An Analysis of Key Publications relating to Marine Energy Skills - offshore wind, wave and tide

March 2010 (updated September 2010)

Government support of the Marine Energy sector has increased substantially since Low Carbon was identified as one of the six priority sectors for development in Building Britain's Future. New Industry, New Jobs in April 2009

The UK Government has undertaken to generate 15% of UK energy from renewable sources by 2020.
Three-quarters of this green electricity capacity, approximately 34GW, is expected to come from wind with hydro, wave & tidal and solar contributing up to another 10GW
This challenging target is part of the European Union's '20-20-20' plan, concrete targets for reducing greenhouse gas emissions by 20% by 2020, raising the share of renewable energy consumption to 20% by 2020 and reducing energy consumption by 20% by 2020.

This document highlights data and discussion relating to marine energy skills (offshore wind, wave and tide) in recent UK published documents. The analysis was completed in March 2010. This September 2010 update adds key documents published in the interim.

The Analysis provides relevant excerpts from the documents, the Bibliography provides the full reference for each numbered excerpt and the link to that excerpt's document online

Browse this analysis by scrolling through the broad sub-sectors as defined in the Contents
or
Link back and forth in the document using the more specific Cross Cutting Themes

Cross Cutting Themes

Home

Click on the number to read further information. Full source details are contained in the Bibliography

Subject

Apprenticeships

66 **EU Skills** Sector Skills Agreement December 2009

…Increase the number of Apprentices to bring new people into the industry;

Forecast the skills needs for new and emerging technologies and develop National Occupational Standards(NOS) and Apprenticeships to meet demand…

74 **Global Climate Network** Creating Opportunity. Low carbon jobs in an interconnected world. Discussion paper no. 3 December 2009

…These gaps will need to be filled with a range of innovative, public academic- private training and apprenticeships partnerships, which are likely to require financial and technical support from governments…

5 **BERR / Douglas Westwood** Supply Chain Constraints on the Deployment of Renewable Electricity Technologies June 2008

…Apprenticeships are key to addressing many of the problems faced by the energy sector. A new approach is needed that includes the SMEs…

25 **British Wind Energy Association / SQW Energy** Todays investment– tomorrows asset: skills and employment in the wind wave and tidal sectors Oct 2008

…There are also ambitious plans for growth in apprenticeship numbers. Currently, the number of apprenticeships is relatively high in electro-technical and engineering. The present supply of apprentices should also be viewed against the backdrop of the Government's plans to increase the total number of apprenticeships from 10,000 to 400,000 by 2020. This will also have the potential to increase the number of entrants to the sector. In addition, a number of institutions are developing tailored course provision, such as Northumberland College's Level 3 course for technicians for wind power stations…

104 **Alliance of Sector Skills Councils** Alliance response to the consultation "Meeting the Low Carbon Skills Challenge June 2010

…The proposal to support 2,500 Apprenticeships in the emerging wind sector for 19-30 year-olds over a two-year period from September 2010 is ambitious. Employers are keen to develop a competent workforce but this will not be solely through the recruitment of Apprentices. There is a need to up-skill the existing workforce across the energy industry and funding for both apprenticeships and „top-up" modules of training to up-skills staff is needed. It would be helpful if the Wind Turbine Operations and Maintenance NVQ could be funded as a standalone qualification and not requiring a full apprenticeship programme.

FE

Bibliography

5 **BERR / Douglas Westwood** Supply Chain Constraints on the Deployment of Renewable Electricity Technologies June 2008

… the way ahead is to:

• Effectively interface with both students and staff in schools and further education…

25 **British Wind Energy Association / SQW Energy** Todays' investment– tomorrows asset: skills and employment in the wind wave and tidal sectors Oct 2008

…there is some evidence of the Further Education sector beginning to develop sector specific training.. The types of skills that the sector is likely to need over the coming decade across the value chain are well defined. It is important to recognise that the sector will need to compete in an open market to ensure that skills development resources are directed towards the needs of WWT rather than to other sectors which perhaps have a higher profile with policy makers, representative bodies, providers and

funders…

78 **Hammer Gerlinde, Röhrig Rolf** Qualification requirement analysis. Offshore wind energy industry Final report Bremerhaven/Bremen July 2005

Section on *Further Education Strategies*.

The overwhelming majority of companies questioned deal with the necessary further education of employees by…

Foundation degrees and Progression

61 **EU Skills** Foundation degree framework specification for the electrical power engineering sector Jan 2010

…The sector employs many tens of thousands of technical engineering staff. Workforce planning analysis undertaken as part of the business planning for the NSAP during 2009 has identified that across the generation (including renewables), distribution and metering industries the sector will need to train more than 65,000 people over the next 15 years (not including on-going refresher training of its workforce). Whilst some of these people will be upskilled or cross skilled from the existing workforce the majority will need to be recruited - either as new trainees or as largely competent marketplace recruits. 25% of the technical workforce will leave the sector between 2010 and 2014 through a combination of retirement and natural wastage. Looking out to 2024 this increases to 90% highlighting the scale of the challenge and the potential benefits of the work based learning approach that Foundation degrees offer to aid knowledge transfer…

60 **EU skills et al** Energy skills – opportunity and challenge Oct 2008

…Employers expect graduate recruitment to become more challenging as demand across the energy sector rises. Apprentice-based training will also need to be developed, with a sound route for progression to Foundation Degree. The most critical skills issue currently is the turnover of service engineers, which at 25%, makes attrition hard to manage. The British Wind Energy Association has called together key employers to develop a skills plan for the industry…

Job Roles

Bibliography

12 **British Wind Energy Association** Choosing a career in wind, wave and tidal energy no date

Job roles
R&D and Manufacture
Technical Analysis
Development
Project Design
Construction
Operations and Maintenance …

52 **DEFRA** Skills for a Low Carbon and Resource Efficient Economy ProEnviRo project 2008

T*he most important generic skills highlighted were leadership and management skills with an emphasis required to further this agenda…*

115 **UKCES** Strategic Skills Needs in the Low Carbon Energy Generation Sector March 2010

There are shortages in most engineering disciplines, both for highly qualified engineers and experienced technicians. There is also unmet demand for project managers with qualifications in
engineering and more specialised areas such as geology, marine engineering and aeronautical engineering (Table 1). There are also more generic skills needs in the sector including project management, leadership and management skills and business development/commercialisation skills…

Within the value chain there is a wide array of jobs, from degree and post-graduate acoustic and design engineers, construction project managers, wind turbine technicians and production engineers and operatives. This diversity of employment creates a need for courses from a short industry course in wind turbine technology to a Masters or Postgraduate Diploma in Renewable Energy. This variety of tailored skill requirements needs to be recognised in terms of training provision within the sector.
Identified skills shortages within the sector include:
• Mechanical and electrical engineers with a postgraduate qualification;

• *Structural Engineers with a postgraduate qualification;*
• *Turbine technicians with the skills and qualifications required to operate inside the nacelle of a wind turbine;*
• *Geologists, civil engineers, aeronautical engineers;*
• *Project managers with an engineering qualification.*

There are currently over 50 specialist training courses ranging from postgraduate qualifications awarded by universities to part-time vocational courses run by private training providers. The university courses appear to be well subscribed, but there are concerns regarding the supply of technicians with Level 2 and Level 3 qualifications

Value to the Economy

111 **The offshore valuation group** The offshore valuation: a valuation of the UK's offshore renewable energy resource May 2010
What is the value of our offshore renewable energy resource? What we found has exceeded our expectations…

South West

Bibliography

93 **SWRDA / ARUP** Achieving a green economic recovery May 2009
whilst the South West has a highly qualified workforce, projections of future demand show that supply will need to increase at intermediate and higher levels and that this must largely be met by more people currently in the workforce acquiring such higher level skills…

88 **REGEN SW** The road to 2020 Sept 2008
Renewable energy directly employs 2,900 FTE jobs in the region today (2008) compared with 1,140 FTE jobs in 2005, equivalent to an average annual growth rate of approximately 37%…

94 **SWRDA** Stephen Peacock's speech to the Society of Marine Industries' Conference Investing in UK Maritime Renewable Energy – Engineering Challenges & Business Opportunities' February 2010
The capital investment in the offshore wind industry in the South West alone will top £5 billion, potentially creating thousands of construction jobs…

58 **Energy Engineering** Offshore wind, wave and tidal issue (27) 2010
Claire Gibson, director of sustainable resources, SWRDA "..the south west has a strong existing supply chain that is ripe for supporting the offshore wind industry. From engineering firms to component manufacturers and technology providers, much of the supply chain is already in place….

97 **SWRDA press release** Wave Hub construction underway Nov 2009

91 **SLIM STEM Bulletin** STEM skills in the South West – what's new? March 2010
…there is a need for more multi-disciplinary working with new graduates; for example, needing both engineering and science knowledge and skills in order to operate. The quality of leadership and management across the low carbon cluster needs to improve…

Scotland

73 **Forum for Renewable Energy development in Scotland FREDS Marine Energy Group (MEG)** Marine Energy Road Map September 2009
Despite the existing level of offshore skills within Scotland's workforce, MEG believes that demand from the emerging marine and offshore wind renewable industries will create a heavy demand on the available workforce. A strategic approach is required to the transfer of existing skills and development of new skills across Scotland's workforce, not only in terms of working in an offshore environment but also for engineering and technical support during the development, design and construction of planned projects.

EU

Bibliography

75 **Global Wind Energy Council Press Release** European offshore wind power set to increase tenfold 8 January 2010
Offshore wind is Europe's largest untapped energy source. There is enough wind across Europe's seas to power Europe seven times over."

70 **European Wind Energy Association press release** More wind power capacity installed… 2010
39% of all new capacity installed in 2009 was wind power, followed by gas (26%) and solar photovoltaics (16%). ……..Taken together, renewable energy technologies account for 61% of new power generating capacity in 2009.

International

76 **Global Wind Energy Council (GWEC)** Wind power is crucial for combating climate change 2008
The most ambitious scenario by the Global Wind Energy Council (GWEC) show that, with growth rates much lower than the 30% the wind sector has experienced over the past decade, global wind energy capacity could increase from 121GW at the end of 2008 to over 1,000GW by 2020 and 2,400 GW by 2030. This would result in annual CO2 savings of more than 1.5 billion tons in 2020 and 3.2 billon tons in 2030.

74 **Global Climate Network** Creating Opportunity. Low carbon jobs in an interconnected world. Discussion paper no. 3 December 2009
Not only can a low carbon technology revolution help achieve climate change goals, it can also create new jobs, boost economic growth and help improve the lives of those currently deprived of access to energy.
…Not only will the development and wide use of low-carbon technology create jobs, but globally these will be measured not in thousands but in millions.

Document Type

Commissioned Research

13 **British Wind Energy Association / BAIN & Company** Employment opportunities and challenges in the context of rapid industry growth A closer look at the development of wind, wave & tidal energy in the UK. Dr. Markus Boettcher, Niels Peder Nielsen and Dr. Kim Petrick 2008

25 **British Wind Energy Association/SQW Energy** Todays' investment– tomorrows asset: skills and employment in the wind wave and tidal sectors Oct 2008

5 **BERR / Douglas Westwood** Supply Chain Constraints on the Deployment of Renewable Electricity Technologies June 2008

78 **Hammer Gerlinde, Röhrig Rolf** Qualification requirement analysis. Offshore wind energy industry Final report Bremerhaven/Bremen July 2005

41 **Crown Estate /BVG Associates** Towards Round 3: Building the Offshore Wind Supply Chain 2009

113 **Renewable UK/Douglas Westwood** UK Offshore Wind: Building an Industry June 2010

Future Skills scenarios

Bibliography

5 **BERR / Douglas Westwood** Supply Chain Constraints on the Deployment of Renewable Electricity Technologies June 2008

52 **DEFRA** Skills for a Low Carbon and Resource Efficient Economy ProEnviRo project 2008

86 **REGEN SW / DTZ** The economic contribution of the renewable energy and energy efficiency sectors in the South West of England April 2008

73 **Forum for Renewable Energy development in Scotland FREDS Marine Energy Group (MEG)** Marine Energy Road Map September 2009

13 **British Wind Energy Association / BAIN & Company** Employment opportunities and challenges in the context of rapid industry growth A closer look at the development of wind, wave & tidal energy in the UK. Dr. Markus Boettcher, Niels Peder Nielsen and Dr. Kim Petrick 2008

25 **British Wind Energy Association/SQW Energy** Todays' investment– tomorrows asset: skills and employment in the wind wave and tidal sectors Oct 2008

29 **British Wind Energy Association** What does the round 3 announcement mean? Briefing note on offshore wind energy Jan 2010

42 **Crown Estate** UK Offshore Wind Report 2010

78 **Hammer Gerlinde, Röhrig Rolf** Qualification requirement analysis. Offshore wind energy industry Final report Bremerhaven/Bremen July 2005

66 **EU Skills** Sector Skills Agreement December 2009

74 **Global Climate Network** Creating Opportunity. Low carbon jobs in an interconnected world. Discussion paper no. 3 December 2009

82 **IPPR** The Future's Green: Jobs and the UK low-carbon transition Oct 2009

8 **BIS** Towards a Low Carbon Economy July 2009
…The Carbon Trust estimates that developing the UK offshore wind industry could provide jobs spread across: R&D, engineering and design; turbine and component manufacturing; services; and operation and maintenance totalling 40,000 jobs; or even 70,000 with a proactive manufacturing strategy. In addition, it is likely that an offshore wind industry would be located in economically-deprived areas of the UK. The wave industry meanwhile could create substantial export opportunities for UK businesses in the medium to longer term, and the Carbon Trust estimates that wave industry jobs could reach 16,000 in 2040s…

46 **DECC** Press Release Offshore wind expansion biggest ambition in the world 8 January 2010

111 **The offshore valuation group** The offshore valuation: a valuation of the UK's offshore renewable energy resource May 2010

113 **Renewable UK/Douglas Westwood** UK Offshore Wind: Building an Industry June 2010
…Government in conjunction with industry needs to agree a realistic target for delivery if sector is not to lose opportunity to create at least 45,000 jobs

Government Policy

Bibliography

44 **DECC** Press Release publication of Marine Energy Action Plan – 15 March 2010

107 **DECC** Meeting the low carbon skills challenge March 2010

108 **DECC** National Renewable Energy Action Plan for the United Kingdom July 2010

Industry Comment

16 **British Wind Energy Association** (**BWEA)** The Next Steps for Marine Energy - An Industry View on the marine energy action plan March 2010

14	**BWEA** Marine Renewable Energy State of the Industry Report October 2009
23	**BWEA** press release We can build new UK industry from offshore wind revolution" 8 January 2010
62	**EU Skills et al**. Low Carbon Cluster Sector Skills Assessment Report Dec 2009
22	**BWEA** press release Wave and tidal plan must be followed by Government investment 04 March 2010
23	**BWEA** press release We can build new UK industry from offshore wind revolution 8 January 2010
113	**Renewable UK / Douglas Westwood** UK Offshore Wind: Building an Industry June 2010 *…Without firmer Government strategy we will get an offshore wind industry which produces clean energy for the UK, but one for the which the production facilities, and the manufacturing jobs are located elsewhere. If ambitious targets are agreed, and the Government acts now on a package of measures to drive forward the industry then wind can be the sector which drives forward the Coalition's pledge to rebalance the economy and create jobs*

Press Releases

Bibliography

44	**DECC** The Marine Energy Action Plan March 2010
46	**DECC** Press Release Offshore wind expansion biggest ambition in the world 8 January 2010
75	**Global Wind Energy Council** Press Release European offshore wind power set to increase tenfold 8 January 2010
45	**DECC** Press release New player in UK Offshore wind market 25 February 2010
19	**BWEA** press release Rebirth of UK Manufacturing: North East on Board 18 February 2010
21	**BWEA** press release Wave and Tidal energy project leases 16 March 2010

An Analysis of Key Publications relating to Marine Energy Skills (offshore wind, wave and tide)

March 2010 (updated September 2010)

Contents

Home

Executive Summary

Home

Government support of the Marine Energy sector has increased substantially since Low Carbon was identified as one of the six priority sectors for development in Building Britain's Future. New Industry, New Jobs in April 2009 [2].

The UK Government has undertaken to generate 15% of UK energy (about 35-45% of UK electricity) from renewable sources by 2020. Three-quarters of this green electricity capacity, approximately 34GW, is expected to come from wind (broadly 2/3 offshore and 1/3 onshore) with hydro, wave & tidal and solar contributing up to another 10GW [20]
This challenging target is part of the European Union's '20-20-20' plan - concrete targets for reducing greenhouse gas emissions by 20% by 2020, raising the share of renewable energy consumption to 20% by 2020 and reducing energy consumption by 20% by 2020 [84].

The Wave and Tidal Power and Offshore Wind Power sectors were included in The Low Carbon Industrial Strategy [9] in July 2009 which announced the creation of a new Low Carbon Economic Area (LCEA) in the South West with a particular focus on wave and tidal power. The Low Carbon Industrial Strategy and The Renewable Energy Strategy [48] announced funds for PRIMaRE, Wave Hub and the LCEA status in the South West. These have been supplemented by funding from the EU, SWRDA and the Technology Standards Board, plus additional support across the regions from bodies such as the Energy Technologies Institute and the Carbon Trust.

This document highlights data and discussion relating to marine energy skills (offshore wind, wave and tide) in recent UK published documents. Reports of the increased activities supporting marine energy are also included in this analysis, both to illustrate this rapid growth of the sectors and to highlight that some of the foundations for the long term stability of the sectors are beginning to be put into place. Much of the research indicates that any projections of growth are dependent on government support, finance, consumer demand and the stability of long term prospects for the marine energy sectors. Even the newly published UKCES Strategic Skills Audit, whilst identifying particular key skills needs in the low carbon sector and predicting great employment potential includes the caveat that this can be predicted 'given sufficient government support and consumer demand' [99]. This analysis is presented chronologically within broad subject areas so that a listing from present day back to earlier publications will highlight the more recent activities and circumstances which could colour earlier skills projections and conclusions.

Most research agrees that there is 'limited information about the types and level of skills required to support the UK's future renewable power industry' [61]. There is consensus on the increased need for a wide range of skills: higher level skills within project management and for leadership and management; for wind turbine technicians and for electrical engineers, to name a few examples. There are useful breakdowns of job roles and changing skillsets together with varying reports on current and predicted hard-to-fill-vacancies, but commentators find it difficult to accurately predict required numbers and timescales because the marine energy sectors are so new and their future UK growth often difficult to anticipate. Some of the documents included here have produced scenario ranges which map employee numbers and job roles against the likely numbers of MW generated. These reports are frequently cited, but their authors also repeat that any projections depend on the external governmental and industry factors referred to above. Indeed, even recent predictions on job creation within offshore wind, after the recent Round 3 wind farm announcements, vary from 50,000 – 70,000 in number.

The research also indicates that the level of job creation in the wave and tidal energy sectors is even more difficult to predict. Experts state that wave and tidal is approximately 10 years behind offshore wind, which is mature in comparison. However, these marine energy sectors are inter-related with the advantage of inter-linked supply chains. Many skills are acknowledged to be transferable between these sectors and it is believed that wave and tidal will benefit from offshore wind's experience as they move from R&D to commercialisation and generation of power.

All the sources in this document acknowledge that there are large skills challenges which will increase as the sectors grow, even though their analyses may vary. The power sector cautions that this skills expansion will be encountered in an environment where both the workforce and the equipment are ageing and need replacing, where there will be increased global competition for skilled people and not enough new entrants to the market [62].

The research considers how these challenges can be met, offering solutions ranging from the strategic level, urging government 'to find out more about the anticipated skills gaps and the employment impacts of policy' [74], through the identification of broad skills shortages which must be anticipated (eg.[82]) to the detailed analysis of anticipated training provision requirements at local level (eg. [64,73]). There is however some consensus in the research that the answer lies in people with solid skills, training and experience, already working, who can top-up with 'renewable skills', whether that is environmental planning, project management, offshore electrics, working at heights etc. and that there is a need to identify these transferable skills and put the mechanisms in place for their transfer.

Another challenge highlighted in the research is that the demand is currently latent. EU Skills commented in a submission to Parliament that 'a lack of skills is holding back industry, and a lack of industry is holding back skills' (EUSKills LCT34). It is reported that the employers, including SMEs and those in the supply chain, may not yet recognise the new marine energy opportunities and their associated skills requirements, the demand is not being articulated and the 'skills delivery framework is ill equipped to anticipate and respond' [52]. It is a common view that the employers and the training providers need to be planning early to meet these new skills demands in advance but this is difficult when demand is not stimulated and organisations do not have the right levels of understanding of the skills requirements to implement change. Some employers have recognised this need however. RenewableUK, for example, is developing a Wind Service Technician Apprenticeship with Sector Skills Councils (part of a joint skills accord) to meet the expanding offshore wind sector's needs.

Commentators are confident that the new jobs will be of high value, referring to 'quality' jobs and 'decent' jobs. Most of them conclude that the difficulties lie in identifying the numbers, the required training provision, the funding mechanisms and the infrastructure to inspire employer confidence, inward investment and the resulting creation of a flexible structure to meet the skills needs as the workforce adapts to the employment benefits of the marine energy sectors.

The analysis below illustrates the above summary by extracting text from the research and industry portfolio and further highlighting key points of interest. Please note that the UKCES report 'Strategic Skills Needs in the Low Carbon Energy Generation Sector' was published too late for this analysis. It is expected that both this report and the forthcoming Low Carbon Skills Consultation Paper from DECC will add further insight to the desk research analysis and will be investigated separately.

115 **UKCES Strategic Skills Needs in the Low Carbon Energy Generation Sector** March 2010

The sector is currently relatively small scale in terms of direct jobs, but has a great deal of potential for growth;
• Current and projected shortages of skills in the sector, particularly in relation to STEM subjects (Science, Technology, Engineering and Mathematics), means that the low carbon sector will need to compete for STEM graduates with industry as a whole
• Wind and nuclear will be the most important sectors in driving growth between now and 2020, but barriers such as access to financing and planning are significant;
• Marine and carbon capture and storage are unlikely to contribute materially to employment in the period to 2020, but are more likely to come to fruition post-2020
• The extent to which new jobs will necessarily be generated throughout the value chain in the medium-term varies by sub sector. In the wind and nuclear sectors, it is likely that there will be relatively large numbers of jobs created in construction and installation, given the ambitious plans for installing new capacity to 2020.

However, there is less likelihood of significant numbers of manufacturing jobs;
• There is considerable potential to exploit skills transfer from other industries such as the upstream oil and gas industry to low carbon energy generation, which will also help to minimise the potential impact of a decline in employment within carbon intensive energy generation or nuclear power
• There is no clear evidence that technical jobs in the sector will change markedly over the next decade – rather, differences are likely to emerge by degree
• There is a lack of official national statistics on the low carbon sector and the on-going debate over what constitutes a 'green job'
• Government will play a critical role in how it seeks to stimulate demand with incentives, but also in how it can remove barriers that could otherwise hinder growth

The low carbon energy generation sector is a relatively small sector in terms of direct employment. We estimate that approximately 30,000 are directly employed by the sector, of which 24,000 work in nuclear energy. The remaining 6,000 work in renewables sectors, primarily wind. In general, the energy workforce is highly skilled, with almost 40 per cent of staff educated to NQF Level 4 or 5, compared to the UK average of around a third. However, the level of qualification varies considerably across occupations and a substantial majority of energy employers report skills shortages in relation to technical, practical or job-specific skills. Our analysis of the low carbon value chain suggests that while the UK is relatively strong in research and development and has some capability for installation and operation and maintenance, there is a relative weakness in manufacturing. Manufacturing capability was also a major concern among the industry stakeholders that we spoke to as part of this research. Our research has confirmed that at present, there are persistent skills shortages across the sector. There are shortages in most engineering disciplines, both for highly qualified engineers and experienced technicians. There is also unmet demand for project managers with qualifications in
engineering and more specialised areas such as geology, marine engineering and aeronautical engineering (Table 1). There are also more generic skills needs in the sector including project management, leadership and management skills and business development/commercialisation skills.
p.Xi

Table 1: Summary of current skills gaps and shortages in low carbon energy generation

Technology	Wind	Marine	CCS	Nuclear	Microgeneration
Estimated direct employment in 2009	4,000	500	0	24,000	1,000
Sector specific skills gaps and shortages	Business Development Managers with project management skills (NQF Level 5) Mechanical Engineers (NQF Level 5) Structural Engineers (NQF Level 5) Geologists (NQF Level 5) Civil engineers (NQF Level 5) Aeronautical Engineers (NQF Level 5) Project Managers (NQF Level 4) Electrical Engineers to connection wind farms to the Grid (NQF Level 4) Engineering technicians (NQF Level 3/ 4) Turbine technicians (NQF Level 3) STEM specialists generally (NQF Levels 4 and 5)	Civil engineers (NQF Level 5) Mechanical engineers (NQF Level 5) Marine engineers (NQF Level 5) Electrical engineers (NQF Level 4)	Process engineers (NQF Level 4) Power engineers (NQF Level 4) Design engineers (NQF Level 4) Knowledge of off-shore storage/site characterisation/ geology	Technical staff (NQF Levels 2 and 3) Design engineers Planners and estimators Geotechnical engineers Project managers High integrity welders Manufacturing engineers Non-destructive engineers Commissioning engineers Nuclear safety case experts A gap of highly skilled and experienced personnel is predicted to emerge driven mainly by retirement attrition	Qualified trades trained in microgeneration technologies (NQF Level 3)
Generic skills gaps and shortages in the UK which will impact the sector	Mechanical engineers (NQF Level 5)	Technology transfer skills STEM skills	Technology transfer skills Service sector consultants (e.g. legal and financial advice and climate change economics)	Management and leadership skills	Management and leadership skills Commercialisation skills

Table reproduced from p.Xiii by kind permission of UKCES

In our view there will be five primary drivers of growth for the low carbon – particularly renewables – energy generation sector;
• Governance; Technology; Economic factors; Consumer demand; and Environmental change.
We consider the first two of these to be the most important.
…Technology, and the level of technological innovation, is also a key driver for renewables (nuclear can be considered a well-proven technology). Different renewable technologies are at different stages of development; wind is relatively proven, notwithstanding the need for larger scale wind farms further off-shore in deeper waters; but marine and tidal, and carbon capture and storage are at a much earlier stage of development. Microgeneration is somewhat mixed. The rate at which these technologies can be deployed will be a major determinant of future employment across these sectors.
However, there are barriers to growth in the sector, including:
• Access to finance; Planning consent; The current infrastructure; and Supply chain weaknesses.

…Wind and nuclear are expected to account for a significant proportion of the capacity installed or under construction in the UK in 2020, and are likely to have the most significant impact on employment and skills requirements in 2020;
• Marine and carbon capture and storage are two emerging areas in which the UK appears to have a strong position – with the potential to become a global market leader. These technologies are at a much earlier stage of development than wind. While the scope of this study is to 2020, these technologies are unlikely to reach maturity before this date. It is clear, however, that if growth in these sub-sectors is to be achieved, consideration should be given now to developing the necessary pipeline in terms of employment and skills required;
…Growth in the wind sector will generate significant employment in construction and installation and in operation and maintenance of wind farms, but will also drive indirect employment for example in the high-voltage engineering required to connect new installations to the National Grid;
p.XV
…While the workforce will need to be fed from STEM graduates, there is an experienced pool of workers in the UK off-shore oil and gas industry that have transferable skills that are applicable for example in the development and installation of off-shore wind farms, in marine installations, or in the storage of CO2 in off-shore North Sea oil and gas reservoirs. Therefore to some extent the growth in employment within low carbon energy generation could help to counteract a decline in more carbon intensive energy generation. Projections for the demand and supply of STEM graduates over the next decade demonstrate a significant shortfall in the numbers of engineers and scientists required to drive growth. In this context, the low carbon sector will need to compete for STEM graduates from industry as a whole.
There is also no clear evidence that technical jobs in the sector will change markedly over the next decade, with differences emerging a matter of degree, particularly in microgeneration. This will exacerbate the existing skills gaps and shortages outlined in Table 1. There is some likelihood, however, that a range of supporting roles may emerge: for instance, sales and marketing roles focused on communicating the benefits of low carbon to consumers and the general public.
It is also not clear whether many new jobs will emerge in the manufacturing sector, at least in the short-term.
…Current vocational qualifications and training provision will have to adapt to the needs of low carbon employers and adult workers, particularly in light of the fact that a significant proportion of the current workforce will still be in place in 2020.
P.XVi
…Overall, there is still a level of uncertainty in the market for low carbon energy generation and much will depend on the effectiveness of the Government's measures to support the industry and to overcome the barriers to growth. These include: strengthening the links between businesses and further and higher education; investing in re-skilling the existing workforce; making the sector a more attractive place to work; facilitating skills transfer from other sectors and strengthening the value chain, particularly in regard to manufacturing.
…**Three possible scenarios for the low carbon energy sector**
Our three scenarios are based on analysis of the findings from desk research and interviews with industry stakeholders and, in particular, the discussion of the drivers for change and the barriers to growth.
…scenarios based on a future which holds 1) Low Governance, Low Innovation; 2) High Governance, Low Innovation; and finally 3) High Government Support, High Innovation.
p.XVii
Industry insight: wind
Estimates of the level of employment in the UK wind sector vary widely. Our view is that employment is currently relatively small-scale, with only around 4,000 directly employed in the sector.
Employment is weighted towards system integration and installation (32 per cent), and maintenance and operations (28 per cent) than it is towards manufacturing (18 per cent) or other activities. This represents the nature of the value chain of activities in the UK; a sector that has considerable potential for an increase in on- and off-shore turbine installation, but which no longer has a major turbine manufacturer present. With the closure of the Vestas plant in the Isle of Wight, 500 manufacturing jobs have been lost. This is likely to have had a detrimental effect on employment in downstream component suppliers to Vestas, but we have not attempted to quantify the impact of the closure given our focus on direct rather than indirect jobs in the sector as a whole. Employment is higher in the on-shore wind sector (75 per cent of jobs) than off-shore (25 per cent of jobs). However, the UK has the highest potential, in terms of natural resources, in Europe for offshore wind, suggesting that off-shore-related jobs could increase rapidly. As the sector grows there will be implications for jobs downstream; these will not necessarily be turbine manufacture, but are likely to be related to the infrastructure that will be essential for the sector to flourish and could include employment in marine construction (to further develop the port infrastructure) and employment in electrical engineering (for the design and construction of the high-voltage connections between wind farms and the National Grid).
Within the value chain there is a wide array of jobs, from degree and post-graduate acoustic and design engineers, construction project managers, wind turbine technicians and production engineers and operatives. This diversity of employment creates a need for courses from a short industry course in wind turbine technology to a Masters or Postgraduate Diploma in Renewable Energy. This variety of tailored skill requirements needs to be recognised in terms of training provision within the sector.
Identified skills shortages within the sector include:
• Mechanical and electrical engineers with a postgraduate qualification;
• Structural Engineers with a postgraduate qualification;
• Turbine technicians with the skills and qualifications required to operate inside the nacelle of a wind turbine;

• Geologists, civil engineers, aeronautical engineers;
• Project managers with an engineering qualification.
There are currently over 50 specialist training courses ranging from postgraduate qualifications awarded by universities to part-time vocational courses run by private training providers. The university courses appear to be well subscribed, but there are concerns regarding the supply of technicians with Level 2 and Level 3 qualifications.
Industry insight: marine
The marine power generation sector is still currently at a relatively early stage in its development; it is a far less well proven technology than power generation from wind. Our estimate of direct employment in the marine sector is less than 500.
Given the early stage of development of the sector, and the nature of the projects underway to prove technical and commercial viability, employment is currently limited to research and development activities, with a small manufacturing component. It is an industry which has the potential to create direct employment in all parts of the value chain, particularly planning and design, manufacturing, construction and installation and operations and maintenance, however, in our view, it is unlikely to create substantial employment by 2020.
Current skills needs within this sub-sector are primarily in engineering research and development. However, as the technology is deployed on a larger scale, employment and the corresponding skills needs will become more diverse, and are likely to be similar to those in the wind sub-sector.
As with the wind sector, marine and tidal resources in the UK offer great long-term potential. Furthermore, given the very early stage of development, the potential exists to develop not just commercial technology, but also a manufacturing base, with the potential for downstream component supply. Assuming commercial viability, there would be a related need for electrical engineers (for the design and construction of the high-voltage connections between marine installations and the National Grid).
Specialist training courses in marine technologies are limited at present, but more might reasonably be expected in the medium to long-term as the industry grows in scale.
p.Xxi

104 **Alliance of Sector Skills Councils Alliance response to the consultation "Meeting the Low Carbon Skills Challenge** June 2010

It is not a new industry but an extension to existing industries and activities across the country. As such many of the skills required to meet the low carbon challenge are not in brand new roles and will not necessarily be linked to new jobs or new industries, but will be achieved through upskilling the existing workforce. Government should therefore be advised not to work on the assumption that it is possible to just train the currently unskilled and unemployed to successfully fill the jobs that this challenge will provide, but that it will require a broader coordinated approach across that covers all aspects of the economy. This is supported by the UKCES National Strategic Skills Audit (March 2010), which emphasises that low carbon is one of the areas that will regenerate the economy, but will not be a provider of a large number of jobs in England.
p.4
The Alliance recommends that employers in general need to made aware of the benefits of engaging and collaborating with universities in terms of meeting current and future skills demands; and obviously the mechanisms for this to happen need to be in place and accessible to employers. Incentives and other encouragements may need to be considered to facilitate this. Case studies and other promotion activities should be developed showcasing best practice and the benefits to employers of collaborating with universities.
p.7
There is no clear evidence that technical jobs linked to low carbon operations will change significantly over the next decade – it is more likely that up-skilling of core skills will be required;
- The profile of the low carbon energy workforce does not appear to differ much from the wider energy sector workforce in terms of age and gender, which will exacerbate existing skills gaps and shortages in the energy sector;
- There are shortages in most engineering disciplines, both for highly qualified engineers and experienced technicians;
- Project managers with qualifications in engineering are needed across a number of technologies and sections of the supply chain;
- It is imperative that there is a healthy energy sector with the resource capability (both level of skill and numbers) to quickly respond to the requirements for the deployment of renewable energy technologies as they are developed.

…The proposal to support 2,500 Apprenticeships in the emerging wind sector for 19-30 year-olds over a two-year period from September 2010 is ambitious. Employers are keen to develop a competent workforce but this will not be solely through the recruitment of Apprentices. There is a need to up-skill the existing workforce across the energy industry and funding for both apprenticeships and top-up modules of training to up-skills staff is needed. It would be helpful if the Wind Turbine Operations and Maintenance NVQ could be funded as a standalone qualification and not requiring a full apprenticeship programme.
p.13

107 **DECC Meeting the low carbon skills challenge** March 2010

The five key challenges for employers, the skills system and Government that this document identifies are:
• Delivering significantly higher volumes of generic STEM skills at all levels;

• Developing and delivering rapidly the specialist skills solutions that will be needed for emerging sectors and technologies;
• Getting more young people and adults interested in low carbon careers, skills and qualifications;
• Stimulating employer demand for and investment in low carbon skills;
• Replicating good practice rapidly in each of the above, within and between emerging sectors.
p.4
NB – Government has changed since the publication of this document. The consultation process is now closed but not yet reported (Sept 2010)

98 **UKCES Skills for Jobs: Today and Tomorrow The National Strategic Skills Audit for England 2010 Volume 1:Key Findings** March 2010

A low carbon economy

Within this sector, a distinction can be made between low carbon energy generation and the more efficient use of energy in the economy. Wind, marine, micro generation, nuclear and carbon capture and storage comprise the low carbon energy generation sector, all of which, except nuclear, are in the early stages of development and implementation. Research and development and engineering activities are therefore prominent, and concomitant skills needs characterised by a dependence on high level STEM skills are reported. For example, there is a need for individuals with skills equivalent to levels 4 and 5 in the following engineering disciplines: mechanical, design, civil and structural, electrical, aeronautical, marine and geotechnical. The nuclear industry too is very much dependent on STEM skills, particularly a broad range of engineering disciplines and safety experts. Technicians are also required at levels 2-4 across the generation sector. More generically, there is also a need for project management, management and leadership, and technology transfer skills. Given sufficient government support and consumer demand, the low carbon energy generation employment has the potential to off-set the expected decline in traditional, carbon-intensive energy production.
p.26

91 **SLIM STEM Bulletin STEM skills in the South West – what's new?** March 2010

Here we look at one strongly emerging area associated with STEM skills - the low carbon sector. A recent report by a cluster of ten SSCs defined as being low carbon recognised that, whilst the number of those with STEM degrees is increasing, demand for specific skills in the low carbon industries is expected to increase at a higher rate. Many low carbon industries are inter-related and inter-dependent, with a variety of supply chain linkages. They have identified that an adequate supply of STEM-qualified individuals is both a critical short and long-term issue for the low carbon sector. SSCs propose that in the short-term action needs to be taken now to ensure that UK firms have access to sufficiently qualified staff to make the shift to low carbon technologies, techniques and markets. This could be through incentives to retain engineers and other STEM-qualified individuals in the labour market for longer, or through use of the Government's new points based immigration system which seeks to give priority to would-be immigrants with skills the country needs. The new Qualifications and Credit Framework (QCF) also provides a new way of recognising achievement through the award of credit for units and qualifications, and will help employers measure quickly the level and size of achievements of prospective employees.
….A significant part of the skills challenge in low carbon industries is for technician and professional level skills at Levels 3, 4 and 5 which often fall outside the scope of public subsidy. Despite their early stage of development, a number of low carbon industries are reporting specific hard-to-fill vacancies and associated skills shortages. Amongst the most acute are: electrical engineers, wind turbine engineers, marine engineers, and energy efficiency contractors. The nature of many low carbon industries means there is a need for more multi-disciplinary working with new graduates; for example, needing both engineering and science knowledge and skills in order to operate. The quality of leadership and management across the low carbon cluster needs to improve .
p.2-4

20 **British Wind Energy Association press release** UK Wind industry welcomes Beauly-Denny power line decision 8 January 2010

Britain is committed to generate 15% of its electricity from renewables by the end of this decade. As the renewable contribution from heat and fuel are so low, up to half of this will have to come from electricity alone. Three-quarters of this green electricity capacity, some 34GW, is expected to come from wind (broadly 2/3 offshore and 1/3 onshore) with hydro, wave & tidal and solar contributing up to another 10GW

61 **EU Skills Foundation degree framework specification for the electrical power engineering sector** Jan 2010

Renewables employers range from large multinationals to SME's and micro organisations. Currently there is limited information about the types and level of skills required to support the UK's future renewable power industry, although recent research undertaken by the proposed National Skills Academy for Power (NSAP) to understand skills needs and provision has revealed that skills shortages and recruitment problems are already apparent and the performance of companies in the sector is being hampered by lack of appropriately skilled recruits.
…. The sector faces numerous challenges over the next ten to twenty years:

- The move to a low carbon economy with the consequent reduction in traditional generation and increase in renewable generation
- The need to replace ageing coal fired plant with new nuclear, clean coal and gas plant, all of which involve significant advances in technology from existing generation assets
- Upgrading of the ageing transmission and distribution infrastructure including introduction of smart grids and smart meters
- High levels of retirements with the consequent need to replace significant numbers of skilled engineers
- The need to attract, train and retain several thousand new people against a backdrop of diminished numbers of young people studying technical / engineering subjects and fewer overall numbers of young people due to demographic shifts in the population.

Looking to the future the electricity generation mix is still not certain. This leads to uncertainty for many sector companies, particularly the contracting workforce, around the development of new skills and forecast volumes. The sectors' key asset, the workforce, reflects the heavy recruitment in the 1970s and 80s and the much reduced intake of the 1990s, leading to a skewed age distribution. Losses to retirement will increase sharply through the late 2010s / early 2020's, which means that, not only recruitment and training must be increased, but the underlying capacity to train needs to be expanded. Moreover, skills gaps, that occur when workers are not fully trained for the job, are increasing as new, unfamiliar, processes and technologies are introduced

p.10,11

…The increase in renewable energy supplies, primarily on- and off-shore wind, will have implications across the whole supply chain including transmission and distribution.

…Together, all this means that the future demands for skilled workers will be far higher than experienced today.

…The sector's skills challenges are compounded by the difficulty in attracting new recruits into the workforce. Like many engineering / technology sectors in the UK, the power sector has suffered in recent years from a poor image, poor perception of career prospects and intense competition from other sectors for high quality skilled people. This has exacerbated the problem of recruiting and retaining learners in the sector, leading to a current and potential future shortfall in required skills. Workforce planning activity carried out by the proposed NSAP, demonstrates that the sector will need to recruit in excess of 15,000 new people over the next 5 years alone (excluding transmission where analysis of demand is currently underway). This level of recruitment increases further in the following 10 years to meet anticipated retirements and industry growth.

…This is further exacerbated by the lack of clear progression routes particularly for those at craft / technician level seeking to move into higher level engineering roles.

p.11

The sector employs many tens of thousands of technical engineering staff. Workforce planning analysis undertaken as part of the business planning for the NSAP during 2009 has identified that across the generation (including renewables), distribution and metering industries the sector will need to train more than 65,000 people over the next 15 years (not including on-going refresher training of its workforce). Whilst some of these people will be upskilled or cross skilled from the existing workforce the majority will need to be recruited - either as new trainees or as largely competent marketplace recruits. 25% of the technical workforce will leave the sector between 2010 and 2014 through a combination of retirement and natural wastage. Looking out to 2024 this increases to 90% highlighting the scale of the challenge and the potential benefits of the work based learning approach that Foundation degrees offer to aid knowledge transfer.

p.12

62 **EU Skills et al. Low Carbon Cluster Sector Skills Assessment Report** Dec 2009

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.

p.13

Current skills needs. The wind industry is suffering from skills shortages currently, primarily in the areas of turbine technicians, project managers and electrical engineers. It is also likely that when the marine industry becomes more established, that these roles will be similarly in demand. The need for these roles is highlighted in the Bain report commissioned by British Wind Energy Association . 'The industry is already facing a considerable staffing challenge today: more than half of companies currently have vacancy levels of above 5%. In certain specialist roles that shortage is significantly higher. The urgency of the shortage is directly linked to the maturity of the industry: roles critical to the planning and development stage (e.g. project managers) are currently in particularly short supply. Acute areas of shortage are:

• Project managers: 46% of companies find this role hard to fill. Project managers are usually qualified engineers who are responsible for managing either the development or the construction process;

• Electrical engineers: 40% of companies find this role hard to fill. Electrical engineers are qualified to design and construct the high voltage connections between the wind farm and the national grid;

• Turbine technicians: 25% of companies find this role hard to fill. Turbine technicians have the skills and qualifications required to operate inside the nacelle of a wind turbine.'

The marine industry, due to being in the early stages of research and development, is currently demanding high-level engineering skills.

p.17,18

… The wind industry is the fastest growing of the large-scale generating technologies and has the most potential to meet the government's 2020 renewable energy targets, particularly offshore. In addition to this expansion demand for skills, current shortages of skills are exacerbated as employees are being lured away to work in other sectors.

As marine energy production is still in the research and development stage, the demand for skills is being driven largely by the need for skilled engineers to assist in design and testing of the new technology. There is also some potential growth, and therefore demand for skills, in the final manufacture of such equipment.

Evidence of skills mismatch

Further to the Bain report which sets out the current need for turbine technicians, electrical engineers and project managers, the Institute for Public Policy Research report summarises a selection of evidence on skills gaps and shortages in the large-scale renewables industry. Sources include the CBI 2009 employer survey, which describes a shortage of STEM graduates, workers with STEM at all levels, technicians and graduates in energy industries. Also cited is the DIUS 2009 STEM survey, which mentions shortages of marine engineers, mechanical and electrical engineers.

Further to these sources, for their 2009 'Mapping Renewables Skills' report, the National Skills Academy Power (NSAP) interviewed employers in the large-scale renewable generation industry.

p.19

Key findings were:

• Wind and marine technologies require 'new combinations of old skills' which are in much shorter supply, leading to poaching of staff and therefore high levels of churn;
• Employers reported that they were currently compelled to train on the job, as ready-made combinations of skills are not currently available in the market place;
• There is a shortage of experienced trainers, both for STEM generally, and renewables specifically.
• Recruitment for remote sites (such as the north of Scotland, where many renewable assets will be based) is particularly difficult.

...Future demand

An ageing workforce and STEM deficiencies will continue to be a factor which will affect the industry for some time to come. Coupled to this, the rapid expansion in renewables will result in a greater demand for skills at a time when such skills are increasingly being demanded in other areas of both the power industry and the UK economy as whole. The upgrades required to the grid in order to handle the greater volume, and intermittent nature, of renewable energy will themselves add to the demand for electrical engineering skills.

The future growth of the marine industry is strongly dependent upon enabling actions and policies from government. Therefore, skills demand will be dependent upon the extent to which government promotes the growth of the industry.

Will anticipated demand meet skills supply?

The Bain report states that; 'current market estimates suggest that the number of engineers graduating each year in the UK is likely to remain broadly flat over the next 12 years'. As a result, the current share of new engineering graduates entering the wind industry is unlikely to be sufficient to support the growth demands of the industry. Some of the historical issues driving the low percentage of engineering graduates entering the sector have been addressed, such as unclear industry prospects, concerns about career path progression, and salary levels, but more needs to be done. Given that fresh graduates will not satisfy the demand for specific skills, firms must also look inward and make significant investments in training and Human Resource (HR) processes to generate in-house capabilities and experience. It is extremely difficult at this point in time to anticipate future demand for skills. The expansion of wind and marine (and biomass to some extent) is very much linked to the success of planning applications. The current complexities of the planning process make it difficult to accurately predict the extent and location of future skills needs.

p.19

Cross Cutting themes

Ageing workforce

particularly concerning in areas such as conventional, renewable and nuclear power generation which are all forecasting large percentages of their workforce retiring over the course of the next 10-15 years. The causes of these demographic problems affecting the low carbon cluster are many and varied but include:

the long-term consequences of the de-layering and downsizing that occurred following the privatisation of former public sector industries; the retirement of 1960's baby-boomers; the relatively low level of female employment across much of the low carbon sector; and the difficulties many employers have found in recruiting young people because of the perceived unattractiveness of many jobs in these industries.

p.62

Uptake of STEM subjects

... with demand for specific skills in the low carbon industries expected to increase greatly over the next decade or so, the supply of STEM skills is not predicted to increase at the same rate, which will have implications for the future workforce. A perceived unattractiveness by young people of many careers relevant to STEM subjects, especially in engineering, is a major concern also for future skill provision

Management and Leadership

Effective and far-sighted management among employers involved in developing low carbon industries is vital if the sector is to meet its potential as a source of significant wealth and jobs for the UK economy in the future.

... At an operational level, project management skills have also been identified by a number of low carbon industries as skills in short supply which are absolutely vital to the successful implementation and creation of a low carbon industrial base. These skills are particularly important during this start-up and infrastructure development phase.

p.63

Latent demand

There is evidence that at the moment the level of economy-wide demand for low carbon related skills is lower than what, ceteris paribus, could be expected. This is believed to be because a significant proportion of the total potential demand for low carbon skills is latent, as employers do not yet fully recognise the importance and potential benefits of integrating low carbon skills into their businesses. Only when these links and a clear business case are made will the aggregate level of demand for low carbon skills move nearer to the required level. The existence of latent demand creates a further problem in a demand-led skills system such as that which exists in England. Until employers start to recognise their need for greater levels of skills and expertise around low carbon techniques and technologies the skills supply system is unlikely to begin the process of increasing the number of individuals with the required skills.

Greening of existing jobs rather than new jobs While the rapid development of a low carbon economy and industrial base will create a range of specific, new roles which have not existed previously, there is also much emerging evidence that low carbon activities will need to be carried out by existing workers adding new 'green' skills to their existing activities. Such a situation will require individuals to undertake additional 'top up' training to familiarise themselves with new concepts and practices which will enable them to operate in low carbon industries.

p.64

top-up training (IPPR chart)

…Use of the freedoms introduced through the QCF will be important in meeting these top-up skill requirements, as will the implementation of accompanying flexibilities in the funding regimes regarding support for units and non-first qualifications that will aid multi-and up-skilling.

p.65

Low carbon industries have the potential to create many thousands of new jobs over the course of the next decade if steps are taken now to address some of the barriers and impediments facing them. The opportunities of shifting to a low carbon economy are particularly attractive as the skills needed by many of these new industries are complementary to those from Britain's industrial heritage, and they therefore offer those who have lost out through deindustrialisation the chance to return to high quality, highly paid jobs. Capturing the potential economic benefits of the shift to a low carbon economy requires all economic agents to work quickly, and in tandem, in order to put in place the necessary infrastructure and building blocks.

…By their very nature, low carbon industries are, in many cases, still in their infancy and relatively little is known about the precise nature of their future skills requirements.

p.66

priority actions…

a significant part of the skills challenge in low carbon industries is for technician and professional level skills at Levels 3, 4 and 5 which fall outside the scope of public subsidy. The government's focus on funding full qualifications may also work against the needs of the low carbon cluster where there is a need for 'top up training to bridge gaps between traditional industrial skills and knowledge and those necessary to operate in a low carbon environment. Government needs to recognise the specific requirements of the low carbon economy and 'bend' funding streams so that they can be deployed to meet these particular requirements. Effective project management skills are vital building blocks for developing many low carbon industries. Skills deficits in this area must be overcome in order to capture the economic potential of the transition to low carbon.

p.67

Despite their embryonic stage of development, a number of low carbon industries are reporting specific hard-to-fill vacancies and associated skills shortages. Amongst the most acute are: electrical engineers; wind turbine engineers; marine engineers; and energy efficiency contractors. Quantifying these gaps and working with providers and others to address them is a clear priority for all parties.

… The nature of many low carbon industries means there is a need for more multi-disciplinary working with new graduates, for example, needing both engineering and natural science knowledge and skills in order to operate. Those designing HE courses need to recognise and respond to this trend for holistic skills and knowledge programmes.

In common with many other sectors of the economy, the quality of leadership and management across the low carbon cluster needs to improve.

…. While broadly in balance at present, available learning provision is likely to be inadequate to meet the level of demand generated by many low carbon industries in the future. One of the downsides of a demand-led skills system is that for emerging sectors (such as low carbon) a lag is likely to occur between when employers actually start to demand specific skills and when education providers can respond. Finding ways of mitigating such a lag between demand and supply is vital if the UK is to gain an advantage among low carbon industries.

Across a number of low carbon industries there are insufficient numbers of individuals trained in both lean manufacturing and Business Improvement Techniques (BIT). BIT refers to a philosophy or practices focusing on continuous improvement in manufacturing activities or business activities in general. It is believed that BIT can play a significant part in helping both emerging low carbon industries as well as traditional industries adapt to low-carbon thinking and operating. The demand for generic low carbon skills is likely to increase alongside the development of the sector. These skills include: sustainable procurement; carbon accounting; performance reporting; environmental management systems; risk management; whole life costing; cost benefit analysis and commercialisation skills.

p.68

Many individuals in traditional occupations are now, as a result of changing legislation and other drivers, having to embrace the low carbon agenda. These drivers are resulting in hybrid job roles which contain low carbon activities and require individuals to retrain and upskill. More work needs to be done to precisely identify these 'top-up' skills requirements and appropriate provision needs to be developed by training providers.

SSCs have developed a range of training programmes that address the emerging demand for 'top up' skills in low carbon industries. These programmes have been developed in partnership with employers and can be delivered flexibly through the QCF to meet the businesses' operating requirements. National Skills Academies also have a key role to

play in leading the upskilling of many already in the working population.
p.69

66 **EU Skills Sector Skills Agreement** December 2009

Analysis carried out by the NSAP, using the workforce planning model, shows that due to an ageing workforce, over 29,000 people (80% of the current workforce) are expected to leave the distribution, generation and metering businesses over the next 15 years. Further to this, the NSAP states that there will need to be a sevenfold increase in skills needed to meet renewable energy targets.
Working Futures analysis predicts a 15% decrease in jobs in the power industry by 2017, from just over 60,000 in 2008 to just over 50,000. However, it is unlikely that this scenario will have fully taken into account the developments in technology expected to take place over this time. It does not appear to mesh well with the current hopes for increased numbers of 'green jobs' arising from the expected growth in renewable energy generation.
p.109
The NSAP has undertaken a more thorough analysis, with the input of employers and taking into account the likely future developments; their analysis is therefore more likely to provide a more accurate picture of future workforce needs. The Working Futures analysis does, however, echo the NSAP work in setting out a predicted 20,000 retirements in the power industry by 2017. It is clear that, in either case, the issue of an ageing workforce will be critical to the future of the industry.

7.3.2 Likelihood of occurrence

The replacement demand caused by the imminent retirement of existing workers is inevitable. Similarly, it is unavoidable that existing infrastructure will need to be replaced, as demanded by European legislation.
While an increase in renewable energy generation is already underway and further expansion is a certainty, the extent and speed of this increase is highly dependent on government support and investor confidence. Also, the expansion of wind and marine (and biomass to some extent) is very much linked to the success of planning applications, which is a highly complex and uncertain area. Also, the development of suitable on- and off-shore grids will be critical.
…..The increasing role of renewable energy in the UK's energy mix will be an additional draw on an already stretched labour market. The expected increase in renewable energy supplies will have implications across the whole power industry supply chain including transmission and distribution.
p.110
The industry has raised the issue of an expected global demand for power engineering skills as much of the infrastructure around the world is of a similar age to that of the UK's. With demand for power output increasing the world over, the UK will have to work hard to gain the quantity and quality of skills it needs and even harder to keep it. Consequently, strong global demand for skilled workers with experience of the electricity generation industry is likely to increase considerably in the coming years. The extent and speed of growth in renewables is highly dependent on government support, and (especially in the case of wind and marine power), the complexities of the planning process. Both of these unpredictable elements will have an impact on both the extent and location of skills that the power industry will need. Despite the difficulties implicit in predicting the future needs of the power industry, there has been much discussion in government and the media around the number of 'green jobs' that could result from a transition to a low carbon economy. Based on differing timescales and assumptions, these predictions vary a great deal, however, the common thread is one of optimism towards the opportunity provided by a low carbon economy. Looking specifically at the power industry as a part of this low carbon economy, the NSAP estimates that current targets of 45GW of renewable energy generation would require a sevenfold increase in skills. This anticipated increase in demand for skills will be further exacerbated by both the ageing workforce and competing requirements from other industries. As a result, there will be a need for increases in recruitment, training and the underlying training capacity.
….In summary, this will require the industry to:

- Place more emphasis on workforce planning to highlight and address age profile issue;
- Raise the profile of the industry to attract employees;
- Increase the number of Apprentices to bring new people into the industry;
- Forecast the skills needs for new and emerging technologies and develop National Occupational Standards(NOS) and Apprenticeships to meet demand;
- Increase the number of engineers entering the industry;
- Increase training capacity across the industry;
- Influence the economic regulator to take account of skills needs in the five-year PCR cycle.

p.111

engineering construction within power

Within power generation, there is substantial UK and global demand for engineers.
….. Industry projects face competition for construction-related skills from the continuing investment in the LNG terminals and gas storage, the off-shore wind programme, a potential up-turn in chemicals and hydrocarbon processing, the aircraft carriers and other Ministry of Defence (MoD) programmes, rail projects, Thames Gateway and, possibly, the Severn tidal power scheme. In addition, of course, there is the continuing maintenance activity in existing power stations. There is also likely to be some fabrication work for the North Sea, to support marine renewables and off-shore carbon storage. The ageing workforce is a phenomenon seen across the world; reports of age-related skills shortages from Europe, North America and Australasia are common. Even in China, the modal age of the working population is rising. The oil and gas industry

worldwide has faced the greatest challenge to date, having started this decade with a badly skewed age profile. Shortage of skilled people has slowed the pace of investment, making it harder for the industry to meet increasing demands for energy. We have already seen in the oil and gas industry that worldwide skills shortages lead to globalisation of the workforce. In turn this creates the opportunity for UK skills to be deployed on overseas projects and many UK jobs exist to service this international business. On the other hand, it creates a challenge for the UK in having to compete for resources against demand from overseas.
p.72

74 **Global Climate Network Creating Opportunity. Low carbon jobs in an interconnected world. Discussion paper no. 3** December 2009

Not only can a low carbon technology revolution help achieve climate change goals, it can also create new jobs, boost economic growth and help improve the lives of those currently deprived of access to energy.
…Not only will the development and wide use of low-carbon technology create jobs, but globally these will be measured not in thousands but in millions.
•New low-carbon jobs are likely to outnumber job losses in carbon-intensive sectors.
•The jobs created will on the whole attract above-average salaries.
… United Nations Environment Programme in a 2008 study estimates that in 2006 2.3 million people were employed in renewable energy industries. The same UNEP study also anticipates a substantial increase in employment in these industries by 2030, by which time it suggests approximately 2.1 million people will be employed in wind energy, 6.3 million in solar PV and 12 million in bio-fuel-related industry and agriculture.
p.4
The UK government has already adopted economy-wide emissions reduction and renewable energy targets and has recently published a Low Carbon Industrial Strategy. Nevertheless, the UK is not in general a leader in low-carbon industries and although offshore wind is a major resource, strong government policy will be needed to attract to the UK the jobs this will create. However, if it is successful in attracting manufacturers and suppliers, this could lead to up to 70,000 UK jobs being created. The UK is also well placed to capture up to half of all jobs worldwide in offshore wind financial and legal services.
p.6
Training is critical to the development of low-carbon sectors.
Each of our national studies concludes that – among other factors – equipping new workforces with the required skills is of high importance. In among the numerical projections, there are also important arguments to be made about the 'quality' of the jobs created.
GCN recommendation: Identify skills gaps and develop a training strategy
A first step towards a low-carbon skills and training strategy should be the identification by national governments or appropriate agencies of the likely skills gaps that might develop if wider low-carbon industrial strategies are pursued.
p.7
A recent European Commission (2009) report estimates the net number of jobs created by reaching the EU's 20 per cent target for the share of renewables in energy use in 2020 at 410,000
p.9
The future growth of clean-energy industries is central to the government's plans to reduce emissions by 34 per cent by 2020 and 80 per cent by 2050, compared with 1990 levels. Rapid and sustained deployment of renewable technologies will also be necessary if the UK is to comply with its obligation under the EU to provide 15 per cent of its electricity through renewable sources by 2020
… The UK paper notes that existing job forecasts for renewable sectors vary widely and are based on a set of different assumptions and variables. A recent study commissioned by the government (Douglas Westwood 2008) estimates that if the UK meets the target, proposed by the Renewables Advisory Board (RAB), of 38.5GW of installed renewable energy capacity by 2020, as many as 133,000 new jobs could be created
… it suggests that if 29GW of offshore wind capacity is installed in 2020, this would create between 40,000 and 70,000 jobs along the supply chain.
An additional study commissioned by the British Wind Energy Association (Boettcher et al 2009) looks at jobs created in the wind power industry as a whole, according to three alternative scenarios, and finds that:
•22GW total wind capacity (offshore and onshore) could create 23,000 jobs by 2020.
•27GW total wind capacity (offshore and onshore) could create 36,000 jobs by 2020.
•34GW total wind capacity (offshore and onshore) could create 57,000 jobs by 2020.
Douglas Westwood (2008) adopts an alternative approach by forecasting jobs created in the wind sector according to the government's ability to attract turbine manufacturers to the UK. It anticipates the creation of:
•5,000 new jobs by 2020 under a low-scale scenario (one manufacturer and 10 per cent of installed capacity manufactured in the UK).
•14,000 new jobs by 2020 under a mid-scale scenario (two manufacturers and 25 per cent of installed capacity manufactured in the UK)
34,000 new jobs by 2020 under a high-scale scenario (three manufacturers and 50 per cent of installed capacity manufactured in the UK).
p.27
It is generally agreed that the majority of jobs in the combined wind industry are likely to arise in two stages of the supply chain: manufacturing and installation.

However, not all jobs will necessarily be local. Given the UK's lack of manufacturing base for renewable energy technologies, wind turbines are likely to be imported from overseas (Carbon Trust 2008). Instead, the UK might be better positioned to generate domestic jobs in component manufacturing, such as the manufacture of towers and foundations which could draw on existing skills and knowledge bases in the offshore oil and gas sectors. Given its relatively mature service sector, the UK may also capture jobs in financial and legal services for domestic and international markets for offshore wind. Indeed, the Carbon Trust (2008) estimates that the UK can accrue half of all service jobs in the global offshore wind industry by 2020.
…. A proactive government skills policy is needed to address shortages in technical, job-specific and generic 'green' skills among the British workforce. The paper also suggests that plans to stimulate clean-energy industries should contribute to reducing inequalities in the labour market. Although low carbon jobs are relatively well-paid and offer good career prospects, the government should consider linking the Low-Carbon Industrial Strategy with its welfare reform agenda to assist the long-term unemployed back into work, and introduce programmes that promote female employment in lowcarbon sectors. Finally, the paper calls for the government to identify jobs – in coal, gas and other carbon-intensive sectors – at risk from the low-carbon transition and develop strategies with employees, trade unions and Regional Development Agencies to protect jobs where possible and support employees in finding new work. This will not only minimise the political risk associated with decarbonisation, but more importantly ensure that the transition is fair.
…Only jobs in operation and maintenance (O&M) will necessarily be located in the UK, owing to the need for them to be in close proximity to wind farms. Despite this, there are still hopes that the UK will be able to develop full offshore wind manufacturing (as opposed to selected component manufacturing). For instance, Clipper Wind has a research centre in Blyth, North East England and Mitsubishi may also set up factories in the region.
…In the wind industry, BWEA point to a shortage in qualified electrical engineers, turbine technicians and project managers among the workforce (Boettcher et al 2009).
p.28
Training is critical to the development of low-carbon sectors
Each national paper that supports this study concludes that – among other factors – equipping new workforces with the required skills is of high importance. Whether or not a workforce is ready to supply new, low-carbon industries with labour will make or break low-carbon industrial strategy. In among the numerical projections, there are also important arguments to be made about the 'quality' of the jobs created.
Many workers employed in new, low-carbon technologies will require a high level of skill and are therefore likely to attract salaries above national averages. This too is good news, not just for governments seeking to orientate their economies higher up the value chain, but also for those concerned about the structural flaws in the global economy caused, in part, by an oversupply of low waged labour.
GCN recommendation: Identify skills gaps and develop a training strategy
A first step towards a low-carbon skills and training strategy should be the identification by national governments or appropriate agencies of the likely skills gaps that might develop if wider low-carbon industrial strategies are pursued.
These gaps will need to be filled with a range of innovative, public academic- private training and apprenticeships partnerships, which are likely to require financial and technical support from governments.
…We might add that this GCN study has identified a significant lack of data on low carbon employment in general, on potential for job creation and on skills gaps and that governments will need a better understanding of the employment impacts of policy if they are to ensure low carbon industrial strategy attracts strong domestic support.
p.32

82 **IPPR The Future's Green: Jobs and the UK low-carbon transition** Oct 2009

This report sets out to investigate what impact the transition to a low-carbon economy could have on jobs and employment and to identify ways in which opportunities can be taken and threats minimised. It concludes that without smart government intervention, the UK will struggle to benefit from new 'green' industries and the workforce is unlikely to be equipped with the right skills to work in the future low-carbon economy.
p.5
A number of UK studies have sought to identify which sectors are set to grow as a result of plans to reduce Britain's emissions of greenhouse gases.
… Projections are highly uncertain and depend on assumptions about the extent of government intervention. Nevertheless, we can identify some sectors where the UK has the strongest potential for job creation. These include the energy efficiency, offshore wind and nuclear energy sectors. Others likely to provide jobs in the longer-term include wave and tidal and carbon capture and storage.
….Our analysis of the Labour Force Survey and a survey of existing low-carbon employers suggests that there are good prospects for high-quality job creation in the likely growth sectors. This provides a clear argument for public support to maximise the social and economic benefits of an expansion in low-carbon employment.
p.6
It is currently unclear what the UK's specific skills needs are for the emerging low-carbon economy. Our analysis of the best existing data, supplemented by a survey of 39 existing 'green' employers, suggests that employers in the low-carbon sector currently have two major skills problems: management, which is regularly identified as a weakness in UK firms in general; and technical, job-specific skills, including but not limited to Science, Technology, Engineering and Maths (STEM) skills.
We did not find any evidence that new low-carbon jobs would require completely new types of skills sets among the workforce. Instead, we identified four broad types of skill shortages:

• Specific skills shortages requiring substantial investment in training and development (for example, high integrity pipe welders and civil engineers)
• Skills gaps that could be addressed by 'topping up' existing workforce skills (for example training electricians to work on roofs so that they can install solar panels)
• Generic skills gaps that apply across the UK economy (for example, management and leadership skills)
• Generic 'green' skills (that is, a broad understanding of the changes needed for businesses to reduce their emissions that will be needed by all employees across the workforce).
Through our interviews with stakeholders we identified a number of problems with existing skills policy with respect to the above:
• 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.
• Funding for adult skills is often inflexible and does not always respond to employers' needs.
• Skills funding, especially in England, is spread across the economy, with little attempt to target support where it can have the greatest impact.
An employer-led skills system is not sufficient in the context of the transition to a low carbon economy; there is a need for government to play a more active role in setting the Direction
….. Public subsidies for workplace training should reflect broad strategic economic priorities (provided this is in line with international and EU trade rules) 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 low-carbon re-skilling.
Finally, employers need a stable and significant demand for low-carbon 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. We also recommend that public procurement should be used to stimulate demand for low-carbon skills.
p.8
In areas like offshore wind and energy efficiency, there is scope for significant job creation and most jobs are likely to be 'decent' jobs, too.
p.9
Wind
The UK's excellent offshore wind resources and status as the world leader in terms of installed capacity have helped to boost hopes that Britain could gain a competitive advantage in this area. In addition, the skills base developed in the offshore oil and gas industry could potentially provide expertise. A key question is whether the UK will be able to benefit from manufacturing jobs in this sector, or whether turbines will continue to be imported, as they are currently. While the manufacturing industry associated with onshore wind is now well established in other European countries and is growing in the United States, China and India, offshore technology is less advanced and there is growing competition to attract the 'next generation' of turbine manufacturers. The decision by Vestas in 2008 to close its onshore wind blade manufacturing factory on the Isle of Wight may have increased scepticism that the UK will be able to attract manufacturers to locate in the UK. However, there are still hopes that the ambitious plans to expand offshore wind capacity over the next decade and the measures set out in the Low Carbon Industrial Strategy will attract component manufacturers to set up in the UK, in particular those that do not already have manufacturing bases elsewhere in Europe (such as Clipper Windpower and Mitsubishi Power Systems). However, there are still question marks over the extent to which the UK can expect to benefit from manufacturing jobs – from full turbine manufacturing, to component manufacturing or assembly jobs.

Table 2.3: Summary of job estimates in the wind sector

Source	Description of sector	Current employment	Projected employment
European Wind Energy Association (EWEA) 2009	Wind (offshore + onshore)	4,000 (in 2007)	-
Innovas 2009	Wind	87,500 (in 2007/08)	156,800 (in 2014/15)
Douglas Westwood 2008	Wind, UK-based	16,000–26,000	5,000–34,000 (in 2020), depending on scenario
Carbon Trust 2008	Offshore wind	-	40,000–70,000 (in 2020), depending on scenario
SQW Energy 2008	Wind, wave and tidal	4,800	12,000–18,000 (in 2014), depending on scenario 23,100–56,900 (in 2020), depending on scenario
Boettcher *et al* 2008	Wind		23,000–57,000 (in 2020), depending on scenario

Table from p.16 reproduced by kind permission of IPPR

A number of other sectors warrant discussion, even though they are unlikely to produce a large number of jobs in the short term. The BWEA has estimated that the wave and tidal energy sector could only provide around 2,000 jobs by 2020. However, it is widely acknowledged that the UK has several advantages in this area, which could lead to the development of a successful industry in the longer term. Wave and tidal technology is still a long way from large-scale deployment and so is not expected to provide many jobs in the short to medium term. But the UK has considerable natural wave and tidal resources, which makes it an ideal location for the development of technology. The country is a leader in R&D in this field with almost half of the world's device-developers located here, as well as two demonstration sites (in Orkney and Cornwall). Finally existing UK-based manufacturers of marine propulsion systems (such as Rolls Royce and Converteam) have the potential to diversify into manufacturing wave and tidal devices. The Government has recently recognised this potential and has designated South West England as a Low Carbon Economic Area specialising in wave and tidal power Many commentators are keen to see that these advantages are maintained and translated into a successful UK-based industry as the technology matures and becomes commercial. The manufacturers' organisation EEF identifies three barriers that could prevent this from happening:

- Financing the commercialisation of technology
- Obtaining planning consent and grid connection
- Limited public support for energy-related R&D.

p.17

Evidence of skills shortages and gaps

It is difficult to gain a clear picture about where skills gaps and shortages exist in the context of low-carbon jobs. Across the labour market as a whole, we know that the UK tends to do less well than many of our European neighbours on many measures of skills …. However, it is difficult to get a handle on the UK's specific skills needs for the emerging low carbon economy. Many organisations with an interest in low-carbon employment have carried out their own surveys or analysis, often focusing on a particular sector or profession. The different sources of information can often produce contradictory messages. There are also widespread perceptions about skills weaknesses in the UK, for example, that we lack sufficient skills in manufacturing or 'STEM' subjects (Science, Technology, Engineering and Maths), although the evidence base for these perceptions is not always clear. More broadly, there is a general lack of data about future skills needs, both in the UK and internationally, particularly data sources that take account of the effects of the 2008/09 recession

…. Here, we attempt to set out what we know about existing skills issues as they relate to low carbon sectors and any emerging or future problems, drawing on a number of different sources. We have tried to select those sources where there is robust evidence on skills problems, rather than anecdote or perceptions. We can supplement the existing evidence with the findings of our survey of 39 low-carbon employers, which provides some information about current skills gaps and shortages.

Table 5.1 sets out some of the key sources we have identified which contain good quality evidence about skills gaps and shortages that could have an impact on the development of low-carbon industries

p.44

Table 5.1: Selection of evidence on skills gaps and shortages relevant to low-carbon sectors

Source	Skills shortages/gaps	Relationship to low-carbon industries
Migration Advisory Committee 2009*	Geologists: including hydrogeologists, geological engineers, and geoenvironmental engineers	Renewables planning and construction, and CCS projects
	Civil engineers: including structural engineers, water engineers, geotechnical engineers and marine engineers	As above
	High integrity pipe welders	Connection of new energy generation to the grid
	Electricity transmission overhead lineworkers	As above
	Not: engineering technicians, other than aircraft component engineering technicians	
Engineering Technology Board 2008	Engineering technicians (qualified to Level 3 or 4, below degree level)	Multiple roles
	No particular shortage of engineering graduates	
CBI 2009 (employer survey)	STEM graduates	Multiple roles
	Workers with STEM skills at all levels	Multiple roles
	Technicians and graduates in energy and water industries	Renewables projects
DIUS 2009 (STEM study based on employer surveys)	Marine and aerospace engineers	Offshore wind installation and maintenance
	Mechanical and electricial engineers	Multiple roles
Innovation, Universities, Science and Skills Select Committee 2009b	Post-graduate-level STEM specialists	Low-carbon R&D
ippr stakeholder interviews	Local government planners	Planning process for renewables and microgen
	Engineers (all levels)	Multiple roles
	Energy efficiency contractors and installers	Domestic and commercial energy efficiency projects
	Ground source heat pump installers	Geo-thermal energy
	Understanding of general low-carbon behaviours in the workplace	All roles across the economy
ippr employer survey	Senior managers and professionals, and management and leadership skills	Multiple roles
	Technicians, and technical and job-specific skills	Multiple roles
British Wind Energy Association (Boettcher *et al* 2008)	Project managers	Renewables planning and delivery
	Electrical engineers	Connect new energy generation to the grid
	Turbine technicians	Wind turbine operations
TUC 2008	Understanding of general low-carbon behaviours in the workplace and ability to influence change in the workplace	All roles across the economy

Note: *The Migration Advisory Committee (MAC) was created as part of the points-based migration system which attempts to manage migration to the UK based on the skills of potential immigrants. The MAC regularly draws up a list of specific occupations where there is evidence that employers are having serious difficulty recruiting sufficient numbers of workers from the existing UK workforce because of a lack of relevant skills or work experience.

Table reproduced by kind permission of IPPR

The variety of occupations contained in Table 5.1 demonstrates the multi-faceted nature of low-carbon industries. In some cases there are overlaps across the different sources, but other sources are contradictory. Engineering, in a variety of specialisms, stands out as a clear cause for concern, but there is disagreement about whether we need more engineers at all levels, or whether technician or graduate level is a priority. This lack of clarity about skills gaps and shortages in emerging low-carbon industries is likely to create confusion and uncertainty for training providers, skills funders and employers. There is a role for a central government agency to collate the existing evidence and to commission a series of robust studies into the likely future skills needs for a low-carbon economy

…. Our survey of low-carbon employers provides some new evidence about existing skills challenges. We asked employers about 'hard-to-fill' vacancies from the last six months – vacancies where employers had struggled to identify and recruit the right person. The number of hard-to-fill vacancies is one way to measure the extent of skills shortages.

Table 5.2 gives a summary of our findings on hard-to-fill vacancies from our employer survey. In our survey, nearly half of respondents (19 out of 40) had had a hard-to-fill vacancy in the last 12 months. This is despite the fact that the survey was carried out in May and June 2009, when unemployment was high as a result of the recession. Of the 19 firms that recorded hard-to-fill vacancies, nearly half (eight) had had more than four such vacancies, suggesting that this is a significant issue for some of the organisations we surveyed.

Table 5.2: Hard-to-fill vacancies from ippr's low-carbon employer survey

No. of hard-to-fill vacancies	No. of firms
0	21
1	2
2	4
3	5
4+	8
Occupational level of hard-to-fill vacancies	**No. of firms**
Senior managers and professionals	11
Technicians	7
Admin, sales and customer service	3
Semi-skilled and unskilled manual	3
Reason vacancy was hard to fill	**No. of firms**
Not enough applicants with right skills/qualifications	14
Not enough applicants with the right work experience	12
Not enough applicants with the right attitudes or motivation	5
Terms and conditions, location, nature of work	4

p.46 Table reproduced by kind permission of IPPR

Employers found it most difficult to recruit high-calibre senior managers and professionals, although seven organisations also reporting difficulties in recruiting technical staff. In the majority of cases, vacancies were hard to fill because employers found it difficult to find people with the right skills, qualifications or work experience. Problems with the nature or location of the job were much less important. It is worth noting that a lack of appropriate work experience among candidates was almost as problematic as a lack of appropriate skills or qualifications.

Our employer survey also collected data on skills gaps within the existing workforce. three-quarters of employers (30 out of 39) in our survey reported a shortage of skills in at least one area. The most common shortages identified were management and leadership skills, technical and job-specific skills, and STEM skills. Relatively few employers reported problems with IT or basic numeracy and literacy skills.

…. This suggests that employers in the low-carbon sector have two major skills problems: management skills, which is regularly identified as a weakness in UK firms and by no means confined to low-carbon employers; and technical, job-specific skills, including but not limited to STEM skills. Our findings on skills gaps also reflect the results on hard-to-fill vacancies, which suggested that managers and technicians were the hardest groups to recruit.

…. all the evidence we have points to four broad types of skill requirement which are increasingly evident as we make the transition to a lowcarbon economy:

1. Specific skills gaps requiring substantial investment in training and workforce development
2. Skills shortages that could be addressed by 'topping-up' existing workforce skills
3. Generic skills shortages that apply across the UK economy
4. Generic 'green' skills.

Substantial investment in training and workforce development

There are a relatively small number of key occupations where there is evidence that the UK is facing skills shortages and where significant investment in training and upskilling is needed. This could apply to some of the occupations listed by the MAC, such as high integrity pipe welders and civil engineers. There is an across-the-board shortage of workers with the appropriate qualifications and work experience, which is a challenge for the low-carbon sector but also for other sectors, some of which will also be strategically important to the UK. There is a case here for public investment in the short term and in longer term training and workforce development programmes to ensure the UK has a sufficient supply of these workers. A lot of this training might be relatively lengthy and expensive. However, the evidence that we have at the moment is that these skills shortages are limited to a small number of occupations and we may not need large numbers of people doing these jobs. Therefore, the overall cost could be minimised.

'Topping up' existing workforce skills

In many cases, new low-carbon jobs could be carried out by individuals who already possess a base of relevant skills. They will require some additional training to familiarise them with new concepts and practices that will enable them to operate in low-carbon industries. Table 5.3 below gives some examples of the kinds of occupations that might fall into this group. Our conversations with industry stakeholders and others suggest that the bulk of new jobs will fall into this category.

Table 5.3. Top-up training for low-carbon jobs

Current job →	Core training requirement →	Additional low-carbon skill requirement →	New low-carbon job
Electrician	Apprenticeship, BTEC or NVQ/SVQ	Working on roofs; installation of solar PV panels	Solar PV fitter
Offshore oil or gas ma intenance technician	Apprenticeship, BTEC or NVQ/SVQ	Offshore wind technology	Offshore wind maintenance technician
Aerospace technician	Apprenticeship, BTEC or NVQ/SVQ	Technology-specific knowledge	Wind turbine technician
Architect	Undergraduate degree, masters degree and paid work experience*	Energy efficiency and zero-carbon knowledge	'Low-carbon' architect
City trader	Undergraduate degree	Carbon literacy, understanding of carbon trading schemes	Carbon trader
Facilities manager	No specific qualification required	Sustainability and energy management issues	'Low-carbon' facilities manager

*These are requirements to become a registered architect with the Architects Registration Board.
BTEC = Business and Technology Education Council qualification; SVQ = Scottish Vocational Qualification; NVQ = National Vocational Qualification

p.48 Table reproduced by kind permission of IPPR

In many cases, occupations will evolve over time to incorporate more and more low-carbon knowledge and techniques. Many of these occupations will not be purely 'low-carbon': an electrician trained to fit solar panels may also spend part of their time doing the more traditional work of an electrician. In other cases, like the wind turbine technician, it will be easier to identify an occupation as being in a particular low-carbon industry. It is likely that the boundaries between what is and

is not 'low-carbon' work will become blurred and, in the long term, increasingly irrelevant as the whole economy makes the low carbon transition. The key issue with many of these roles is that they are unlikely to require substantial investment in upskilling or re-skilling programmes targeted at large numbers of people. In many cases, the key skills already exist and the challenge is to provide workers with additional knowledge and techniques which enable them to transfer their existing skills to new and emerging industries and roles.
p.49
The current approach to skills policy is focused around industry sectors, with Sector Skills Councils being the main forum in which employers can report training needs. This has many benefits because firms in similar sector tend to face similar skills challenges but it also means that sector-specific, technical skills can take precedence over more generic, transferable skills like management, marketing and commercial understanding. Clearly, we need to find ways of ensuring that low-carbon employers have staff with sufficient expertise in management and other cross-sector skills, otherwise the growth potential of these businesses will be thwarted.
p.50
However, a key problem emerges if employers fail to articulate sufficient demand for skills that are likely to be needed in the future. A number of our interviewees raised this as an issue in the context of the low-carbon transition: many employers in some of the key sectors, including construction, engineering and manufacturing, have yet to fully realise the impact of the transition on their future business and are therefore not yet articulating the demand for low-carbon skills to the relevant Sector Skills Council. There are a number of reasons for this. Employers are often focused on the immediate challenges and can, understandably, sometimes fail to fully comprehend where their business needs to be in five or 10 years' time. This can particularly be the case for small businesses where they lack the expertise or capacity to look to the future. Secondly, there is some evidence that the 'stop/start' nature of some of the Government's climate change policy means that employers are hesitant to move into low-carbon sectors, and so their skills needs remain relatively unaffected. Finally, there is a wider question about the extent to which society as a whole has fully grasped the extent of the transition that is necessary and the impact it will have across the economy.
p.51
Industry stakeholders have told us that an employer-driven skills system will not by itself create the stimulus that is necessary to increase low-carbon skills among the workforce. Government must step in to ensure that the UK has the right skills to maximise future employment opportunities. This is not about returning to a centrally-planned system and ignoring employers. Rather, it means working with employers, Sector Skills Councils and other employer bodies to understand the current pressures on employers and the challenges they face in thinking about the extent and impact of the low-carbon transition. It also means being clear about government policy on the transition and providing the certainty that employers need to be able to invest in skills.
p.54

85 **Power Sector Skills Strategy Group Sector Skills Strategy 2009 to 2014.** Sept 2009

.... over the next five years the sector will face:

- A potential change of UK government with consequent changes in learning and skills policy and a different emphasis on energy policy issues;
- A continued aging of the workforce as the rate of retirement increases and limited output from new training activities struggling to meet the gap;
- Substantial investment is already planned in generation, distribution and transmission;
- The supply of school-leavers and graduates with relevant qualifications remains low, indeed the prospect of a recession may reduce the number of students prepared to accumulate substantial student debt;
- Reduced birth-rates restrict the total number of students seeking qualifications at all levels so there is an increased need to encourage students to pursue science and maths rather than arts subjects: whilst the skills gap has partially been bridged by immigration, there is a global skills shortage and a long-term supply of skilled migrant staff is uncertain;
- Increased investment in green energy will change the skills required of both new and existing staff in both generation and networks businesses

PSSSG still needs to focus on its long-term goal of producing a suitably skilled and flexible workforce for the next twenty-five years.
…..By the end of 2010, we should have over 75% of the sectors workforce renewal data inputted into the Workforce planning tool. This will inform the strategies for the National Skills Academy for Power and EU Skills
…During 2010 we should complete the technical skills assessment for craftpersons, technicians and engineers that identifies skills trends and changes in demands for these types of role for the remainder of the five year planning cycle

8 **BIS Towards a Low Carbon Economy** July 2009
The Carbon Trust estimates that developing the UK offshore wind industry could provide jobs spread across: R&D, engineering and design; turbine and component manufacturing; services; and operation and maintenance totalling 40,000 jobs; or even 70,000 with a proactive manufacturing strategy. In addition, it is likely that an offshore wind industry would be located in economically-deprived areas of the UK. The wave industry meanwhile could create substantial export opportunities for UK businesses in the medium to longer term, and the Carbon Trust estimates that wave industry jobs could reach 16,000 in 2040s.
p.85

93 **SWRDA / ARUP Achieving a green economic recovery** May 2009

recommendations
Ensure that green skills in key sectors, are addressed at intermediate and higher levels - whilst the South West has a highly qualified workforce, projections of future demand show that supply will need to increase at intermediate and higher levels and that this must largely be met by more people currently in the workforce acquiring such higher level skills. This is particularly the case for emerging technologies in the low carbon economy. RETG should encourage higher-level vocational skills development to match the needs of the low carbon economy and ensure that regional skills objectives are clearly embedded in the regional priorities established for Higher Education.

It will be important to provide the resources and facilities to deliver new models of delivery for work-based higher level green skills, including bitesize 'on the job' learning, for the workforce.Information, advice and guidance on transitional opportunities - good quality low carbon careers advice will be vital in ensuring that both learners and re-trainers make effective choices. More tailored green careers training provision is required and this needs to be of good quality and appropriate.It has been suggested that a baseline assessment of the skills required for a green economy should be undertaken across the region. A report on the current skills development activity surrounding the agriculture sector is currently being carried out and may have some useful conclusions that can be drawn in to this work. Local Authority Employment Skills Boards could be a good way of disseminating good practice.
p.11

37 **Crossley, Peter** Changing industry landscape reveals skills shortages The Joule Centre March 2009

There has been optimism that the skills needed may lie in diversification between the renewables sector and the oil and gas (O&G) industry. UK oil production peaked in 1999, while gas production peaked in 2000. Both are expected to decline to more than half their peak rates of production by 2011. Stagnation and decline in O&G creates a potential for the industry's workers to transfer their skills into the renewables sector.
O&G companies have experience in areas such as supply chain co-ordination, manpower and equipment supply, procurement, planning and logistics support. Civil engineering skills and the ability to undertake construction activities in adverse conditions are also crucial for the renewables industry. For off-shore wind farms, in particular, marine expertise is vital: cable laying, lifting and installation; use of equipment like sub-ploughs; and knowledge of marine legislation and control. These are all skills shared by O&G workers.
Ideally, as O&G declines and renewables undergoes growth, a happy overlap of skills should emerge between the two sectors, with O&G diversifying into renewables.
However, even as it approaches stagnation, O&G is still far more profitable than renewable energy, which means that experienced engineers continue to radiate towards the bigger salaries and benefits of O&G. The fact is, the UK urgently needs to build skills in science and engineering from scratch, if it is to reach its lofty renewables targets in the next few years
....Advances in technology and an increase in the outsourcing model of business mean that distance is no longer a barrier to doing business. This means that the most skilled workers are the most prized, no matter their location in the world. It's a simple fact that if the UK does not produce more skilled workers in the energy sector, then other countries will be able to fill the skills gap

....The renewables sector can no longer just be seen as the realm of scientists and environmentalists. A wide range of skills is needed to bring our vision of a low-carbon future to fruition. Skills at all levels are required in renewables: from the 'black trades', through to technicians and graduates. The UK is certainly not lacking in the natural resources necessary to be at the global forefront of renewable energy. But now its academic capacity needs to be more clearly focused to encourage uptake of the skills necessary for a truly sustainable future.

60 **EU skills et al Energy skills – opportunity and challenge** Oct 2008

There are no reliable estimates of current UK employment in renewables or its growth potential, although, given the growing certainty of a policy framework centred on 15% of UK energy from renewables by 2020, such forecasting should now be more reliable.
From a skills perspective, renewable energy is a fragmented sector. Only wind energy can be regarded as mature and many other technologies are still in development or emerging into the mainstream. Nevertheless, the sector is growing and getting stronger, with an increasing demand for skills that can be hard to satisfy.
For the Sector Skills Organisations, renewables present some issues not seen elsewhere. Perhaps the most important is the uncertainty around the future demand for skills,

especially for those technologies yet to complete their development. The production of competent, skilled workers takes 5-10 years from leaving school but it is not possible to estimate the demand for skills so far ahead with any certainty. The danger of not producing enough skills, hence delaying the introduction of the technology is obvious. But equally damaging would be the production of large numbers of people ahead of demand, as this could lead to a backlash for future recruitment.
The footprint for renewables is also complex. There are 8 SSC's, 9 RDAs and 3 devolved administrations all trying to tackle the issue and there is possible overlap, in total, with 14 Sector Skills Organisations. This includes many for whom renewables is not mainstream, for example the 2 million workers in the construction sector who might occasionally install renewable systems. Energy and Utility Skills takes the lead in coordinating the approach to renewable energy but, to date, a cohesive strategy has proved elusive. There needs to be better co-ordination of effort, with dedicated resources to address the issues more effectively.
p.96
Most of the existing workers in renewable energy were trained in mainstream energy or engineering and we believe the most effective medium-term strategy would be to expand this mainstream training provision to cater for a spin-off to renewables.
…Wind will bear the brunt of meeting the 2020 targets for renewable energy. Installed wind energy capacity will overtake nuclear for a time in the late 2010s. Therefore, a competent skills base is essential to support growth and maintain the infrastructure. Generally, skills and recruitment are in reasonable shape, but current capacity cannot support the high level of growth in new installations. However, offshore, which is the most important sector for growth, is likely to experience recruitment difficulties, due to the unattractive work-life balance.
Employers expect graduate recruitment to become more challenging as demand across the energy sector rises. Apprentice-based training will also need to be developed, with a sound route for progression to Foundation Degree. The most critical skills issue currently is the turnover of service engineers, which at 25%, makes attrition hard to manage
The British Wind Energy Association has called together key employers to develop a skills plan for the industry, which will also encompass marine renewables.
…Many thousands of jobs will follow the successful development, manufacture, installation and maintenance of large-scale wind and wave-related technologies…
p.97

88 **REGEN SW The road to 2020** Sept 2008

(2008 so before govt strategies such as low carbon ind strategy, before offshore wind round 3 announcements, before SW gained LCEA status and wave hub funding, before increased accelerator and other funding programmes.)
Our analysis indicates that generating 15% and 20% of all energy consumed in the South West from renewables is possible by 2020, but requires rapid changes in national policy and stronger support from decision makers at a local level. Without such changes less than 5% of the region's energy will come from renewable sources.
• The challenging nature of a 2020 target and the significant deployment risks mean that it will be essential to achieve high and rapid deployment in all technologies.
• Achieving 15% is critically dependent on the development of offshore wind in the region. Achieving 20% additionally requires very extensive installation of renewable heat systems in existing buildings.
• Achieving a 15% target could result in the equivalent of two-thirds of the region's total electricity consumption being generated by renewable projects, and will require any constraints in the national and regional electricity networks to be speedily addressed.
….Offshore wind deployment is critically dependent on being able to construct foundations in water depths of 30–50 metres at reasonable cost. We highlight the need for a UK technology accelerator programme to support engineering innovation in deeper water turbine installation.
p.3
On the basis of this analysis we predict that renewables will have to produce 19 TWh by 2020 to be producing 15% of the South West's final energy consumption, or 26 TWh to meet a 20% target.
p.5
15% scenario
It is clear from our preliminary analysis, that to achieve renewables at anything close to 15% will require a large component of offshore wind and that this will have to be located in water depths of between 30 to 50 metres. We have assumed that one of the possible Severn tidal schemes is constructed and contributes 4 TWh by 2020. This corresponds to the potential 2020 contribution to target of the Cardiff–Weston Barrage at 17 TWh: half this figure is credited while it is under construction and we have assumed that the output would be split 50:50 between the South West and Wales.
…..20% scenario
an additional 250 MW of onshore wind, and an extra 300 MW from wave energy
p.6
….in Scenario 3 renewable energy meets 20% of the region's total energy demand, but 73% of its electricity demand.
Scenario 2 renewable energy meets 15% of the region's total energy demand, but 66% of its electricity demand.
p.8
Offshore wind in the South West is critically dependent on being able to construct foundations for water depths of 30 - 50 metres at reasonable cost. Neither wave nor tidal stream technology has yet been commercialised and progress has been very slow. These technologies are not therefore expected to make a significant contribution by 2020, but are likely to have an important role to play by 2030 and it is important that work continues to bring forward commercialisation

p.12
However offshore wind deployment in deeper water poses a new opportunity to engineer financially viable ways of deploying in water depths greater than 30m. With few global offshore turbine manufacturers, a supply chain already stretched by onshore wind, and over half the total cost in balance of plant, there are significant opportunities for the region, particularly if it can become a centre for research and innovation in deeper water technology. If offshore wind farms are built in the region there are certain activities that have to take place locally and a higher probability that business can be won by South West businesses. Maximising the opportunities for economic development from new offshore wind farms will also require the identification of ports available for construction and maintenance and the protection of large areas in those ports for laying down key components. Wave and tidal stream technologies are commercializing slowly but the South West has an edge in wave research and demonstration with Wave Hub and PRIMaRE, the marine energy institute set up by Exeter and Plymouth Universities. The South West also has leading tidal stream companies, Marine Current Turbines and Tidal Generation, headquartered in the region. The Carbon Trust estimates that UK annual revenues from marine renewables could range from £300–900 million by 2020.
p.14
Renewable energy directly employs 2,900 FTE jobs in the region today *(2008)* compared with 1,140 FTE jobs in 2005, equivalent to an average annual growth rate of approximately 37%.
….The growth in employment has occurred through a combination of larger firm size and an increase in the number of firms. However, the sector is still dominated by small businesses as these results show:
• 61% of businesses employed less than 10 employees.
• 22% of the firms surveyed were start-ups, established since 2005.
• Renewable energy businesses make just under a third (32%) of their purchases and a similar amount of their sales in the region.
…..Businesses in the renewable energy sector tend to be focused on consultancy (32% up from 22% in 2005) and project development (23%, no change from 2005).
p.15

5 **BERR / Douglas Westwood Supply Chain Constraints on the Deployment of Renewable Electricity Technologies** June 2008

How the skills shortage could affect the Renewables sector
The 2007 Energy White Paper: 'Meeting the Energy Challenge', has given the renewables sector a welcome boost with the ambitious target of generating 20% of the UK's electricity by 2020. However, surging demand for energy, an aging workforce and a lack of new entrants to the energy industry in general is combining to threaten the UK's energy strategies and specifically the delivery of this 20% renewables target. The skills shortages are not specific to the renewables sector, or the energy sector as a whole, but symptomatic of an historic lack of national investment in all levels of skills development in engineering and the trades.

Competition with Traditional Energy Sectors
The demand for energy is now being driven up by the developing countries, in particular China and India, whilst at the same time production of oil & gas is reducing in non-OPEC areas such as the UK North Sea. The result is oil prices at record levels and a surge in exploration & production activity, particularly in the Middle East and offshore in West Africa, Latin America and North America. This is fuelling major worldwide competition for human resources at all levels, but the key need is for experienced staff.
Although there seem to be plenty of graduates and post-graduates willing to enter the renewables sector, the general opinion from companies within the renewables supply chain is that there is a lack of experienced staff, especially engineers and project managers in the UK, willing to enter the sector. Cross-sector competition for experienced staff was also highlighted by many of those interviewed as an issue that affects a company's ability to hold onto staff and build good teams. With all energy sectors struggling with the same issue, developing renewable sectors are trying to compete with the more traditional sectors of Oil & Gas and Marine who have plenty of work and much bigger cheque books.
The end result is that the developing renewables sectors in the UK such as wave & tidal will experience bottlenecks in the project development process as they struggle to attract and/or retain experienced staff.
Engineering skills shortage
The 'baby boomers' that entered the energy industry in the late 1970s and the early '80s are now retiring and there appears to be a lack of experienced staff across the entire energy industry to fulfil current demand. The energy companies themselves are able to offer good salaries and excellent training programmes, so the real problem is amongst the huge number of companies that constitute the supply chain and in particular those in the developing energy sector of renewables.
By 2016 it is likely that some 15 to 20 GW (about a quarter of the UK's existing generating capacity) will need to be replaced, and further substantial investment on a similar scale may be required in the following decade. Conventional and nuclear power generation and the oil & gas industry are all, together with other engineering sectors, competing for the same people as the renewable energy sector.
p.23
Education unfit for purpose
The core of the problem is that, in the view of many, the UK's education system has been unfit for purpose. It has failed to provide young people with the necessary skills to enter the workforce at all levels, from the 'black trades', through technicians to graduates. The recent UK Employers Survey noted that the main skills lacking were technical and practical ones. Another noted a 'lack of specific engineering skills with the right levels of experience'. And this is happening a time when (in 2007) over 518,000 18-24

year olds were out of work. The House of Lords Select Committee on Economic Affairs noted in its July 2007 report that 'many young people leave school without the basic functional literacy and numeracy required for apprenticeships and that schools also fail to inform many students about apprenticeship'.
Even the OECD has criticised UK government urging it to 'devote more effort to getting better value for money' and to 'take care that a greater quantity of education is not sought at the expense of quality'.
Again, in the view of many companies, the current major problem is the production of graduates with economically valueless degrees. The respected Petroleum Review notes that 'in the past few years the UK has produced more media studies graduates than physics and chemistry graduates combined.' In addition, the present system responsible for delivering skills is dominated by skills providers' rather than end users. The 2006 Leitch skills review has called for a 'simplified structure, focus & control'. In short, the system is over-complicated and is difficult for individuals to access.

The future

On November 1 2007, the Prime Minister pledged to overhaul the apprenticeships system and to introduce a legal entitlement to an apprenticeship for every young person by 2013. And on November 16th 2007 the government promised a massive skills push including 3.5 million literacy and numeracy courses.
Over the period to 2020 DWL forecasts further growth of energy demand and that the basic skills situation could slowly improve but the experience deficit grow. The UK's offshore oil & gas and nuclear decommissioning programmes plus power station replacement will increase competition for human resources in future years and the UK renewable energy programme is likely to be hit by skills shortages.
Energy skills development comprises four key needs: to educate, attract, train and retain. The main issues identified by industry are:
• The need to change perceptions of the energy industry to improve its appeal as a career
• The requirement for more employer involvement in skills development
• The need to re-focus the skills providers / training organisations on employers needs
• The considerable differences in needs of the various energy sectors.
Recent work we have carried out for the East of England suggests that the way ahead is to:
• Effectively interface with both students and staff in schools and further education
• Change perceptions of the energy industry across all age groups and with government at local, regional and national levels
• Apprenticeships are key to addressing many of the problems faced by the energy sector. A new approach is needed that includes the SMEs
• Assure employers fully buy-in to future initiatives.
With regard to getting 'experience' into the industry, cross-training from other industry sectors outside of the energy sector will have to be considered. Such sectors are identified in our consultations with industry.
p.24
(forecast job numbers in this report, by MW, by no of turbines manufactured etc p.17-18 – now updated by events/other reports)

52 **DEFRA Skills for a Low Carbon and Resource Efficient Economy ProEnviRo project** 2008

Overall, the evidence base on Low Carbon and Resource Efficient Economy (*LCREE) skills is weak, with available research focused on high level and general comments.*

…. 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
…. This leaves us in a 'Catch 22' situation – 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 SSC's) to respond to.
• It is considered unlikely that current levels of skills training capacity will be sufficient to meet demands in the event of increased conversion of latent potential demand to actual demand, though further evidence based work and forecasting are recommended to quantify this.
• LCREE skills need to be considered by, and integrated into, the whole of the skills delivery system.
p.5
A lot 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 and mechanisms for their transfer.
• The most important generic skills highlighted were leadership and management skills with an emphasis required to further this agenda effectively (such as communicating the LCREE message and strategic business planning with LCREE in mind), sustainable procurement and STEM (Science, Technology, Engineering and Mathematics) skills in general.
Job roles included, a little dated…

86 **REGEN SW / DTZ The economic contribution of the renewable energy and energy efficiency sectors in the South West of England** April 2008

Regen SW commissioned DTZ to undertake a study to identify and quantify the impact of the recession on the economic contribution of the Renewable Energy (RE) and Energy Efficiency (EE) sectors to the South West economy, updating a previous study

…Total employment in these companies (all sectors) has risen by two percent since 2008, with average employment per company increasing from 73 to 75 employees.

☐ Total employment in the RE and EE sectors has increased from 1,510 (2008) to 2,110 (2009) – an increase of 40%.

… Compared to last year, there are 60 more managerial posts, 270 more professional/technical posts, 100 more admin/clerical posts, and 70 more skilled trades posts in these companies. This rapid growth may have implications in terms of the future availability of skilled staff in the region.

☐ Companies are generally positive about growth in the next year or two, with 68% indicating that they think their market will grow, 70% stating that they think their business will grow, and 92% stating that they are likely to increase employment.

p.2

All Marine

111 **The offshore valuation group The offshore valuation: a valuation of the UK's offshore renewable energy resource** May 2010

What is the value of our offshore renewable energy resource?

What we found has exceeded our expectations. In harnessing 29% of the practical offshore renewable resource by 2050:

• the electricity equivalent of 1 billion barrels of oil could be generated annually, matching North Sea oil and gas production and making Britain a net electricity exporter;

• carbon dioxide reductions of 1.1 billion tonnes would be achieved by the UK between 2010 and 2050 – a major contribution towards 2050 climate targets;

• 145,000 new UK jobs could be created by industry.

The next four decades of technological development could enable us to harness a practical resource ten times the size of today's planned deployments. Integration with neighbouring electricity networks though a 'super-grid' could provide access to a single European electricity market, enabling the UK to sell renewable electricity across the continent

p.2

Three deployment scenarios were examined to reveal a landscape of different options. Each scenario envisages a level of deployment greater than that currently planned but exploiting less than the full practical resource:

Scenario 1	78GW installed capacity	13% resource utilisation	£170B capital expenditure	£28B annual revenue in 2050	**50% UK demand**
Scenario 2	169GW installed capacity	29% resource utilisation	£443B capital expenditure	£62B annual revenue in 2050	**Net electricity exporter**
Scenario 3	406GW installed capacity	76% resource utilisation	£993B capital expenditure	£164B annual revenue in 2050	**Net energy producer**

The scenarios are neither predictive nor prescriptive. Their achievability will ultimately be determined by the level of the UK's ambition; by the level of demand for the UK's renewable electricity in the wider European market; and by evolving technology costs.

p.3

DECC Press Release publication of Marine Energy Action Plan – 15 March 2010

Harnessing the full potential of marine energy could provide enough power for up to 15million homes and save up to 70million tonnes of C02 by 2050 according to the Government's Marine Energy Action Plan, released today. The document also highlights the potential for the marine energy sector to provide up to 16,000 jobs, with a quarter of these in exports

44 **DECC The Marine Energy Action Plan** March 2010

Key recommendations include:

Forming a UK-wide strategic coordination group to develop a planning and consenting roadmap for all types of marine renewables;

Consideration of support levels for marine technologies under the review of banding of the Renewables Obligation in Autumn;

Ensuring that the appropriate levels of targeted funding are available to bridge the technology market failures that exist in this developing sector, subject to the budgets in the next public spending round;

Leveraging private equity, and in the longer term, project capital into the sector;

Establishing guidelines and best practice in the development of new technologies; and

Building a UK marine energy supply chain and utilising the current skills base already established from the offshore wind, oil and gas, and maritime industries

2.4 Infrastructure, Supply Chain & Skills
Government, Devolved Administrations and Regional Development Agencies
Capitalise on the current skills base already established, notably from the offshore wind, oil and gas, fisheries, shipping, by continuing to employ a strategic approach to transfer skills and develop a highly experienced workforce for the emerging industry (e.g. the Centres of Excellence and Marine Skills Centres as part of initiatives by the south west England RDA and through initiatives in the forthcoming Low Carbon Skills Consultation led by DECC).
All relevant stakeholders should provide collective and formalised responses to the forthcoming Low Carbon Skills Consultation led by DECC.
DECC engage with relevant departments on the further development of the forthcoming Low Carbon Skills report.
manufacturers and relevant supply chain become more aware of the requirements of the industry, and with the knowledge that it will require some bespoke equipment, manufacturing facilities and a strong skills base from which to escalate the industry forward.
all relevant stakeholders should provide information to higher education careers advisers, allowing through-flow of an industry relevant work force.
the **TSB** continue to promote wave and tidal energy activities through its Knowledge Transfer Network. This will help to reflect the needs of the members and can focus on enabling innovation through the networks, which can then result in a greater number of Knowledge Transfer Partnerships (KTP).
technology developers use the KTP mechanism to gain knowledge on a variety of issues including those that they wouldn't have an in-house capability to address.
p.30,31
The Action Plan recommends that **DECC, relevant departments and stakeholders** include the needs of the tidal range sector in any relevant initiatives aimed at addressing skills and supply chain issues in the renewables sector, including the wider construction and other issues specific to tidal range developments.
p.33

16 **BWEA The Next Steps for Marine Energy** - An Industry View on the marine energy action plan March 2010
(BWEA re-named RenewableUK in 2010)
K*ey recommendation* - RenewableUK believes the Department for Business, Innovation and Skills (BIS), and industry should complete an industrial strategy to make the most of the emerging skills and expertise clustered around particular nodes in the value chain.
p.2
Discussions with RenewableUK members revealed that if the industry receives sufficient support in the early stages of development, by 2020 the UK could have installed 2GW of marine energy projects, powering 1.4 million homes.
The actual level of capacity installed by 2020 and the future domestic market will be strongly dependent on enabling actions and policies that support the development of the marine energy industry.
p.3
The UK is currently the marine energy world leader, with a capacity of 2.4MW currently installed, 27MW in the planning process, 77.5MW of projects being developed and over 1GW of projects about to be announced by the Crown Estate. The UK also has world-class testing facilities that, combined with some of the best wave and tidal resources in the world, place it in an ideal situation to become 'natural owner' of a world-leading industry, with fantastic export potential.
p.4
The UK wave and tidal industry now requires Government to deliver continued targeted investment to develop technology, similar to the amount that has been provided in the past year, as the scale of investment needed to overcome the present challenges is insurmountable by industry alone.
This document outlines a minimum requirement for the Government to commit additional funds of approximately £220 million for technology development up to 2015. It is estimated that this upfront investment **will result in an industry with revenue of £0.9 billion per annum by 2020**.
RenewableUK is committed to delivering the additional research that will be required to further define investment and revenue figures.
p.10

94 SWRDA Stephen Peacock's speech to the Society of Marine Industries' Conference **Investing in UK Maritime Renewable Energy – Engineering Challenges & Business Opportunities'** February 2010

(SW) over 230 businesses and organisations working in renewable energy, employing around 3,000 people and contributing around £300 million to the economy
employment levels increase by up to 158 per cent since 2005
…the North Cornwall coast enjoys between 15 and 25 kilowatts per metre of wave crest and that rises to between 35 and 40 kilowatts off the Isles of Scilly and in the far west of the region less susceptible to the extreme storm conditions that exist off the western shores of Ireland or Scotland, which means wave power devices have potentially much better survivability in South West waters
tidal resource of national significance thanks to the second highest tidal range in the world in the Severn Estuary

….. and there is good tidal stream activity around Portland Bill in Dorset

strong electricity network, which exists close to the coast, but we need to be wary of future constraints. Although there is capacity for connecting new generation to this system, upgrades will be required before 2020 if the predicted growth in wave, tidal and offshore wind is achieved
…Wave Hub project off the North Cornwall coast,
20MW electrical hub in 50 metres of water some 17 kilometres offshore and connected to the grid via a subsea cable.
£42 million demonstrator project funded by the RDA, Department of Energy and Climate Change and the European Regional Development Fund. It will allow arrays of wave energy devices to be tested in real conditions on a scale not seen anywhere before.
We expect the first wave energy devices to be connected to Wave Hub sometime in 2011
It will give fledgling device developers the infrastructure they need to carry out pre-commercial testing, and complements work being undertaken in other parts of the UK, including at EMEC in Scotland and at NAREC in the North East

PRIMaRE is a collaboration between the Universities of Exeter and Plymouth consisting of 15 world-class academic staff, 60 researchers and a dedicated technology transfer team that works with businesses to support high quality job creation across the South West.

The capital investment in the offshore wind industry in the South West alone will top £5 billion, potentially creating thousands of construction jobs

Severn Estuary. With the second highest tidal range in the world at 14 metres, the estuary represents a huge and untapped renewable energy resource….subject of a major cross-Government study, which will assess whether Government could support a Severn tidal power scheme and if so, on what terms. The shortlisted options include barrages and lagoons with generating capacities ranging from 625MW to a massive 8.6GW, representing up to 5 per cent of the UK's electricity demand. The final phase of the study is looking at the options in detail with a view to making recommendations to Ministers later this year.

There are significant commercial benefits to developing the marine energy industry, not least in the supply chain. The Government's own research estimates that wave and tidal technologies could contribute around 1.3GW to the UK's 2020 renewable energy target, and provide up to 20% of the UK's electricity needs by 2050. And estimates of global market size for marine renewables vary from £60 billion to a massive £190 billion, per year.

58 **Energy Engineering** Offshore wind, wave and tidal issue (27) 2010

Claire Gibson, director of sustainable resources, SWRDA "..the south west has a strong existing supply chain that is ripe for supporting the offshore wind industry. From engineering firms to component manufacturers and technology providers, much of the supply chain is already in place….this strong skills base is very encouraging but, as with any growing industry, more new skills will be necessary to fill the gap. Offshore wind development will not only deliver energy and jobs, but also it will help bridge the gap towards developing other marine renewables and develop skills in the region that can be transferred to wave and tidal in the future"

12 **British Wind Energy Association** Choosing a career in wind, wave and tidal energy no date

By 2020 the UK aims to have reduced its CO2 emissions by over 30% compared to 1990 levels. It is obliged under EU law to generate 15% of its energy from renewable sources by this date too. An ambitious target. The largest single source of this renewable energy is set to come from the wind, whilst marine energy will also play an increasingly important part in meeting our future energy demands.
Wind Energy
Wind has been the world's fastest growing renewable energy source for the last seven years. As the costs of generating fall and the urgent, international need to tackle CO2 emissions and prevent climate change grows, it's a trend that's set to continue. In fact exponential growth means wind energy is about to break the 4GW barrier only 12 months after reaching 3GW. As the windiest country in Europe and world leader in off-shore technology, the potential exists to power our country several times over using this free fuel.
Marine Energy
Wave and tidal power is a new and exciting form of energy generation. At the moment it is still in the developmental stage, but the UK is already its global leader, with just under 2MW installed capacity and the potential to produce 20% of our electricity demand by 2050. With rapid sector development from emerging companies expected, newcomers to this industry will have the opportunity to play a major part.
p.3
Job roles
R&D and Manufacture
Exciting new developments and innovations are driven by mechanical and electrical engineers, scientists and technical experts. They also feed into the work of those involved

in the manufacture of components.

Technical Analysis

Software developers, data analysts, GIS technicians, environmental analysts, marine scientists and aerodynamicists are key to the development, construction and operation of renewable energy facilities.

Development

Those with skills and experience in planning, science, engineering, project management, law, finance or other numerate subjects often work at this complex and crucial stage, which also calls for expertise in "softer" skills.

Project Design

From procurement of kit and designing turbines to electrical and grid connection, there's a huge volume and range of work here – attracting mechanical and electrical engineers (including grid connection), geophysical, construction and marine specialists.

Construction

Project, contract and site management, cabling, civil engineering and general construction skills are essential here. Turbine and other component manufacture also involve process and production management, while off-shore projects present new kinds of challenge.

Operations and Maintenance

Engineering and associated skills and experience in grid connections, electricity generation and physical inspection and maintenance are all essential here.

p.5

14 **BWEA Marine Renewable Energy State of the Industry Report** October 2009

The review of the marine industry presented in this report highlighted the following points as the key issues / concerns faced by the industry:

• BWEA members think that most of the early UK marine energy projects will be in Scotland due to the higher level of financial support available;

• Discussions with BWEA members revealed that the industry believes that by 2020 the UK could have installed 1 GW to 2 GW of marine energy projects; however the actual level of capacity installed will be strongly dependent on enabling actions and policies that support the development of the marine industry;

• It is important for the Government to express confidence in the marine industry and the future growth of the marine energy market in order to encourage private investment, not only to make projects happen but also to ensure that companies survive;

• The industry believes that there is a funding gap between the capital grants available for small prototype development and the revenue support for long-term operation of projects;

• Based on the experience of the solar and wind industries, the level of UK support for marine energy is not yet of the magnitude required to develop a world-class industry.

p.4

Recent years have seen exciting progress in the marine industry with testing of full-scale prototype devices at sea and the installation of the first gridconnected deep-water wave energy device and tidal stream devices. There is significant activity in the R&D of innovate technologies as well as some devices maturing into the pre-commercial stage.

2.1 Current UK Installed Capacity At the end of April 2009 the UK has 0.5 MW of wave energy installed and 1.45 MW of tidal stream installed

p.7

The Crown Estate owns the seabed out to the 12 nautical mile (nm) territorial limit and has the rights to license the generation of renewable energy on the continental shelf within the Renewable Energy Zone out to 200 nm.

p.10

The *(Scottish)* SEA *(strategic environmental assessment)* concluded that between 1 GW and 2.6 GW of generating capacity could be developed with generally minor effects on the environment

p.10

It is recognised that the development of a commercially successful marine industry would lead to job creation within the UK; however there are differing opinions regarding the level of job creation. A study published by the Scottish Executive predicted that 7000 direct jobs could be created in a diverse marine industry in Scotland by 2020, supported by sustainable research development and skills bases19. A study completed for BWEA identified that the growth of the wave and tidal sector could provide up to 2100 jobs in the UK by 202020.

p.21

The current short-term challenge facing the marine industry is gaining sufficient experience of operating devices and multi-device projects in the marine environment to demonstrate to all investors (public and private) that the technology works, and the future potential for the industry.

p.22

73 **Forum for Renewable Energy development in Scotland FREDS Marine Energy Group (MEG) Marine Energy Road Map** September 2009

Companies across the UK involved in the renewable energy industry have reported difficulties in recruiting skilled personnel in, for instance, the fields of engineering (electrical, mechanical) and project management. This is due in part to a general shortage of graduates specialising in such disciplines in the UK, combined with a difficulty in attracting experienced personnel from other sectors due to competition with other more established industries (in particular, the oil and gas industry).
p.15
Jobs and Skills Profiles
Developers, where possible, will be looking to source expertise and services locally to support their projects. The following areas of work have been identified as having strong local employment opportunities for the Scottish workforce: permitting/consenting, vessel hire, divers and ROV surveys, environmental and geotechnical monitoring, maritime operations consultancy, fabrication and final assembly, cable installation, operations and maintenance as well as port facilities.
….Scotland already has an experienced offshore industry supporting the oil and gas sector. MEG appreciates that there are vital skills within the oil and gas sector which could be translated to the marine renewables industry, particularly in the coming years as projects start deploying in Scotland" s seas, to ensure early deployment success. Lessons learned from the offshore wind and other marine sectors (such as fisheries, shipping etc) will also be of value to project developers working in the offshore environment.
Despite the existing level of offshore skills within Scotland's workforce, MEG believes that demand from the emerging marine and offshore wind renewable industries will create a heavy demand on the available workforce. A strategic approach is required to the transfer of existing skills and development of new skills across Scotland's workforce not only in terms of working in an offshore environment but also for engineering and technical support during the development, design and construction of planned projects.
…Operations support staff will be needed post-deployment to operate and maintain the projects.
p.45,46
….MEG modelled the growth of the sector on the basis of assumptions about progress
…. Progress would be determined by a very broad range of financial, regulatory and engineering-related factors. The scenarios were drafted to reflect speed of initial technology demonstration, and capacity growth thereafter. The scenarios include situations where growth is steady, where growth is capped, and where growth is delayed (because of, for instance, lead times for construction of essential infrastructure).

The economic impact of each scenario is explored in full on p.18 of the document

13 **British Wind Energy Association / BAIN & Company Employment opportunities and challenges in the context of rapid industry growth A closer look at the development of wind, wave & tidal energy in the UK. Dr. Markus Boettcher, Niels Peder Nielsen and Dr. Kim Petrick 2008**
wind stats are often onshore and offshore combined..

Wind industry - approximately 145,000 people employed in the European Union (EU) wind energy sector at the end of last year (*2007)* Germany, Spain and Denmark have secured the majority of the benefits from that growth and now account for more than 70 percent of the EU's installed capacity
…these three countries account for more than 90 percent of the EU's wind-sector employees.
p.4
large parts of the wind industry value chain have become firmly established in the UK (e.g. development, technical consulting and construction and installation), the majority of turbines are being imported from the continent. The current level of employment in the UK wind industry stands at approximately 5,000.
…Of these employees, a large percentage are located in parts of the value chain where the business models are local in nature (such as development or construction and installation).
p.5
aggressive EU targets for power generation from renewable sources that have been set for all member states. The UK will need to add about 260 terawatt hours (TWh) of renewable energy production by 2020 in order to meet its target,
…Wind energy is expected to be the primary contributor, with 35 percent to 40 percent of the overall renewables target.
…The offshore market is still emerging, and the UK is strongly positioned to capture a significant share of installations due to its excellent offshore wind conditions and the offshore operating experience accumulated in the British oil & gas industry.
p.6
Solid progress scenario (base case). This scenario assumes clear political support for wind energy, market leadership in offshore development, the UK becoming self-supplying and achieving a limited degree of export in knowledge-related activities such as technical consulting and offshore operations.
By 2020, this scenario would lead to wind capacity of 27 GW, which is broadly in-line with current market consensus. This scenario would generate cumulative investment of £26B and 36,000 jobs. (Design & Manufacturing would cover 35 percent of the UK's offshore turbine market along with a limited amount of export);
• Dynamic scenario (best case). This scenario assumes stronger political support for wind energy, recognition of the UK as the global centre of expertise in offshore development and manufacturing clusters that allow the UK to become self-supplying and a significant exporter of both knowledge and components.
By 2020, this scenario would lead to wind capacity of 34 GW, which is broadly in-line with the current estimate from the British Wind Energy Association (BWEA). This

scenario would generate a cumulative investment of £39B and 57,000 jobs. (Design & Manufacturing would cover 70 percent of the UK market for offshore turbines and would be exporting a similar volume to continental Europe)
p.6,7

Current barriers to growth within the wind sector:

Grid connectivity, site approval, supply chain, offshore operations, employment and skills supply

Employment and skills supply. The UK faces a significant demand/supply imbalance in the wind energy labour market already, and the sector continues to grow. The pools of people with the skills and experience to perform many of the roles are limited. As growth accelerates, filling the new roles will be challenging, and a number of specialist roles will become even more difficult to fill. Industry players currently see this issue as the fourth most significant barrier to growth in the sector, though it is set to increase in importance
p.8,9

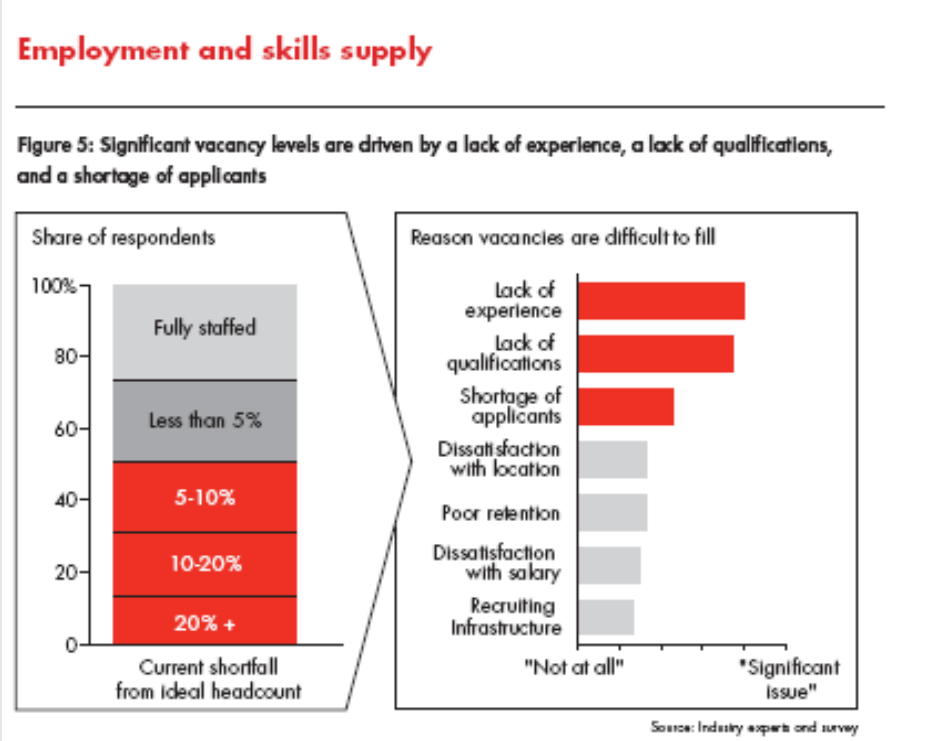

Table reproduced by kind permission of RenewableUK (BWEA)

In the scenarios described above, it is estimated that 18,000 to 52,000 additional FTEs will be needed to support the UK wind industry in the medium-term future. However, the industry is already facing a considerable staffing challenge today: more than half of companies currently have vacancy levels of above 5 percent. In certain specialist roles that shortage is significantly higher. The urgency of the shortage is directly linked to the maturity of the industry: roles critical to the planning & development stage (e.g. project managers) are currently in particularly short supply. Acute areas of shortage are:
Project managers: 46 percent of companies find this role hard to fill. Project managers are usually qualified engineers who are responsible for managing either the development or the construction process;
Electrical engineers: 40 percent of companies find this role hard to fill. Electrical engineers are qualified to design and construct the high-voltage connections between the wind

farm and the national grid;
Turbine technicians: 25 percent of companies find this role hard to fill. Turbine technicians have the skills and qualifications required to operate inside the nacelle of a wind turbine.
The majority of non-graduate hires into the sector have experience in some other related industry, such as another renewable energy, oil & gas, or construction. Hiring from other sectors, as well as from other markets, must be actively pursued. The current shortage of skilled personnel within the sector has also led to employees being lured away to work for rival firms. That has resulted in above-average wage increases and a high level of intrasector mobility over recent years. Current market estimates suggest that the number of engineers graduating each year in the UK is likely to remain broadly flat over the next 12 years. As a result, the current share of new engineering graduates entering the wind sector is unlikely to be sufficient to support the growth demands of the industry. Some of the historical issues driving the low percentage of engineering graduates entering the sector have been addressed, such as unclear industry prospects, concerns about career path progression, and salary levels, but more needs to be done. Given that fresh graduates will not satisfy the demand for specific skills, firms must also look inward and make significant investments in training and HR processes to generate in-house capabilities and experience.
p.11

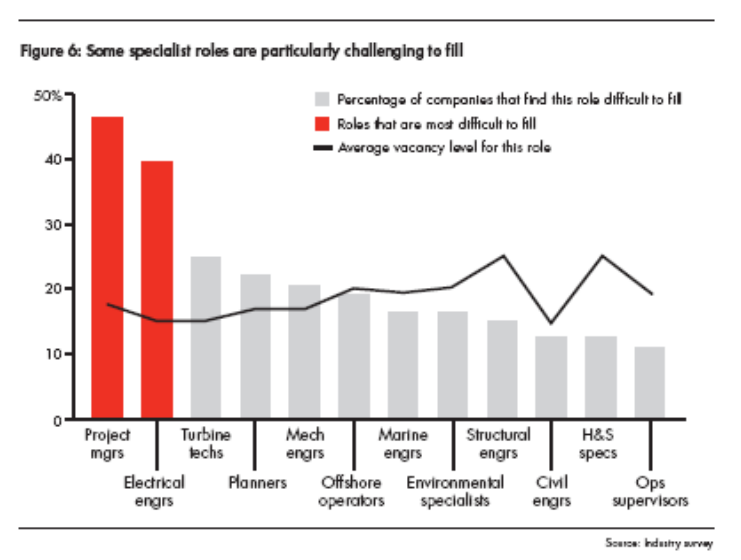

Table reproduced by kind permission of RenewableUK (BWEA)
p.10
Wave & tidal-based power generation is often cited as a renewable energy source in which the UK has very strong prospects. The sector comprises a number of different emerging technologies which generate electricity from ocean waves or marine currents. Currently, a relatively broad variety of prototypes can be found in testing and piloting phases.
…These technologies build on resources which are theoretically capable of providing up to one-fourth of global and one-fifth of UK electricity consumption (based on Bain analysis with data from CIA world fact book and Carbon Trust). To tap into this potential at a meaningful scale, further R&D is required, the funding of which will have to be supported to a great extent by national governments and international bodies.
Building momentum. Bain & Company has examined the time required to reach inflection for a range of comparable renewable technologies that are now more mature. The analysis shows that commercial viability by 2015 might be achievable if wave & tidal can build up similar momentum to wind energy in its early days, but also that the process could take significantly longer if growth is more comparable to that of solar PV.
p.11
In the most optimistic case, which broadly reflects some of the available projections, the UK wave & tidal sector could add roughly 1.4 GW of capacity by 2020, thereby providing up to 2,100 jobs. This would represent a greenfield opportunity for the UK to create an industry cluster similar to that of Denmark in the wind sector (which in 1995, eight years after the technology entered the demonstration phase, had provided 9,000 jobs). The country that succeeds in developing Europe's dominant wave & tidal industry cluster would be in a position to harvest a significant share of the economic benefits that the industry generates. Besides the UK, a handful of other EU countries – including Portugal and Denmark – are in a comparatively strong starting position. As private investment will be a function of the proximity of the industry to commercialization, "the

winner" is likely to be the country which provides the greatest public support over an extended period of time, thus allowing the development of a robust and affordable technology.
…The wave & tidal sector will be associated with a high degree of risk until the technology has been proven and should, therefore, be viewed as a distinct set of technologies in a diversified portfolio of investments including but not limited to, other energy-related R&D projects.
p.12
A number of actions are required to boost employment and address the skill shortage. The shortage of engineers is not unique to the renewable energy sector and is being addressed at a national level. At the same time, the industry can increase its share of the talent by doing the following things:
• First, the wind industry must seek to attract talent by levelling the playing field with sectors such as oil & gas. That may require the adaptation of taxation schemes for offshore wind employees in order to match the tax breaks available to many offshore employees in oil & gas. In addition, the effective marketing of career paths that are both challenging and fulfilling will increase the attractiveness of the sector;
• Secondly, the government is expected to invest further in education, perhaps through the provision of university grants for engineers or by continuing in technical colleges. Over time, specialised education programmes tailored for the wind industry should be developed;
• Finally, the government and companies alike have a role in establishing an attractive value proposition for the sector based on the opportunities and rewards that a high-growth and ecologically sound sector can present. They also have a role communicating this to potential employees via educational establishments and the media. The government and the private sector need to work together to create a framework for world-class training and professional development.
p.13
A key factor in resolving supply chain issues is the creation of the right environment for investment to enter the UK. Companies must then take advantage of that environment and build new R&D or manufacturing capacity to meet the increase in demand generated by growth. The European experience demonstrates that a highly effective way to stimulate growth of the supply chain is through the development of sector clusters. As previously discussed, in key European clusters, the establishment of turbine manufacturing plants was soon followed by component manufacturers, R&D facilities, and educational establishments. Strong infrastructure (port facilities, airport, and roads), a deep supply of qualified but relatively inexpensive labour, proximity of sub-suppliers, and support and incentives from the government are required to kick off the growth of a cluster.
p.14
In summary, the UK wind industry is poised for extraordinary growth, though for that to be fully realised, numerous obstacles must be overcome. There are many specific actions that the government and companies must take to overcome these obstacles. If that can be achieved, and the sector is promoted in the right way, then 50,000 new jobs could potentially be created in the wind industry in the UK.
p.15

25 **British Wind Energy Association / SQW Energy Todays' investment– tomorrows asset: skills and employment in the wind wave and tidal sectors** Oct 2008

A number of occupations have been identified as being important to the sector. These occupations were identified from the Occupational and Functional Map of the UK Renewable Energy Sector developed by EU Skills and subsequently discussed with BWEA. Central to these occupations being able to undertake their functions effectively is an appropriate and continually updated skill set.

Figure 2-1 below summarises the key occupations for the sector and the typical qualifications associated with these occupations. Many of the occupations are characterised by a requirement for higher level skills, including degree, post graduate or professional qualifications including Chartered Status.

Figure 2-1 : Skills, Occupations and Qualifications within the WWT sector

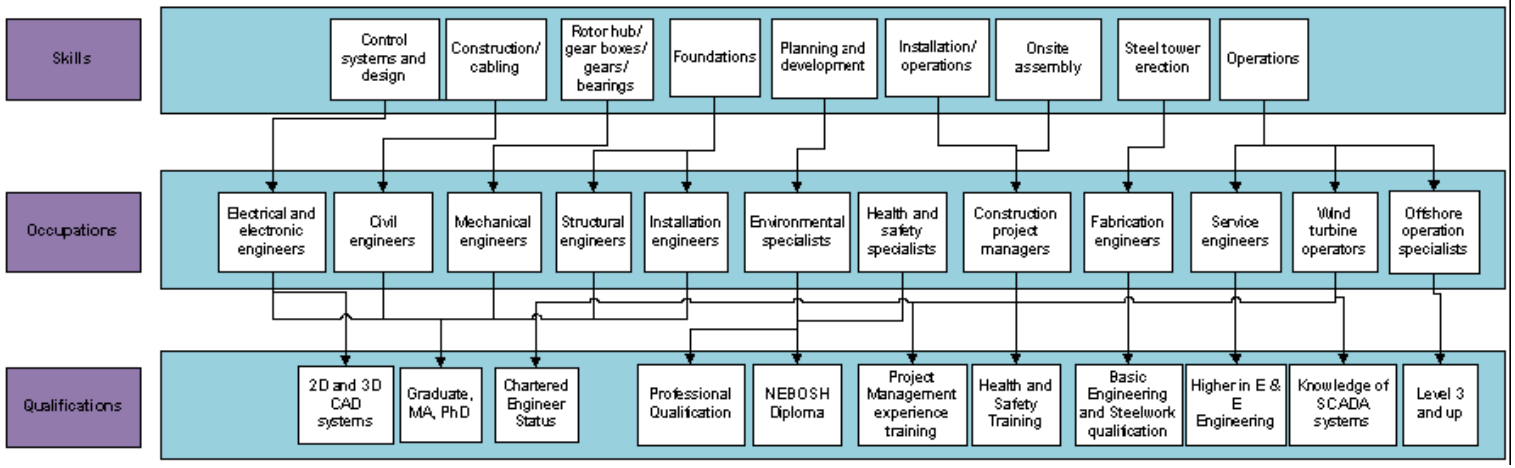

Table reproduced by kind permission of RenewableUK (BWEA)

The current supply of skills

Currently in excess of 50 courses are available from a range of training providers varying from Universities to private training providers across the UK. The types of skills training offered also vary from full time undergraduate or postgraduate (e.g. the University of Edinburgh offers a Bachelors course in Mechanical Engineering with Renewable Energy), vocational qualifications (such as City and Guilds which offer a National Vocational Qualification in Fabrication and Welding Engineering) to part time, short course professional and others (for example Northumberland College which offers a Diploma for Wind Turbine Technicians). Further information on the range of education and training available relevant to the sector is provided in a separate Directory developed for BWEA.

Growth projections for occupations relevant to the sector

Information provided by the SSCs for competing sectors discussed in the previous section –science, engineering, manufacturing and marine, electricity, gas and waste water, oil and gas, nuclear and polymers and engineering construction - indicate that these sectors will require almost 149,000 additional professionals (mostly engineers and project managers) and technicians by 2014 in order to satisfy growth and replacement demand

p.5

Growth projections for the Wind, Wave and Tidal sector

Within the Wind, Wave and Tidal sector there are currently approximately 4,800 full time employees (FTEs) working across a range of functions. The wind sector's value chain (which currently represents the majority of employment) has been split into a number of categories based upon supporting work undertaken elsewhere: Planning and Development, Design and Manufacturing, Construction and Installation, Operations and Maintenance and Technical, Financial and Legal Services. The largest growth area, and the focus of this study, has been primarily on the first four phases of the value chain, as these require the most technical and highly skilled occupations.

p.6

Three scenarios have been modelled and fed through from this supporting study to reflect potential outcomes in relation to the growth of the sector and consequent employment growth and demand for skills. These are:

• Slow growth (referred to as 'static' in the work undertaken by Bain & Co.) – based upon the assumptions of a lack of political support for WWT, most manufacturing and skills reside outside the UK, and there is limited or no export

• Solid progress (base case) – based upon assumptions of clear political support for the sector, an almost self supplying manufacturing industry, and limited export

• Dynamic - based upon assumptions of political support for ambitious targets, clusters with wind turbine manufacturing and the export of offshore expertise and components.

Projections for the WWT sector in the period to 2020 suggest significant employment growth, and with it significant requirements for skills development in all areas of the value chain. Figures for **total** employment in the WWT sector are shown below in Table 2-1.

Table 2-1: Projected total employment (FTEs) within the Wind Wave and Tidal sector

Year	Sub sector	Slow Growth	Solid Progress	Dynamic
2014	Wind, Wave & Tidal	12,000	14,500	18,000
2020	Wind	23,100	35,900	56,900
	Wave & Tidal	350	1,600	2,100

Source: SQW Energy

Table reproduced by kind permission of RenewableUK (BWEA)

Before 2014 the majority of growth is anticipated in the wind sector, with little forecast growth for the wave and tidal sectors, for this reason it is not possible to split projections for the sectors in 2014. By 2020 however, modelling suggests that these two sectors may employ between 350 and 2,100 FTEs, although the wind sector will still dominate overall employment within the sector, with 57,000 FTEs employed within a total employment pool of approximately 59,000 FTEs.
In terms of anticipated additional employment within the sector, it is clear that whatever the scenario considered, these projections represent considerable growth within the sector from the current employment levels of approximately 4,800 FTEs. Within six years it is anticipated that the number of FTEs within the WWT sector will have more than doubled from 4,800 to 12,000 based upon the most conservative scenario, whilst the dynamic scenario reflects an almost four-fold increase in employee numbers within the sector. By 2020, the estimated numbers of individuals working in the sector will have increased by between approximately 500-1250% compared with employee numbers in 2008.
Within this anticipated growth, demand will vary across different areas of the value chain described *above* In Table 2-2 demand for **new** employees is shown for all scenarios in six and twelve year's time.

Table 2-2 : Number of additional employees needed for each part of the value chain by 2014 and 2020

	Total Additional employees required by WWT sector	Planning & Development (11%)	Design & Manufacturing (26%)	Construction & Installation (29%)	Operations & Maintenance (25%)	Technical, Financial & Legal Services (9%)
2014 Slow growth	***7,170***	790	1,865	2,080	1,790	645
2014 Solid Progress	***9,630***	1,060	2,505	2,790	2,410	865
2014 Dynamic	***12,895***	1,420	3,355	3,740	3,220	1,160
2020 Slow growth	***18,710***	2,060	4,865	5,420	4,680	1,685
2020 Solid Progress	***32,710***	3,600	8,505	9,485	8,175	2,945
2020 Dynamic	***54,210***	5,965	14,095	15,720	13,550	4,880

Source: SQW Energy

Table reproduced by kind permission of RenewableUK (BWEA)

The figures presented in this section show that the number of individuals employed within the WWT sector is forecast to grow considerably between now and 2020. Whilst it is likely that the overall requirements for growth and replacement demand of professionals and technicians across the sectors is likely to increase in number as SSC data is

refined, it is still likely that the total numbers within WWT will represent a significant proportion of overall numbers within the EU Skills footprint. The exact trajectory of growth is not yet clear and will be in part dependent upon a number of external factors which will be become clearer over time. However, even if the most pessimistic of scenarios – that of slow growth, becomes reality, there will still be profound implications for attracting new, appropriately skilled, experienced and qualified entrants into the sector. It will also place requirements on businesses within the sector to ensure that the training and upskilling of those currently working within the industry is planned effectively and strategically

p.8

The previous section also referred briefly to the competing nature of demand – a range of sectors will be in competition with WWT for the same types of individuals able to undertake the same types of jobs with often similar (generic) skill sets. Whilst the overall numbers of new entrants to the sector projected in 2014 is not huge by comparison with the overall projected requirements identified by the four SSCs closest to WWT (9,360 in the base case solid progress scenario, compared with 148,600), the sector will still need to compete in an open market with other sectors which perhaps have a higher profile within more mature industries. In addition, by 2020, the needs of the WWT sector are anticipated to have grown considerably, underlining the importance of effective intervention to ensure that supply of skills meets future demand.

Currently….

At present, evidence from the sector suggests that there are difficulties associated with obtaining individuals with the correct types of skills needed for the sector. This was felt to be particularly evident in relation to identified occupational shortages of project managers, structural engineers, electrical engineers and overhead linesmen. Similarly, a number of skills shortages and gaps were identified by sector based companies in respect of higher level skills amongst engineers, offshore capabilities (operational and technical skills) and broader experience relevant to the sector. A parallel study gathered feedback from over 100 companies active in the sector which suggested that companies are adopting compensating practices to tackle a number of occupational and skills shortages. The types of approaches adopted include transfer of workload to existing staff, recruiting relevant staff from other firms in the WWT sector and wider industry, attracting staff through attractive remuneration packages (which it is suggested is leading to pay inflation in certain areas of the sector) together with attempts to import skills through recruitment of staff from overseas. However, all those involved in the study recognised that such practices were neither sustainable nor sufficient to meet future demand.

…and looking to the future

Data from within the sector suggests that companies are being forced to adopt short term "pinch and pay" type strategies to address their immediate skills needs; this is recognised as being unsustainable. In the longer term the solution must lie in a more strategic approach to developing activities to encourage the largest possible "funnel" of appropriately skilled and engaged potential employees. Such potential employees will be at different stages of their educational and skills development: entering higher, further or vocational training of various types, or within the schools system.

p.9

The supply of graduates

Overall the potential supply looks promising for graduates. There is significant estimated growth in UK engineering and technology graduates – an estimate by (the then) Department of Trade & Industry forecasts 3.6% annual growth over the period 2004-201417. However, although the overall pattern of growth is encouraging, inevitably the headlines mask some specific issues. One example is around electrical and electronic engineering where the number of home acceptances into electronic and electrical engineering courses has decreased from 5,100 in 2001/02 to around 2,900 in 2005/06. At the same time the number of foreign students enrolled on such courses has increased by 41%. This may suggest potential problems of recruitment in the future and possible issues relating to retention of graduates in the UK upon completion of their studies. This is in contrast to the situation relating to general and mechanical engineering where the number of home acceptances has increased slightly over the same five year period. Therefore, whilst there are some discipline areas of potential longer term concern, overall projections for engineering and technology graduates suggests growth to 2014. In addition, a review of organisations offering courses more tailored to the specific needs of the sector has identified over 50 undergraduate/postgraduate courses with renewable energy elements. Interviews with some of the institutions offering these courses also suggest that they are becoming increasingly popular and that the expectation is that the number of admissions to these courses will grow.

Vocational training and the supply of apprentices

There are also ambitious plans for growth in apprenticeship numbers. Currently, the number of apprenticeships is relatively high in electro-technical and engineering. The present supply of apprentices should also be viewed against the backdrop of the Government's plans to increase the total number of apprenticeships from 10,000 to 400,000 by 2020. This will also have the potential to increase the number of entrants to the sector. In addition, a number of institutions are developing tailored course provision, such as Northumberland College's Level 3 course for technicians for wind power stations.

Young people

At an earlier stage in the skills 'supply chain', the number of young people aged 16-18 is forecast to drop over the period to 2020, which will serve to reduce the overall pool o young people available to this sector as well as all others. However, data relating to 'A' level results at B or higher in science, technology and maths in 2008 show an increase of 30% since 2003. This suggests that the educational attainment of potential recruits to the sector in relevant subject areas is improving. Data relating to Scottish Higher achievement in similar subjects also indicates a relatively large number of students taking Science, Technology, Engineering and Mathematics (STEM) subjects (potentially) of relevance to the WWT sector. This section has examined the overall likely nature of demand for skills within the sector together with the current situation relating to the supply of skills – both 'near market' and more long term. In the following section the implications are reviewed together with number of possible actions that the sector may wish to consider to ensure that it is able to draw upon the biggest pool of appropriate labour as is possible.

p.10
One of the key elements underpinning this growth will be a skilled workforce reflecting the current and future needs of the sector. The ability to obtain and retain such a workforce will in part be influenced by the sector's profile with key players within the skills arena, recognition by policy makers of the sector's significance, a reflection of this in skills policies together with actions taken by the sector itself.
Supporting work suggests that the most technical and highly skilled occupations will be the most important within the sector's value chain in terms of growth. Modelling of employment growth and consequent demand for skills within the sector points to significant growth from the current (2008) position in terms of FTEs employed within the sector by 2014 and onwards to 2020.
Feedback from companies within the sector suggests that currently there are difficulties with recruiting individuals with the types of skills needed. Compensating practices adopted within the sector to tackle these issues are not sustainable and will not meet future demand. In the longer term, the situation looks potentially more positive. The overall supply of graduates within the broad subject areas of engineering and technology is estimated to grow, although overall growth projections may mask some decreases in specific disciplines of relevance to the sector. The number of organisations offering courses more tailored to the specific needs of the sector is also growing, seemingly fuelled by a desire amongst Higher Education Institutes to offer courses more closely aligned to the needs of industry.
Similarly, there are also ambitious plans for growth in apprenticeship numbers and there is some evidence of the Further Education sector beginning to develop sector specific training.. The types of skills that the sector is likely to need over the coming decade across the value chain are well defined. It is important to recognise that the sector will need to compete in an open market to ensure that skills development resources are directed towards the needs of WWT rather than to other sectors which perhaps have a higher profile with policy makers, representative bodies, providers and funders.
However, the focus upon skills within WWT is timely. There is currently an opportunity to influence – increasingly, there is a recognition of the link between skills, productivity and competitiveness at the highest levels within the public sector. Allied to this is an awareness of the fundamental role that employer involvement plays in ensuring a demand-led agenda for skills – ensuring that *businesses* get the skills they need rather than the skills that *providers* think they need. At the same time, new reforms to improve the delivery of adult and young people's skills will result in a wholesale change to the planning, delivery and funding regime to meet business needs.
p.11
Consequently, a number of specific actions are put forward for consideration by the WWT sector, the overall objective being: to deliver, at an increasing rate, the appropriate supply of skills to the sector by:

☐ influencing careers choices (from school to recent graduates and competing sectors)

☐ increasing the number of graduates/technicians from relevant courses

☐ increasing retention and the internal capacity to train

This objective can be achieved through focussing upon three areas: Influence, Direct Action and Partnership/Alignment of Activities.

Influence

EU Skills is the SSC with specific responsibility of the needs of the sector. It is important that the WWT sector, through BWEA and others, develops a close and effective working relationship with the SSC in order to ensure that it understands and represents the skills needs of the sector. The sector should proactively engage with, and contribute to, EU Skills' activities such as the direction of the recently announced National Skills Academy for Power, the SSC licensing process as well as inputting to Working Groups such as the Power Sector Strategy Group and its sub groups.
In addition, the sector should seek to work with the SSC and industry to identify and create appropriate National Occupational Standards suites which are capable of being mapped to National Vocational Qualifications (NVQs) together with mapping WWT occupations to appropriate NVQs.
The sector may also wish to consider developing a dialogue with a number of other organisations including SSCs with a relevance to the sector - Semta, Cogent and ConstructionSkills together with other key players including ECITB and UKCES. Other organisations that the sector should seek to influence in relation to skills issues are listed in earlier sections and the Stakeholder Database and include Government Departments and Devolved Administrations across the four nations of the UK, and funding organisations including the LSC, Higher Education Funding Council for England (HEFCE) and the Scottish Funding Council (SFC). In addition, the sector should consider developing links with professional institutions for whom skills issues are important, such as the Institute of Mechanical Engineers (IMechE) and the Institute of Civil Engineers (ICE).

Direct action

Together with activities which seek to influence the activities of others, BWEA, its members and the sector overall have the opportunity to take direct action themselves in areas where they can act as a catalyst. Indicative activities include encouraging EU Skills to identify a nominated individual with responsibility for renewables and contributing to the EU Skills re-licensing process by providing input to UKCES.
The sector should also consider how best to communicate and promote existing skills opportunities for employers such as Apprenticeships, Diplomas, Train to Gain and Integrated Skills Brokerage. The most obvious organisation to take a lead on such activities is BWEA. Underpinning such activities is a need for actions to ensure that there are sufficient trainers and mentors within the sector, adequately trained to support apprenticeship programmes in the longer term.
Given the developing nature of skills development within the sector, it may also be prudent to consider how best to track and gather data on the employment destinations of WWT graduates. This would provide valuable market intelligence on the numbers being retained within the sector, the reasons for those leaving the sector and to help inform

decisions relating to skills and training provision and development.
p.12

Wave and tidal

Home Bibliography

21 **British Wind Energy Association press release** Wave and Tidal energy project leases 16 March 2010

The Crown Estate lease awards 'exceed expectations'…the Pentland Firth and Orkney Waters Strategic Area leasing round was an overwhelming success, which demonstrated the enormous potential of the UK's marine energy resource and the wave and tidal energy sector.

The Crown Estate awarded an unprecedented 1.2GW of wave and tidal energy project leases consisting of six wave energy projects totalling 600MW and four tidal projects amounting to 600MW

22 **British Wind Energy Association press release** Wave and tidal plan must be followed by Government investment 04 March 2010

Call for Government to invest a further 150-200 million in wave and tide to solidify the UK lead and create world class wave and tidal industries
Over the last decade the Government has invested around 60 million in wave and tidal research and development

RenewableUK's 'State of the Wave and Tidal Industry' report forecasts that as much as 2 gigawatts of marine energy could be installed in the UK by 2020 – enough to power 1.4 million homes.

The report states that the UK is still leading the world with the largest installed generating base of 2.4 megawatts (MW), a further 27MW with planning consent, 77.5MW of projects in planning, and 700MW expected in the Pentland Firth area by 2020. In total, RenewableUK forecasts 1-2 GW of wave and tidal energy installations in the UK by 2020, contributing significantly to the country's carbon reduction targets.

Peter Madigan, the association's Head of Offshore Renewables said: *"…. The Danish government spent 1.3 billion to establish onshore wind, which currently brings 2.7 billion per year in revenue. A properly capitalised wave and tidal sector could create 43,500 direct jobs and generate a potential £4.2 billion per year in revenue for the UK economy.*

47 **DECC Press Release -** Testing the water for Wave and Tidal potential 4 March 2010

Wave and tidal energy in England and Wales today received a boost as plans for the first full Strategic Environmental Assessment for wave and tidal energy were outlined. The SEA - which will also pave the way for storage of carbon dioxide, and further offshore wind and oil and gas activities - will ensure that environmental concerns are addressed as the UK's offshore energy resources are developed further.
Speaking at the Renewable UK Wave and Tidal Conference 2010, Energy and Climate Change Minister David Kidney said:
"I am keen that we get as much of our energy as we can from home-grown sources, and our seas are a fantastic asset that can help us do this - in a number of ways. The exercise I'm launching today will help us identify opportunities for new development, whilst taking into account any possible impacts on the marine environment.
"And by including wave and tidal in this assessment for the first time, we're laying the foundations for commercial deployment of these technologies. This SEA and our forthcoming Marine Action Plan, alongside our other support measures, will create the kind of investor certainty that will help us maintain our position as world leaders in marine energy technology."

34 **Carbon Trust press release** Marine Energy ready for mass deployment by 2020 2 February 2010

Marine energy will be ready for mass scale deployment and an important new commercial UK industry by 2020
…Marine energy is currently ten years behind offshore wind energy in its development, but ….costs can be dramatically reduced over the next ten years, which could see up to a thousand devices operating in the water by 2020.
..Tom Delay, chief executive of the Carbon Trust, said: "…. marine energy could over time provide up to 20% of the UK's electricity. Generating electricity from the UK's powerful wave and tidal resource not only plays a crucial role in meeting our climate change targets but also presents a significant economic opportunity for the UK. Wave alone presents a £2 billion economic opportunity for the UK."
Carbon Trust analysis shows that 25% of the world's wave and tidal technologies are being developed in the UK. Marine energy is an emerging industry with massive growth potential and each successful technology is competing for a stake in what will be a major growth industry.

97 **SWRDA press release** Wave Hub construction underway Nov 2009

Wave Hub is a major marine renewables infrastructure project that will create an electrical 'socket' on the seabed in some 50 metres of water around 16kms (10 miles) off the coast of Cornwall in South West England and connected to the National Grid via a subsea cable. Groups of wave energy devices will be connected to Wave Hub and float on or just below the surface of the sea to assess how well they work and how much power they generate before going into full commercial production. There are four berths available at Wave Hub, each covering two square kilometres. Wave Hub will have an initial maximum capacity of 20MW (enough electricity to power approximately 7,000 homes) but has been designed with the potential to scale up to 50MW in the future. The project will be built in the summer of 2010 with the first wave energy devices expected to be deployed in 2011.
An independent economic impact assessment has calculated that Wave Hub could create 1,800 jobs and inject £560 million in the UK economy over 25 years. Almost 1,000 of these jobs and £332 million could be generated in the South West.'

Offshore Wind

Home
Bibliography

113 **Renewable UK / Douglas Westwood** UK Offshore Wind: Building an Industry June 2010
(RenewableUK press release http://www.bwea.com/media/news/articles/pr20100629.html)

The report outlines scenarios for UK offshore wind development from 2015 to 2030. The lead "Healthy industry scenario", would be capable of attracting a substantial and sustainable manufacturing base creating at least 45,000 UK-based jobs. Crucially, decisions on new factories will need to be made in the next 12-24 months if this is to be realized. In contrast, the "Low Added Value" scenario – which is in line with energy outputs from the Government's Renewable Energy Strategy – would only see limited UK manufacturing facilities, and while it would provide the UK with a significant green energy production, it would be a missed opportunity for the UK in terms of jobs and industrialization.

…the Coalition Government needs to act quickly and decisively to reaffirm Britain's commitment to the development of offshore wind energy through confirming upgrades to port facilities, maintaining market stability and agreeing targets for energy production from wind. If this is done then an industry employing at least 45,000 people with a substantial manufacturing base can be created
RenewableUK Chief Executive said: *"Offshore wind presents the UK with a major opportunity not only reconfigure its energy production towards clean and renewable sources, but a once-in-generation opportunity to build a home-grown manufacturing and R&D base for a new industry, and become the world leader in the field." "Without firmer Government strategy we will get an offshore wind industry which produces clean energy for the UK, but one for the which the production facilities, and the manufacturing jobs are located elsewhere. If ambitious targets are agreed, and the Government acts now on a package of measures to drive forward the industry then wind can be the sector which drives forward the Coalition's pledge to rebalance the economy and create jobs."*

46 **DECC Press Release** Offshore wind expansion biggest ambition in the world 8 January 2010

Potential for 6,400 additional turbines generating 32GW far exceeds previous plans

£75 billion offshore wind industry could support up to 70,000 clean energy jobs by 2020

These are high value jobs in manufacturing, research and engineering, installation, operation and services

…. biggest expansion of wind energy ever seen in the world. The announcement has the potential to see an additional 32GW of clean electricity feeding into the UK grid, on top of 8GW from previous rounds. 32GW is enough offshore wind energy to supply nearly all the homes in the UK and will mean an extra 6,400 turbines. Investment in UK offshore wind overall could be worth £75 billion and support up to 70,000 jobs by 2020. The next generation of offshore wind farms that will be developed under the licenses announced today will require larger and more efficient turbines, capable of generating 5MW of power.

23 **British Wind Energy Association press release** We can build new UK industry from offshore wind revolution" 8 January 2010

Today's announcement of nine vast new offshore wind farm zones with a total capacity of 32GW would, if fully developed, be enough to power every home in the UK. With between 5,000-6,000 turbines installed Round 3 would result in carbon savings of between 40 – 80 million tonnes annually.
Offshore wind currently represents only 1% of the worldwide wind market, which has annual turbine sales of $60bn. This new development signals an enormous step change in global demand for offshore wind, which will stimulate large scale new manufacturing investment. To attract that inward investment into Britain BWEA argues that the Government needs to lead on upgrades to UK ports to provide state-of-the-art quayside facilities and create coastal manufacturing and research hubs for manufacturers (similar to the way in which coastal hubs were created for the offshore oil and gas industry in Aberdeen and the German offshore wind industry in Bremerhaven). With new turbine assembly plants in UK ports, domestic manufacturers would be able to enter the component supply market for gearboxes, bearings and castings.

In 2008, a BWEA-commissioned report from Bain & Co revealed that if 20GW of offshore wind were developed in UK waters by 2020 and two-thirds of the manufacturing took place in the UK it would mean the creation of 45,000 UK based jobs in manufacturing, operations and maintenance
McCaffery added: *"We need to ensure the UK also benefits through a boost in manufacturing, engineering and skills: but this will only happen if additional action is taken by the Government through working actively to create coastal manufacturing hubs. This will encourage wind energy manufacturing companies to locate in the UK and enable British businesses to take full advantage of the supply chain opportunities, for the benefit of jobs and the UK economy as well as Britain's energy security."*

38 **Crown Estate Briefing Note.** Supporting Information Relating to the Announcement of Round 3

Two previous competitive rounds have been held by The Crown Estate: in 2001, Round 1 allocated 14 lease options totalling just over 1GW. Round 1 was a 'demonstration' round, enabling prospective developers to gain technological, economic and environmental expertise. Round 1 full term leases are for twentytwo years (including 1 year for removal and decommissioning).
In 2003, following a SEA undertaken by BERR (then the Department of Trade and Industry), The Crown Estate held Round 2 for commercial scale offshore wind projects, allocating lease options to 15 projects totalling 7.2GW in the three strategic areas considered to have the largest potential for offshore development
- the North West, the Greater Wash, and the Thames Estuary. For the largest Round 2 projects, the full term lease is for fifty years including decommissioning.

75 **Global Wind Energy Council Press Release** European offshore wind power set to increase tenfold 8 January 2010

The development of a new European industry - offshore wind power - took an important step forward today with the announcement by the British government of the go-ahead for offshore wind farm development areas with a capacity ten times greater than Europe's existing European offshore wind energy capacity.

These are European companies building a European industry and generating some 45,000 European jobs. "It takes Europe closer to exploiting the power of our seas and developing a brand new European offshore wind industry. Offshore wind is Europe's largest untapped energy source. There is enough wind across Europe's seas to power Europe seven times over."

The 25 GW is part of the over 100 GW of offshore wind power currently being planned by European utilities, developers, and governments, mostly in the North Sea. Once operational this 100 GW plus would supply 10% of Europe's electricity. In order to connect these farms to the electricity grid, EWEA has proposed a 20 year grid development plan. This year the European Commission will publish a Blueprint for a North Sea grid. This Blueprint was described by the Commission's 2008 second Strategic Energy Review as aiming to "interconnect national electricity grids in north-west Europe together and plug-in the numerous planned offshore wind projects".

45 **DECC Press release** New player in UK Offshore wind market 25 February 2010

Mitsubishi Power Systems Europe signs MOU signalling intention to invest up to £100 million in UK wind turbine R&D project
Up to 200 highly skilled jobs to be created by 2014
This project will be the first step towards the production of turbines for the next generation of offshore wind farms. By working closely with Mitsubishi, the UK is a strong contender to be a manufacturing base for Mitsubishi in the future, which could create up to 1,500 new jobs

…Today Lord Mandelson and Ed Miliband also announced new funding of £18.5 million for an offshore wind test site in the North East of England.
The site, off the coast near the New and Renewable Energy Centre (Narec) in Blyth, will act as a technology demonstration and development platform for the next generation of large multi-megawatt offshore wind turbines. It also complements Government support for a blade test facility in the North East that will enable the testing of blades up to 100m in length. These world-leading testing facilities will make the UK a prime location for companies such as Mitsubishi.

70 **European Wind Energy Association press release** More wind power capacity installed… 2010

More new wind power capacity was installed in the EU in 2009 than any other electricity-generating technology, new statistics published today by the European Wind Energy Association (EWEA) reveal. 39% of all new capacity installed in 2009 was wind power, followed by gas (26%) and solar photovoltaics (16%). ……..Taken together, renewable energy technologies account for 61% of new power generating capacity in 2009.

Wind power's total capacity in the European Union has now reached 74,767 MW, up from 64,719 MW by the end of 2008 with Germany remaining the EU country with the largest installed capacity, followed by Spain, Italy, France and the UK.

19 **British Wind Energy Association press release** Rebirth of UK Manufacturing: North East on Board 18 February 2010
BWEA (RenewableUK), the UK's leading trade association, welcomed today's announcement from US company Clipper Windpower on plans to build the world's largest turbine blade in Newcastle, for its proprietary 10 megawatt (MW) Britannia wind turbine. Each Britannia turbine will be able to satisfy the annual electricity consumption of over 6500

households. The factory building the blades will be based on Tyneside, creating 500 jobs by 2020.
….Maria McCaffery, BWEA Chief Executive, said: *"Wind energy presents a significant opportunity for the UK economy, leading to between 60,000 and 70,000 new jobs by 2020. The potential 40+ gigawatts (GW) of offshore wind alone could supply over a third of our country's electricity*

…….. Various agencies are estimating the short-term potential of European offshore wind at 150GW

29 **British Wind Energy Association What does the round 3 announcement mean? Briefing note on offshore wind energy** Jan 2010

UK is leading the world in the scale of offshore wind development
• Round 3 will develop across nine zones and the capacity of the leases issued is expected to be at least 25 gigawatts (GW).
• Taken together with earlier rounds of offshore wind development, Round 3 will mean over 40GW of sites are currently being brought forward.
• If just 20GW of offshore capacity is developed by 2020 it will secure up to £60 billion of private investment and could create 45,000 UK based jobs.
• Projects currently operational in the UK have a capacity of 688 MW, across 9 projects, and this represents 228 turbines. A further 1156 MW of projects are under construction.

The UK is already the leading market for offshore wind development in the world, with just under 700MW operational, over 1,000MW under construction and a further 3,500MW consented. Wind developers are currently setting out plans to deliver at least 40GW of capacity offshore across all leasing rounds, this represents up to £120 billion of private sector investment. BWEA commissioned Bain and Company to produce a report that modelled the number of jobs that could be created in the UK by the growth of wind energy. In a scenario where 20 GW of offshore capacity were constructed by 2020 and 70% of the design and manufacturing took place in the UK then nearly 45,000 British jobs would be directly created, with an additional 14,000 created by onshore wind industry growth.

Table 1. Direct jobs that could be created by offshore wind

	Number of jobs
Planning & development	3,382
Design & manufacturing	20,909
Construction & installation	10,598
Operations & maintenance	6,734
Technical, financial & legal services	1,121
Total offshore	42,745
Total onshore	14,000
Total	**56,745**

p.3 Table reproduced by kind permission of RenewableUK (BWEA)

A major concern is whether new maufacturing facilities will actually be built in the UK close to the new market, or whether they will be based on the continent where there are already established onshore wind turbine manufacturing facilities.While onshore wind manufacturing is dominated by Denmark, Germany and Spain, as a new area of business offshore wind offers opportunites to new entrants from both overseas and the UK to emerge as market leaders in innovation and the supply of technology to create a British based supply chain. A solid skills base will be required to build industry. The emerging offshore wind industry can draw on the engineering excellence and maritime history of the UK; however industry will need to be mindful of potential shortages in the number of suitably qualified and experienced new candidates. Addressing the most immediate demand for installation, operation and maintenance skills will be prioritised. Support for the wind industry's efforts in developing UK wide training scheme for apprentices is central to ensuring that there is a big enough pool of skilled workers in the UK to meet demand.

42 **Crown Estate UK Offshore Wind Report 2010**

The UK leads the world in generating electricity from offshore wind farms with almost 1GW installed, and more projects in planning or construction than any other country. Offshore wind will play a major role in ensuring our energy security while also meeting our climate change goals. There is also the potential for enormous benefits in terms of the UK's energy supply, job creation and inward investment. This places the offshore wind industry at the very heart of the UK's shift to low carbon and will be a major boost to the green economy. Renewable energy is central to the government's objective to secure a diverse energy supply and to achieve reductions in carbon dioxide emissions.
Round 3 offshore wind zones in UK water - potentially totalling 32GW in capacity.
The capital investment required for Round 3 is of the order of £100bn, including contributions from grid and the supply chain, as well as for the generation assets themselves. The delivery of Round 3, will require over 10,000 wind turbines to be installed on the seabed, and up to 200 kilometres offshore. The aggregate target zone capacity

contained within all nine zones for Round 3, commit our partners to seek consent for at least 32 GW of projects within the period to 2020. This is sufficient to ensure that the 25 GW that has been enabled by the Government's SEA for offshore renewable energy can be achieved

By 2020 25% of the UK's electricity demand could be met by 25GW of offshore wind and according to The Carbon Trust, offshore wind in the UK can support 70,000 UK jobs by 2020. The combined total for Rounds 1, 2 and 3 along with Scottish Territorial Waters could amount to over 47GW by 2020.

All projections and dates in this report including the total GW brought online will obviously depend on a number of factors, including building the supply chain capability.

Preparatory activity by Crown Estates for Round 3 development includes: Aerial bird surveys, mairne mammals consenting strategy, archaeological survey and development of protocols, NATS En-route radar 'fixes', sediment studies etc.

Next stage activity – planning and consent. Need for an Enivronmental Impact Assessment – environmental sensitivities, potential effects of wind farm development and associated infrastructure. A need for 'analysis, assessment and communication of the environmental and planning investigations'

The planning and consenting works required for Round 3 represents a significant opportunity for suppliers of support services, including, for example: environmental surveyors and the vessels and aircraft these rely upon; technical advisors, including those with expertise in ecology; planning and environmental consultants.

Turbine manufacture - the size of the UK and European offshore wind market in the next ten years will require a major change in the manufacturing output of offshore wind turbines. The build profile for Round 3 would suggest a peak annual volume of 6GW, which on current business models would support six turbine manufacturers each supplying from a UK base. Although currently there are only four equipment suppliers with offshore models, announcements by both existing and new companies in the past year would provide in excess of 12 products being brought to market by 2015. Whilst the current machines are 3-3.6MW, the predicted size of machines for Round 3 is 5-6MW and both gearless direct drive and traditional gearbox designs are being developed.

This number is expected to grow in the coming years as early research and development of new variants, such as vertical axis offshore turbines, demonstrate their commercia viability. Most importantly the new breed of machines are being specifically designed for offshore conditions and deployment, and companies are now challenging the accepted configuration and size of the traditional horizontal axis turbines with twobladed concepts and 10MW rated capacity, Part of the challenge in reducing cost is intended to be met through improved logistics in the global supply chain by producing the turbines and associated sub-structures in the UK within coastal manufacturing hubs around key ports.

..the projects constructed under the Round 2 leases - and planned for Round 3 - will require much larger numbers of offshore substations. Currently there are four based in UK waters, but this figure could increase to a peak figure of 16 a year requiring installation and commissioning. There would appear to be both sufficient time and capacity available to the existing supply chain to increase production to achieve these numbers, as well as the necessary heavy lift vessels required to install them.

The sizes of individual projects within the zones and their distance from shore will require a mix of AC and DC cable types. The global supply capacity for offshore cables is approximately 5000km per year and existing companies will need to expand to meet the demand from Round 3, STW and the other European projects.

New facilities can take up to four years to reach production capability and will be closely linked to portside facilities, from where existing lay vessels and the additional fleet will transfer the cables from 2014 onwards. Existing vessels capable of laying interarray and long distance transmission cabling are sufficient for the demand up to around 2014, but additional capacity will be needed to meet the rapid increase from 2015 onward as the Round 3 projects start to get built out. Some marine companies are already investing in the next generation of vessels capable of laying 150kg/m cable using advanced dynamic positioning systems. Companies investing in new capacity can also reap additional long term benefits from the growing European and global offshore renewable energy markets, as other countries look to connect and transmit electricity from their installed generators.

Foundations for European wind farms have been traditionally been dominated by two types; gravity based structures and monopiles, the latter accounting for over 70% of the installed facilities. However the monopile solution is reaching the limit of performance as sites move further offshore. Sites' in Round 3 will be in water depths deeper than 30m and turbine sizes will increase to 5-6MW. Early deep water demonstrated that jacket foundations transported and installed in one piece were considerably lighter than alternative structures and are now being used on current projects such as Ormonde, supporting 5MW machines. With most foundations in Round 3 being installed in water depths between 30 - 50m the jacket structure is currently perceived as the "foundation of choice", however with increasing numbers of manufacturers focusing on purpose designed turbines, there is an increasing interest in other foundation types.

The increasing water depths associated with Round 3, and the limited number of purpose built vessels like the MV Resolution available, means that a new breed of vessel is required to respond to the harsher environments, larger foundation loads and next generation turbines.

As the number of installed turbines accelerates, it is likely that we will see the further development of installation and feeder vessels, designed to minimise transect times and deliver smarter JIT (just in time) delivery.

The key challenges for Round 3 will be to raise reliability of the turbines to better than onshore standards and to rethink maintenance strategy for far offshore installations. Working in an offshore environment presents its own unique health and safety issues and with installations in place up to 200km from land, could potentially increase risk to personnel. It is therefore crucial to keep the number of maintenance visits during the turbine's design life of 20 years to an absolute minimum, and investigate the most convenient method of access to each installation

By 2015 there could be some 3000 turbines generating and by 2020 over 10,000 working around our coastline requiring monitoring.

40 **Crown Estate Offshore wind supply chain conference Bristol** 9 March 2010

Crown Estate presentation Dermot Grimson Head of External Affairs, The Crown Estate
Offshore Wind Energy: GW on the table
47+ GW of installed energy: a third of the UK's electricity demand
Rounds 1+2: 8 GW approved
Round 3: Bids received for 32GW
Round 2 Extension: Interest in 1 GW plus
Scottish Territorial Waters: Option leases awarded for 6.4 GW
The Prize
• 47 GW of energy from the UK waters from all programmes
• 15% UK energy
• 30% UK electricity
• UK energy security of supply
• Climate change targets
• Investment of £100 billion+
• Jobs: 50,000+
• Business development opportunities
The Challenges
• Planning and consenting process
– Zone development plans
– Environmental Impact Assessment
– Infrastructure Planning Commission
–UK Government
• Grid
• Ports, harbours and manufacturing sites
• Supply chain: turbines and cables
All elements that will contribute to offshore wind energy production: components; skilled workforce; infrastructure; and economic environment.

Martin Marais, crown estate – Round 3 Development Manager Round 3: A new approach
• Scale
– Flexibility in project location within zones
– Investment in supply chain and infrastructure
– Est. 70,000 jobs
• The Crown Estate as a development partner
Enabling Actions
Aerial Bird Surveys
Marine Mammals
Bursarys
Archaeology
Radar
Supply Chain Events
Phases
Consenting; procurement; construction; operation (graphs with MW and supply of vessels, turbines etc)
R&D within offshore wind – need R&D skills for eg offshore wind accelarator, marine energy accelarator (?), carbon trust. Program objective: Catalyse a 10% reduction in the cost of offshore wind power through a targeted set of RD&D activities.

Andrew Garrard Garrad Hassan How big is the offshore market?
Onshore installed capacity in 2009 34,000 MW
Total Round 3 capacity is 32,000 MW

Offshore capacity is likely to be less than 10% for ever!

Guy Madgwick Eneco
Eneco Round 3 Development Limited
• Zone located off Dorset / Hants / IoW
• Target Zone Capacity – 900MW (only a fraction of the total Zone capacity)
Zone award – Jan 2010
• Appraisal / surveys / consultations – Jan 2010 – late 2012
• Permit application - late 2012
• Permit award (?) – late 2013
• Financial close – 2014
• Start of offshore construction – 2016
• Construction complete - 2018
Supply Chain
• Development (2010 – 2014)
- Surveys (environmental / engineering)
- Consultancy / support
• Construction (2015 – 2018)
- Foundations
- Substations
- Wind turbines (inc towers and components)
- Cables (export / inter-array)
- Vessels (construction & support)
- Port
• Operations & Maintenance (2016 – 2066)
-Port (warehousing, offices, quays)
-O&M services
-Support services

Robert Thornhill RWE npower renewables R3 represents significant opportunity for the UK in terms of wealth creation via a new industry and jobs
Estimated it will cost >£100 billion to deliver the UK EU target
Key challenges/barriers that need to be overcome for R3 to be realised: Economic viability, Supply chain capability, Grid capacity and infrastructure, Skills availability.
R3 zones larger, further from shore and in deeper waters than before.
To overcome the economic (as well as construction and operational) challenges is going to require developments in technology. Foundations key example of area requiring development Typically constitutes approx 20% of total costs of energy. Monopiles not suitable for most R3 zone water depths
Other areas requiring development include installation methods, turbine reliability and O&M strategies
Represents an opportunity for UK building on experience from offshore oil and gas industry
Skills availability is another area that is constrained
Renewables UK (2008) reported that 5,000 employed in the UK wind industry – forecast that 50,000 will be employed by 2020. The need for '*Good people*' recognised as key element to successful delivery of R3 Renewables UK – Renewable Energy Apprenticeship programme – technical staff
Further initiatives required for other work areas – HSE and environmental specialists, project managers etc

Bruce Valpy BVG Associates, Offshore Wind In the UK Supply Chain Perspectives with a SW Focus Presentation at REGEN SW Offshore Wind Supply Chain Conference March 2010
http://www.regensw.co.uk/about-us/publications

Customer need + supply excellence = chance of supply success
Possibility of supply to:
• Projects local to SW

• All other projects (including outside UK)

SW will have local offshore wind farms by 2020. There will be much development and consenting activity - some underway
SW is not going to be assembly location for a wind turbine manufacturer. Hence need global excellence to supply to turbine manufacturer

Wind farms may be constructed from a local port
• In Bristol Channel, could be on Welsh or English coast or …
• For West of Wight, could be UK or …
O&M Base will be very local to wind farms. Could be on Welsh or English coast; not France

Environmental services and support – opportunities for SW
• Tower and foundation manufacture
• Offshore substation assembly
• Onshore substation assembly
• Project construction base
• Installation and commissioning support
• O&M and logistics support
• Project management / engineering and other professional services

Significant success for SW
= 10% of value of Bristol Channel + West of Wight zones
= 10% of £8bn = **£800m**
Construction could mean **400-800 jobs in SW (2015-2020)**
Operation could mean **250-500 jobs in SW (2015-)**
Need good look at strengths, weaknesses, opportunities, threats for SW + close contact with customers & targeted SW suppliers

RWE npower renewables leaflet Atlantic Array Offshore Wind Farm Energy from sea to shore
…when fully operational, the project is estimated to have the potential to generate up to 1,500MW of clean energy.
Site extends over an area of approx 492 square km in depths of 23 to 56 metres.
First generation expected from this site as early as 2015

39 **Crown Estate / BVG Associates A Guide to an Offshore Wind Farm** 2010

In all cases looking forward, there will be a need for new capacity to enter the supply chain as the industry continues to grow significantly year on year. There is also competition for some resources from the oil and gas and infrastructure sectors which has particular impact on installation vessels and export cable supply and availability of experienced staff at many levels.
p.4
Stages in development of a Round 3 wind farm broken into:
Development and consent - Development services (e.g. feasibility, licensing, planning, radar),
Environmental surveys, Coastal process surveys, Met station surveys, Sea bed surveys, Front-end engineering and design, Human impact studies
Manufacture of the wind turbine and its components – Nacelle, Rotor, Tower
Balance of plant – cables, turbine foundations, offshore substation, onshore substation
Installation and commissioning – export cable laying, foundation installation, array cable laying, construction port, offshore substation installation, sea-based support, turbine installation, commissioning
Operations and Maintenance – support during the lifetime of the wind farm to ensure optimum output. Monitoring performance, routine observation, service and repair: O&M port, technician and equipment transfer, offshore accommodation, large component maintenance and repair

33 **Carbon Trust Offshore Wind: The Challenge –** webpage accessed 11/3/10

To meet the EU's 15% renewable energy target for the UK, we expect that 40% of electricity must come from renewables in 2020. Currently, the figure is just 5%, so an

eight-fold increase is required.

To achieve this, mass-deployment of offshore wind will be required. We believe that it has the potential to supply 25% of the UK's electricity by 2020. To help make this happen, the Carbon Trust launched the Offshore Wind Accelerator, a ground-breaking research and development initiative. The aim is to reduce the cost of energy by 10%
This is the scale of the task: UK will need to install more than 6,000 turbines – structures larger than 30 St Mary Axe (the Gherkin) – as far as 200km out to sea, in water depths of 60m – all in the space of the next 3,650 days. The predicted cost is £75bn, equivalent to eight Channel Tunnels over the next 10 years. To meet this challenge, the Carbon Trust is calling on the best minds in the business to apply their knowledge and skills to make offshore wind a viable commercial solution to help meet the targets for renewables.
Since 2003, 350 turbines have been installed close to shore in depths typically less than 20m. They provide 1GW of capacity. To meet the target, another 28GW are required by 2020. To date, turbines have been installed at the rate of one every 11 days. To achieve 2020 targets, the installation rate must accelerate to one a day between 2010 to 2016, and to at least 2.5 a day from 2017 to 2020. But it's not just a question of building them faster. We also need to overcome the complexities of building them in ever more difficult locations, in deeper water and further from shore

41 **Crown Estate /BVG Associates** **Towards Round 3: Building the Offshore Wind Supply Chain** 2009

2.6. Skills Availability
There have been a number of recent studies conducted to quantify the skills gap and opportunity in the offshore wind industry, both at a UK and a European level.
EWEA's Wind at Work report, published in January 2009 concluded that:
• 15.1 jobs (for a year) are created in the EU for every MW installed (per year).
• 0.4 jobs are created (long-term) per MW of cumulative capacity in operations and maintenance and other activities.
• Of the 108,000 people directly employed in the European wind industry in 2007, 37% are employed by wind turbine manufacturers and a further 22% by component suppliers.
• Almost 80% of the direct jobs are in Spain, Germany and Denmark.
• There are an estimated further 42,000 indirect jobs as a result of the wind industry, making the industry responsible for 150,000 jobs in total.
• This figure will more than double by 2020 (based on total installed base of 180GW). By then, half of the jobs will be offshore related.
The BWEA published two studies in 2008. A report by Bain found that:
• Around 5,000 are employed now in the UK wind industry.
• Under a dynamic growth scenario (34GW installed offshore and onshore by 2020), employment in the UK wind industry rises to 57,000.
An SQW report published alongside the Bain study maps key skills required and the organisations seeking to address the needs. Professionals required by the wind industry include:
• Electrical and electronic engineers.
• Structural and marine engineers.
• Health and safety specialists.
• Construction project managers.
• Maintenance workers.
The report goes on to discuss key methods to address needs. 'We recognise the work underway in this key area and the considerable extra focus required but it is outside scope to provide a detailed view. '
p.17
Balance of plant manufacture - Onshore Electrics
Lack of availability of skilled power engineers. ABB, Siemens T&D and others expressed concern over the lack of available experienced power engineers, partly due to high demand from other sectors. At the moment, postgraduates frequently are recruited from overseas as there are not enough with suitable skills coming out of UK universities.
(Amber status - An area of concern. Some proactive intervention is required in order to address market disconnect.)
p.29, 32
Installation and commissioning – civil engineering/construction management
…significant construction management resource is needed in all projects and in offshore wind this is in relatively short supply. There are a number of highly competent players especially from oil and gas and other infrastructure supply that are yet to manage offshore wind farm construction and it is likely that we will see these enter the market in due course, though there is concern about the cost of oil and gas teams.
For many projects, front-end engineering design (FEED) activities are becoming more detailed. Such studies enable more focussed procurement, reduce project contingencies

and post-consent timescales and can facilitate innovation on a range of levels.
Issues - **Limited experienced skills base.** There are few people with long-term experience in offshore wind construction, but there are possibilities to draw in skilled people from other sectors. The challenges of effective delivery of offshore wind projects with a fair degree of repeated process are similar but different from oil and gas and other infrastructure work dominated by single, high value activities.
(Amber status - An area of concern. Some proactive intervention is required in order to address market disconnect.)
p.37
Operations and Management
UK asset managers are starting to address the issue of increasing numbers of onshore turbines coming out of warranty, prompting them to develop maintenance and support strategies. The three main options for maintenance are:
• Continue to purchase from the turbine manufacturer;
• Move to using a 3rd party service provider; and
• Establish in-house maintenance expertise.
A number of utilities advise a strategy of using in-house expertise from their other power generation support functions for maintaining onshore wind turbines and using specialist third party service providers (such as blade and gearbox specialists) where necessary. **(Amber status -** An area of concern. Some proactive intervention is required in order to address market disconnect.)
p.37
Operations and maintenance – transport & accommodation
Raise awareness of anticipated offshore skills needs
Round 1 and 2 wind farms are being maintained from a base at a nearby port. The maintenance base houses crew areas and spare parts as well as the transport vessels. The relatively short distances to port makes transportation by small vessels a viable solution. As the distance and size of wind farms increase, such vessels no longer become the optimal transportation solution. Siemens have stated that they will be using helicopters for personnel transportation for Greater Gabbard, for example.
For even larger and more distant Round 3 wind farms, it is expected that the offshore wind industry will follow the trend of the oil and gas industry with the use of founded or floating hotels rather than solely using helicopters. Personnel will stay away from land for many weeks, using smaller vessels or helicopters to transfer to individual turbines.
Horns Rev 2 is the first offshore wind farm to have some level of offshore accommodation.
Issues
Turbine access. Currently access between the vessel and turbine is limited due to sea conditions. In the oil & gas industry more innovative solutions have been deployed to minimise the lost time of not being able to get personnel on to the rig. Similar innovation is required for offshore turbines.
Health and safety. Key concerns relate to helicopter access and greater distance from shore for Round 3 projects.
Impact of new strategies. In response to the significant changes in operating conditions, new strategies for maintenance and staffing will be required. In some cases, these may impact design of turbines and installation methods, so consideration needs to be given to this area at an early stage.
(Amber status - An area of concern. Some proactive intervention is required in order to address market disconnect.)
p.38,39

76 **Global Wind Energy Council (GWEC)** Wind power **is crucial for** combating climate change 2008

Over 140,000 wind turbines are now producing electricity in over 70 countries around the world. This includes sites in Europe, Africa, Asia North and Latin America and Australia, and many turbines operate in severe weather conditions, in deserts, in snow, at high altitudes, and of course at sea.
p.1
The most ambitious scenario by the Global Wind Energy Council (GWEC) show that, with growth rates much lower than the 30% the wind sector has experienced over the past decade, global wind energy capacity could increase from 121GW at the end of 2008 to over 1,000GW by 2020 and 2,400 GW by 2030. This would result in annual CO2 savings of more than 1.5 billion tons in 2020 and 3.2 billon tons in 2030.
p.2
Europe is the region with the highest installed capacity of wind energy, and can therefore rely on wind power to substantially reduce CO2 emissions and to reach both its 2012 Kyoto target and its pledge to reduce emissions by 20-30% by 2020.
In the European Union, wind power in 2008 avoided 91 tons of CO2, or 20% of the EU's target for that year. In 2012, wind energy is forecast to save 146 tons of CO2, which represents 32% of the EU's Kyoto target. In 2020, 29% of the EU's promised emissions reduction of 20% could be achieved by wind power.
p.3

78 **Hammer Gerlinde, Röhrig Rolf Qualification requirement analysis. Offshore wind energy industry** Final report Bremerhaven/Bremen July 2005

2005 data… but job roles, skills gaps, training remains the same… amplified by increasing size of market to 2020

Summary

New requirements with regard to employee qualifications in the areas of project management, national and international law, quality assurance, occupational safety and health care, technical English and English for negotiations as well as offshore training arise in almost all sectors of the value added chain. In addition, sector-specific qualification requirements have been demonstrated which concern the areas of engineering training, welding and fibre composite technology as well as additional mechatronic knowledge for assembly and service employees. Preferred types of further education were also enquired about, as was experience in cooperation with research institutes and competence centres. Finally, the detailed analysis of the transnational cooperation of companies in the whole European market also revealed deficits which can be attributed to a lack of comparability and transferability of national professional qualifications, certificates and standards and which repeatedly lead to cost-intensive friction in cross-border cooperation. Therefore, the creation of comparable European training and qualification standards would be one factor leading to an improvement in cooperation.

p.5

The wind energy field of business can be seen as a complex value added chain ranging from planning to production, through to maintenance and repair of the plants.

2.1 Definition of the Offshore Wind Energy Use Value Added Chain

The value added chain sequence can be shown as follows:

1. Planning/Development/Finance/Insurance
2. Foundation technology and tower construction
3. Mechanical engineering and plant construction (e.g. gears)
4. Plastics and fibre composite technology (e.g. rotor blades, nacelle cladding)
5. Electrical engineering (e.g. construction of generators)
6. Assembly and logistics
7. Service, maintenance, repairs
8. Maritime construction & consulting

p.7

The greatest growth potential for the wind energy industry is at sea. The sea offers high wind speeds, which can also be better exploited than on land, covering extensive areas. These are great advantages over onshore operation. The disadvantages, such as acoustic and visual burdens (shadows) on inhabitants, hardly apply at all due to the fact that the wind parks are a long way from the shore.

However, the requirements in terms of planning, construction and operation of wind energy plants at sea are also greater. On the one hand, numerous conservation, fishing and seafaring rights have to be taking into account during the planning phase. On the other hand, the offshore plants are planned mainly in very deep waters of 20 to 40 metres, far from the coast. There, they are exposed to far greater stress from the wind and waves than onshore plants. The salty sea air makes heavier demands on corrosion protection. Maintenance and service work depends heavily on weather conditions at sea and is very cost intensive. All in all, however, these more difficult operating conditions are balanced out by the greater efficiency of larger, more innovative plants which have two to three times the onshore capacity of a windmill and are expected to produce an output of 5 MW in the future. With few exceptions, wind parks at sea require an investment volume which can only be provided by large banks, energy groups and other global players. The profile of companies involved in offshore development is changing accordingly.

p.10

Results of survey and expert interviews with 32 companies in the offshore wind sector on job roles across Europe are displayed in graphic form and expanded further on pages 24 and 25 of the original document

Planning, Development, Finance, Insurance

1. The management needs in-depth knowledge of **national and international laws** which are to be complied with in the planning of offshore parks and are often represented in the cost calculation. A taxation of products for export unknown in one's own country can make a project more expensive, a subsidy for energy sources unusual here could have the opposite effect. Therefore, it also pays to have legal knowledge.
2. Project managers must cooperate with representatives of authorities in the approval procedure as well as with banks and insurance companies in matters of finance. Negotiating skill is therefore a must.
3. Planning an offshore project involves technical questions as well as legal and commercial ones. A planning company looking for financially strong partners for its project must have a management which can present the entire project as an integrated whole and explain all important technical, official and financial aspects concisely and convincingly. The **dovetailing of technical, commercial and legal skills** is a qualification requirement of project managers on the EU market.
4. Strategies for **quality assurance** are increasingly becoming the standard. Certification in line with DIN ISO 9000 ff should be the goal, as the competition will have an advantage over companies without certification of quality.

5. Last but not least: English is not only a specialist language but also the language of negotiation. **Technical English and English for negotiation** are part of the requirement profile for transnational planners and developers.

Foundation Technology and Tower Construction

This results in a **bundle of new qualification requirements** for craftsmen and technologists:

1. New welding technologies must be taught by appropriate institutes. **Submerged arc welding** replaces shielded arc welding.
2. Technologists and engineers need new **software knowledge** concerning computer supported analysis of statistics and stress profiles for tripods and towers.
3. **Quality assurance strategies** are becoming essential. As a rule, quality certificates from certifying institutes are required for international offshore operation.
4. **Occupational safety** is becoming a decisive qualification component and lever in competition for orders. Small and medium-sized businesses which do not have suitable measures and certificates are at a disadvantage.
5. **Offshore training** is indispensable for all craftsmen and technologists who assemble towers on site, i.e. at sea. This includes abseiling, man-over-board manoeuvres and basic knowledge of nautical safety.

Mechanical Engineering and Plant Construction (Especially Gears)

1. Industrial mechanics, structural steel engineers and electricians involved in plant construction require an additional qualification which provides knowledge of **mechatronics** or at least an area of it. It is in this segment of plant construction that mechanical and electrotechnical activities are becoming more and more intermeshed.
2. Engineers in this sector, who are concerned with construction and design of gear units, usually have a degree in mechanical engineering or electrical engineering. However, the complex technology involved in wind power plants brings together a number of different areas of knowledge: mechanics, aerodynamics, electrical engineering. This is where **additional wind-specific modules** for vocational and further training of engineers are necessary.

Fibre Composite Technology (Especially Rotor Blade Technology)

1. The proportion of unskilled and semiskilled workers employed in production is relatively large. There is requirement for qualifications to impart basic knowledge in **plastic and fibre composite technology**.
2. Industrial mechanics and timber processors need the additional knowledge of an electrician in order to solve mechanical and electrical problems (lightning conduction, monitoring sensors). At least some **specialist mechatronic knowledge** is desirable.

p.31

Electrical Engineering (Components, Cables and Network Connection)

Overall, there are the following new **qualification requirements** in this field:

1. For engineers, **wind energy-specific knowledge** of offshore plants is a great advantage.
2. Technicians and electricians need for installation work involving high-voltage components a sound further education in **occupational safety**.
3. As almost all the components in wind power plants are traded on an international market,

the use of the corresponding manuals requires knowledge of **technical English**. p.32

Assembly and Logistics

1. **Offshore training** is obligatory for all those sailing on a ship. The training is provided by state-certified companies.
2. **Knowledge of a foreign language** (English) is vital in view of the need to cooperate with foreign companies during on-site assembly.

Service, Maintenance, Repairs

1. Of course, **offshore training** is obligatory for every service technician.
2. Knowledge of **technical English** is vital due to extensive maintenance literature for individual components.
3. Lastly, a meshing together of the various vocational skills and knowledge into an independent **service qualification** is needed: mechanical engineering, electrical engineering, hydraulics, fibre composite technology – you must have a basic knowledge of these subjects.
4. **IT knowledge** for the operation of the condition monitoring system (CMS) is very useful for service technicians.

p.34

Maritime Construction

1. Knowledge of **project management** is required in order for one person to have both technical and commercial knowledge.
2. In addition, qualifications are required in terms of **national and international law** relevant to area identification, putting together a contract and handling financial matters for major projects.
3. In particular, engineers must rely on new **software** suitable for the mathematical modelling of plant design and wind park layout.

p.35

All Qualification Modules At a Glance An overview of the previously explained qualification requirements is provided on pages 36 and 37 of the original document.

Further Education Strategies

The overwhelming majority of companies questioned deal with the necessary further education of employees by carrying out in-house training. Really large-scale enterprises also run their own competence centres for this purpose with company-specific training programmes. In addition, external experts run in-house training sessions, mostly due to new equipment or new products being introduced. In this case, the producer or supplier is responsible for showing employees how to use the new technology.

In addition, there are external further education seminars. Institutes of Further Education, professional associations, and also higher education institutions and university competence centres are all prepared to cooperate. Lastly, learning on the job is a common way of introducing employees to their new tasks. This is done by experienced "old hands" in the business mentoring the new employees. In comparison, the role played by e-learning and hybrid forms such as blended learning is very insignificant. The general rule is that the bigger the company, the more financial capacity it has to run its own training centres. In contrast, smaller companies find the costs of further education too great. According to the companies, there is a lack of information in this respect in all the countries investigated. It is not very well known which institutes of further education offer what and under what conditions. Remedying this lack of information would be an important step in making companies aware of the need for qualifications. In the short term, a serious lack of qualified employees may not be a problem, so that the orthodox methods of learning on the job are sufficient. But when the huge offshore projects, such as that currently being planned for the German North Sea, come to fruition, the number of employees and their qualifications will be an important factor. Any deficiency in this respect costs both time and money. p.36-38

Bibliography

Home

1. **Aldersgate Group Mind the Gap. Skills for the transition to a low carbon economy.** Nov 2009
http://www.aldersgategroup.org.uk/reports

2. **BERR Building Britain's Future. New Industry, New Jobs** April 2009
http://www.dius.gov.uk/~/media/publications/N/new_industry_new_jobs

3. **BERR Fishing liaison with offshore wind and wet renewables groups (FLOWW)** Recommendations for fisheries liaison Best practice guidance for offshore renewables developers May 2008
http://www.berr.gov.uk/files/file46366.pdf

4. **BERR/Innovas Low Carbon and Environmental goods and services: an industry analysis** March 2009
http://www.berr.gov.uk/files/file50253.pdf

5. **BERR/Douglas Westwood Supply Chain Constraints on the Deployment of Renewable Electricity Technologies** June 2008
http://www.berr.gov.uk/files/file46792.pdf

6. **BIS Jobs of the Future** Sept 2009
http://www.hmg.gov.uk/media/41730/jobs_of_the_future.pdf

7. **BIS Skills for Growth National Skills Strategy** Nov 2009
http://www.bis.gov.uk/policies/skills-for-growth

8. **BIS Towards a Low Carbon Economy – economic analysis and evidence for a low carbon industrial strategy BIS Economics Paper No.1** July 2009
http://www.berr.gov.uk/files/file52165.pdf

9. **BIS/DECC The UK Low Carbon Industrial Strategy** July 2009
http://interactive.bis.gov.uk/lowcarbon/publications/

(N.B. **British Wind Energy Association** was renamed **RenewableUK** in March 2010 – all refs from this organisation are authored BWEA for consistency**)**

10. **British Wind Energy Association / Redpoint Energy Ltd The benefits of marine technologies within a diversified renewables mix** May 2009
http://www.bwea.com/pdf/marine/Redpoint_Report.pdf

11. **British Wind Energy Association BWEA31 Skills Summit Renewable Energy Apprenticeship Programme Skills Accord** Oct 2009
http://www.bwea.com/jobs/skills/summit.html

12. **British Wind Energy Association Choosing a career in wind, wave and tidal energy** no date
http://www.bwea.com/pdf/careers/careers.pdf

13. **British Wind Energy Association / BAIN & Company Employment opportunities and challenges in the context of rapid industry growth** 2008
http://www.bwea.com/pdf/publications/Bain%20Brief_Wind%20Energy%202008_FINAL.pdf

14. **British Wind Energy Association Marine Renewable Energy State of the Industry Report** Oct 2009
http://www.bwea.com/pdf/marine/Marine_report_enteclogo.pdf

15. **British Wind Energy Association** report of **Marine Renewables Supply Chain Workshop** Nov 2009
http://www.bwea.com/pdf/marine/Supply_Chain_Event_Technical_Feedback.pdf

16. **British Wind Energy Association The next steps for Marine Energy** March 2010
The industry view on the Marine Action Plan
http://www.bwea.com/pdf/press/R-UK_Marine_Action_Plan.pdf

17. **British Wind Energy Association Offshore wind worldwide** no date
http://www.bwea.com/offshore/worldwide.html

18. **British Wind Energy Association Powering a green economy** 2009
http://www.bwea.com/pdf/publications/Powering%20a%20Green%20Economy.pdf

19. **British Wind Energy Association press release** Rebirth of UK Manufacturing: North East on Board 18 Feb 2010
http://www.bwea.com/media/news/articles/pr20100218.html

20. **British Wind Energy Association press release** UK wind industry welcomes Beauly-Denny power line decision 8 Jan 2010
http://www.bwea.com/media/news/articles/pr20100108-1.html

21. **British Wind Energy Association press release** Wave and tidal energy project leases 16 March 2010
http://www.bwea.com/media/news/articles/pr20100316-2.html

22. **British Wind Energy Association press release** Wave and tidal plan must be followed by Government investment 04 March 2010
http://www.bwea.com/media/news/articles/pr20100304.html

23. **British Wind Energy Association press release** We can build new UK industry from offshore wind revolution" 8 Jan 2010
http://www.bwea.com/media/news/articles/pr20100108-2.html

24. **British Wind Energy Association RenewableUK Manifesto 2010** Feb 2010
http://www.bwea.com/pdf/RenewableUK_Manifesto2010.pdf

25. **British Wind Energy Association / SQW Energy Todays' investment – tomorrows asset: skills and employment in the wind wave and tidal sectors** Oct 2008
http://www.bwea.com/pdf/publications/BWEA%20Skills%20Report%20FINAL%2016oct.pdf

26. **British Wind Energy Association UK Offshore Wind: Charting the Right Course** no date
http://www.bwea.com/pdf/publications/ChartingtheRightCourse.pdf

27. **British Wind Energy Association UK offshore wind: Moving up a gear** Winter 2007
http://www.bwea.com/pdf/offshore/movingup.pdf

28. **British Wind Energy Association / Garrad Hassan UK Offshore Wind: Staying on Track** no date
http://www.bwea.com/pdf/publications/CapReport.pdf

29. **British Wind Energy Association What does the round 3 announcement mean?** Briefing note on offshore wind energy Jan 2010
http://www.bwea.com/pdf/Round3Briefing.pdf

30. **British Wind Energy Association Why Marine?** no date
http://www.bwea.com/pdf/marine/FINAL%20WHY%20MARINE.pdf

31. **Carbon Trust Future Marine Energy** Results of the Marine Energy Challenge: Cost competitiveness and growth of wave and tidal stream energy 2006
http://www.carbontrust.co.uk/Publications/pages/PublicationDetail.aspx?id=CTC601

32. **Carbon Trust Offshore wind power: big challenge, big opportunity** Oct 2008
http://www.carbontrust.co.uk

33. **Carbon Trust Offshore Wind: The Challenge** webpage accessed 11 March 2010
http://www.carbontrust.co.uk/emerging-technologies/current-focus-areas/offshore-wind/pages/the-challenge.aspx

34. **Carbon Trust press release Marine Energy ready for mass deployment by 2020** 2 Feb 2010
http://www.carbontrust.co.uk/news/news/press-centre2010/2010/Pages/marine-energy-ready-for-mass-deployment.aspx

35. **CBI Pulling Ahead: Innovating for low carbon leadership** July 2009
http://www.cbi.org.uk/pdf/20090907-cbi-pulling-ahead-innovation-for-low-carbon-leadership.pdf

36. **CEDEFOP Future skills needs for the green economy** 2009
EU workshops and research
http://www.swslim.org.uk/documents/themes/lt18-resource34.pdf

37. **Crossley, Peter Changing industry landscape reveals skills shortages** The Joule Centre March 2009
http://www.joulecentre.org/news-centre/index.php?option=com_content&view=article&id=41:changing-industry-landscape-reveals-skills-shortages-for-uk-renewables&catid=17:skills&Itemid=46

38. **Crown Estate Briefing Note. Supporting Information Relating to the Announcement of Round3** no date
http://www.thecrownestate.co.uk/round3_briefing_note.pdf

39. **Crown Estate / BVG Associates A Guide to an Offshore Wind Farm** 2010
http://www.thecrownestate.co.uk/guide_to_offshore_windfarm.pdf

40. **Crown Estate Offshore wind supply chain conference** Bristol 9 March 2010

http://www.regensw.co.uk/about-us/publications

41. **Crown Estate / BVG Associates Towards Round 3: Building the Offshore Wind Supply Chain** 2009
http://www.thecrownestate.co.uk/round3_supply_chain_gap_analysis.pdf

42. **Crown Estate UK Offshore Wind Report** 2010
http://www.thecrownestate.co.uk/uk_offshore_wind_report_2010.pdf

43. **DECC Investing in a Low Carbon Britain** 2009
http://www.decc.gov.uk/en/content/cms/news/090423_low_car/090423_low_car.aspx

44. **DECC Marine Energy Action Plan** Executive Summary and Recommendations March 2010
http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/explained/wave_tidal/funding/marine_action_/marine_action_.aspx

45. **DECC Press release New player in UK Offshore wind market** 25 Feb 2010
http://www.decc.gov.uk/en/content/cms/news/pn10_033/pn10_033.aspx

46. **DECC Press Release** Offshore wind expansion biggest ambition in the world 8 Jan 2010
http://www.decc.gov.uk/en/content/cms/news/pn10_004/pn10_004.aspx

47. **DECC Press Release -** Testing the water for Wave and Tidal potential 4 March 2010
http://www.decc.gov.uk/en/content/cms/news/pn10_039/pn10_039.aspx

48. **DECC The Renewable Energy Strategy** July 2009
http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

49. **DECC Severn Tidal Power – Phase One Consultation: Government Response** July 2009
http://www.decc.gov.uk/en/content/cms/consultations/stp_phase1/stp_phase1.aspx

50. **DECC The UK Low Carbon Transition Plan** July 2009
http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

51. **DECC** Fact Sheet: **UK Ports for offshore wind** 2010
http://www.decc.gov.uk/

52. **DEFRA Skills for a Low Carbon and Resource Efficient Economy ProEnviRo project** 2008
http://skills4lowcarboneconomy.co.uk/reports.aspx

53. **DEFRA Unlocking talent building a low carbon economy** May 2008
http://www.defra.gov.uk/environment/business/innovation/commission/pdf/cemep-response-execsumm.pdf

54. **Devon County Council / Step Ahead Research Devon Renewable Energy Skills and Training Project** March 2008
http://stepaheadresearch.co.uk/uploads/files/DREST%20Report.doc

55. **East of England Development Agency**. **Power Infrastructure Study** Sept 2009
http://www.eeda.org.uk/files/EEDA_Power_Infrastructure_Study_2.pdf

56. **East of England Energy Strategy Group / Douglas Westwood Ltd Catalogue of Energy Industry Classifications** June 2005

http://www.offshore-power.net/Files/Dok/energy_industry_classifications_june05.pdf

57. **EEF Is UK plc ready for low carbon?** Nov 2009
http://www.eef.org.uk/publications/reports/Under-the-Microscope-Is-UK-plc-ready-for-low-carbon.htm

58. **Energy Engineering** Offshore wind, wave and tidal issue (27) 2010
http://www.energyengineering.co.uk/

59. **Engineering and Technology Board et al. Environmental Audit Committee Green jobs and skills inquiry** June 2009
http://www.publications.parliament.uk/pa/cm200910/cmselect/cmenvaud/159/15902.htm

60. **EU skills et al Energy skills – opportunity and challenge** Oct 2008
http://www.euskills.co.uk/home/resources/search/search/hal/title//

61. **EU Skills Foundation degree framework specification for the electrical power engineering sector** Jan 2010
http://www.euskills.co.uk/home/resources/974/Foundation+Degree++Framework+Specification+for+the+Electrical+Power+Engineering+Sector

62. **EU Skills et al. Low Carbon Cluster Sector Skills Assessment Report** Dec 2009
http://www.euskills.co.uk/home/2009-sector-skills-assessment/

63. **EU Skills Occupational and Functional Map for the renewable energy sector** March 2007
http://www.euskills.co.uk/home/resources/511/Occupational+and+Functional+Map+Renewable+Energy+Sector

64. **EU Skills Renewable Sector Skills Analysis – Scotland** 2009
An investigation of demand and supply side issues of the renewables sector in Scotland
http://www.euskills.co.uk/home/resources/search/search/renewable/title//

65. **EU skills Sector Qualifications Strategy** Feb 2010
http://www.ukces.org.uk/tags/sqs/sector-qualifications-strategy-energy-and-utility-skills

66. **EU Skills Sector Skills Agreement** Dec 2009
http://www.euskills.co.uk/home/resources/search/folder/148/title/Sector+Skills+Assessment+2009+

67. **EU Skills/SWRDA Sector skills mapping in the environmental technology sector** no date
http://www.euskills.co.uk/home/resources/109/Sector+Skills+Mapping+in+the+Enviornmental+Technology+Sector

68. **EU Skills South West England SSA Stage 5 report** 2007
http://www.euskills.co.uk/home/resources/search/search/ssa/title//

69. **European Wind Energy Association Oceans of opportunity. Offshore wind fact sheet** no date
http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Offshore_Fact_Sheet.pdf

70. **EWEA press release** More wind power capacity installed... no date
http://www.ewea.org/fileadmin/ewea_documents/images/homepage/press_releases/More_wind_power_capacity_installed_last_year_in_the_EU_than_any_other_power_technology.pdf

71. **European Wind Energy Association Wind Energy - The Facts** website accessed 13/3/2010
http://www.wind-energy-the-facts.org/

72. **European Wind Energy Association Wind energy and the job market** no date

http://www.ewea.org/fileadmin/ewea_documents/documents/publications/factsheets/EWEA_FS-employment.pdf

73. **Forum for Renewable Energy development in Scotland FREDS Marine Energy Group (MEG) Marine Energy Road Map** Sept 2009
http://www.scotland.gov.uk/Resource/Doc/281865/0085187.pdf

74. **Global Climate Network Creating Opportunity. Low carbon jobs in an interconnected world. Discussion paper no. 3** Dec 2009
http://www.globalclimatenetwork.info/%2Fecomm%2Ffiles%2Fgcn_low_carbon_jobs.pdf

75. **Global Wind Energy Council Press Release** European offshore wind power set to increase tenfold 8 Jan 2010
http://www.gwec.net/index.php?id=30&no_cache=1&tx_ttnews%5Btt_news%5D=241&tx_ttnews%5BbackPid%5D=4&cHash=3147d728a5

76. **Global Wind Energy Council Wind power is crucial for combating climate change** no date
http://www.gwec.net/fileadmin/documents/Publications/Wind%20&%20climate%20fact%20sheet%20low%20res.pdf

77. **Hammer Gerlinde, Röhrig Rolf Qualification requirement analysis. Offshore wind energy industry** Energy Industry Classifications July 2005
http://www.offshore-power.net/Files/Dok/energy_industry_classifications_june05.pdf

78. **Hammer Gerlinde, Röhrig Rolf Qualification requirement analysis. Offshore wind energy industry** Final report July 2005
http://www.offshore-power.net/Files/Dok/final_report_grs.pdf

79. **Hatfield-Dodds S, Turner G, Schandl H CSIRO Sustainable Ecosystems Growing the Green Collar Economy: Skills and labour challenges in reducing our greenhouse emissions and national environmental footprint** Report to the Dusseldorp Skills Forum June 2008
http://www.csiro.au/resources/GreenCollarReport.html

80. **HM Treasury Pre Budget Report Section 7 Low Carbon Economy** Dec 2009
http://www.hm-treasury.gov.uk/d/pbr09_chapter7.pdf

81. **Institution of Mechanical Engineers Marine Energy** Energy Policy Statement Sept 2007
http://www.imeche.org/NR/rdonlyres/27203DBC-2E66-4AA7-9835-216E02FEA3AC/0/MarineEnergyIMechEPolicy.pdf

82. **IPPR The Future's Green: Jobs and the UK low-carbon transition** Oct 2009
http://www.ippr.org/publicationsandreports/publication.asp?id=712

83. **North West Development Agency / ECOTEC Assessment of the skills provision for a 'Well Adapted and Low Carbon Northwest'** Final report to the NWDA December 2009
www.**nwda**.co.uk/docs/NW_Regional_Priorities_Statement_2010-11.doc

84. **OECD Economic Survey of the European Union 2009. Energy policy and the transition to a low carbon economy** Chapter 4 OECD Sept 2009
http://www.oecd.org/document/28/0,3343,en_2649_34111_43712732_1_1_1_1,00.html

85. **Power Sector Skills Strategy Group Sector Skills Strategy 2010 to 2015.** Dec 2009
http://www.euskills.co.uk/power/power-sector-skills-strategy-group/

86. **REGEN SW / DTZ The economic contribution of the renewable energy and energy efficiency sectors in the South West of England** April 2008
http://swslim.org.uk/documents/themes/lt18-resource26.pdf

87. **REGEN SW Marine energy and offshore wind South West Company directory 2nd Edition,** Oct 2009

http://www.regensw.co.uk/downloads/RegenSW_356.pdf

88. **REGEN SW The road to 2020** Sept 2008
http://www.regensw.co.uk/downloads/RegenSW_210.pdf

89. **Scottish Government Renewables Action Plan** Section 9 Skills July 2009
http://www.scotland.gov.uk/Publications/2009/07/06095830/11

90. **SLIM Green Skills, Green Jobs Learning Theme publications** 2009
http://www.swslim.org.uk/themes/researchbriefs-details.asp?theme_ID=27

91. **SLIM** Bulletin **STEM Skills in the South West – what's new?** March 2010
http://www.swslim.org.uk

92. **Social Research and Regeneration Unit Skills needs of the marine and maritime sector in the south west of England** University of Plymouth July 2003
http://www.serio.ac.uk/resources/files/Skills%20Needs%20Of%20The%20Marine%20And%20Maritime%20Sector%20In%20The%20South%20.pdf

93. **SWRDA / ARUP Achieving a green economic recovery** May 2009
http://download.southwestrda.org.uk/business-growth/general/Green-Economic-Recovery-21-05.pdf

94. **SWRDA** Stephen Peacock's speech to the Society of Marine Industries' Conference **Investing in UK Maritime Renewable Energy – Engineering Challenges & Business Opportunities'** Feb 2010
http://www.press.southwestrda.org.uk/2010/02/11/stephen-peacocks-speech-to-the-society-of-marine-industries/

95. **SWRDA Marine Energy A new industry in the making** 2008
http://download.southwestrda.org.uk/file.asp?File=/business-growth/general/Marine-Energy.pdf

96. **SWRDA / ECOTEC Skills Demand and Supply in Resource Efficiency in the South West** May 2006
http://www.swslim.org.uk/documents/themes/lt18-resource18.doc

97. **SWRDA Press Release Wave Hub construction underway** Nov 2009
http://www.southwestrda.org.uk/news_and_events/2009/november/wave_hub_construction.aspx

98. **UKCES Skills for Jobs: Today and Tomorrow The National Strategic Skills Audit for England 2010** Volume 1:Key Findings March 2010
http://www.ukces.org.uk/reports/skills-for-jobs-today-and-tomorrow-the-national-strategic-skills-audit-for-england-2010-volume-1-key-findings

99. **UKCES Strategic skills needs in the low carbon energy generation sector** March 2010
http://www.ukces.org.uk/evidence-reports/strategic-skills-needs-in-the-low-carbon-energy-generation-sector

100. **UKCES Working Futures 2007-2017 Evidence Report 2** Dec 2008
http://www.ukces.org.uk/working-futures-2007-2017-evidence-report-2

101. **UK Energy Research Centre (UKERC) Marine (Wave and Tidal Current) Renewable Energy Technology Roadmap** Summary Report March 2008
http://ukerc.rl.ac.uk/Roadmaps/Marine/Tech_roadmap_summary%20HJMWMM.pdf
http://ukerc.rl.ac.uk/ERR0303.html

102. **Valpy, Bruce Offshore Wind In the UK Supply Chain Perspectives with a SW Focus** BVG Associates. Presentation at REGEN SW Offshore Wind Supply Chain Conference March 2010
http://www.regensw.co.uk/about-us/publications

103. **Wales Government Capturing the potential. A green jobs strategy for Wales** July 2009
http://wales.gov.uk/docs/det/publications/090709capturingthepotentialagreenjobsstrategyforwalesen.pdf

September 2010 update Recent Publications relating to this Analysis

Home

104. **Alliance of Sector Skills Councils Alliance response to the consultation "Meeting the Low Carbon Skills Challenge"** A consultation on equipping people with the skills to take advantage of opportunities in the low carbon and resource efficient economy June 2010
www.ssc**alliance**.org/nmsruntime/saveasdialog.aspx?lID=1507&sID=7

105. **BIS A Simplified Further Education and Skills Funding System and Methodology** Consultation process July 2010
http://www.bis.gov.uk/Consultations/fe-funding-consultation?cat=open

106. **BIS Skills for Sustainable Growth** A consultation on the future direction of skills policy July 2010
http://interactive.bis.gov.uk/comment/skills/

107. **DECC Meeting the low carbon skills challenge:** a consultation on equipping people with the skills to take advantage of opportunities in the low carbon and resource efficient economy 31 March 2010
http://www.decc.gov.uk/en/content/cms/consultations/low_carb_skill/low_carb_skill.aspx

108. **DECC National Renewable Energy Action Plan for the United Kingdom** July 2010
The NREAP is based on a template set by the European Commission, which asks for the trajectory and measures that will enable the UK to reach its target for 15% of energy consumption in 2020 to be from renewable sources. The 'lead scenario' set out in the UK NREAP demonstrates that it is possible to achieve the 15% target and provides one view of the technology mix in 2020. However, this scenario does not represent a target for any particular sector or technology and it should not be seen as an upper limit to the UK's ambition for renewables deployment
http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/renewable%20energy/ored/25-nat-ren-energy-action-plan.pdf

109. **DECC Press Release Energy Secretary Chris Huhne** Address to RenewableUK Offshore Wind Conference July 2010
Confirmation of the new Coalition government's commitment to offshore wind
http://www.decc.gov.uk/en/content/cms/news/renukcon10/renukcon10.aspx

110. **IPPR Green and Decent Jobs: The case for local action** An ippr scoping paper June 2010
http://www.ippr.org.uk/publicationsandreports/publication.asp?id=759

111. **The offshore valuation group The offshore valuation: a valuation of the UK's offshore renewable energy resource** Executive Summary May 2010
www.OffshoreValuation.org

112. **PricewaterhouseCoopers 100% renewable electricity A roadmap to 2050 for Europe and North Africa** March 2010

Demonstration of how a single European power market plus a single North African power market could generate sufficient energy using only renewables by 2050 using offshore wind, wave and tidal power, solar, hydro and biomass
http://www.pwc.co.uk/eng/publications/100_percent_renewable_electricity.html

113. **Renewable UK / Douglas Westwood** **UK Offshore Wind: Building an Industry** Analysis and scenarios for industrial development June 2010
http://www.bwea.com/pdf/offshore/offshore-wind_building-an-industry.pdf

114. **South West Regional Employment and Skills Board / EMB** **Marine Energy (Wave and Tidal) and Offshore Wind Skills Analysis** August 2010
Contact http://swresb.co.uk/ for further information

115. **UKCES** **Strategic Skills Needs in the Low Carbon Energy Generation Sector** March 2010
http://www.ukces.org.uk/evidence-reports/strategic-skills-needs-in-the-low-carbon-energy-generation-sector

UK Trade and Investment **UK Renewable Energy: Wind and Marine** May 2010
http://www.ukenergyexcellence.com/common/documents/brochures/UK_Renewable_Energy_Brochure.pdf

116. **Work Foundation / C Levy** **A 2020 Low Carbon Economy** April 2010
http://www.theworkfoundation.com/research/publications/publicationdetail.aspx?oItemId=243&parentPageID=102&PubType=
Press release http://www.theworkfoundation.com/pressmedia/news/newsarticle.aspx?oItemId=308