low carbon skills training can begin. Direct public investment, with a provision that appropriate skills are in place or developed, can kick start the development in skills that is needed in the wider economy.

It will be sensible to concentrate on areas where existing Government plans have tough targets that require major investment, e.g. in low energy buildings, biomass and waste management. The following sections set out a broad approach that could be taken in each of these areas.

3. Key sectors

3.1 *Low energy buildings*

The Government has set out ambitious plans for low energy buildings – notably for all new homes to be zero carbon by 2016 and non-domestic buildings by 2019. These are extremely challenging, but in many ways only the first step towards a low carbon building sector. In any year, new build comprises about 1% of the total stock – the bigger goal is to retrofit the existing building stock to low carbon standards. The implications for skills are very substantial. Whilst the majority of new building is undertaken by specialist companies, notably the major housebuilders, building retrofit is undertaken by a much wider range of actors, mostly SMEs and sole traders, many within single trades such as electricians or plumbers, but also with a substantial component in the informal economy and DIY.

Current policy on building energy efficiency has rightly emphasised a focus on highly cost effective improvements – roof and cavity wall insulation, double glazing, high efficiency boilers and fluorescent lighting. Much of this work has been undertaken by specialist contractors – the obvious exception being boiler replacement which required a significant training programme (see Annex). The next steps towards a very low carbon building stock will be more complex, involving insulation of solid walls (internally or externally), increasing building air-tightness, innovative heating systems (micro-CHP and heat pumps) and roof mounted renewable energy systems (solar water heating, photovoltaics and micro-wind).

In total, building retrofit is a huge industry, exceeding £25 billion annually just for homes. Estimates of the cost of retrofitting buildings to very high energy standards vary but are probably in the region of £400M over 40 years. The implication is that this does not require a massive change in the scale of the industry, but rather a reorientation so that energy efficient and low carbon solutions become part of the wider refurbishment agenda. In practice, delivering low carbon at a reasonable cost will require this approach – floor insulation is most sensible when a floor is replaced, internal wall insulation when a room is redecorated and roof-top renewables when a roof is renewed.

There are skills implications for most buildings trades. Heating engineers and electricians will need the skills to fit entirely new equipment. But plumbers and general builders will need to understand the importance of air-tight building and avoided thermal bridges. Perhaps most, importantly, there may need to be an entirely new skill set of ‘low carbon retrofit building manager’ – someone who can provide a coherent and costed plan to take a house to low carbon, given the constraints of building form, cost, occupancy etc.

Social housing has a key role to play in providing a market in which these skills can begin to be developed. For example if CLG were to announce that all refurbishment contracts for social housing would only be open to contractors accredited to an approved low carbon building skills standard that would provide an huge incentive to develop and roll out a skills programme. Critically, the more complex skill set for low carbon refurbishment management are only likely to be developed in the large scale programme that this sector is uniquely placed to commission. The Technology Strategy Board funded demonstration programmes recently announced should form an initial plank of this policy.

3.2 Wind Energy

Employment in the UK wind energy sector is currently estimated to be 4,000, (according to BWEA) which is small compared to the estimates of 20,000 in Denmark, 30,000 in Spain and 80,000 in Germany. For total employment, much of course rests on the effectiveness of industrial support schemes, which are outside the scope of this report. The UK wind sector currently focuses on parts and assembly, rather having than a complete manufacturing capability. There is good reason to believe this will change if global manufacturers see the prospect of a strong and sustained market in the UK. There is scope to raise the size of the sector to more than 50,000 jobs by 2020⁶.

However, even at the scale of the current industry, skills shortages are reported, particularly for project managers and engineers. The industry expects this to remain a significant constraint in the short term. For the longer term, the wind sector itself has identified the types of skills that are likely to be required⁷ and is more optimistic that higher rates of professional training in Higher Education will deliver the highest levels of skill needed. At technician level, the future depends critically on plans to increase the total number of apprenticeships, although there should also be increased provision of specific courses at diploma level.

3.3 Biomass

Growing and using biomass may seem straightforward but the economics are currently fragile. The key barrier to developing a successful biomass sector is building supply chains that give both suppliers and users commercial security. This already forms the focus of much Government support, e.g. in supporting both biomass planting and wood combustion. However, there are skills issues that need to be addressed, in particular in ensuring that producers, and potential producers, understand the market opportunities.

⁶ Bain and Co. A Closer look at the development of wind, wave and tidal energy in the UK. http://www.bwea.com/pdf/publications/Bain%20Brief_Wind%20Energy%202008_FINAL.pdf

⁷ SQW Energy. Today's investment, tomorrow's asset. <http://www.bwea.com/pdf/publications/BWEA%20Skills%20Report%20FINAL%2016oct.pdf>

Within producers, the skills needed fall into three main categories: business and marketing skills, crop management and harvesting and processing. In each case the focus needs to be on practical farm level skills rather than advanced technology.

Business and marketing skills

The sector is very under developed and there is little knowledge of what kind of biomass the market needs, what areas of the market are likely to grow in the future and how to ensure a secure income in a context where the market is uncertain. There needs to be a focus on identifying funding opportunities, option evaluation and general 'biomass producer' skills including insurance, land rental and environmental monitoring. Supporting FE college provision in this area this area is likely to be the best route forward as courses in business and marketing skills for land based industries are already well established.

Crop management

Experience of appropriate crops for UK climates and soils is under developed. The potential range of biomass crops and other resources includes short rotation coppice (willow and poplar), miscanthus and wastes and residues from agricultural, commercial municipal wastes. Crop planting, species selection, thinning regimes, yield management, pest and disease management and water management are all relevant skills.

Harvesting and processing

Harvesting and processing needs to be done in a context of the market, product and end user needs. Relevant skills include, machinery selection e.g. knowledge of appropriate chipper types, knowledge of safe and efficient harvesting operations (and wider health and safety issues), log production, pellet specification, awareness of current chip standards and maintaining chip quality and consistency, drying methods, storage options, moisture testing screening and sorting techniques and transport options.

3.4 Waste management

The waste management industry has always needed a wide range of skills, from chemical engineering to basic customer care skills at recycling centres, to ensure it operates effectively. The industry has been driven by a range of regulations and EU directives over the past 20 years as well as more recently the introduction of the landfill tax and changing public perceptions of the role of the industry from being 'end of pipe' disposal to a key element of the resource management and climate change mitigation agenda.

In this context, the skill sets needed by those working in the sector are changing rapidly and any organisation requires a multi-disciplined workforce. Many of the new waste processes being used have been developed outside the UK. Our history of using landfill as the default waste disposal technique has led to insufficient investment in UK technologies and skills. The kinds of technical and management skills that are becoming more important and require further investment include:

- Development of new markets and products generated from waste,
- Knowledge of new processes in biotechnology,
- Skills in energy technology, as significant quantities of waste are suitable for energy generation,
- Improved marketing, communications and promotional skills to interact with the public on waste reduction, reuse and recycling,
- Better health and safety practice (waste management has the worst accident record in UK industry and new techniques risk exacerbating this without high quality training),
- Knowledge of materials separation techniques (mechanical and chemical engineering for the waste management industry).
- Financial evaluation, risk management and project management skills.

Perhaps most critically, there is a need to raise the status and skills of waste operatives who engage with the public, both on household waste sites and collection rounds. Currently, since they tend to be paid at the lowest levels, waste operatives are difficult to retain in the sector with a result that they often move to other jobs and skills are lost from waste management. The public is a lot more committed to waste reduction, recycling and composting than a decade ago. This behaviour change is arguably more impressive than changes in smoking, drink driving and seatbelt wearing, where there is clear personal benefit, but it needs constant reinforcement and support. However, further progress needs significant improvements in waste operatives skills (and probably therefore remuneration), including customer care, materials types and sorting knowledge.

4. Recommendations

1. Business Link advisors should be trained to identify carbon and natural resource management as an issue for all businesses and managers.
2. Government should ensure carbon literacy training for all senior civil servants and senior managers in the public sector.
3. For all targets within the broad agenda of the low carbon economy, Government and the SSCs should systematically identify the employment and skills required.
4. The Construction and Summit SSCs need to accept the centrality of low carbon buildings (new and refurbished) to the future skills agenda, review existing training in this context and incorporate low carbon refurbishment into the SSA and NOS across their sectors.
5. CLG should ensure that all refurbishment contracts for social housing will only be open to contractors accredited to an approved low carbon building skills standard.
6. The Technology Strategy Board funded demonstration programmes recently announced should be used to develop low carbon refurbishment management skills.
7. Government plans to expand apprenticeships should include the technical skills required for a low carbon economy, which will be key growth areas for employment.
8. FE College courses in land management should give a higher priority to the biomass sector.
9. The Government and Local Authorities should develop a strategy for improving the skills and status of waste management operatives who act as the key interface with the public in developing a sustainable waste sector.

Annex 1

Training Gas Engineers for Condensing Boilers

Gas condensing boilers with an efficiency of 86% or higher were commonly installed in European countries such the Netherlands from the 1970s, as an alternative to non-condensing boilers with an efficiency of 70-80%.

In the UK market progress was much slower. Despite the cost and carbon saving advantages, key actors in the supply chain, particularly merchants and installers were unwilling to recommend the technology. Early models had a lower reliability than conventional technology, implying the need for 'return calls'. And the technology required some additional installation work to remove liquid condensate and prevent unsightly 'pluming' of the exhaust. Both concerns were exacerbated by most gas engineers suffering inexperience of, and lack of training in, the technology. It was common householder experience to be warned off condensing boilers by sceptical installers.

Some market growth was achieved by the inclusion of gas condensing boilers as an eligible technology in the Energy Efficiency Commitment from 2002, but market share remained low until the announcement in the 2003 Energy White paper that condensing boilers (strictly speaking boilers with an efficiency exceeding 86%) would be mandatory in the majority of installations under Building Regulations from April 2005.

There was initially some concern in the industry and energy efficiency proponents this goal would not be achieved because of industry resistance. Training was identified as the key barrier. With Government support via the Energy Saving Trust a large training programme was mounted, delivered largely through Colleges of Further Education and the training facilities of the major boiler manufacturers and merchants. The training was linked to the 'competent persons' scheme of CORGI registration, i.e. the mainstream qualification route for the sector. Within 2 years, the skills and attitudes of the industry were transformed. An estimated 80,000 installers were trained, largely SMEs and sole traders. The market share of condensing boilers grew from <20% to >95%, successfully delivering huge cost, energy and carbon savings.

The lessons of the case study are widely agreed:

- Government can induce change by providing clarity of objectives and timescales
- Training is essential and can change attitudes as well as skills
- It is essential to engage the industry in delivery of training
- Training in low carbon should be considered as part of mainstream training not an optional extra.