

BIS/DECC consultation: Meeting the Low Carbon Skills Challenge

Submission by the Energy Institute

June 2010

Introduction

The Energy Institute (EI) is pleased to make the following submission to the BIS/DECC Low Carbon Skills Challenge consultation. This document is a synthesis of the views of EI members collected through a call for contributions and a stakeholder workshop chaired by Phil Willis, former Shadow Secretary of State for Education and Skills and Chair of the House of Commons Science and Technology Select Committee.

The EI is the professional body for the international energy industry. It has a membership of over 14,000 individuals and 300 organisations and provides an independent focal point for the energy community, bringing together industry, academia and Government. The EI's purpose is to develop and disseminate knowledge, skills and good practice towards a safer, more secure and sustainable energy system. In fulfilling its purpose, the EI can address a wide range of topics in detail, from upstream and downstream hydrocarbons and other primary fuels and renewables, through to power generation, transmission and distribution to sustainable development, demand side management and energy efficiency.

As a charity, incorporated by Royal Charter, with membership across the full range of the energy sectors, it is not appropriate for the EI to promote specific technologies or options. Instead, we seek to assist the policy process by helping to clarify the key issues and by improving the evidence base on which decisions will be made.

Key Recommendations

There are some clear messages the EI would like to put forward on behalf of its members relating to the subject of Low Carbon Skills as a whole. Thereafter, our comments are numbered to correspond to the questions asked. In their broadest terms, the five key points generated by the stakeholder workshop are that:

- The new Government must send out very strong signals to which industry can react. Without these signals, it will be very difficult for businesses to pick up this agenda, especially given the current economic climate. Government must lead this agenda, without dictating the answers. The stop-start nature of markets may adversely affect skills issues, and more joined-up thinking is needed to meet the long-term skills requirements of industry. Although this is a BIS/DECC consultation, it should be noted that it affects every other Government department and every policy, all of which need to be involved generally in the delivery of a low carbon resource efficient economy (LCREE) and specifically in the delivery of the skills and knowledge needed to make the transition. It requires the principles of sustainable development to be embedded in Government and into every business in the UK.

- The amount of re-skilling needed requires a quantum leap in the delivery of training. Up until now, so much training has involved a linear, or ladder based progression. The reality is that we need to re-engineer the way in which we train the workforce effectively. Government has a clear role to play in setting out an overall structure for the implementation of such a change. Existing delivery mechanisms may not be the most efficient methods and Sector Skills Councils (SSCs) in particular have been forced to focus on fundraising activities incompatible with what should be their priorities, such as ‘accreditation’ and ‘membership’ schemes at the expense of skills development and delivery.
- Collaboration and cooperation are key components to meeting the challenges we face. There is a need to share knowledge, skills and experience to ensure new developments and lessons learned are rapidly communicated across sectors and professional disciplines. We must build on peoples’ existing skills and companies’ existing expertise by fostering cross-sector structures and organisations that aim to identify skills and knowledge common to multiple areas and to adapt applications from one sector to the next.
- Consideration of planning issues is important and in particular, the effect the planning system can have on achieving a low carbon society. Local planning, spatial planning, regions and cities have an opportunity to effectively plan their energy use. The resource efficient locating of future energy supplies will need to not only demonstrate their value to the communities in which they are situated but also to compensate such communities appropriately, for example, with lower energy costs and access to employment opportunities.
- Government and industry need to take active involvement in influencing and changing behaviour. This will switch people on to careers within the low carbon economy and in particular the energy industry. **Every skill set and qualification must be developed with sustainability at its core and low carbon thinking and resource efficiency as a key component of training. This thinking should not be compartmentalised or left solely to the sectors and industries highlighted in this consultation.** Only through this holistic approach will the step change in behaviour necessary to achieve a truly low carbon resource efficient economy be achieved. Raising ‘carbon’ as an issue to inform decisions throughout peoples’ lives is as important as all the technological changes and up-skilling that is needed. There is the need to create the social environment and a need for lateral thinking. There is a perceived lack of understanding and awareness of the ‘Low Carbon Economy’ both in terms of industry and the public. This flows over into stimulating education from a very early age. These issues tend to cut across each other and be interdependent.

Additional Recommendations

The Energy Institute, in association with Deloitte and Norman Broadbent, conducted three surveys investigating the skills needs in the energy industry, first published in 2008. Following this research, several recommendations were made:

For the industry generally

- Raise the profile of the energy industry as one of the most exciting to work in to combat increasing competition from other industries for these shortage skills – the sector needs to be well presented to young people as a prime career choice.
- Re-skill and cross-train existing or new staff to combat the decline in science, technology, engineering and mathematics (STEM) skills – support for training organisations, particularly universities, is critical if those organisations are to meet industry needs on high level skills.

- Get the rewards right for engineers and technical specialists in order to combat decreasing numbers of STEM graduates choosing to enter a STEM career.
- Develop new and potential graduates at an early stage to combat lack of experienced hires for key roles in an expanding industry – employers need to be more innovative in their methods of training and development, looking for efficient and effective ways of benchmarking employees' competence and giving them the experience and support to develop those skills.

For individual energy companies

- Treat skills shortages and leadership development as strategic boardroom issues that need long term planning.
- Invest in in-house training and development programmes to upgrade skills of existing and future workforce.
- Develop strategies to manage retention of experience – even beyond retirement – and transfer of knowledge. Make a more creative use of your experienced workforce and prospective returners to combat the rapid strides towards larger scale retirement year on year.
- Engage with universities to offer technical support, student placements and allow recruits to return to university to promote the industry to future graduates.
- Make it clear to potential recruits that the energy industry as a whole offers a worthwhile and fulfilling long-term career.

For academia

- Engage closely with industry to develop and deliver qualifications that meet business needs.
- Demonstrate the 'can do' skills of your students to employers when seeking to secure work placements.
- Liaise with professional membership bodies to provide students with a head start towards professional recognition and use such bodies as sources of useful information and contacts.

Achieving the above will come down to economics. A key issue is accessing finance and skills within the finance and political communities. There is a need to make the UK an attractive place to do business in order to attract jobs/skills. STEM careers need to be seen as attractive and financially rewarding to compete with 'high flying' roles in finance, management and law.

There are two separate issues that need to be balanced: the technical challenges we face to deliver a LCREE, the skills required and ensuring both are used efficiently and effectively; and the long-term challenge of educating and involving the public, refocusing the aspirations of future generations towards STEM skill development and highlighting the opportunities of low carbon jobs.

Meeting the Low Carbon Skills Challenge

1. What more can employers, schools and Government do to promote the take up of STEM subjects by young people, and encourage them to consider careers in low carbon sectors?

1.1 There is a need to reach out to younger children to ensure that the interest in and aptitude for maths and sciences is retained and fostered at an earlier stage in their education. This relates to having high quality STEM teachers, supported by industry involvement and STEM Ambassadors. Feedback from energy professionals surveyed by the EI show that many are

interested in giving something back to the industry, through the STEMNET programme or via a mentoring programme such as that offered by the EI to its Graduate members. The onus is on industry to highlight the career opportunities available through studying STEM subjects; however, this must be incentivised by Government to ensure equal opportunities and jobs for British workers.

1.2 Employers can do much to demonstrate the value of jobs that require STEM qualifications, i.e. their value to society generally and to the individual financially. They also need to retain the links between their employees and the future generation through the support of educational initiatives such as the courses provided by Tomorrow's Engineers and others.

1.3 Programmes such as Energy Foresight are useful to establish the link between school science and the world of work in the energy industry, but they only give a glimpse of the industry's requirements and potential.

1.4 Professional bodies can play a part in this too although their efforts are again often fragmented. The EI has offered free CPD workshops to secondary STEM teachers and careers guidance staff on energy engineering and its place in the UK curriculum.

2. What more can universities, working with businesses, do to help stimulate demand for the high level STEM skills required in the low carbon economy?

2.1 It is probably not the role of universities to stimulate the demand – they are really only able to respond to such demand. However, businesses do need clear signs and indications of the direction that policy is taking in order to invest sufficiently both in the required technologies and the skills needed to deliver them. Similarly, universities need clear and timely guidance in order to react to anticipated future needs in the timescale that industry requires. There are good examples of how such interactions occur but, particularly amongst industry, there needs to be higher awareness of initiatives such as Doctoral Training Centres, Knowledge Transfer Networks and the benefit of activities provided by professional bodies.

2.2 Early exposure to the demands of industry is also helpful to students during their studies. At present around 25% of UK graduate engineers never enter engineering as a profession and the industry needs to be more proactive in promoting itself to students ideally at an early stage of their studies via their university. The EI tries to support these aims by arranging for senior industry professional members to visit universities with which the EI has have a link to give presentations on careers in the energy industry. Similarly, once EI Student members leave university, get their first jobs and become Graduate members, the EI offers them a range of free CPD workshops and discounts for events and conferences to provide them with some broad skills training and give them the opportunity to network with possible future employers.

3. How can more colleges and universities be encouraged to respond to the need for specialist skills in emerging low carbon sectors?

3.1 There needs to be stronger links between industry and the educational world in order to ensure that the highest-level skills can be transferred. This will probably require greater numbers of technical specialists from industry being able to contribute to the Higher Education and particularly the Further Education sectors, in order to disseminate such expertise effectively. When businesses have more immediate pressures of development and delivery internally, this is the part of the skills supply chain that is perhaps most easily broken.

4. Is our overall analysis of the skills challenges, as outlined in this document, correct?

4.1 The workforce of 2020 will need a level of flexibility that can be achieved through a strong generic STEM skills platform, as suggested in the consultation. Core STEM teaching and learning is critical to developing the right skills, as is demonstrating the career value of STEM

qualifications. EI members are seeing a lack of flexibility from new graduates to move away from their specific discipline. The EI supports the strong focus placed by the consultation on increasing the numbers of skilled technician level employees, including maintenance staff. This was a point made by several EI members, with agreement that modern working apprenticeship schemes need to be focused at the right industries, a point highlighted throughout this consultation response.

4.2 The concept of Low Carbon needs to be embedded in everyday jobs through communication and training. A sustainability module should be included in every course and every basic training/education module in the same way that health and safety considerations have been incorporated generically into a wide range of job roles.

4.3 One contributor working within emerging new technologies for sustainable development said, "There is definitely a lack of understanding as to how new processes and technologies relate to sustainable development and the lowest carbon option is not always the most sustainable. Schools, colleges and universities need to be better equipped, i.e. the teachers need to be better educated in sustainable development and this should be incorporated into design and technology, science and degree level engineering and science programmes, including construction."

4.4 Government support for training must be flexible enough to allow new technologies to be supported as well as the trusted incumbent technologies. Support for R&D and knowledge networks should continue as well as support for apprenticeships, part-time working (as this allows more people into the sector) and support for SMEs in training staff further to cope with anticipated changes in the market place.

5. What are the best ways to replicate the examples of good practice provided throughout this document quickly and effectively?

5.1 To replicate these initiatives, case studies and details of their funding/support structure should be recorded, collated and made available in order to be disseminated as widely as possible. The issues and solutions will often be regional or sector specific and organisations involved in skills delivery may need to adapt or merge two or more good practice examples in order to suit the particular industry or situation.

5.2 The EI runs technical training courses, developing skills and knowledge in specialist areas of expertise as well as specialist technical workshops for lab technicians in order to increase knowledge of particular techniques or develop particular skill sets.

5.3 Student and/or employee exchanges between countries bring significant developments in knowledge on both sides.

6. Is stimulating innovation in skills development and delivery the best way forward?

6.1 Attracting students into degree courses is not going to be a successful strategy if in four years' time there are no jobs. This is the greatest problem - when there are no jobs and no confidence, we need people to join the engineering profession - when there is a shortage of jobs we need to deter them, often to the detriment of the later time when they will be required again.

6.2 The opportunities available in the energy, environment, material, sustainable resource management and low carbon industries needs to be highlighted to young people, new graduates, and those looking for a change in career. Taking the energy industry as an example, the message needs to be put across that this is not limited to those with a technical or scientific background, but also relies on marketing executives, financial analysts, human resource professionals, etc. This is the case for all similar industries within a LCREE.

6.3 What is needed is innovation in the methods and resources used to recruit individuals to work in a LCREE as well as the methods for development and delivery of skills. However, care

should be taken by the education system not to introduce too great a level of complexity and number of different qualifications too early on in career development. The workforce should be multi-skilled with strong foundations in core subjects and a broad knowledge. The low carbon sector is still in its infancy and we have to accept the technologies needed to implement the transition to a low carbon economy will be subject to change. However, they will continue to be based on fundamental scientific and engineering principles and it is grounding in these that allow the workforce to develop both specialist and innovative skills at a later stage of their development.

Decarbonising the Power Industry

7. How should employers and Government plan for the future re-deployment of skilled workers from high carbon industries to low carbon industries, and ensure a just transition?

7.1 Training and professional development is an integral part of a career in the energy sector. In response to an Ipsos Mori survey, commissioned by the EI in 2008 to seek the views of energy professionals, it was established that many respondents have not only taken short training courses, but also committed time and energy to finishing an online course or part-time university degree. The results suggest that many employers are supportive of these efforts, often picking up the costs of training.

7.2 As stated in the consultation document, by 2024, 80% of today's power industry workforce will have reached retirement age. Government, industry and individuals must be made aware of the continuing need for specialist skills within the high carbon industry. The training these specialists receive should include provision for the broad technical and engineering skills needed to allow for a flexible workforce, able to make the transition to a LCREE. Government has a role to play to help make links between education and industry, to identify existing skills and any knowledge gaps. Identification of existing skills, at a time of volatile demographic change, is a major challenge before identifying the required new skills.

7.3 The competition for skills across the low carbon sector (as well as from existing high carbon industries) needs to be recognised and understood. It is unlikely companies will be encouraged to invest in skills and training if employees consistently move elsewhere to continue their careers. Steps should be taken to appeal to those leaving other sectors and facilitate their rapid redeployment e.g. public sector workers.

7.4 One large supplier (EDF) is developing two state of the art campuses to develop the skills of all employees: one will promote nuclear professionalism and create opportunities for existing and future engineers; the other will bring together employees and the communities in which they work. This approach to learning is designed to break down the barriers between different parts of the business, making more use of transferable skills to deliver low carbon power. We believe this to be a useful model that should be encouraged and adopted more widely.

8. For the power sector skills we have identified, what is the best way to accelerate skills development beyond what is planned?

8.1 Investment in the further education and adult learning sector is critical - transferable skills should be encouraged, with training common to different companies and industries. Organisations within the power sector have a role to play to better identify and coordinate training and skills development, promoting campaigns to raise the visibility of engineering and technical qualifications. Industry should be encouraged to work with training providers to further support professional development of existing staff, through alternative forms of training such as mentor schemes, sandwich courses and summer placements as well as through sponsorship of university places, careers talks from industry leaders and schools programmes. Professional bodies are in a unique position to facilitate the much-needed discussion on future skills requirements, providing a link between universities, further education providers and industry.

9. What more can be done, both within the power industry, and through Government energy policy, to promote energy-related careers to young people?

9.1 There is a need to define core 'energy' skills to help define both the energy professional and the engineer. Investment is needed to raise the profile of the opportunities of studying STEM subjects, whilst highlighting the benefits of a career in the energy industry. This should start at primary level and be encouraged through secondary and tertiary education. The accessibility and quality of vocational schemes for 14-19 year olds and further education should also be expanded. Schemes such as the Energy Foresight teacher-training programme can be highlighted as examples of good, collaborative practice.

9.2 There is a perception that the energy industry, and particularly power generation, is a low tech and 'dirty' industry. All parties need to portray the industry more positively and demonstrate how crucial power generation is to our existing way of life and how it could change, through new technologies and different distribution systems, in the future.

9.3 The EI promotes the industry through its educational website Energyzone (www.energyzone.net) and by working to raise the profile of the energy professional through surveys of its membership and promotion of professional membership and registration. EI professional membership includes unique Chartered titles for Energy Manager, Energy Engineer and Petroleum Engineer as well as licences to award Chartered Engineer, Chartered Scientist and Chartered Environmentalist to its members.

9.4 EI research shows that the energy industry tends to be one that commands loyalty from its staff and that 84% are 'fairly' or 'very' satisfied with their jobs. It is an industry that offers good job prospects – over three-quarters of them have changed their job role since joining the industry. 83% believe that their work is personally fulfilling and 82% believe that the public has little understanding of the industry.

9.5 EI research also shows that in this male dominated industry (less than one in 10 are women), men are more likely to be engaged in all types of training and professional development. Specific effort should be made to promote careers in energy to diversify the future workforce.

10. How can we stimulate the demand for the skills required to meet the carbon capture and storage (CCS) market opportunity, including a range of skills; from advanced R&D skills, to crafts and technical skills?

10.1 There is still the need for certainty from Government to escalate take up of CCS requirements by companies and for sufficient skills investment to take place. CCS is based on existing technologies and should not be identified as a new sector, rather considered an extension to the power generation industry, following the example of SO_x and NO_x recovery operations. Most of the skills already exist and are readily transferable. The facilitation of CCS skills development at levels 3 and 4 should be considered within the remit of existing organisations, rather than a separate entity being formed.

10.2 CCS does involve the use of existing skills in a new way – through integration of the whole chain of activities. This has led to previously very different traditional industry sectors forming collaborations and partnerships in order to deliver comprehensive research to demonstrate the viability of CCS technology. The Energy Institute, working in partnership with the HSE and the Carbon Capture and Storage Association (CCSA), set up a Joint Industry Project, drawing together members from the oil and gas, power generation, pipeline and industrial gases sector, along with the Health & Safety Laboratory, the Environment Agency and HSE, to set about addressing two of the key issues. The outputs from this activity are two guidance documents, both of which were published in May 2010.

10.3 One EI member highlighted the need for geology skills, particularly regarding aquifers (as opposed to depleted oil and gas fields) as it is believed that these will prove some of the most easily accessible storage locations. Currently, relatively little is known about their capacity for storing CO₂ in the same way it is understood in the oil and gas sector.

Decarbonising Buildings and Construction

11. Can the Zero Carbon Hub approach be used as a model for identifying skills needs, and stimulating demand for those skills, across the construction sector?

11.1 There is little enthusiasm for this idea amongst EI members – there are already models better placed to deliver the aims of the Hub. They are not convinced a central hub would generate new input unless the costs and benefits were sufficiently outlined to potential contributors. This used to be the Energy Efficiency Office. EI members do not believe a central national hub can disseminate the information needed across a disparate and fragmented industry. The construction and buildings industry is sub-contractor led and very fragmented, making the information dissemination goals of the Hub far too ambitious at this stage. There are other models working locally and regionally that can act as ‘mini-hubs’ to establish the specific needs of local industry, training people with the necessary skills to meet those needs and delivering newly skilled workers to the marketplace; an example of providing appropriate skills for the appropriate system.

11.2 A better method for identifying skills needs and stimulating demand for those skills would be to enforce regulation. There are regulations in place for new build and retrofit buildings that are not properly enforced. A sustained up-skilling and training programme of the buildings control workforce to include new technologies would ensure the capacity to deliver the required enforcement. This training would be self-sustaining with costs being recovered from Building Regulations Part L fines or penalties for non-compliance. Once the regulatory system is in place, industry would need to demonstrate compliance, thus requiring further investment in training and skills in a crucial sector of the low carbon economy.

13. What more should Government and industry do to ensure that those retrofitting existing buildings have the necessary skills?

13.1 Most energy savings could be made by operating buildings more efficiently. The management of new buildings will not necessarily be any better than that of older buildings until the workforce has been trained to read meters and properly interpret and report the results. **The management of buildings and the skills needed to deliver this should be at the top of the Government’s agenda.** This could be achieved through legislating for all buildings to have energy managers and up-skill people to manage them. Again, enforcement of standards will help to drive the market in the right direction.

13.2 There is an opportunity for new skills and technologies in the Built Environment e.g. the introduction of IT and utilities. More needs to be done to encourage professionals, new-entrants and re-skilling in these areas to consider the Built Environment as a career path. EI members call for an increase in the number of apprenticeships and on-the-job learning so that each industry sector can identify and meet its own needs. Government needs to help identify where the training provision for this can be met. The value of technician level qualifications should not be underestimated; there is a substantial need for different grades of technician to deliver theoretical and practical solutions.

13.3 Professional bodies and other organisations will also need to play a part. The EI sees retrofitting existing buildings, particularly in the non-domestic sector, as a key measure in meeting UK emissions targets. To this end, the EI has highlighted the skills and effectiveness of key job roles such as the Energy Manager through training and education programmes and the resulting new title of Chartered Energy Manager (approved by the Privy Council in February 2010). The EI hopes to send a clear signal to industry and Government that investment in energy efficiency is at least as important as resolving future energy supply questions in meeting the UK’s wishes for energy security and a low carbon sustainable society. The required training of everyone involved in the ownership and operation of buildings will go far beyond the Energy Manager, but the EI has begun this process by identifying the key role that holds the expertise and regulatory authority to make a substantial difference.

14. What more could be done to improve awareness of low and zero carbon regulations along construction industry supply chains to enable them to take advantage of new low carbon markets?

14.1 In terms of buildings, EI members agree that strong regulation has the potential to be the driving force to reduce carbon footprints and increase energy efficiency. The problem is that there are not the people with the relevant skills to interpret, enforce and effectively use the regulations. Similarly, there is a lack of regulators with the knowledge and skills to ensure enforcement. The point is – enforce it and it will send a strong message to clients which will drive down energy usage whilst creating jobs across the sector. The level of skills for designing projects to meet the regulation is very high; the issue comes with the delivery. There is a significant difference between the fabric of the building and its operation, with the fabric accounting for approximately only 5% of total energy use over a building's lifetime.

14.2 Display Energy Certificates (DECs) are only mandatory for public sector buildings over 1000m². DECC analysis suggested that potential savings would be too small for buildings any smaller than this. The signal this sends is enormous. DECs should be mandatory across the whole of the UK's building estate. This is where the potential savings are to be found. It is about real energy, not theoretical energy in a black box model (the Energy Performance Certification (EPC) approach). Mandating DECs, coupled with climate reduction commitments (CRCs) and other regulations, which are properly enforced will save energy. EPC for new buildings, working in conjunction with DECs still has a role to play. However, the EI believes this enhanced approach will work strongly to raise awareness of low and zero carbon regulations across the supply chain.

15. How should we capture and respond to the key skills demand and supply issues in the eco-towns projects and share lessons learnt more widely?

15.1 The role of town planning and urban regeneration professionals in the planning process should be looked at to ensure all opportunities to make the transition to a LCREE are taken. Rather than focusing on eco-towns, EI members would prefer to see good practice and eco-thinking spread around large-scale development generally. This should be brought back to a regional agenda as it is difficult to envisage a one size fits all solution. The London Plan is an excellent example of this and will provide new jobs, new skills and new learning opportunities, which can then be exported around the world.

Decarbonising the Transport Sector

16. What are the key technical disciplines involved in the transition to ultra-low carbon vehicles? How can we ensure the new skills required are met?

16.1 EI members feel that many of the skills needed to decarbonise transport are already well established. The need is to create and manage the business drivers to take sustainable travel to market. Project management skills are needed to ensure harmonisation between disciplines. Other skills requirements will include knowledge of batteries and energy storage, battery management and battery integration, as well as the design, systems integration, safety and standardisation of electricity, hydrogen and automotive fuels. Apprenticeship skills in manufacture and maintenance will be required.

17. What more do we need to do to ensure that UK companies have the skills they need to capitalise on the transition to lower carbon aviation?

17.1 This is an evolutionary industry. The significant short and medium term business opportunities, coupled with good engineering graduates and apprentices interested in the aviation industry, leave the UK aviation sector in a strong position. We will need a supply chain that can manage more complex high temperature materials and therefore more graduates with carbon and high temperature composites experience. Failure investigation for different types of composite, maintenance and repair of composite components will also be required.

18. Are the skills priorities identified for the freight and logistics sector correct? What more do we need to do to ensure employers in the freight sector have the skills they require?

18.1 Investment in integrated systems and logistics and management courses at higher degree level and CPD training is needed in order to understand the impact of operations and systems on carbon emissions accounting. Those working in the logistics arena need more information and communication system skills in order to maximise data management, manipulation and sharing opportunities.

19. What more should Government and employers do to ensure UK companies have the skills they need to capitalise on the electrification of rail and future rail projects?

19.1 Government should focus on apprenticeship qualifications, by supporting the development of new apprenticeship training, Masters and CPD courses in relevant areas such as the design, maintenance and safety of electric drive train systems as well as increasing knowledge of fuel cells and hydrogen. Universities and colleges should be encouraged to work with Japan and France and other leading countries to share best practice in training to support these relatively new technologies.

Decarbonising Supply Chains across the entire Economy

20. What more should Government and employers do to up-skill existing, and future, workers in the forestry and farming industries, in particular to support the emerging bio-energy, biomass processing and renewable heat sectors?

20.1 Fuel quality is a key consideration in biomass combustion. It will be essential that the supply chain operatives understand the issues surrounding the quality of the fuel and its impact on the combustion process:

- This will require those supplying chip to understand which chippers provide fuel quality chip
- Understanding of storage, handling and distribution of the fuel, especially for pellets
- Mechanical durability of pellets and the impacts of poor quality and fines from degradation during the blowing process can affect the operation of the system
- Understanding the European (CEN) standards for fuel quality assurance and specifications and classes of the fuels.

20.2 Biomass combustion strategies are different to other fossil fuel combustion strategies and need to be understood:

- Skills in designing and installing biomass combustion and hydraulic interfaces need to be developed
- Integration strategies with other renewable energy technologies need to be developed
- Utilisation of accumulator tanks (large water storage) need to be understood and the issues surrounding standing water, such as, legionnaires
- For low carbon homes there needs to be an understanding of low temperature systems design, such as they have in Europe, which leads to better use of heat
- There needs to be additional skill sets in community and district heating and its capabilities. This is especially so for small community schemes

- Development of the skills in designing and laying distribution network pipework is required to reduce the 30 – 50% increase in costs of installing these types of systems in the UK as compared to Europe (this has been reported in previous DECC reports).

Skills for Adapting to Climate Change

24. What will the key skills needed be, to build adaptive capacity for climate change, enabling organisations to minimise risks, and capitalise on the opportunities that climate change will bring?

24.1 An integrated approach should be taken to the shaping of the built and transport environments through collaborative working practices to deliver transferable skills that are not too specific. The fundamental skills are here but they need to be directed towards new technologies.

24.2 On top of core STEM skills, those needed will include:

- Manufacturing
- Maintenance
- Planning
- Good advocacy
- Facilities management and retrofitting of technologies
- Procurement strategies to support new markets
- Sustainable development and its relationship to low carbon
- Corporate social responsibility
- Financial understanding of energy industries
- Legal skills to ensure projects can be expedited.

Acknowledgments

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