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UK COMMISSION FOR EMPLOYMENT AND SKILLS

Sector Skills Insights: Energy

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Intelligence › Investment › Impact

Sector Skills Insights: Energy

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UK Commission for Employment and Skills

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Foreword

The UK Commission for Employment and Skills is a social partnership, led by Commissioners from large and small employers, trade unions and the voluntary sector. Our mission is to raise skill levels to help drive enterprise, create more and better jobs and promote economic growth. Our strategic objectives are to:

- Provide outstanding labour market intelligence which helps businesses and people make the best choices for them;
- Work with businesses to develop the best market solutions which leverage greater investment in skills;
- Maximise the impact of employment and skills policies and employer behaviour to support jobs and growth and secure an internationally competitive skills base.

These strategic objectives are supported by a research programme that provides a robust evidence base for our insights and actions and which draws on good practice and the most innovative thinking. The research programme is underpinned by a number of core principles including the importance of: ensuring '**relevance'** to our most pressing strategic priorities; '**salience'** and effectively translating and sharing the key insights we find; **international benchmarking** and drawing insights from good practice abroad; **high quality** analysis which is leading edge, robust and action orientated; being **responsive** to immediate needs as well as taking a longer term perspective. We also work closely with key partners to ensure a **co-ordinated** approach to research.

This report contributes to the UK Commission's work to transform the UK's approach to investing in the skills of people as an intrinsic part of securing jobs and growth. It outlines the performance challenges faced in the **energy** sector, the 'real-life' skills solutions implemented by leading and successful businesses to overcome them, and the benefits from doing so. Similar reports are available for the following sectors: Advanced Manufacturing; Construction; Digital and Creative; Education; Health and Social Care, Professional and Business Services; Retail; Tourism. Each report is summarised by an accompanying PowerPoint slide pack. By understanding the key performance challenges employers face and the skills solutions available to address them on a sector-by-sector basis the UK Commission can make better use of its investment funds to support economic growth.

Sharing the findings of our research and engaging with our audience is important to further develop the evidence on which we base our work. Evidence Reports are our chief means of reporting our detailed analytical work. Each Evidence Report is accompanied

by an executive summary. All of our outputs can be accessed on the UK Commission's website at www.ukces.org.uk

But these outputs are only the beginning of the process and we will be continually looking for mechanisms to share our findings, debate the issues they raise and extend their reach and impact.

We hope you find this report useful and informative. If you would like to provide any feedback or comments, or have any queries please e-mail info@ukces.org.uk, quoting the report title or series number.

Lesley Giles
Deputy Director

UK Commission for Employment and Skills

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GLOSSARY

This report uses data from several sources and a slightly varying definition of the sector depending upon which data sources are available.

PRINCIPAL DATA SOURCES

Employer Perspectives Survey 2010 (EPS 2010)

The UK Commission's Employer Perspectives Survey 2010 (Shury et al., 2011) gathered the views of approximately 14,500 employers on the UK's employment and skills system. The aim of the survey is to provide evidence to stakeholders operating in the system across the four UK nations to inform policy and improve service delivery.
http://www.ukces.org.uk/publications/er25-employer-perspectives-survey

The UK Commission's UK Employers Skills Survey 2011 (ESS 2011)

The UK Commission's UK Employer Skills Survey (UK Commission, 2012) provides UK-wide data on skills deficiencies and workforce development across the UK on a comparable basis. It was undertaken at the establishment level and involved over 87,500 interviews, with a follow up survey of over 11,000 employers focusing on employers' expenditures on training.
http://www.ukces.org.uk/publications/employer-skills-survey-2011

Working Futures Database

Working Futures 2010-2020 (Wilson and Homenidou, 2011) is the most detailed and comprehensive set of UK labour market forecasts available. The results provide a picture of employment prospects by industry, occupation, qualification level, gender and employment status for the UK and for nations and English regions up to 2020. The database used to produce the projections is held by the University of Warwick Institute for Employment Research and Cambridge Econometrics.
http://www.ukces.org.uk/assets/ukces/docs/publications/evidence-report-41-working-futures-2010-2020.pdf

Labour Force Survey

The Labour Force Survey (LFS) is a quarterly sample survey of households living at private addresses in the United Kingdom. Its purpose is to provide information on the UK labour market that can then be used to develop, manage, evaluate and report on labour market policies. It is conducted by the Office for National Statistics. Figures quoted in this report are based on a four quarter average unless otherwise stated in the text.
http://www.ons.gov.uk/ons/guide-method/surveys/respondents/household/labour-force-survey/index.html

SECTOR DEFINITIONS

The definition of the sector used in this report is: Mining and oil and gas extraction (SIC07 05-09); Recycling/Materials recovery (SIC07 38 and 39); and Electricity and utilities (SIC07 35-37).

This mirrors the UKCESS sector definitions of Mining and Quarrying (SIC07 05-09) and Electricity, Gas and Water (SIC07 35-39).

Some data is not available at this level and so a slightly different sector coverage used. Where this is the case, it is clearly indicated in the report.

Executive Summary

This report considers the current situation of the energy and utilities sector in the UK, the challenges it faces over the medium term and the implications for skills. The intention is to provide a summary of the extent to which the performance challenges faced by the sector can be addressed through skills development and thereby bring about growth and contribute to the recovery of the UK economy.

The Importance of the Sector

A strong energy sector provides the products and services that are essential to modern living. An efficient sector underpins a productive and sustainable economy. A diverse sector is strategically vital for the UK to improve its balance of trade and reduce its dependency on overseas energy sources. The energy sector is at the forefront of the development of a low carbon economy.

The energy and utilities sector consists of three main areas of business activity, which have shown quite different development trajectories in recent years:

- **Mining and oil and gas extraction**: which employs more than 100,000 people, although numbers declined in mining, quarrying and oil extraction during the 2000s.
- **Recycling/Materials recovery**: a growing sub-sector, which developed from contractor services for local authority run waste collection, and employed 23,000 people in 2010.
- **Electricity and other utilities**: this subsector is dominated by large scale regulated providers for electricity, gas and water utilities, employing almost 200,000 people in 2010.

The sector as a whole employs over 300,000 people. It accounts for around four per cent of national output and around one per cent of employment. Output per head is the highest of any major UK sector, but in recent years productivity growth has fallen behind most of our international competitor countries.

The sector's structure broadly mirrors the national labour market picture, although there are more large employers than in most other sectors, as well as a growing number of small businesses, and a relatively high proportion of employees in the sector who are process or plant operatives. The sector's workforce is older than that of other sectors and the average age of managers and professionals working in the sector is increasingly relatively fast, suggesting low inflows of younger people to these roles.

Key Challenges

The key challenges facing the sector over the coming decade are; the need to increase productivity; meeting increases in demand for energy; and further reducing the environmental impact of energy production. There are therefore three main drivers of innovation in the medium to long run:

- The growth of energy from renewable sources
- The renewal of current energy production facilities
- A long-term increase in the demand for electricity.

Greater emphasis on electrically powered vehicles and micro-generation will place further demands on the distribution network. There will continue to be changes in other parts of the sector too, such as waste management, as the emphasis switch to recovering value from waste rather than disposal.

Skill Demand

The above demands facing the sector mean that employment across the sector is expected to expand by at least four per cent between 2010 and 2020, with the strongest growth in occupations requiring higher level qualifications. In addition, there is likely to be a significant demand for new recruits to replace an ageing workforce, creating a strong demand for technical and engineering skills in the electricity, gas and water industries.

A number of core technical and job-specific skills are required to meet regulatory demands to decarbonise energy production. Smaller workplaces in particular may find this shift particularly challenging.

Key skills that are likely to be required across the sector include:

- Adaptability and transferability skills (to enable workers to learn and apply new technologies and processes)
- Environmental and sustainability awareness;
- Systems and risk analysis skills
- Entrepreneurial skills
- Innovation skills (to identify opportunities and create new strategies)
- Communication and negotiation skills
- Marketing skills (to promote products and services)
- Consulting skills (to advise consumers about green solutions and to spread the use of green technologies)

- Networking, IT and language skills (to perform in global markets).

Skills Supply

In some respects the skills supply to the sector is relatively healthy, with an overall growth in students studying relevant subjects at university level, growing number of apprentices in the energy and utilities sector, and above average levels of workplace training. However, there are some signs that parts of the sector and particular groups of staff experience skill deficiencies. In addition, there are concerns about the medium-term capacity of the skills supply infrastructure to meet a growth in demand for sectorally-specific skills in the future. Specific areas of concern include:

- Many STEM graduates find jobs outside STEM sectors, and energy and utility sectors may not be seen as particularly attractive graduate destinations
- The UK relies heavily on international migration to supply skills relevant to the sector. The Migration Advisory Committee's shortage list identifies a number of shortage occupations, including engineering professional occupations, engineering technicians, and skilled trades such as welders and line repairers.
- While training activity is relatively high across the sector, the proportion of professional and technical staff in receipt of training is proportionally low, as is the proportion of employers providing training to Level 4 qualifications in the utilities sector. In addition, a relatively high proportion of training in the sector is induction or Health and Safety related.
- Although the incidence of skill shortages across the sector is below average, a significant proportion of employers identify problems recruiting process operatives
- Skill gaps are below average, but where they occur affect process operatives, professional and associate professional occupations and managers.
- Wage growth across the sector is higher than average, particular in the mining sub – sector, which could be an indicator of skills mismatch.

Conclusion

Expansion and productivity growth could be severely limited by a lack of high level skills and the ability to innovate and commercialise technological developments. The sector's full potential and highest performance will only be achieved by attracting, retaining and refreshing talent. This will require:

- Developing alternative sources of skills supply to maximise the number of recruits to the sector, for example by encouraging vocational entry routes to the sector such as apprenticeships and Foundation Degrees.

- Making the sector more attractive to new recruits, by: increasing awareness of the benefits of working in the sector; improving the provision of careers information, advice and guidance; and encouraging existing employees to act as ambassadors and promote the benefits of working in the sector to potential new recruits.
- Encouraging further investment in workforce development, including continuous professional development, management training and sector initiatives to support smaller employers in managing their training programmes and accessing suppliers.

1 The Economic and Policy Climate

Increasingly, the competitiveness of advanced industrial nations is explained with reference to the capabilities of their respective labour forces. Hence, national education and training systems are seen as providing comparative economic advantages. It is notable that over the recent past education and training have taken centre stage in policies designed to foster the UK's competitiveness and lie at the heart of the current Government's plans to kick start the recovery against a backdrop of challenging global economic conditions. To understand the role skills development might play in stimulating growth within the energy and utilities sector requires some consideration of the current economic situation and current skills policy.

In 2012 the UK economy, and indeed the global economy, is still coming to terms with the repercussions of the 2008/9 economic recession. By comparison with previous recessions, 2008/9 was relatively deep and it continues to cast a long shadow over the country's medium-term economic prospects (see Table 1.1). The economic climate at the time of the 2008/9 recession and in the period afterwards has been characterised by low interest rates and a depreciation of sterling against other currencies, notably the dollar and the euro. Whilst these would usually be sufficient to give a fillip to the economy by boosting demand and, given time, increasing output, the potential for export led growth has been seriously undermined by continuing weak demand conditions across the global economy, especially in the Eurozone and the USA. Also the difficulties households and businesses have had gaining access to finance as the banks have sought to increase their capital has restricted growth. Moreover, the markets' continuing disquiet over developments in the Eurozone has contributed further to the climate of uncertainty in the global economy thereby further dampening demand.

Table 1.1 Four recent periods of recession in the UK

	Start date	Date of bottom of recession	Length of period from start to bottom of recession	Total decline in GDP (%)	Time taken for GDP to recover to level at start of recession
1	1974 Q4	1975 Q3	4 Quarters	3.8	7 Quarters
2	1980 Q1	1980 Q4	4 Quarters	5.9	13 Quarters
3	1990 Q3	1992 Q2	8 Quarters	2.3	11 Quarters
4	2008 Q2	2009 Q1	6 Quarters	6.3	?

Source: Office of National Statistics Quarterly Economic Accounts 1975, 1981, 1993, and 2010

As a consequence of the above developments, the rapid acceleration in growth observed after the recessions of the early 1980s and 1990s has failed to materialise. Nevertheless the economy is expected to resume its long-run growth path over time (see Figure 1.1) but in order to do so there are specific steps the UK economy needs to take. BIS and the UK Treasury have identified a number of weaknesses which need to be addressed if a sustained recovery is to be achieved (BIS, 2011):

1 the level of debt funded household consumption;

2 the share of the economy accounted for by the public sector;

3 weak business investment;

4 an over-dependence upon financial and business services; and

5 unbalanced regional growth.

Government has identified four ambitions which need to be realised in order to restore long-term sustainable growth (BIS, 2011):

1 creating the most competitive tax system in the G20;

2 making the UK one of the best places in Europe to start, finance and grow a business;

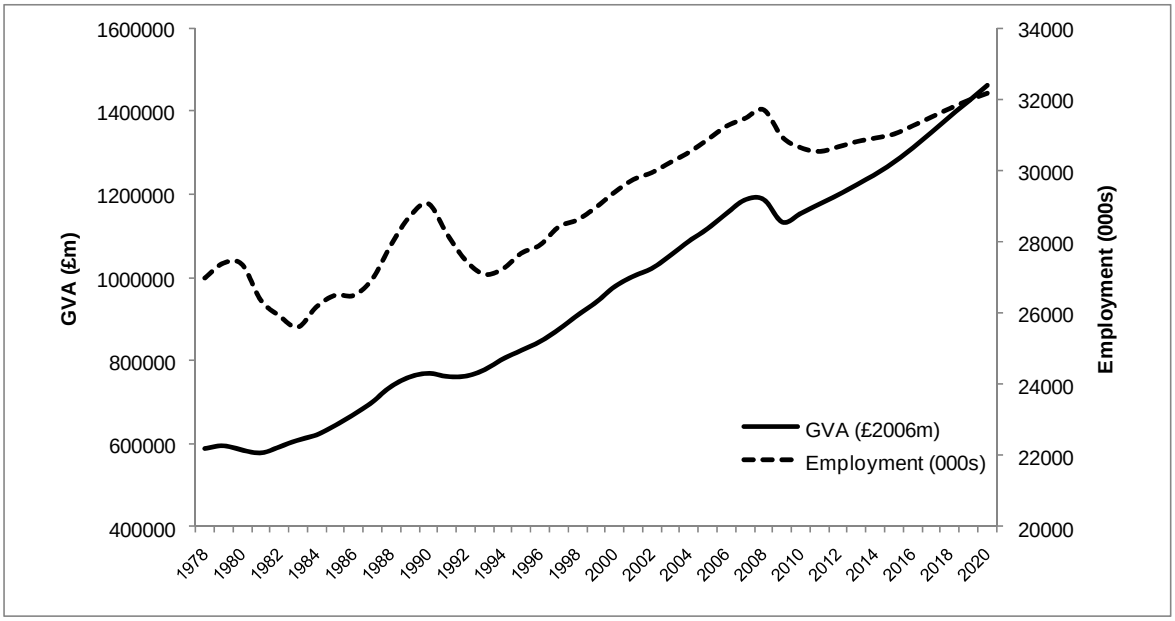
3 an over-dependence upon financial and business services; and

4 creating a more educated workforce that is the most flexible in Europe.

Therefore, the role of skills in national economic policy is clearly an essential one; to bring about recovery and sustainability by creating jobs and growth.

From the employer's perspective there is a need to adapt to both global demand side conditions and the consequences which are likely to arise from policies designed to rebalance the UK economy. Depending upon the sector there are likely to be a number of skill-related performance challenges which employers will need to address as they seek to consolidate existing markets, develop new ones, and introduce technical and organisational changes to improve their competitiveness. The importance of these challenges become even more apparent if one considers the role of skills in the economic cycle. Evidence demonstrates that the recovery from previous economic recessions was hampered by skills shortages, and that these skill shortages then contributed to further downturns in the economy (Blake *et al*., 2000). Therefore, the message is clear: a failure to invest sufficiently in skills now has the potential to dampen future growth.

Figure 1.1 Employment and Gross Value-Added 1978 - 2020



Source: Wilson and Homenidou (2011)

At a time when capital investments are constrained as a consequence of problems in the global banking system, investments in skills, and human resources more generally, made through programmes such as Apprenticeships and Investors in People, and funded through initiatives such as the Growth and Innovation Fund, may be the most amenable to employers.

Based on the latest evidence available, this report considers the specific situation in the energy and utilities sector to provide:

- an overview of the size and structure of the sector and the principal drivers of change over the medium term which are likely to have some bearing upon skill demand;
- an outline of current and expected patterns of skill demand in the sector;
- a description of skills supply and how this has adapted to changing patterns of skill demand;
- an analysis of mismatches between the demand for, and supply of skills, and the implications of this for the sector.

In conclusion, the report identifies the performance challenges faced by the sector and highlights the skills solutions available to address them thereby delivering increased levels of growth and contributing to the recovery of the UK economy.

2 The Importance of the Sector

The energy and utilities sector provides the essential commodities required to fuel and maintain the modern economy. A diverse and secure sector is strategically vital for the UK to improve its balance of trade and reduce its dependency on overseas energy sources. Demand for energy will continue to increase, with implications for sector skills.

The sector is in a period of substantial technological change, which affects how energy will be produced, transmitted, distributed and traded, with more changes in energy production and consumption to follow. The sector employs over 300,000 people and produces 4% of the UK's GVA. The industry has high productivity, with a value contribution to the economy far beyond the proportion of people who work in the sector. Skills employed in the industry are slightly above the UK average levels, and wages are much higher than average.

Legislative requirements to reduce greenhouse gas emissions and carbon dioxide in particular ('the low carbon economy') will increase the role of electricity in energy production, because it can be produced with fewer emissions from renewable sources (such as wind and solar power). In addition, increasing use of renewable sources will reduce reliance on imported energy. These trends substantially increase the growth prospects of the sector. However, the availability and quality of skills of those working in the sector will have a significant effect on the extent to which future growth prospects are realised.

Definition of the sector

This report defines the energy and utilities sector as follows:

1. **Mining and oil and gas extraction** (SIC07 05-09): Mining (of coal), quarrying and the extraction of oil and natural gas employs more than 100,000 people, although numbers have declined in mining, quarrying and oil extraction since the early 2000s. However, dynamically growing high-technology support industries for mining in the UK now employ about half of all people working in this area of the sector.

2. **Recycling/Materials recovery** (SIC07 38 and 39): The second field of activity is a growing recycling and materials recovery sector, which developed dynamically from contractor services for local authority run waste collection, and consists mainly of SMEs which provide specialised services in materials recovery. About 23,000 people were working in this area of the sector in 2010.

3. **Electricity and utilities** (SIC07 35-37): The third sub-sector mainly comprises large scale providers for electricity and other utilities, which – following privatisation – are regulated firms. Labour Force Survey (LFS) data for 2010 show employment in these companies of just below 200,000.

The contribution of the sector to the UK economy's Gross Value Added (GVA) is 3.8 per cent and has been broadly stable since the 1990's. In the past, the contribution was proportionally much higher than this (for examples, 9.8 per cent in 1984), when prices for crude oil and production in the UK were above current levels (see Table 2.1).

Table 2.1 Sector GVA as share of total UK GVA (per cent)

	1970	1980	1990	2000	2005	2009
A-B: Agriculture & fishing	3.0	2.2	1.8	1.0	0.7	0.7
C,E: Mining and Quarrying; Energy & water	4.8	9.5	4.9	4.7	4.0	3.8
D: Manufacturing	32.7	26.5	22.5	17.4	13.3	11.1
F: Construction	6.4	6.3	6.7	5.3	6.3	5.8
G-H: Distribution, hotels & restaurants	14.0	12.8	13.6	14.9	14.6	14.0
I: Transport & communications	8.5	7.2	8.1	8.0	7.2	7.0
J-K: Banking, finance & insurance etc.	16.5	18.4	21.6	27.0	30.4	33.8
L-N: Public admin, education & health	14.2	17.1	17.1	16.9	18.4	18.8
O-Q: Other services	0.0	0.0	3.7	4.9	5.2	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: UKCES (2011)

The sector has by far the highest GVA per employee in the UK, with GVA per employee double that for financial services (see Table 2.2). However, GVA per employee has declined in recent years (as for most sectors of the economy).

Table 2.2 GVA per person employed in the UK by sector (residence based) CVM (£2006 000s)

	2002	2003	2004	2005	2006	2007	2008	2009
A-B: Agriculture & fishing	19.84	19.19	19.33	19.43	19.03	18.43	17.48	15.39
C,E: Mining and Quarrying; Energy & water	195.13	210.51	214.52	193.42	180.22	156.92	144.11	137.12
D: Manufacturing	33.95	36.08	38.23	39.41	41.28	41.52	43.42	43.88
F: Construction	33.23	33.22	32.79	31.93	32.02	32.73	32.17	30.79
G-H: Distribution, hotels & restaurants	27.32	27.39	28.98	29.42	31.24	32.54	31.36	30.1
I: Transport & communications	38.09	38.95	40.39	40.96	42.85	45.34	45.11	46.37
J-K: Banking, finance & insurance etc.	68.93	71.84	74.91	75.84	81.39	81.75	84.52	78.67
L-N: Public admin, education & health	18.43	18.46	18.2	17.9	18.25	18.71	18.43	18.03
O-Q: Other services	36.47	35.17	34.1	34.43	34.14	34.33	33.78	32.15
Total	36.2	36.76	37.44	37.68	39.14	40.08	40.05	38.54

Source: UKCES (2011)

However, an alternative measure of productivity, Gross Domestic Product per hour worked (GDP/h), captures the effect of reduced working times as the economy moved into recession. Total working hours declined substantially from 2008, but the number of persons employed did not fall to the same extent. GVA per employee declined by four per cent between 2008-2010, but GDP/h declined by one per cent (see Appendix Table A.1).

The sector has the second highest export share of all UK sectors (47 per cent of the sector's GDP) and the second highest import share (71 per cent), after manufacturing (53 per cent and 73 per cent respectively) (UKCES, 2010). The high import and export shares suggest a high degree of openness, which supports higher productivity as the sector can supply larger markets and achieve returns to scale and the benefits of specialisation. Highly internationalised sectors benefits from 'enhanced competition leading to improved productivity of domestic firms, … removed distortion bias in domestic industries that protection would have created, … and dissemination of knowledge and innovation embodied in goods, services and investments' (BIS/DFID, 2011).

2.1 Overall Output and Employment Performance

Sector employment declined by 15,600 between 2000 and 2010 to 314,526, and output declined to £29.6 billion (2006 prices) (Wilson and Homenidou, 2011). Output is forecast to decline further until 2020, to 83 per cent of the 2000 level, while employment is forecast to be 99 per cent of the 2000 level. Sector output has been declining since 1999, when it stood at £38.4 billion (in 2006 prices), and decreased rapidly from 2005 (£37.3 billion). Between 2000 and 2010, sector output decreased by 1.3 per cent per year (Table 2.3).

Wilson and Homenidou (2011) found that sector productivity, defined by output per person employed, declined between 2000 and 2010 by 17 per cent. Productivity is predicted to decline until 2015, to around 22 per cent below the 2000 level, before starting to increase again.

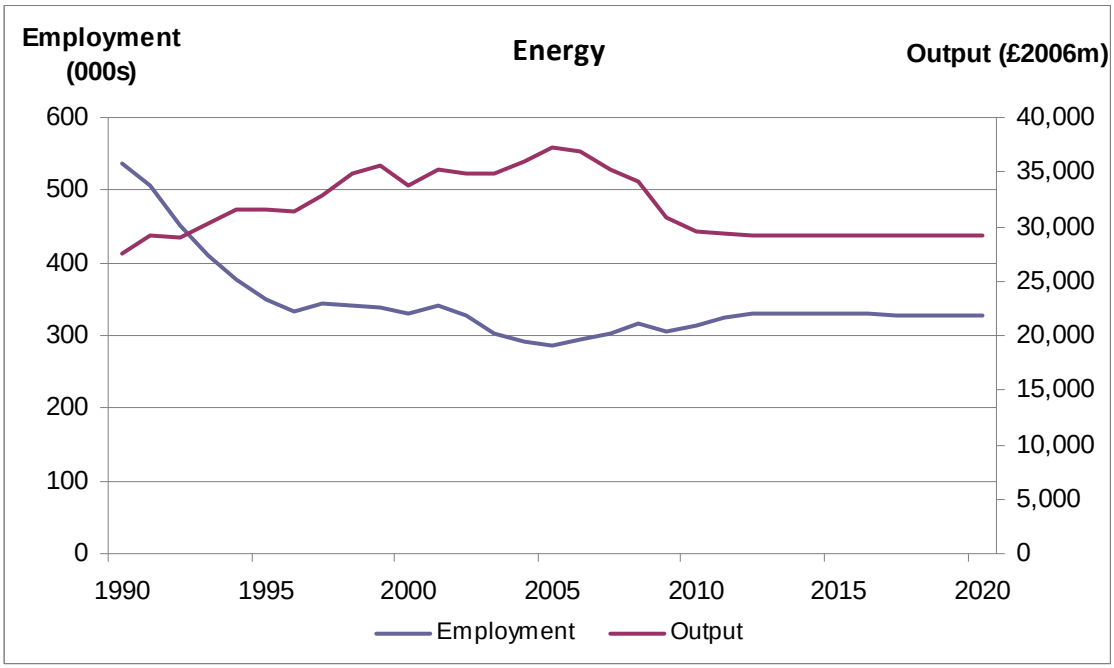
Table 2.3 Key Output and Employment Indicators

	2010 level	Growth rate: 2000-2010 (% p.a.)	Changes (absolute)	Growth: 2010-2020 (%)	Growth rate: 2010-2020 (% p.a.)	Changes (absolute)
Output (£2006m)	29,152	-2.3	-7498	5	0.5	1445
Employment	315	-0.5	-16	3.8	0.4	12
Part time employment	28	0.4	1	32.1	2.8	9
Full time employment	257	-1	-28	1.9	0.2	5
Self employment	30	5.2	12	-6.7	-0.7	-2
Male employment	243	-0.5	-13	-2.5	-0.2	-6
Female employment	71	-0.4	-3	25.4	2.3	18

Source: Wilson and Homenidou (2011)

For the economy as a whole, output per worker employed grew by 11 per cent between 2000 and 2010, and is predicted to grow by 24 per cent by 2020. Substantial employment growth is also predicted, with overall employment in 2020 9.6 per cent higher than in 2000.

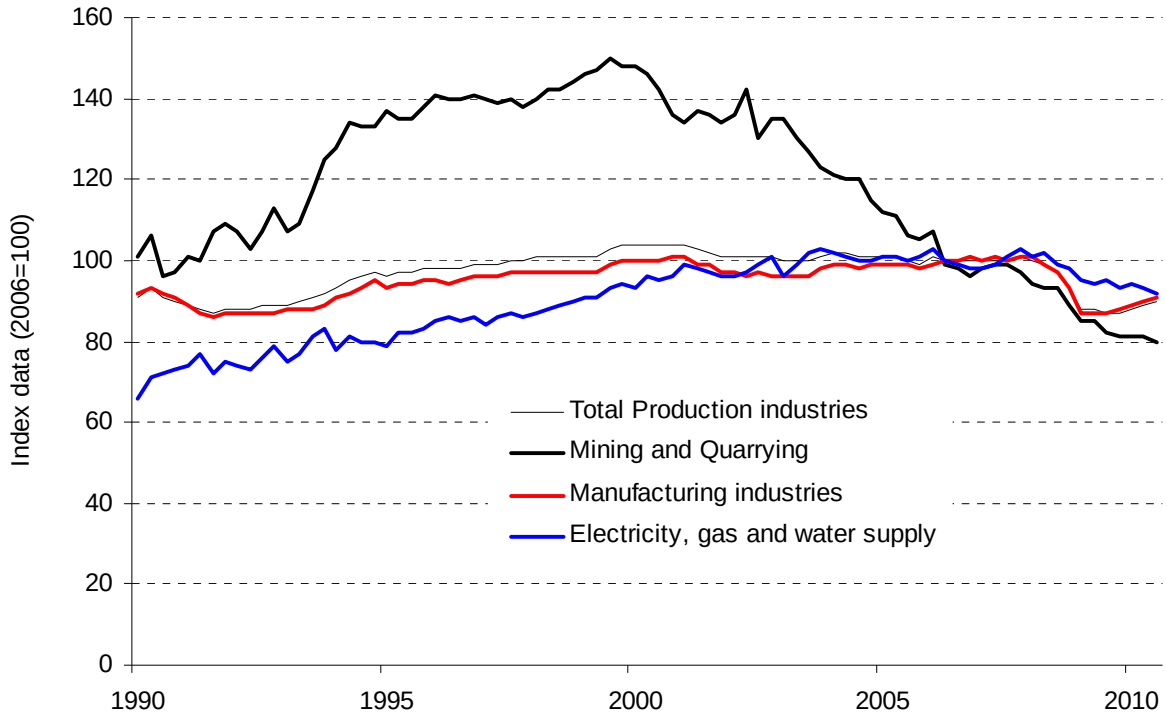
Figure 2.1 Trends in Employment and Output



Source: Wilson and Homenidou (2011)

Overall, the Working Futures scenario (see Wilson and Homenidou, 2011) suggests long-term decreases in output and relatively stable employment levels, which suggest negative productivity growth (see Figure 2.1). Alternative predictions (reported in UKCES, forthcoming) suggest that the sector will expand over the next ten years with, for example, employment growth in renewable electricity generation outweighing further declines in employment in mining industries and oil and gas extraction. Data from the quarterly index of production between 1990 and 2010 appear to confirm this point (see Figure 2.3). The reduction in economic activity is almost entirely caused by the reduction of production in mining and quarrying industries, while electricity and water supply were growing. While the quarterly index of production for total production industries (2006 = 100) decreased from 104 (in 2000) to 90 in 2010, for mining and quarrying it decreased from 148 to 80. In contrast, the quarterly index of production in electricity, gas and water supply was 93 in the first quarter of 2000 (exactly the same as in the second quarter of 2010), with the highest output observed in both the fourth quarters of 2003 and 2007 (figure 2.2).

Figure 2.2 Quarterly index of production (seasonally adjusted)



Source: ONS (2012)

Employment trends at a sub-sectoral level, based on Labour Force Survey data, are set out in Table 2.4. They show the changing structure of the overall sector with significant declines in employment in coal and other mining and growth in electric power distraction, support activity for petrol and gas extraction and, in particular, recycling.

Table 2.4 Employment in "main activities" 2000-10 (aggregating some 3-digit SICs)

Industry group in main job (3 digits, 2010)	2000	2010	Numerical change	Percentage change
Coal	15,487	5,580	-9,907	-64%
Oil and gas extraction	20,885	21,543	658	3%
Support activity for petrol & gas extraction	36,367	55,225	18,858	52%
Other mining and quarrying	32,479	24,671	-7,808	-24%
Recycling/materials recovery	4,458	23,330	18,872	423%
Electric power generation, transport & distribution	98,880	123,205	24,325	25%
Other utilities	99,929	98,401	-1,528	-2%
Total	308,485	351,955	43,470	14%

Source: LFS microdata (ONS, 2010)

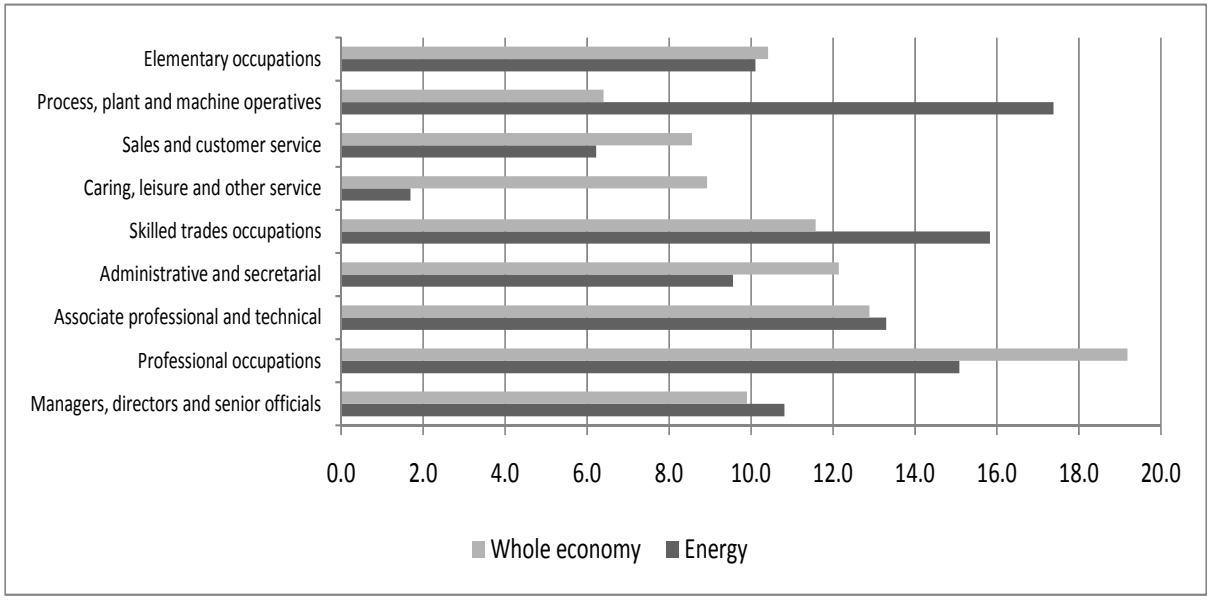
2.2 Employment Structure 2010

This section discusses sector patterns of employment by occupation, qualification level, firm size, gender and age.

Employment by occupation and qualification level

Around 39 per cent of the sector's workforce is employed in managerial, professional or associate professional roles, compared to 42 per cent for the economy as a whole. The sector has a relatively high proportion of process and plant operatives (17 per cent compared with six per cent across all sectors) as well as people in skilled trades occupations (16 per cent compared to 12 per cent for the whole economy. The sector employs negligible numbers of people employed in personal service occupations (just 2 per of the total sector workforce, compared to nearly nine per cent for the economy as whole) (see Figure 2.3).

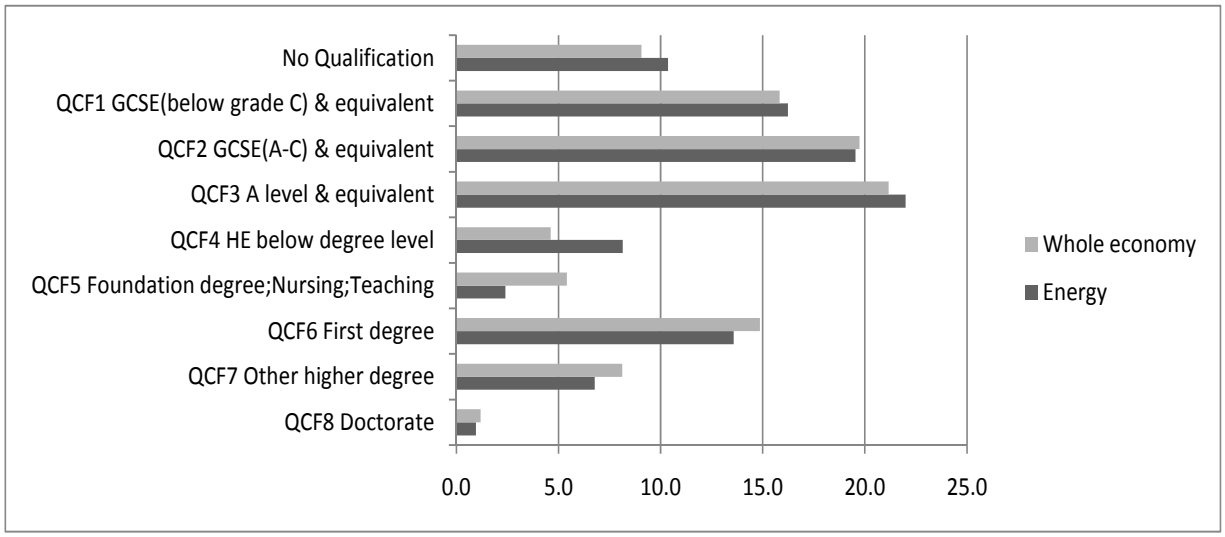
Figure 2.3 Employment by Occupation (percentage of 2010 workforce)



Source: Wilson and Homenidou (2011)

The qualification profile of the sector's workforce is slightly below average. However, over half of the sector workforce (54%) holds at least a Level 3 qualification, compared to 55% for the economy as whole; and 32% hold at least a Level 4 qualification, compared to 34% for the economy as a whole (Figure 2.4).

Figure 2.4 Employment by highest qualification held (2010; % of workforce)



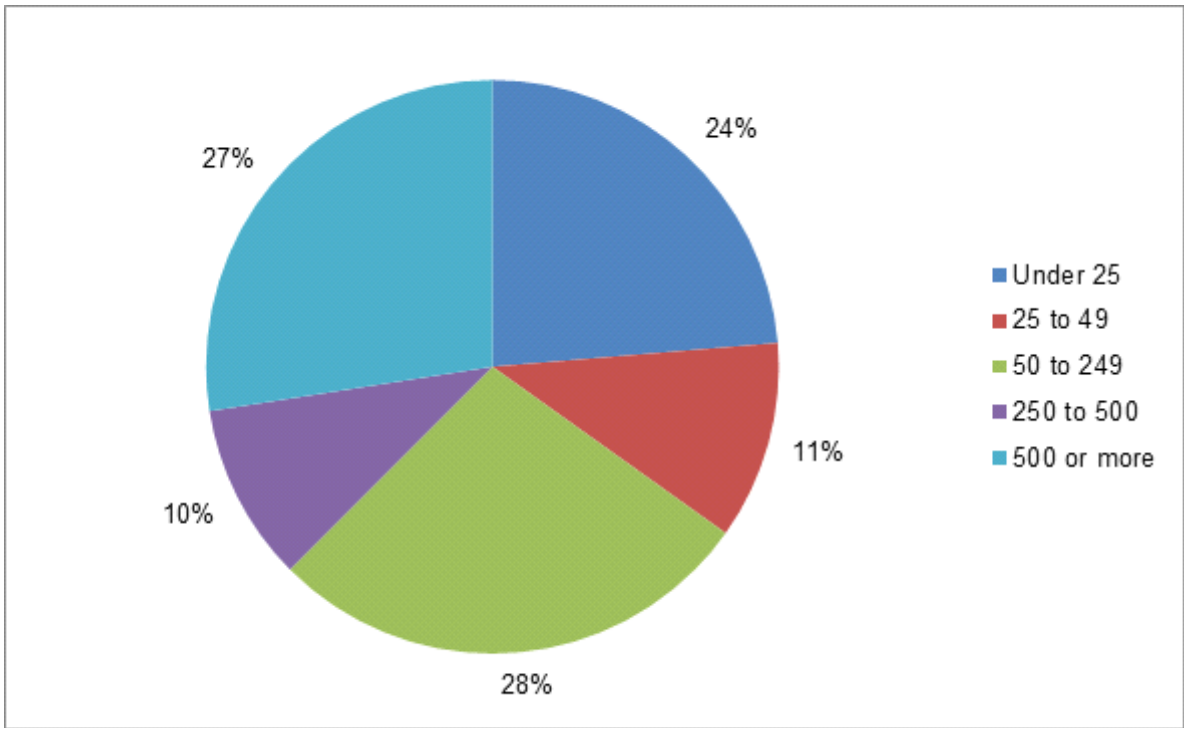
Source: Wilson and Homenidou (2011)

Employment by firm size

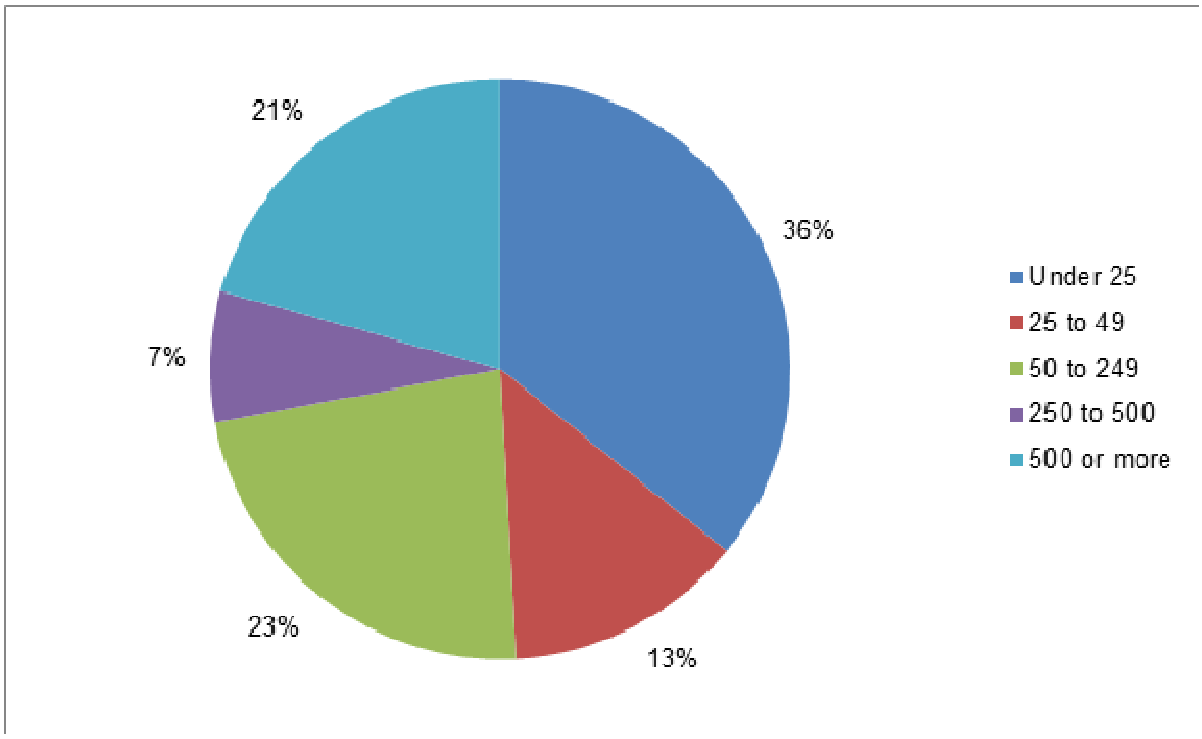
The sector is dominated by large organisations. Recent growth in micro-generation of electrical power has not changed this significantly. A higher than average proportion of workers in the sector is employed in firms with more than 500 employees (22 per cent compared to 15 per cent for the rest of the economy). Just a fifth (22 per cent) of employees work in firms with less than 25 employees, compared with 32 per cent across the whole economy (Figure 2.5).

Figure 2.5 Size Structure of Employment (% of employment by employer size band)

Energy



Whole economy



Source: Labour Force Survey (ONS, 2010)

A further analysis of firm size for by subsectors shows a relatively large number of specialist suppliers (SMEs) in waste management and at the utility end of the gas sector (Energy & Utility Skills, 2010). However, even in these subsectors, the majority of the workforce is employed by large organisations (see Table 2.5): for example, large companies employ 72% of the power workforce, and companies with ten or fewer employees less than two per cent (Energy & Utility Skills, 2010).

Table 2.5 Business units by size-band (Great Britain)

	Total	1-10	11-49	50-199	200+
Power	929	569	167	111	82
Gas (transmission & distribution)	316	125	98	76	*
Gas (utilisation)**	50,300	49,300	800	*	*
Waste Management	6,800	4,750	1,550	450	
Water	2,438	1,785	461	149	*

*Note: * Denotes less than 50. ** Denotes the inclusion of non-VAT registered business units.*

Source: Energy & Utility Skills (2010)

There is a low incidence of self-employment in the energy and utilities sector. In 2010, self-employment accounted for just under 10 per cent of total employment, compared to a whole economy average or almost 14 per cent (Table 2.6). However, the proportion of self-employment in the sector has increased significantly since 2000, from six per cent. Absolute numbers of self-employed people in the sector increased from 18,000 in 2000 to 13,000 in 2010. Self-employment across the economy as a whole grew by two percentage points (from 12.2 to 14.3 per cent) over the same period (see Table 2.5)

Table 2.6 Incidence of self-employment

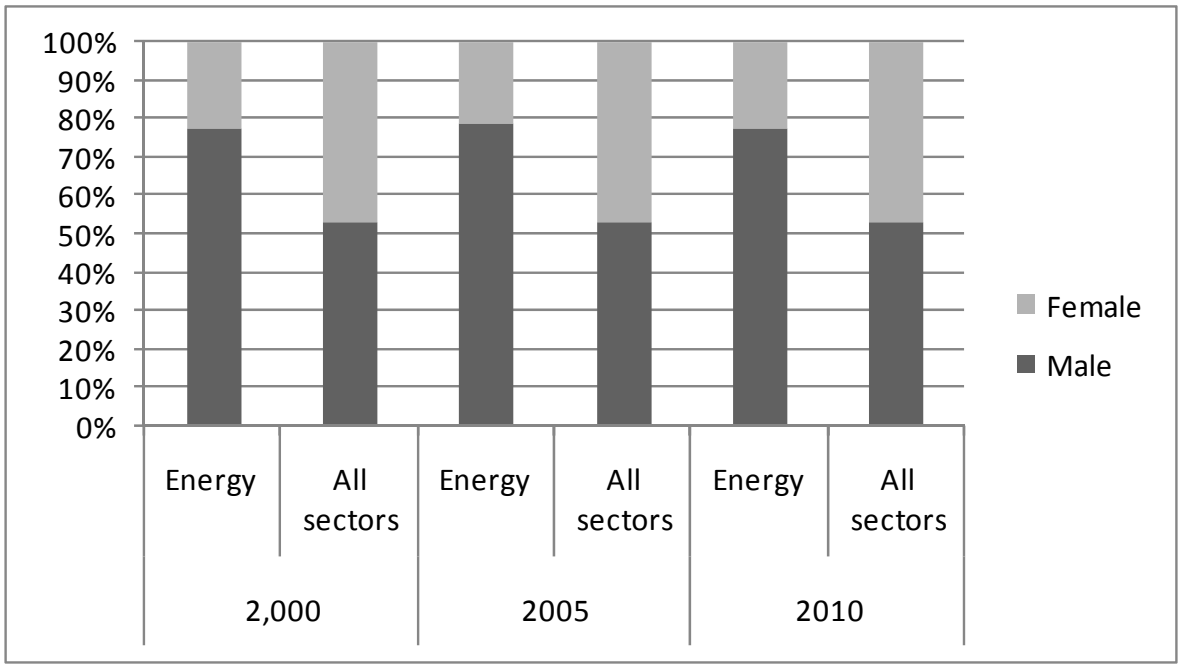
	2000				2010			
	Whole economy	Energy sector	Whole economy	Energy sector	Whole economy	Energy sector	Whole economy	Energy sector
	000s		%		000s		%	
FT Employee	17,925	285	61	86	17,616	257	58	82
PT Employee	7,677	27	26	8	8,489	28	28	9
Self-Employed	3,590	18	12	6	1,348	30	14	9

Source: Wilson and Homenidou (2011)

Employment by gender

The sector workforce is dominated by men: 77 per cent of the workforce is male, compared to 53 per cent on average across all sectors. The proportion of women in the workforce decreased from 23 per cent in 2000 to 21 per cent in 2005, but has since increased again to 23 per cent (2010). The proportion of women in the workforce as a whole has stayed relatively stable at around 47 per cent over the same period (Figure 2.6).

Figure 2.6 Proportion of workforce that is female



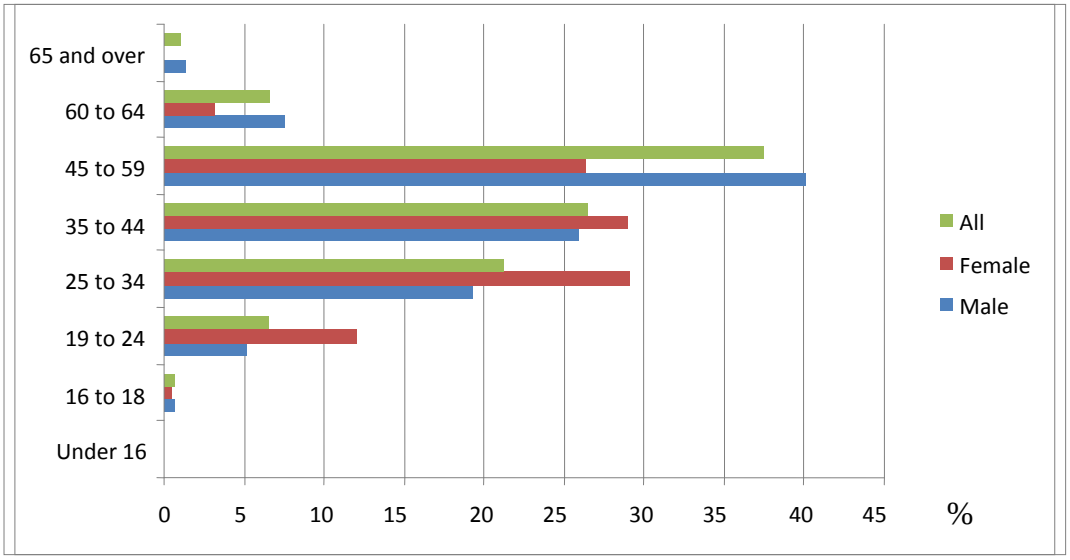
Source: Wilson and Homenidou (2011)

Age structure of employment

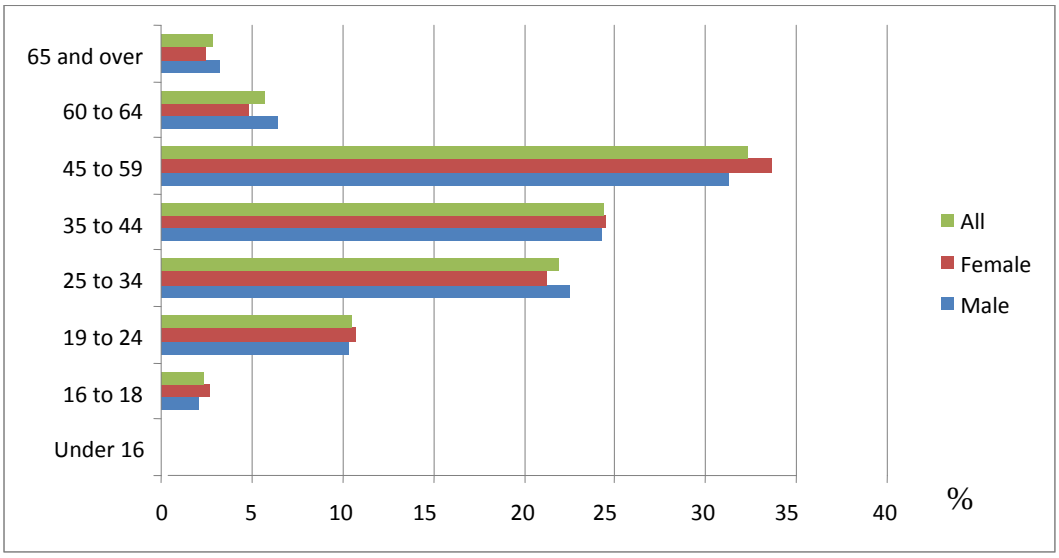
The energy sector has a significantly older workforce than the rest of the economy, particularly among the higher skilled. Half the sector workforce is 45 or older, compared to 41 per cent across all sectors. The share of workers aged 45-59 (37 per cent) is five percentage points higher than the UK average (32 per cent). The share of employees aged 60-64 is eight per cent in the sector, compared to six per cent on average (Figure 2.7).

Figure 2.7 Age Structure of Workforce

Energy



Whole economy



Source: Labour Force Survey (ONS, 2010)

Analysis of qualification levels by age (Table 2.6) shows that there are higher shares of older workers (aged 50 or more) with higher qualifications (Level 3 and above) than for the rest of the economy. For example, 16 per cent or sector employees with Level 4+ qualifications are aged 50-60, compared to 10 per cent for the economy as a whole. Young people working in the sector are less likely to hold Level 4+ qualifications than for the economy as a whole (four per cent compared to eight per cent on average). Similarly, just nine per cent of those in the

%

energy and utilities sector holding Level 3+ qualifications are under 25, compared to 30 per cent across the economy as whole. This largely reflects the fact that the sector age profile is older than average.

Table 2.7 Age of employees with qualification levels 3/4

	NQF level 3 and above		NQF level 4 and above	
	Energy	Whole economy	Energy	Whole economy
16-24	9%	30%	4%	8%
25-40	35%	29%	38%	38%
40-50	24%	19%	29%	24%
50-60	16%	8%	16%	10%
60-70	16%	15%	14%	20%
Base	128,199	12,935,790	64,041	6,637,202

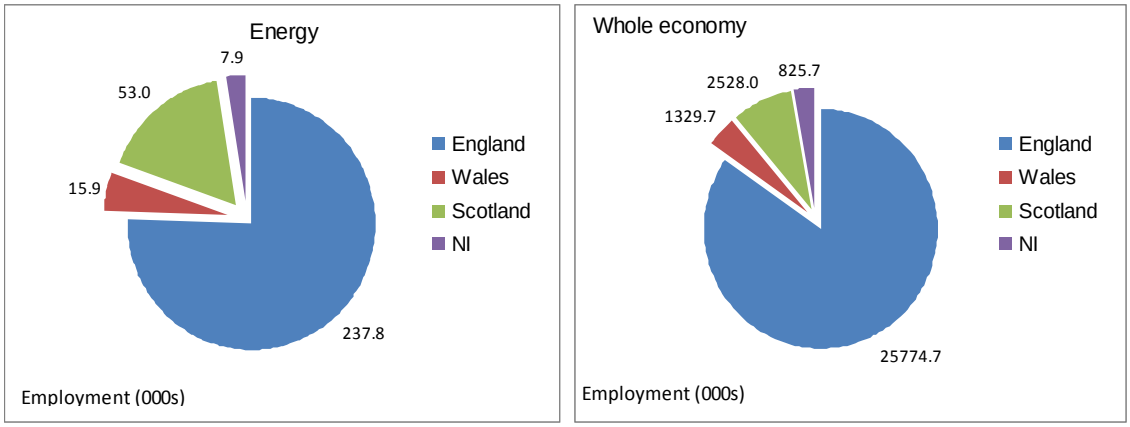
Source: LFS Q2/2010 (nb based on single quarter)

The age structure of some key engineering professions in the electricity power generation and transmission was recently analysed by Energy & Utility Skills, the Sector Skills Council for the sector. This identified a rapidly ageing professional workforce and large reduction in numbers of chartered engineers of working age (Energy and Utility Skills, 2009).

2.3 Distribution of Employment by Nation and Region

Total sector employment is just under 315,000. Of this employment, 75.6 per cent (or 237,800 workers) is based in England; 17 per cent in Scotland; five per cent in Wales; and three per cent in Northern Ireland. Equivalent shares for all sectors are 85 per cent for England; eight per cent for Scotland; four per cent for Wales; and three per cent for Northern Ireland (Figure 2.8). Compared with the whole economy, the share of people working in the sector is much higher in Scotland, and reflects the importance of off-shore oil in Scotland.

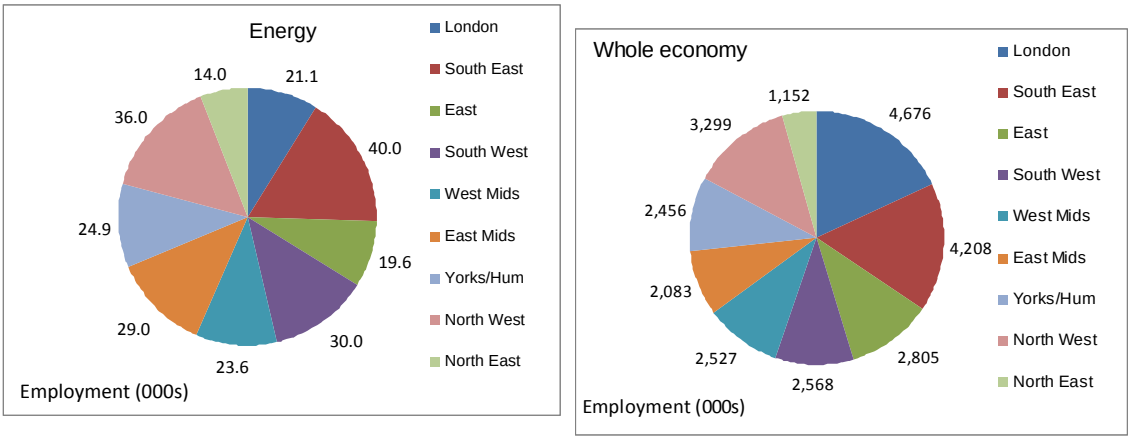
Figure 2.8 Employment in Nations of the UK



Source: Wilson and Homenidou (2011)

In England, employment in the sector is relatively more important in the North West, where it corresponds to 15 per cent of the regional labour market (the employment share of the North West for the whole economy is 13 per cent). It is a relatively smaller sector in London (nine per cent of all sector employment compared to 18 per cent of the total employment) and therefore, the corresponding shares in other English regions are slightly above average (Figure 2.9).

Figure 2.9 Employment in Government Office Regions in England



Source: Wilson and Homenidou (2011)

In England, under nine per cent of the sector workforce is based in London, compared to a whole economy average of over 16 per cent. The corresponding shares of sector employment in other English regions are therefore generally slightly above average (Table 2.8).

Table 2.8 Distribution of employment by English region

	Energy sector	Whole economy	Energy sector	Whole economy
	000s		%	
London	21.1	4,676	8.9	18.1
South East	40.0	4,208	16.8	16.3
East of England	19.6	2,805	8.2	10.9
South West	30.0	2,568	12.6	10.0
West Midlands	23.6	2,527	9.9	9.8
East Midlands	29.0	2,083	12.2	8.1
Yorkshire and the Humber	24.9	2,456	10.5	9.5
North West	36.0	3,299	15.1	12.8
North East	14.0	1,152	5.9	4.5
England	238.2	25,774	100	100

Source: Wilson and Homenidou (2011)

2.4 International Standing of the Sector

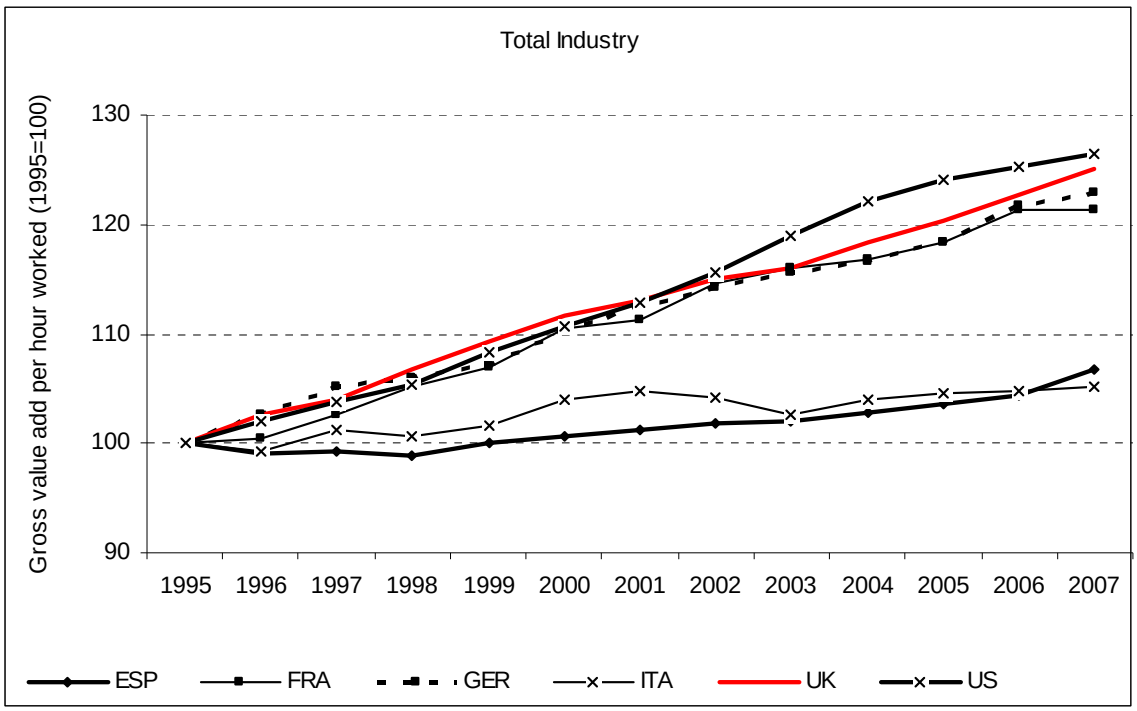
The UK enjoys a number of natural advantages with regards to renewable energy sources, with a long coastline providing significant opportunities to produce electricity from wind, wave and tidal power. However, research by PwC (2010) found that the low carbon sector provide under a fifth of the energy generated in the UK, and when nuclear power was excluded, this feel to just six per cent. In 2007, the UK was 20th of 27 European countries in terms of proportion of energy generated from renewable sources.

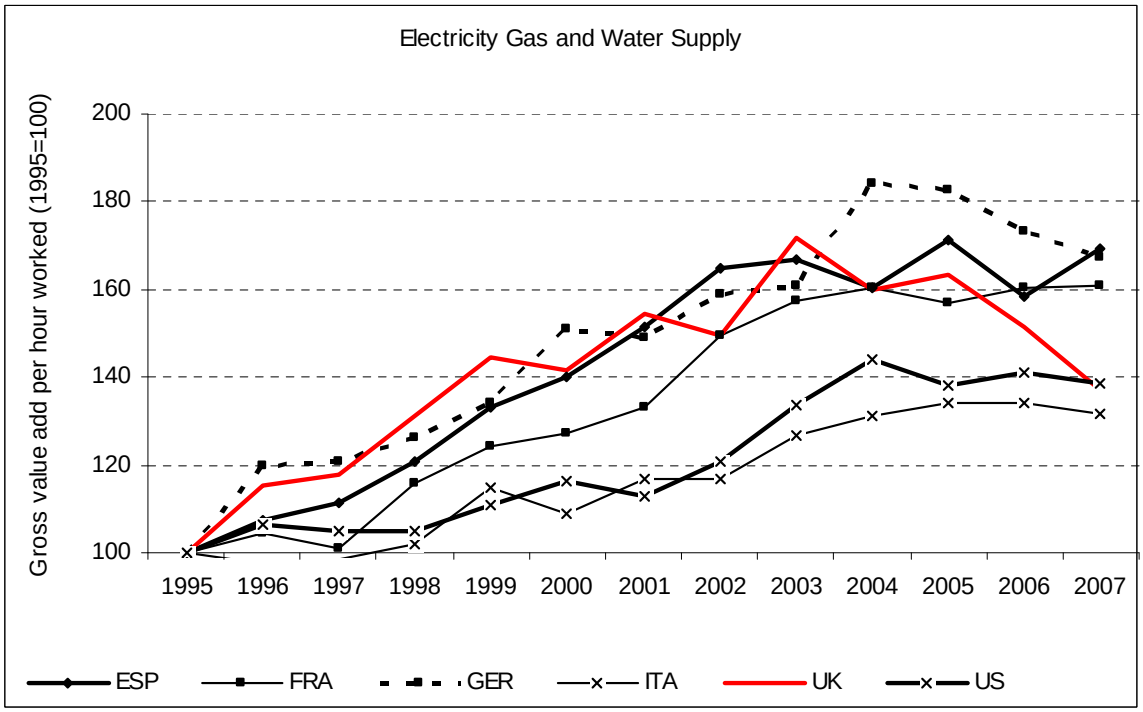
Data are available from Office for National Statistics (ONS) which compare real GDP per hour or per person employed for the UK with international competitors (ONS, 2011). These figures show that GDP per worker in the total economy is second lowest of all G7 countries. GDP per hour in the UK is higher than in Japan, Italy and Canada, but it is 15 per cent higher in France than in the UK, 18 per cent higher in Germany and 23 per cent higher in the US.

The best available measure of comparison at disaggregated sector level is labour productivity based on gross value added per hour worked. In the rest of this section we compare this indicator for the UK, major European economies and the US using EU KLEMS data to 2007 (volume indices, 1995 = 100).

Productivity growth in the UK production industries as a whole exceeded the corresponding trend in other European economies between 1995 and 2007. and was almost as high as the in US. The picture is rather different for electricity, gas and water supply, where UK productivity growth exceeded than in most countries until the early 2000's, but then fell to second lowest of the countries shown in the graph (see Figure 2.10).

Figure 2.10 Gross value added per hour worked (1995 = 100)

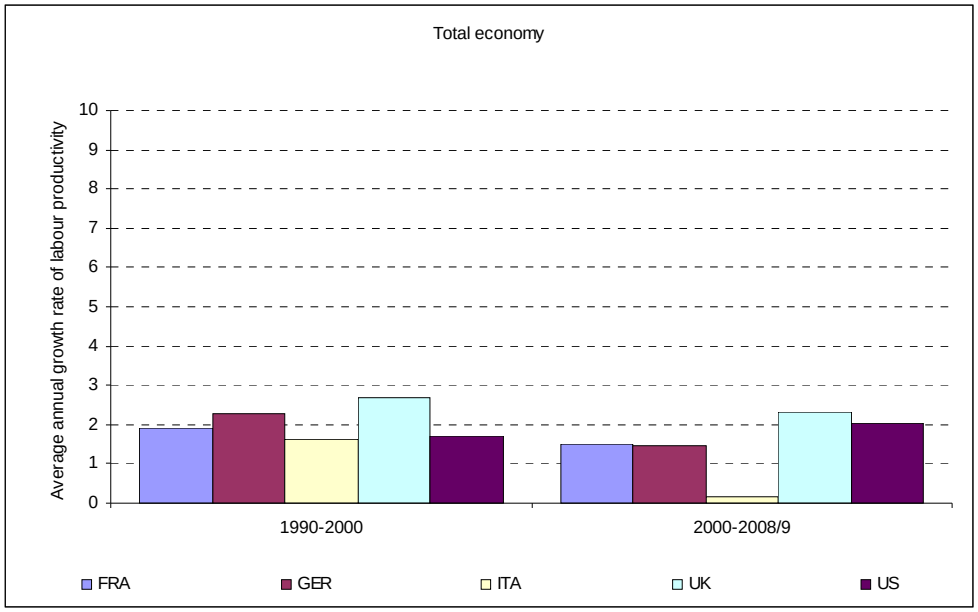


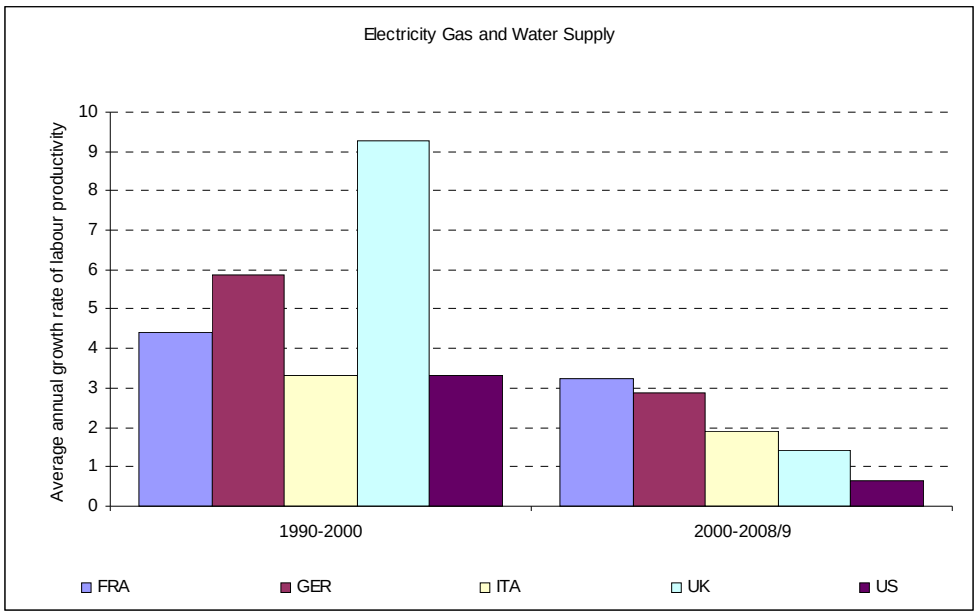


Source: EU KLEMS (2009)

OECD sector data confirms this picture. While the average annual growth rate for the UK economy as a whole was higher than for other key OECD economies between 1990 and 2008/9, for the Electricity, Gas and Water supply sector annual productivity growth fell from over nine per cent (for 1990-2000) to less than one per cent between 2000 and 2008/9, and below the sector growth rate in France, Germany and Italy (see Figure 2.11).

Figure 2.11 Average annual growth rate of labour productivity in the economy and electricity, gas and water supply





Source: OECD (2011)

Sector employment as a proportion of total employment (1.7%) in 2008 was slightly lower that the European average (1.9%), but at a similar level to that in Germany and France (Eurostat, 2011). The proportion of employers providing training was significantly higher than the EU average (93 per cent of UK mining and quarrying employer provide training, compared to an EU average of 54 per cent, and 89 per cent of UK electricity, gas and water supply employers compared to an EU average of 79 per cent) (see Table 2.9).

Table 2.9 Employers providing training (%) by European nation (2005)

	Mining and quarrying	Electricity, gas and water supply
Germany	69	92
Spain	44	59
France	76	99
Italy	27	69
United Kingdom	93	89
European Union average (27 countries)	54	79

Source: Eurostat (2011)

However, participation in continuous Vocational Training courses also varies by country. For example, in the UK sector employees spend an average of four hours (Electricity, gas and water supply) or five hours (Mining and quarrying) a year on continuous Vocational Training courses. These levels are significantly lower than the EU averages of nine and fifteen hours respectively, and well below the fourteen hours per employee in Germany (see Table 2.10).

Table 2.10 Hours in continuous Vocational Training courses per employee (2005)

	Mining and quarrying	Electricity, gas and water supply
Germany	14	14
Spain	7	16
France	9	14
Italy	18	19
United Kingdom	5	4
European Union average (27 countries)	9	15

Source: Eurostat (2011)

2.5 Conclusion

The energy and utilities sector comprises three main industries with different economic and employment track records and prospects. The mining, oil and gas extraction sub-sector has shrunk but is still a significant employer. The recycling sub-sector is small but has grown rapidly in recent years and currently employs around 23,000 people. The electricity, gas and water supply utility sub-sector is the largest of the three, and experienced steady growth during the post-war period, which has tailed off since the millennium.

The energy and utilities sector is the most productive sector in the UK, accounting for four per cent of output with just one per cent of total employment. However the sector's productivity has declined in recent years, relative to both the rest of the UK economy and internationally. Generating higher levels of productivity growth is a key performance challenge for the sector.

Large employers are more important than in most other sectors, but there is a growing number of small businesses. A relatively high proportion of employees in the sector are process or plant operatives. The sector's workforce it is significantly older than in other sectors and the average age of higher skilled employees, including managers and professionals, is increasing. There is therefore a strong risk that skills will be lost to the sector in the near future as the existing workforce retires, placing pressure on the skills supply pipeline to meet replacement demand.

The sector is at the forefront of the creation of a low carbon economy with new technologies driving forward the growth of renewable energy sources and reduced emissions from conventional energy. The demands on the sector over the next decade and the implications for the sector's skill base are examined in more detail in the next two chapters.

3 Key Challenges Facing the Sector Over the Medium-Term

3.1 Recession and recovery

As we saw in the last chapter, the output of the sector has been affected by two contrasting trends. Output in mining and quarrying has continuously decreased in real terms since 2000 and now stands at 80 per cent of the 2006 output. In contrast, output in electricity, gas and water supply was fairly stable throughout the last decade but has experienced recent decline.

In contrast to output, employment in the sector seems to be relatively unaffected by the recession. While employment declined by 11,000 between 2008 and 2009, it then increased again, so that in 2010 sector employment was only slightly below 2008 levels (-2,000) (Wilson and Homenidou, 2011).

Overall, the impact of the recession on output and employment was lower than for the economy as a whole. Energy demand declined less than demand for other goods and services, although some areas of the sector were more affected than others (eg reduced house building required fewer new gas or electricity connections).

The development of the sector to 2020

Electricity generation will be significantly affected by initiatives to reduce greenhouse gas emissions, such as the large Combustion Plant Directive (LCPD) and the Industrial Emissions Directive. In addition, some 20 per cent of existing electricity production facilities will be closed over the period to 2020. All business in the sector will be affected by the changes required to meet the UK's 2050 carbon emissions reductions target. Key issues by subsector include:

1. **Mining**: The impact of the shift to a low carbon economy will particularly affect refining and processing of fuels. This will remain a significant industry and increasingly involve biogenic fuels. There is substantial future growth potential/investment in biomass-to-liquid (BTL) and biomass-to-gas technologies (converting whole crop-biomass), which will make BTL fuels more sustainable and economically viable.

2. **Recycling/materials recovery**. Recycling of domestic waste has increased steadily and there have been substantial investments by firms in the sector to develop new treatment processes and technological innovation. Regulatory changes towards more recycling as outlined in Defra's 2007 waste strategy for England will continue under the Coalition Government. Landfill tax will be increased year on year (Emergency Budget of 2010),

which will make it relatively less attractive to use landfill sites and will encourage investment in energy recovery from waste.

3. **Electricity, gas and water supply**: This sub-sector will be affected most substantially by investment and innovation to reduce greenhouse gas emissions. Replacement energy sources for about 20 per cent of the total UK power generation by 2020 have already been agreed (DECC, 2011).

The renewal of energy production facilities is also a top priority. HM Treasury announced investment of £110 billion to 2020 to renew electricity generation and transmission infrastructure, which will also enable further investment in 'green' technology (see BIS, 2011).

Production technology, distribution and use of electrical power will radically change as on- and off-shore wind generation increases. This will require investments in power generation on- and off-shore, storage facilities to balance peaks, and an integrated grid that connects the remote areas of the UK. Electrical power generation will become relatively more decentralised. Consumption patterns are expected to change when innovations such as smart metering are implemented on a large scale.

It is anticipated that meeting the target of reducing greenhouse gas emissions by 85 per cent (1990 base) will require investment of between £200 billion and €1 trillion. It will also result in a strong demand for essential sector-related technical and management skills across the EU (European Commission, 2010; Ofgem, 2009).

3.2 Investment, Research and Development and Innovation

The long-term outlook points towards more innovation and sector investment, driven by both increases in demand for energy and further reductions in the environmental impact of energy production. There are three main drivers of innovation in the long run:

- The growth of energy from renewable sources
- The renewal of current energy production facilities
- A long-term increase in the demand for electricity.

Below we look at each of these factors in turn and then consider the implications for skills.

The potential for the growth of renewable energy sources

In September 2011, the share of electricity produced from renewable sources in the UK came close to 10 per cent (DECC, 2011). Further substantial growth in electricity generation from renewable energy sources is planned. The Electricity Networks Strategy Group reviewed existing proposals for electricity generation from renewable sources, and expects 29 GW of operational capacity by 2020, primarily through investments in off-shore wind power generation (ENSG, 2009). On this basis, the EU target of 15 per cent of the UK's energy to be produced from renewable sources by 2020 is likely to be reached.

The growth in renewable energy sources will positively influence the growth prospects of other production industries, such as the manufacturing, operation and maintenance of renewable energy facilities, supply of biogenic fuels and related research activities. It is difficult to forecast the related growth caused by investments in renewable energies. Renewable UK predicts that the wind industry and its supply chain will employ almost 90,000 people by 2021 (RenewableUK, 2011). However, this is a more positive forecast than some other sources (see for example PwC, 2010). In any case, expansion of the renewable sector will have a number of implications for skills demand, including skills needed to build, maintain and distribute energy from new sources.

Further renewal of production facilities

The low carbon economy could make production of electrical energy from nuclear sources a more attractive policy option, as this allows a steady energy supply without increased greenhouse gas emissions. Although there is great concern in the public and political debate about the safety of nuclear power, the extension of existing operations is likely. There will also be a growth potential for employment because of increased decommissioning of older power stations. It is likely that new facilities will be built, requiring highly skilled engineering construction workers (Cogent et al., 2008).

Fossil fuels will continue to play a vital role in supplying the UK with reliable sources of energy. However, reductions in emissions will require substantial investment in existing generating capacity to improve energy conversion efficiency and allow the use of alternative fuels (in particular natural gas) instead of coal. Other changes required to reduce environmental impacts of electricity generation (in addition to CO2 reductions) include gas desulphurisation (the removal of sulphur dioxide (SO2) from exhaust flue gases of fossil-fuel power plants) and cogeneration (the generation of heat and electricity at the same time) (Cogent et al., 2008).

There is likely to be continuous investment in transmission and distribution of electrical energy to connect new generating capacity based on renewable energy sources, and further investments at the consumer end (smart-metering, innovative pricing models and demand management, micro-generation). The Electricity Networks Strategy Group estimated that investment of £4.7 billion is required to build a network that can accommodate a further 45 GW of generation, of which 34 GW is combination of onshore and offshore wind generation. (ENSG, 2009).

Long-term demand increases for electricity

Macroeconomic predictions rely on assumptions based on today's production technology and known facts about consumption patterns, price levels and international trade. However, improved technology and changes in consumer prices can greatly affect consumption behaviour. Therefore, scenarios such as Working Futures are subject to some uncertainty because prices and consumption patterns may change in the long run. For the energy sector, prices for fossil fuels have increased more than anticipated over the last years, and there is great uncertainty how these will develop over the next 20 years.

It is likely that prices for fossil fuels will continue to increase because growth of global production will not match global demand increases. In addition, there will be increasing pressure to reduce CO2 emissions. Regulation will increase the taxation of fossil fuels and prices will increase correspondingly. This will increase demand for substitute energy sources, for example for mobility based on electrical power instead of combustion engines. Such long-term substitution in consumption will be reinforced as energy production based on renewable sources progresses.

Storage of energy will become increasingly important. Electrical energy produced by wind generators can result in relatively unsteady supply and periods of production peaks. Centralised systems of storage and demand management will be needed ensure a steady supply of electricity from renewable sources which can replace some of the conventional electricity generation capacity.

3.3 Global competition

While domestic mining and oil and gas extraction are exposed to some international competition, much of the UK's energy sector is domestic. International competitiveness may be less important than in other sectors with tradable goods such as Advanced Manufacturing. However, the sector competes globally for recruits with the appropriate skills, and a lack of skills may affect sector competitiveness.

3.4 The role of skills in overall competitiveness

Sector success will depend on the ability of the sector to generate and take advantage of sufficient:

- Strategic management skills to effectively plan and deliver significant investment in generating capacity and network infrastructure within a changing regulatory environment (see Chapter 4)
- Professional and technical skills to design and implement new production and extraction techniques, as high-level skills may be lost to the sector through retirement
- Operative and technical skills to run and maintain new plant and machinery in a safe and efficient way.

The level of investment in building new generating plants is also likely to have consequences for other sectors, most notably engineering construction.

Chapter 4 discusses employment and skill demand in the sector.

4 Employment and Skill Demand in the Sector

4.1 The Changing Demand for Employment

As a result of the trends outlined in the previous chapter, demand for skilled labour in the sector is expected to rise over the next decade (Wilson and Homenidou, 2011). Workforce qualification levels are expected to increase significantly by 2020 (see Figure 4.1), as follows:

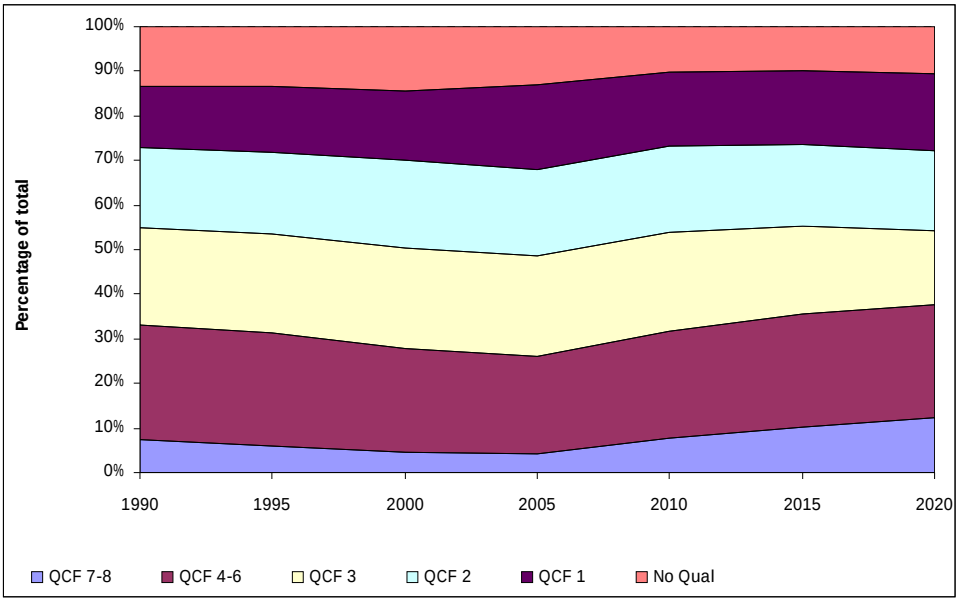
1. The percentage of people with the equivalent of a university degree (Level 4 qualification) in the sector will increase from 15 per cent in 2000 to 28 per cent in 2020 (compared to 21 per cent and 27 per cent for the whole economy respectively).

2. The percentage of workers with mid-level qualifications in the sector will remain relatively unchanged. About 18 per cent of all workers are expected to have Level 3 qualifications and 19 per cent Level 2, which is about the same as the whole-economy average.

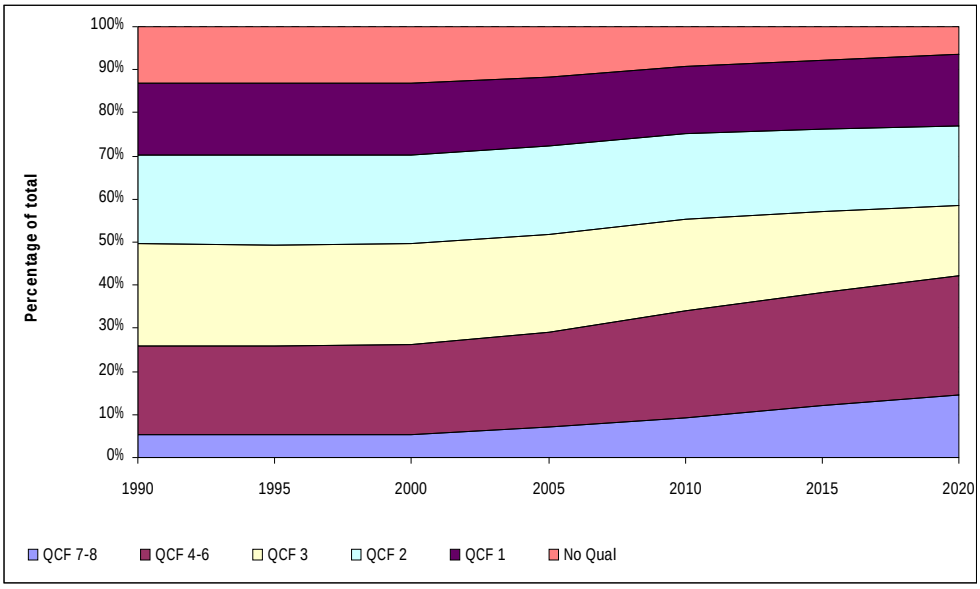
3. The share of people without any qualifications in sector will be 14 per cent, compared to six per cent for the economy as a whole. Similarly, there will be a relatively lower share of people with postgraduate qualifications in the sector (seven per cent) compared to the rest of the economy (15 per cent).

Figure 4.1 Qualification levels of workforce

Mining, Energy and Utilities



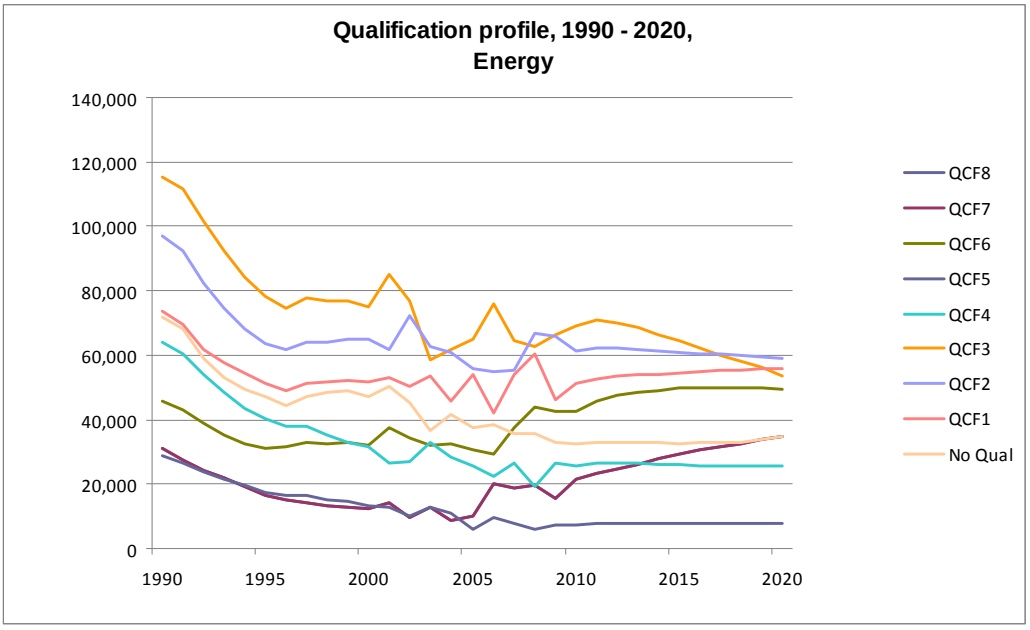
All employment



Source: Wilson and Homenidou (2011)

In terms of total employment, the number of people with a Level 4 qualification working in the sector is expected to increase between 2010 and 2020 by almost 7,000 to 49,468. Similarly, employment with postgraduate qualifications in the sector is expected to grow to 40,774, an increase of 16,477 on 2010 levels. There will be substantial decreases in numbers of people with Level 3 qualifications (-15,403) and small decreases in those with Level 2 (-2,334).

Figure 4.2 Workforce qualification profile



Source: Wilson and Homenidou (2011)

However, wider issues may positively affect the demand for skills and employment in the energy sector, as discussed in the next section.

4.2 Factors Affecting the Demand for Skill

The National Strategic Skills Audit (UKCES, 2010) identifies a number of key drivers that will impact on the demand for skills in the future. These drivers are interdependent and the dynamic interplay of these means that the future skill requirements are not certain. Some of these drivers and their impacts on the sector have been discussed in Chapter 3 above. The implications of these drivers for skills demand are explored further here.

Policy, regulation and legislation

Global, European and national policies and regulation all impact on the sector. The Kyoto Protocol requires a reduction in greenhouse gas emissions of 12.5 per cent by 2012, and the 2008 Climate Change Act set out an obligation to reduce greenhouse gas emissions by 34% by 2020 and 80% by 2050 (1990 baseline) (DECC, 2011). The UK is currently on track to meet the 2020 target.

Regulation and taxation policy is crucial for the future growth of the sector and in consequence will shape the future demand for skills. It is particularly difficult to clearly anticipate how UK regulatory changes interact with European policy (such as Energy 2020) and national regulation in neighbouring countries, which makes skills planning problematic. In the best case scenario, Britain will benefit from substantial increases in renewable energy demand, which will help grow a world-leading industry that takes full advantage of the geographical position of the UK and its potential to supply an increasing share of Europe's energy from renewable sources through an integrated of a pan-European electricity grid. This could be possible in the next ten years and would increase the overall demand for skills across both the renewable sector and in transmission and distribution.

The Energy & Utility Skills Sector Skills Assessment (Energy & Utility Skills, 2010) concluded that economic regulation had a strong influence on skills strategy and investment as the five year regulatory cycle incentivised management to focus on relatively short time horizon. However, skills investment issues and the length of time required to develop appropriate skills for the sector are likely to be given greater prominence in any revised regulatory regime.

The UK Government has published a suite of documents on how it will work with businesses to enable and support the transition towards a ‘green’ economy (BIS, 2011d). More

generally, planning regulation and controls will influence the ease with which new energy generation facilities (from wind farms to replacement nuclear power stations) can be built. Their locations will affect patterns of labour demand in the waste management, electricity generation and distribution sectors as well as the engineering construction sector.

The more detailed skills implications of regulation on the sector include:

- Further regulation to increase efficiency and raise quality across the sector is likely to increase demand for higher and intermediate-level technical skills.
- Health and Safety regulation will continue to require employees using equipment and machinery to gain the competency and skills to do so safely. This is likely to increase skills across the sector, and particularly in high risk areas (such as offshore facilities and nuclear).
- The Large Combustion Plant Directive and the Industrial Emissions (Integrated Pollution, Prevention and Control) Directive will result in about 22GW of generating capacity needing to be replaced before 2020 (UKCES, forthcoming), about a quarter of the UK's total capacity. For example, the Large Combustion Plant Directive will lead to closure of around 12 GW of coal and oil-fired generation by the end of 2015 (DECC, 2011) This will result in a high level of demand for engineering construction, energy generation and nuclear skills at intermediate and high levels.

Technology

Research in key technologies for energy storage and electro-mobility (ie electric vehicles for individual and public transport) is progressing rapidly. This is likely to create a continued source of demand for high-level skills in research and development as well as broader-based business skills to exploit and commercialise innovation.

The range of technological developments in electricity generation discussed through this paper (including small scale local generation and networks, onshore and offshore wind energy, marine energy, carbon capture and storage) will continue to demand high-level STEM skills.

New forms of technology will also require new intermediate-level skills to maintain new equipment and machinery. This is likely take the form of a change in the type and range of skills and experience required, rather than necessarily an increase in the number of people with those skills.

The waste management industry is in the midst of a 'technological revolution' as it moves more towards recovering value from waste rather than burying it in landfill. The growth in the number of energy generation facilities from waste and anaerobic digestion facilities are difficult to predict as they depend on planning consent and the availability of finance and subsidies (UKCES, forthcoming). However, there is likely to be an increased demand for intermediate and high skills in the subsector

Globalisation

The UK is increasingly dependent on foreign fossil fuel resources for its energy. As concerns over energy security rise and interest in the low carbon energy production intensifies, there is likely to be a long-term shift towards domestic, reliable and eco-friendly energy production. However, the rapidly growing renewable energy sector provides the potential for exports to other EU countries. The UK is in a good position to capitalise on its natural advantages in wind and tidal power.

Demographic change and consumer demand

The projected increases in both population and in the number of households will increase the demand for electricity generation and waste management (as per capita consumption is higher in smaller households). This will increase the overall demand for labour in those sectors.

Consumer preferences for different forms of energy for transportation (such as electricity or gas) is likely to increase the demand for skills in the distribution side of the sector.

The numbers of young people are projected to fall and this may restrict the supply of young apprentices and graduates to replace the sector's aging workforce. It will therefore need to attract and reskill those currently employed in other sectors or attract migrant labour with skills that are likely to be in demand across the world. To some extent this trend will be counterbalanced by lengthening working lives which mean that skilled and experienced labour can be retained for longer. However, as indicated in Chapter 2 the workforce in the energy sector is older than average and there is likely to be significant replacement demand for skills (particularly technical skills) over the coming decade (see also section 4.4).

4.3 Changing Patterns of Skill Demand

There are two main ways in which additional jobs (and therefore demand for skills) are created. The first is expansion demand, where a sector grows in absolute terms and additional job openings are created. The second, replacement demand, occurs when workers leave the sector through retirement, death or ill health, or move to work in another sector or country. Replacement demand can be significantly high than expansion demand, particularly in sectors with a relatively mature workforce. Net change in skill demand is therefore the sum of expansion demand plus replacement demand.

Sector employment is expected to increase by 3.8 per cent between 2010 and 2020, to a total around 327,000[1] (Wilson and Homenidou, 2011). The growth will result from increases of professional and associate professional (ie level 3) occupations. There are currently 123,300 employees in managerial, professional and associate professional occupations in the sector (2010), which will increase to 141,000. In contrast, employment in skilled trade and business administration occupations will decrease. Table 4.1 shows that the observed and expected number of people employed in the different occupational groups of the sector until 2020.

- Numbers of managers (+6,000) and associate professionals (+6,000) are expected to grow most substantially
- Professional occupations are predicted to increase by 4,000 and elementary occupations and other service qualifications by 2,000 each
- There is likely to be fewer people in skilled trades occupations than in 2010 and also fewer plant and machine operators (-4,000 each).

Table 4.1 Changing Pattern of Skill Demand

	2010	2015	2020	2010	2015	2020	2010-2020		
Employment Growth	**Numbers (000s)**			**% shares**			**Change (000s)**	**Change (%)**	**Whole economy change (%)**
Managers, directors and senior officials	34	39	40	10.8	11.8	12.4	6	18.6	18.0
Professional occupations	47	52	52	15.1	15.7	15.9	4	9.4	14.9
Associate professional and	42	46	48	13.3	14.0	14.8	6	15.4	14.0

[1] Note that Working Futures data and UK LFS data differ substantially for 2010 (WF: 315,000 and LFS: 352,000). In the following, we use the Working Futures projection for the sector until 2020, which suggest that there will be an increase of 3.8 per cent of the sector employment. WF data reported here are for the total sector and can be expected to affect primarily electricity generation and transmission.

technical									
Administrative and secretarial	30	30	30	9.6	9.2	9.0	-1	-1.8	-10.5
Skilled trades occupations	50	50	46	15.8	15.1	13.9	-4	-8.6	-6.5
Caring, leisure and other service	5	6	7	1.7	1.9	2.2	2	32.2	11.5
Sales and customer service	20	21	19	6.2	6.2	5.9	0	-1.2	0.1
Process, plant and machine operatives	55	53	50	17.4	16.1	15.4	-4	-7.8	-10.9
Elementary occupations	32	33	34	10.1	10.0	10.5	2	7.7	3.2
All occupations	315	330	327	100.0	100.0	100.0	12	3.8	5.1

Source Wilson and Homenidou (2011)

However, some sector bodies suggest that job growth could be significantly higher: one estimate suggests that over 45,000 new jobs could be created directly within the renewable sector and a further 22,000 in the supply chain (RenewableUK and Energy & Utility Skills, 2011).

A number of core technical and job-specific skills are required to manage and implement change in the energy sector, including:

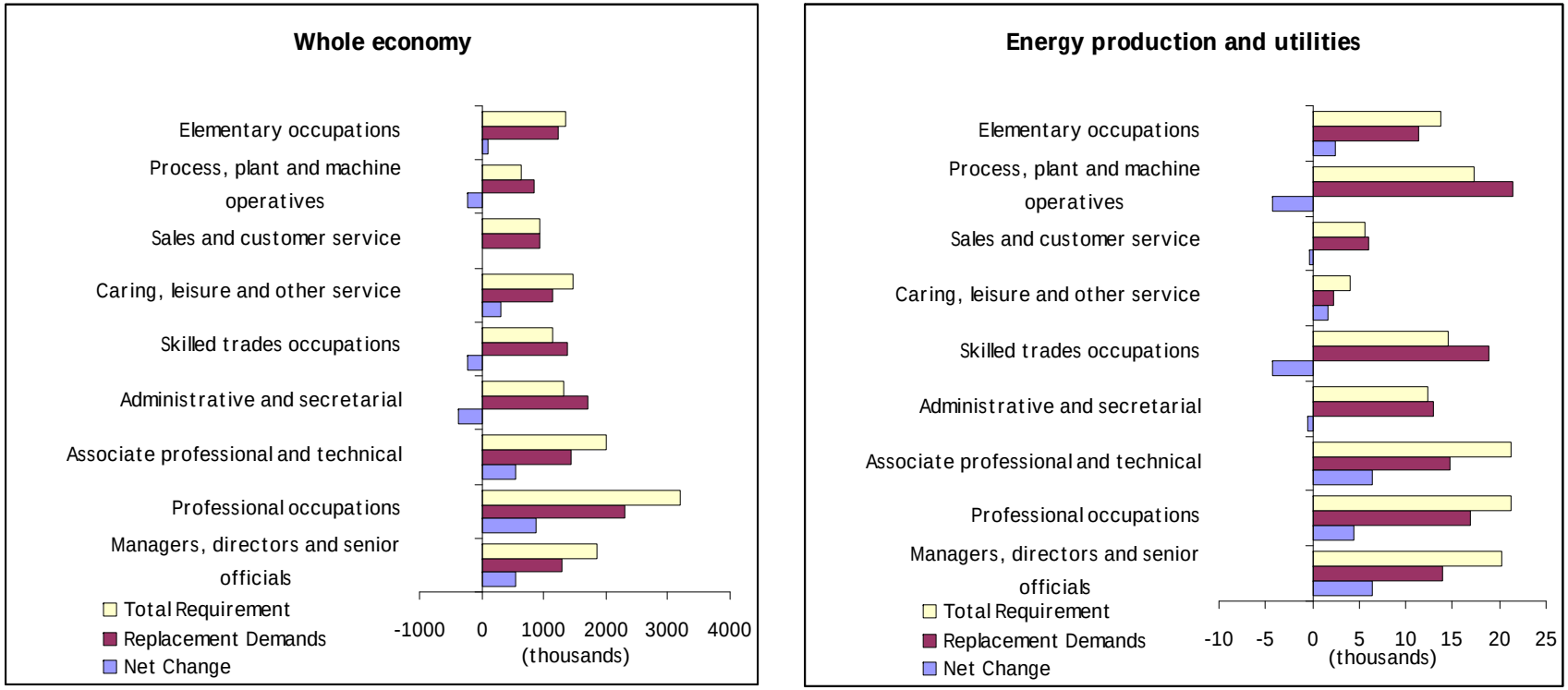
- Adaptability and transferability skills (to enable workers to learn and apply new technologies and processes)
- Environmental and sustainability awareness
- Systems and risk analysis skills
- Entrepreneurial skills
- Innovation skills (to identify opportunities and create new strategies)
- Communication and negotiation skills
- Marketing skills (to promote products and services)
- Consulting skills (to advise consumers about green solutions and to spread the use of green technologies)
- Networking, IT and language skills (to perform in global markets).

These skills are reported to be becoming increasingly important within the energy sector, especially for SMEs operating in the renewable energy/ low carbon sector (UKCES forthcoming).

4.4 Replacement Demand

In addition to the net expansion of the sector workforce, there will be a need to replace retirees and people who leave the sector. This will affect the sector more than the rest of the UK economy, as it has a relatively older workforce. In addition, backfill (when an existing employee is promoted and leaves an unfilled vacancy) will create additional net demand Wilson and Homenidou (2011) (Figure 4.3) shows total requirements for sector specific skills created by net increases and replacement demand.

Figure 4.3 Net change, replacement and total requirement of occupational employment



Source: Wilson and Homenidou (2011)

Total requirements are highest for professionals, associate professionals and managers with about 21,000-22,000 new entrants required to 2020. The total requirement for elementary occupations will be 14,000 new entrants. New vacancies for process, plant and machine operators will be around 19,000, although there will be a net decline of 4,000 in total employment at the same time. Skilled trade occupations, which will decrease by a total of 4,000 until 2020, show a total requirement of 15,000 new workers, and administrative and secretarial occupations (declining by 1,000) have a total requirement of 13,000.

However, the Energy and Utility Skills Workforce Planning Model identifies even higher levels of demand. It estimates that between 2012 and 2025 there will 32,500 vacancies for technical and engineering workers in the electricity industry, a further 10,880 in gas distribution and another 16,000 in the water industry. This is almost three times the Working Futures estimate (UKCES, forthcoming).

4.5 Conclusion

Regulation and technology are important influences on the demand for employment and skills in the energy and utilities sector. They support a shift to a low carbon economy, by encouraging the efficiency of energy production and the use of renewable and low carbon sources of energy. Greater emphasis on micro-generation will place further demands on the distribution network. There will continue to be changes in other parts of the sector too, such as waste management as the emphasis switches to recovering value from waste rather than disposal.

These trends underline the greater emphasis that is likely to be placed in the sector on both professional skills and intermediate skills. More active consumer demand may also underline the need for improved customer service skills.

These trends also suggest that employment numbers, particularly in the utility sub-sector, are likely to increase. Working Futures predicts sectoral growth in employment of around four per cent between 2010 and 2020, with the strongest growth among managers, professionals and associate professionals. Sector-based sources predict faster rates of growth. In both cases, there is likely to be increased pressure on the skills and employment supply pipeline to ensure that the sector has the workforce it needs. In the next chapter we turn our attention to the supply side, before identifying the extent of skills mismatches and deficiencies that currently exist.

5 Skills Supply

This chapter covers the supply side of the energy and utilities labour market. It examines the overall supply infrastructure, sources of initial supply including higher education, vocational education and training such as apprenticeships, and the skill development and training provided by employers.

5.1 The Supply Infrastructure

The vocational education system is currently undergoing considerable change, affecting both learning providers and employers, as changes outlined in the "Skills for Sustainable Growth" are implemented (BIS, 2010). The strategy focuses on developing a more flexible and transparent system of vocational qualifications. There is a particular emphasis on levels 3 and 4, and making "technician level" training and occupations more attractive to learners and available to employers. Apprenticeships are at the core of the vocational skills supply chain, with progression routes to higher levels, including level 4 Apprenticeships and higher education.

Entitlements to publicly-funded further education will change. From 2013, public subsidy will no longer be available for individuals aged 24+ to enrol for courses and to take up apprenticeships qualifying to level 3 skills. Public funding will be available for a first level 3 qualification for people under 24. Those aged 24 and over will be eligible for loans (see Table 5.1). This change may make it more attractive to start level 3 qualifications at a younger age. As a consequence, people considering Level 3 training, including apprenticeships, may be incentivised to achieve higher qualifications earlier in life.

Table 5.1 Entitlements for 2013/14

Learning Level	Priority population groups and entitlement to Government subsidy for learning		
	Individuals aged from 19 up to 24	Individuals aged 24+	Individuals who are unemployed and on active benefits
Basic Skills	Fully funded	Fully funded	Fully funded
Level 2 (first)	Fully funded	Co-funded	Fully funded targeted provision for learners with skills barriers to employment aged 23 and under and/or training below Level 3. Loans for those aged 24+ on courses at Level 3 and above.
Level 2 (retraining)	Co-funded	Co-funded	
Level 3 (first)	Fully funded	Loans	
Level 3 (retraining)	Co-funded	Loans	
Level 4 (any)	Co-funded	Loans	

Source: Skills for Sustainable Growth (BIS, 2010)

There are a range of relevant training programmes offered by FE Colleges and private training providers, including, for example level 1 and 2 qualifications in electrical installation, which prepare for apprenticeships and a career in the industry. Employers in the energy and utilities sector are more likely than average to use external training providers, although they are more likely to use private rather than public providers such as further education colleges and higher education institutions (Shury et al, 2011).

Employers are engaging with the supply infrastructure through:

- The introduction of new apprenticeship schemes, often leading to accreditations of professional bodies, such as the Institute of Engineering and Technology (IET), which supports a number of company apprentice schemes.
- Employer-driven skills initiatives, such as National Skills Academies (NSAs), which are funded by employers and the government. Employer engagement in this area will create more coherence of the various types of internal development programmes across employers, which help to secure supply of vital skills from employees already working in the company. Two NSAs exist in the sector: one covering the nuclear industry and another covering the rest of the energy sector.
- Development and involvement in HE programmes such as the Power Engineering Foundation degree, developed between First Degree Froward and Energy & Utility Skills (Energy & Utility Skills, 2010b).

As outlined in the 'Plan for Growth' (BIS, 2011), additional initiatives are being developed to further strengthen the supply of a workforce with relevant skills for the sector, by expanding University Technical Colleges for 11-19 year olds. The aim is open 24 new colleges by 2014, in partnership with universities and businesses. This will help to increase student numbers in subjects relevant to the sector (such as engineering), which currently growing less quickly than total student numbers.

Catapult Centres (previously Technology and Innovation Centres) were launched in 2010 by the Government to encourage universities and businesses to work together, and commercialise research findings. A Catapult in Offshore Renewable Energy specialising in technologies applicable to offshore wind, tidal and wave power, is being established in Summer 2012 in Glasgow (BIS, 2011a).

5.2 Trends in Skill Supply

Apprenticeships

The Apprenticeship system has seen a fundamental transformation in recent years. The Coalition Government pledged to increase the number of apprenticeships by at least 50,000. There is evidence that this aim will be exceeded in the current year (2010/11) by 100,000 new apprentices. Approximately 460,000 apprenticeships have been started in 2010/11, compared to 290,000 in the previous year, representing an increase of 66 per cent (BIS, 2011b).

Apprentice numbers are not available for the energy and utilities sector as a whole. However, there were 1430 apprenticeship starts in 2010/11 across the sector frameworks covering the electricity, gas and water industries, compared with 970 in the previous year: an increase of 47 per cent (Data Service, 2012). This compares to an increase of 63% in all apprentice starts over the same period.

The 2010 Employer Perspectives survey (Shury et al., 2011) showed that eight per cent of employers in the mining and quarrying sub-sector and six per cent in utilities had an apprentice at the time of the survey, higher than the five per cent national average. A further four per cent of mining and quarrying employers and seven per cent of utility companies planned to offer apprenticeships in the future. This was just half the national average of eight per cent.

Higher Education

There has been a steady increase in students studying science subjects over recent years in the UK. The number of STEM students (those studying medicine & dentistry, subjects allied to medicine without nursing, biological sciences, veterinary science, agriculture & related subjects, physical sciences, mathematical sciences, computer science, engineering & technology, architecture, building & planning) increased between 2002/03 and 2009/10 by 14 per cent, to a total of 840,620 (HESA, 2011). There was an increase of 33 per cent in numbers of STEM graduates between 2002/03 and 2009/10 (excluding subjects allied to medicine).

However, some STEM subjects (medicine, agriculture, computer science, architecture) are less relevant to the energy and utility sector than others. Cogent's Sector Skills Assessment analysed STEM subjects of particular relevance to energy and utilities, such as engineering and electrical engineering (Cogent, 2010). Student numbers in related subjects such as electronic/ electrical engineering declined by 12 per cent since 2002/03. In addition, over 40 per cent STEM graduates work in non-STEM occupations, indicating the extent of the leakage in the high level skills supply line to STEM-related sectors (UK Commission, 2011b).

With relatively smaller birth cohorts for the years 1990/01 and increased demand for skills, it will be particularly important for the industry to encourage more students to study relevant subjects. The sector must also ensure the attractiveness of a career choice in energy and utilities for talented school leavers, apprentices and HE graduates below degree level.

Table 5.2 Students in subjects relevant to the sector

	2002/03	2009/10	Growth
Biology	24,410	28,520	17%
Genetics	2,695	2,265	-16%
Microbiology	4,195	3,295	-21%
Molecular biology, biophysics & biochemistry	9,280	11,455	23%
Chemistry	19,015	20,575	8%
Materials science	435	625	44%
Physics	12,830	16,805	31%
Geology	6,735	9,180	36%
Physical & terrestrial geographical & environmental sciences	21,830	17,725	-19%
Mathematics	20,120	34,165	70%
Statistics	3,940	3,895	-1%
General engineering	18,990	20,875	10%
Civil engineering	16,325	26,455	62%

Mechanical engineering	21,070	27,625	31%
Electronic & electrical engineering	37,440	32,990	-12%
Production & manufacturing engineering	9,885	6,685	-32%
Chemical, process & energy engineering	5,585	9,495	70%
Materials technology not otherwise specified	2,990	2,470	-17%
Industrial biotechnology	135	1,120	730%
STEM (COGENT definition)	237,905	276,220	16%

Source: Cogent (2010)

5.3 Employer Investment in Skills

Information on employer investment in skills is available from the UK Labour Force Survey and the Employer Skills Survey. Overall a higher proportion of the sector's workforce received training over a 13 week period than for the economy as a whole (see Table 5.3). However, there were relatively fewer employees in receipt of training at professional and associate professional levels in the sector compared to the UK average. One third (34 per cent) of all professionals working in the sector were in receipt of training over the past 13 weeks, compared to an average of 40 per cent for professionals across all sectors. Managers in the sector were also more likely than average to receive work-related training, which may reflect a higher need for management training in the sector. In contrast, skilled trades and process operatives were more likely to received training.

Table 5.3 Employees in receipt of work-related training over the past 13 weeks

Occupations	% of workforce in energy and utilities sector	% of workforce in whole economy
1 Managers and senior officials	25.0	22.6
2 Professional	34.1	39.5
3 Associate professional and technical	34.1	35.3
4 Administrative and secretarial	18.3	21.1
5 Skilled trades	36.6	15.6
6 Personal service	33.8	36.5
7 Sales and customer service	21.7	19.4
8 Process, plant and machine operatives	24.1	15.2
9 Elementary	16.2	14.5
All	27.2	25.5
Men	23.9	28.9
Women	28.0	22.6

Source: Labour Force Survey (ONS, 2010)

The UK Commission's UK Employer Skills Survey 2011 (Davies et al., 2012) suggests that an above average proportion of employers in the sector provide training to their employees, although average training expenditure per head, particularly in utilities, is well below average (see Table 5.4).

Table 5.4 Employer Investment in Skill Development

	Mining and quarrying	Energy, gas and water supply	Whole economy
% of employers training	75	68	59
% average number of training days (per trainee)			8.9
Average expenditure on training per trainee	£3,025	£2,125	£3,275
Average expenditure on training per employee	£1,425	£1,150	£1,775
% of employers who have any staff undertaking Apprenticeships at their site (EPS 2010)	8	6	5
% of employers who currently offer Apprenticeships at their site (EPS 2010)	3	2	4
% of employers who plan to offer Apprenticeships in the future (EPS 2010)	4	7	8
% of employers who have recruited someone aged 16 to their first job from school	9	6	7
% of employers who have recruited someone aged 17 or 18 to their first job from school	11	7	9
% of employers who have recruited someone aged 17 or 18 to their first job from FE College	3	8	8
% of employers who have recruited someone to their first job from college/FE/university/HE	9	8	10

Source: Shury et al. (2011), Davies et al. (2012)

Training in the sector is more likely than average to be induction or health and safety related: 51% of sector employers that train report that more than half of training is induction or health and safety related, compared to 28 per cent of employers across the whole economy (Wilson and Homenidou, 2011)

Employers in the mining sub-sector are also more likely than average to fund management and supervisory training (Table 5.5).

Table 5.5 Types of training funded or arranged for employees (%)

	Mining and quarrying	Electricity, gas and water supply	All sectors
Job specific training	80	88	84
Health and safety/first aid training	95	82	71
Induction training	72	64	52
Training in new technology	39	45	47
Management training	49	32	34
Supervisory training	48	39	32
Personal Development Training	1	3	3
Other	0	*	*
None of these	0	*	1
Don't know	0	*	*

Source: Davies et al. (2012)

Generally, employers in the sector adopt a fairly formal approach to training, with a higher proportion than average having training budgets and plans (Table 5.6), holding Investors in People accreditation (Table 5.7), providing training towards a qualification and reviewing staff performance (Table 5.6).

Table 5.6 Further Indicators of Training Activity

	Mining and quarrying	Electricity, gas and water supply	All sectors
% all establishments with business plan	70	62	61
% all establishments with training plan	59	47	38
% all establishments with training budget	41	35	29
Annual review of staff (all establishments)			
All staff reviewed	52	47	47
No staff reviewed	34	43	43
Provide training (all establishments)	75	68	59
Train towards qualification (all employers providing training)	68	55	43
Training to Level 2 qualification	23	18	14
Training to Level 3 qualification	37	16	16
Training to Level 4 qualification	24	13	12
Assess training delivered	65	65	65
% of employees trained towards a qualification in last 12 months	21	16	12

Source: Davies et al. (2012)

Table 5.7 Investors in People accreditation

	Mining and quarrying	Electricity, gas and water supply	UK
IIP accredited (%)	28	15	16
Not IIP accredited (%)	55	73	69
Don't know (%)	18	12	15
Weighted base	2,027	10,583	2,299,921
Unweighted base	188	1426	87,572

Source: Davies et al. (2012)

5.4 Migration

Sector employers can also source skills from abroad, both from within and outside the EU. The Migration and Advisory Committee (MAC) skills shortage list includes occupations in the sector (see Table 5.8). However, international recruitment is only a limited option. The sector needs to ensure a sustainable domestic source of skills supply, particularly as it faces international competition for labour from countries such as the US.

Table 5.8 Tier 2 Shortage Occupation List, Government approved version

Occupation title and SOC code	Specific titles/skill levels included on the shortage occupation list (energy/utilities only)
Production, works and maintenance managers (1121)	project manager in the electricity transmission and distribution industry
Managers in mining and energy (1123)	site manager in the electricity transmission and distribution industry
Physicists, geologists and meteorologists (2113)	hydro geologist geophysicist geoscientist geophysical specialist engineering geophysicist engineering geomorphologist geologist geochemist environmental scientist technical services manager in the decommissioning and waste areas of the nuclear industry nuclear medicine scientist radiotherapy physicist staff working in diagnostic radiology (including magnetic resonance)
Civil engineers (2121)	geotechnical design engineer geotechnical specialist reservoir panel engineer rock mechanics engineer soil mechanics engineer geomechanics engineer mining geotechnical engineer mining and coal engineer

	wells engineer tunnelling engineer petroleum engineer drilling engineer completions engineer fluids engineer reservoir engineer offshore and subsea engineer control and instrument engineer process safety engineer
Mechanical engineers (2122)	
Electrical engineers (2123)	all electrical engineers in the oil and gas industry the following jobs in the electricity transmission and distribution industry: - power system engineer - control engineer
Chemical engineers (2125)	
Design and development engineers (2126)	design engineer in the electricity transmission and distribution industry simulation development engineer
Planning and quality control engineers (2128)	the following jobs in the electricity transmission and distribution industry: - planning / development engineer - quality, health, safety and environment (QHSE) engineer
Engineering professionals not elsewhere classified (2129)	geoenvironmental specialist geoenvironmental engineer contaminated land engineer landfill engineer metallurgical / mineral processing engineer the following jobs in the aerospace sector: - aerothermal engineer - stress engineer - chief of engineering
Engineering Technicians (3113)	electricity transmission and distribution industry only: - commissioning engineer - substation electrical engineer
Welding trades (5215)	high integrity pipe welder where the job requires three or more years relevant experience
Line repairers and cable jointers (5243)	overhead lines worker in the electricity transmission and distribution industry, working on high voltage lines (at least 275,000 volts)

Source: Home Office (2011)

5.5 Conclusion

Although in some respects the skills supply to the sector is relatively healthy, with overall growth in students studying relevant subjects, a growing number of apprentices in the energy and utility sector and above average levels of workplace training, these sources are unlikely to be sufficient to meet growing demand to labour over the coming decade.

Many domestic STEM graduates find jobs outside STEM sectors, and the energy and utility sectors may not be seen as particularly attractive graduate destinations. The UK relies heavily on the international supply of engineering skills, with 13 energy-related occupations on the MAC list of skill shortage occupations. Management training is also an issue: 32 per cent of employers in electricity, gas and water supply fund or arrange management training, below the whole economy average of 34 per cent. While training activity is relatively high across the sector, average spending is relatively low. The proportion of professional and technical staff in receipt of training is relatively low, as is the proportion of employers providing training to a level 4 qualification in the utilities sector.

This has implications for skills mismatches, which are considered in Chapter 6.

6 Skill Mismatches

6.1 Defining Skill Mismatches

Mismatch of labour supply and labour demand can take a number of forms, including:

- Skills shortages, ie the available and future skills supply do not match an existing and future demand for particular skills
- Skills gaps, where exiting workers are not fully proficient at their job
- Underemployment - where workers currently employed have skills that are not needed by their employer
- Unemployment – where people are seeking to deploy skills which employers do not want.

6.2 Employer reported skill deficiencies

Evidence on skills mismatches comes from the UK Commission's UK Employer Skills Survey 2011 (Davies et al., 2012), which reports the extent of vacancies, hard-to-fill vacancies, skill shortage vacancies and skill gaps. Just under four per cent of energy and utility employers reported a hard-to-fill vacancy (compared with just over five per cent of all employers). Only eight per cent of all sector vacancies were difficult to fill for skill related reasons compared with 16 per cent for the whole economy. However, twice as many energy and utilities employers who reported having a skill shortage vacancy were short of managers than for all employers, and 37 per cent of sector employers with a shortage were finding it difficult to recruit process operatives – five times the proportion for employers as a whole (see Figure 6.1).

Energy and Utility Skills also report that a number of specific engineering disciplines are in short supply, as are project management and management and leadership skills. Although the scale of demand for these skills may be small when compared to other sectors of the UK economy, the impact could be significant. For example, delays in infrastructure installation or maintenance may have further knock-on effects in other parts of the economy (including jeopardising the achievement of national carbon reduction and renewable energy targets) (UKCES, forthcoming). In addition, sub-optimal management affects the productivity of all staff.

Table 6.1 Skill Deficiencies in the energy and utilities sector

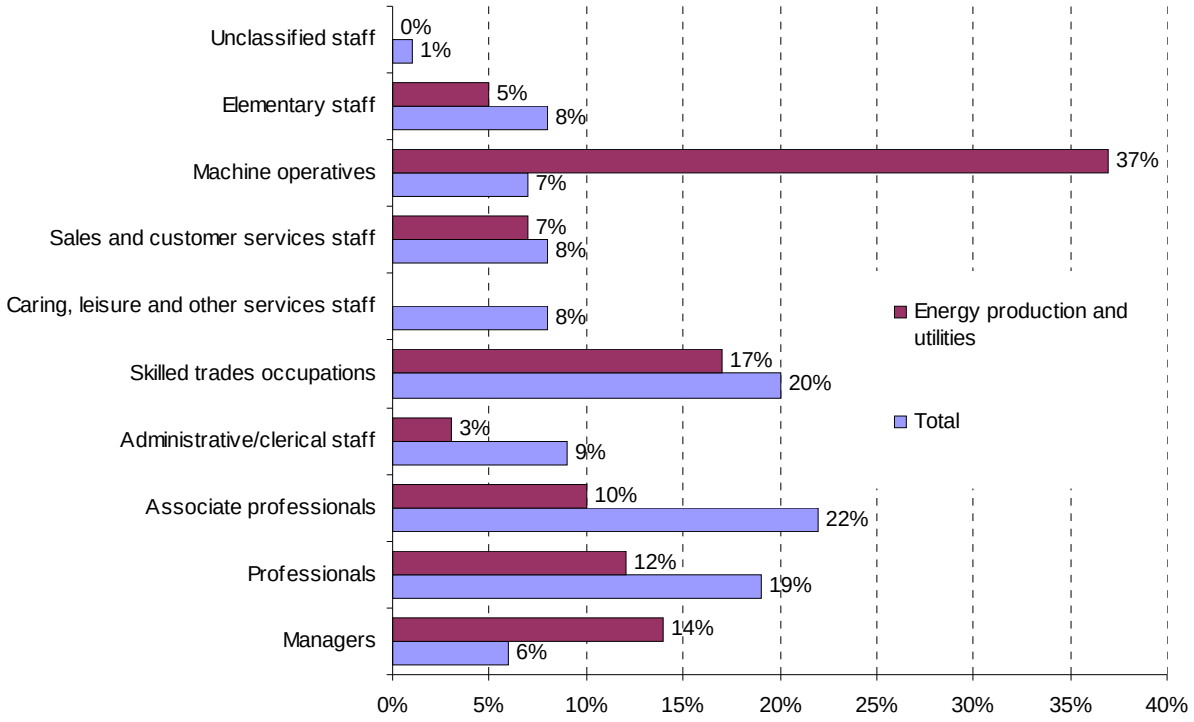
	Energy and utilities sector	All sectors
Vacancies		
per 1,000 employees	24.4	23.1
as a % of employees	2%	2%
% of establishments with at least one vacancy	14%	12%
Total	5,079	635,900
Hard to fill vacancies (HtFVs)		
per 1,000 employees	3.9	5.2
as a % of vacancies	15%	23%
% of establishments with at least one HTFV	5%	4%
Total	703	143,550
Skill Shortage Vacancies		
per 1,000 employees	2.5	3.8
as % of all vacancies	8%	16%
% of establishment with at least one SSV	4%	3%
Total	418	103,450
Skill Gaps		
per 1,000 employees	29.7	54.1
as % of employees	6%	5%
% of establishments reporting a skill gap	16%	13%
Total	14,036	1,489,500

Various bases: All establishments; Vacancies as a % of employees based on all employment; Hard-to-fill vacancies as a % of vacancies based on all vacancies; SSVs as a % of vacancies based on all vacancies; Skills gaps as a % of employees based on all employment. Notes: Numbers rounded to nearest 50

Source: Davies et al. (2012)

There was a below average number of skill gaps per 1,000 employees, in the sector, although 16 per cent of employers reported that at least one of their employees was not fully proficient (ie had a skills gap) compared with 13 per cent of all employers (Table 6.1). The proportion of employees in the sector with a skills gap (six per cent) was only just above the all-sector average (five per cent). Skills gaps in the sector were above average for professional occupations (16 per cent of reported sector skills gaps compared to nine per cent across all sectors) and among managers (12 per cent compared to 11 per cent, as well as machine operative (13 per cent compared to eight per cent) (Davies et al., 2012).

Figure 6.1 Occupational Distribution of skill shortage vacancies in the Energy and utilities sector



Base: All skill shortage vacancies

Source: Davies et al. (2012)

6.3 Underemployment and overemployment

The UK has more high skill jobs than high skilled people (implying a shortage of people with high level skills), and the growth in numbers of high skilled people significantly exceeds the growth in the numbers of high skill jobs. The growth in high skilled jobs is also occurring at a slower rate than in other countries. There is also an emerging gap between the supply of and demand for graduates as well as an increase in the proportion of workers who are 'over-qualified' for their current jobs (UKCES, 2009).

A recent report which compared skills demand and supply found that: 'Across the UK there are more people with qualifications than there are jobs requiring qualifications. . . . the excess is greatest at levels 2 and 3' (Green, 2010). The report also found substantial variation in mismatch across industries and distinguished between formal over-qualification of job holders, over-skilling and true over-qualification as follows:

- Over-qualified - people who have achieved a higher (formal) qualification level than is required to get their job (UK average 39 per cent)

- Over-skilled workers - either disagree/strongly disagree that they have enough opportunity to use the knowledge and skills that they have or have very little or little opportunity to use their past experience, skill or abilities in their job (UK average 33 per cent)
- Real over-qualified - both over-qualified and over-skilled (UK average 18 per cent)

The report found that 'real over-qualification' was highest in service industries (up to 50%), but far less of an issue in the energy sector (see Table 6.2).

Table 6.2 Mismatch By Industry Division in 2006

Industry Division	Over-qualified	Over-skilled	Real Over-qualified	Base survey number
Coal, Lignite Mining, Peat Extraction	81.4	19.8	19.8	4
Oil, Gas, Extraction, etc. (Not Surveying)	26.2	6.4	6.4	19
Other Mining, Quarrying	48.6	21.3	0.0	13
Recycling	35.7	61.2	21.2	9
Elec., Gas, Steam etc. Supply	23.5	20.4	5.5	35
Water Collection, Purif., Supply, etc.	20.9	27.1	0.7	21

Source: Green (2010)

Recycling and coal mining report 'real over-qualified' proportions above the national level, but there are relatively few observations in these cells. In other subsectors, mismatch is much lower than average, with 5.5 per cent real over-qualification reported in electricity, gas and steam supply and less than one per cent in water supply.

Green (2010) also examined changes in the level of mismatch at sector level between 1992 and 2006. This analysis that real over-qualification decreased between 2001 and 2006 in mining and quarrying and energy and utilities, while over-qualification actually increased in mining, but decreased substantially in the utility sub-sector (Table 6.3).

Table 6.3 Mismatch By Industry Section, 1992 - 2006.

Industry Section		1992	1997	2001	2006
Mining & Quarrying	Over-qualified	27.7	25.3	29.0	46.1
	Over-skilled			34.0	15.2
	Real Over-qualified			10.4	6.3
Electricity, Gas &	Over-qualified	22.0	32.6	37.7	23.3
Water Supply	Over-skilled			22.4	21.2
	Real Over-qualified			13.5	4.0

Source: Green (2010)

6.4 Evidence of Relative Wage Growth

Average wages in the energy and utilities sector are significantly higher than the UK average (both mean and median), reflecting the productive nature of the sector. They are higher in the mining subsector than in the utility or waste management subsectors.

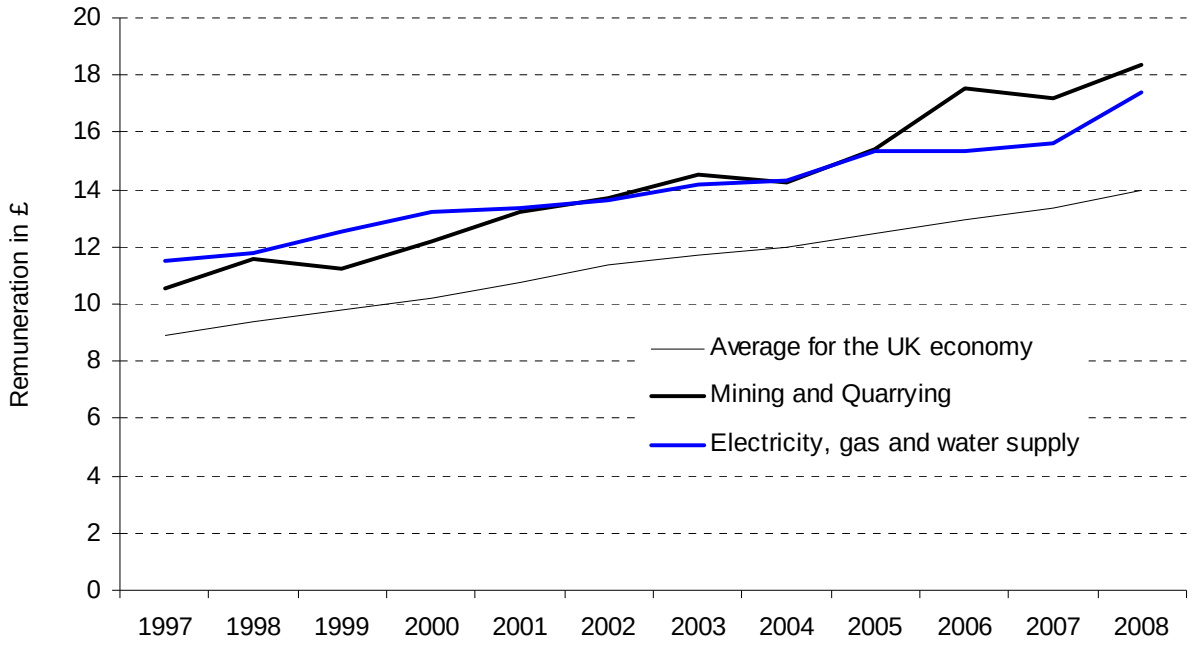
Table 6.4 Earning growth in the energy and utilities sectors

Sector	SIC Code	Median (£)	Annual % change	Mean (£)	Annual % change
All Employees	-	403.9	0.0	491.4	0.8
All Service Industries	-	384.4	0.1	478.0	0.7
Mining and quarrying	05 – 09	781.4	10.1	918.9	8.0
Electricity and gas supply	35	590.9	-4.3	695.5	0.8
Water supply, sewerage and waste management	36-39	494.9	1.9	556.0	3.0

Source: ASHE (2011) (provisional data)

Over recent years, sector wages have been growing at a faster rate than the all-economy average, and gap between wages paid in different parts of the sector has widened (see Figure 6.2).

Figure 6.2 Wage growth 1997-2008



Source: UKCES (2011)

6.5 Other Evidence of Skill Deficiencies

The National Strategic Skills Audit (UKCES, 2010) found that a relatively high proportion of managers in the utilities sector were not qualified to Level 4. According to the UK Commission's UK Employer Skills Survey 2011 (Davies et al., 2012), nearly half of all managers and professionals in the UK's energy sector do not hold a level 4 or higher qualification; ten percentage points higher than the all economy average. This is likely to partly relate to the age of the workforce and, as the audit acknowledges, there is not necessarily a correlation between a certain qualification level and the management skills required. That said, high quality management skills are reported to be crucial to both investment and innovation decisions (Energy & Utility Skills, 2010).

A recent Government report on skills for a green economy (BIS, 2011c) did not identify any significant management skill deficiencies in the energy sector and the Energy and Utilities Sector Skills Council found in their 2010 Sector Skills Assessment that:

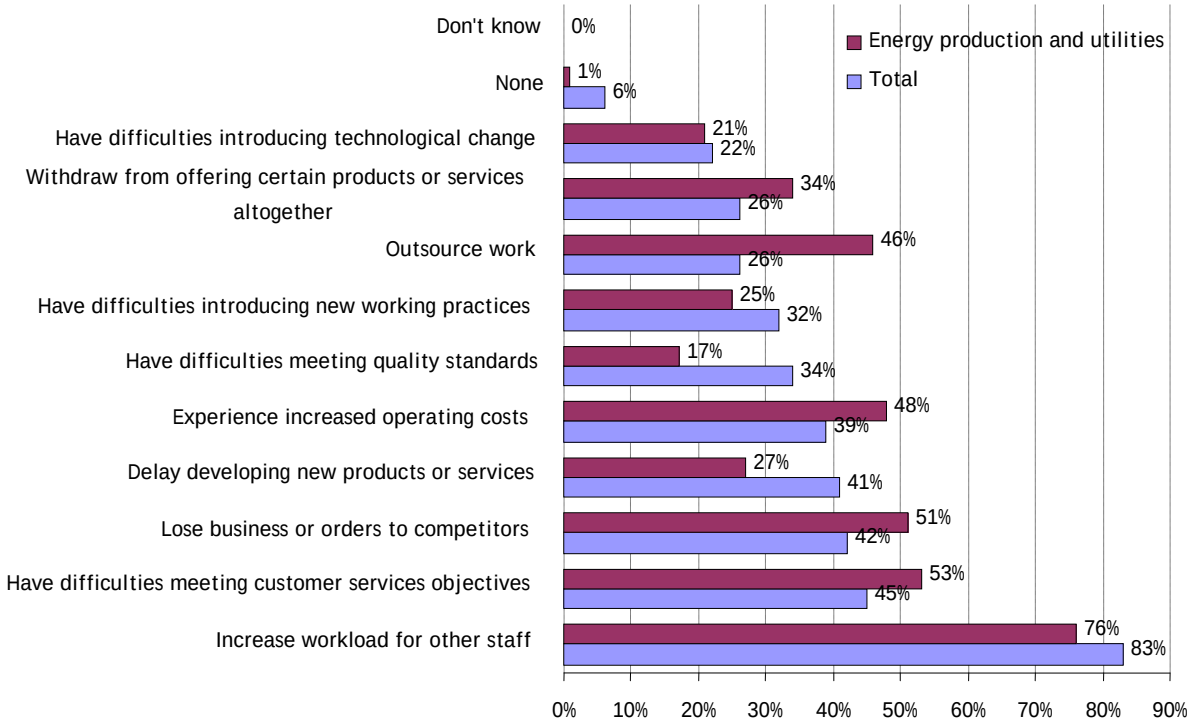
> 'Despite having a relatively high proportion of managers in the workforce, electricity, gas and water companies report relatively few management skill problems' (Energy & Utility Skills, 2010)

6.6 Causes, Impacts and Remedies

The impact of hard-to-fill vacancies on the sector are similar to the impacts for the rest of the economy. The greatest impact is on the workload of other staff, which 76 per cent of all firms reported had increased because of hard-to-fill vacancies. More than half of the firms affected say they are losing business or having difficulties in meeting customer demand.

Companies in the sector were much more likely than average to report that they outsourced activity (46 per cent of compared to 26 per cent in the average economy) or experienced higher operational costs (48 per cent compared with 39 per cent) as a result of difficulties filling vacancies (Figure 6.3).

Figure 6.3 Implications of hard-to-fill vacancies in the energy and utilities sector

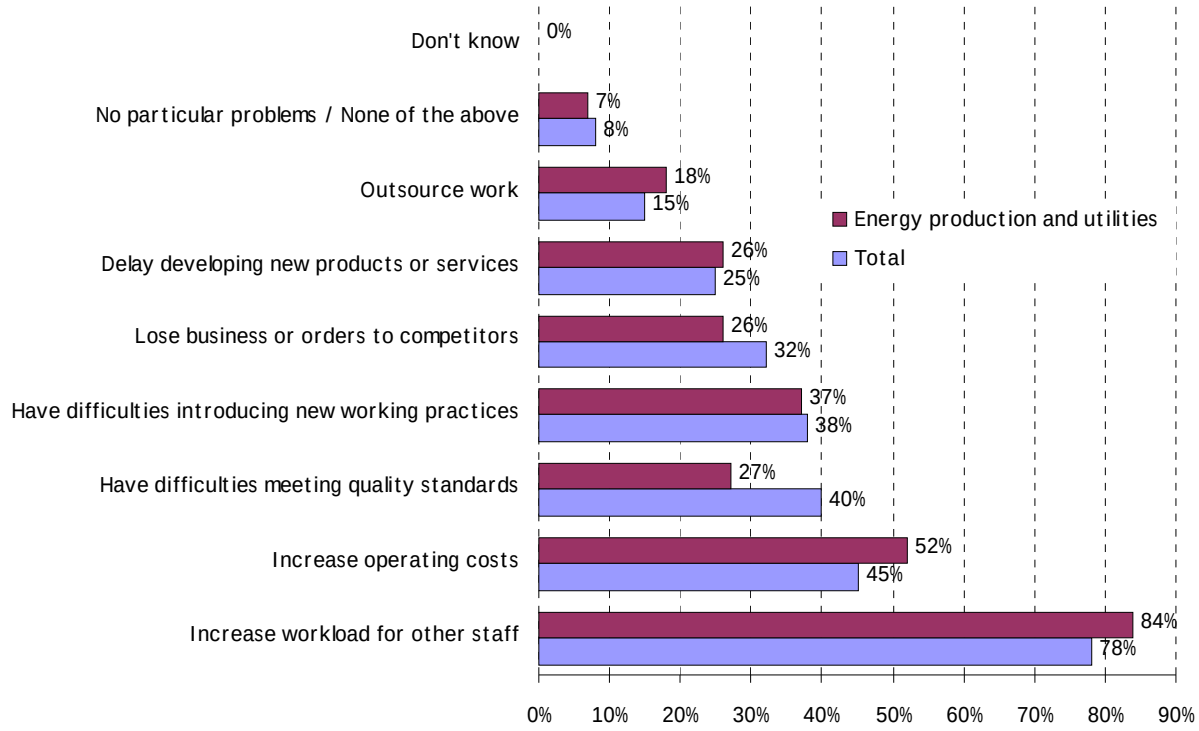


Base: *All with hard to fill vacancies*

Source: Davies et al. (2012)

The impact of hard-to-fill vacancies on the sector is similar to the impacts of all skills gaps. Sector businesses affected report increased workload (84 per cent) for existing staff and higher operational costs (52 per cent), higher than the economy wide averages of 78 and 45 per cent respectively

Figure 6.4 Implications of skills gaps on firms in the energy and utilities sector



Base: All with skills gaps that have impact on establishment performance
Source: Davies et al. (2012)

6.7 Conclusion

The evidence of skills mismatch suggest relatively limited short-term skill problems, although that parts of the sector and particular key groups of staff experience skill deficiencies. Most of the concerns are about the capacity of the skills supply infrastructure to meet growth in demand for employment and skills in the future.

Overall, the evidence on skills gaps and shortages suggest that the sector's experience is similar the rest of the economy. However, areas of concern include:

- Although the incidence of skill shortages across the sector is generally below the average for the economy as a whole, a greater proportion of employers in the sector have problems recruiting machine operatives and managers with the required skills, experience or qualifications. The shortage of machine operatives is particularly acute, and that for managers, at more than twice the national average, is particularly worrying given the challenges the sector is facing.
- The Migration Advisory Committee's shortage list includes a range of engineering professional occupations, as well as engineering technicians and skilled trades such as welders and line repairers.

- Skill gaps generally affect process operatives, professional and associate professional occupations and managers.
- Wage growth across the sector is higher than average, particular in the mining sub – sector, which could be an indicator of skills mismatch.

7 Conclusion

7.1 The Sector Today and Tomorrow

A strong energy sector provides the products and services that are essential to modern living. An efficient sector underpins a productive and sustainable economy. A diverse sector is strategically vital for the UK to improve its balance of trade and reduce its dependency on overseas energy sources. The energy sector is at the forefront of the development of a low carbon economy.

Energy production and utilities make a substantial contribution to our economy (in terms of GVA) far beyond the proportion of people who work in the sector. While some parts of the sector, such as mining, are in decline, others (including recycling) are experiencing strong growth. Overall sector performance is driven by the performance of the electricity, gas and water utility subsector.

Employment and production levels have not changed very substantially for the sector during the recession, but there are important and prolonged changes in output levels caused by ongoing structural change. The sector has the highest productivity of any UK sector (with GVA per employee of £137,000), but its productivity has recently fallen compared with both the rest of the UK economy and equivalent sectors abroad.

In the future, the prospects of the sector are positive and growth can be secured as:

- existing sources of energy production facilities are renewed
- the generation of energy from renewable sources is expanded
- the demand for electricity steadily increases.

7.2 The Performance Challenge

To create a low carbon economy and meet agreed targets, investment is required to replace out-dated capacity, expand renewable energy generation, and extend the infrastructure and distribution network. The development and application of new technology has the potential to further support growth in the sector. Further increases in demand for electro-mobility and electricity consumption mean that the sector could expand beyond current projections.

In addition to electrical power generation, improved environmental standards will affect businesses across the sector in areas such as:

- processing forms of carbon-based fuels, which increasingly involve biomass

- increasing standards and reduction in landfill and technological improvements in materials recovery
- the distribution, storage and peak demand management for energy consumption.

However, expansion and productivity growth could be severely limited by a lack of high level skills and the ability to innovate and commercialise technological developments. There are some signs that the demand for skills already exceeds supply in some essential occupations (eg engineers, lines repairers and cable jointers). There is increasing global demand for such skills which can make competing in an international skills market difficult. Engineering graduates and technicians are in high demand from other domestic sectors, and replacement of retirees affects the sector more than the rest of the UK economy because of a relatively older cohort of higher-skilled workers.

7.3 Growth through skills

The sector's full potential and highest performance will be achieved by attracting and retaining and refreshing talent through:

- Developing alternative sources of skills supply
- Making the sector more attractive to new recruits
- Further increasing investment in workforce development.

Developing alternative sources of skills supply

For some young people, a higher education course is not the most appropriate way of developing higher-level skills. Apprenticeships can offer a more practical and attractive route, particularly for the associate professional, skilled and operative roles that are fundamental to the sector. Employers in the sector are already engaged in offering apprenticeship places and initiatives to guarantee their value in the labour market. For example, the Institute of Engineering and Technology (IET) accredits apprenticeship schemes for employers who demonstrate commitment to establishing the career foundations for engineering apprentices. One of the benefits for apprentices of completing an approved scheme is a simplified application process for professional status as an Engineering Technician (EngTech) (Williams and Hanson, 2011).

There are also benefits to employers offering apprenticeships, as apprentices often remain with the company, as shown in the case study below.

Securing the future: British Gas Apprenticeship Programme

The challenge

British Gas currently employs over 8,000 engineers and needs to recruit around 600 engineers each year. In the past, the firm found it difficult to recruit 'enough top-quality engineers to meet demand'.

The approach

British Gas set up an Energy Academy, based across six sites, to train gas engineers. It has also invested in a strong apprenticeship programme, recruiting 500 Apprentices per year. The programme covers technical skills as well as wider work skills, such as customer service, team-working and problem-solving.

New recruits are seen as the potential managers of the future: two thirds of the engineers required at British Gas each year come through the Apprenticeship programme.

The benefits

The programme helps to ensure a steady supply of well-trained employees who are committed to the company and keen to develop their careers. Over 80% of British Gas Services' Gas Servicing and Installation Managers started as apprentices, and over 90 per cent of apprentices recruited in the past five years are still with the company.

Sources: Williams and Hanson (2011); UKRC (2012)

The development of Foundation Degrees can provide another pathway into higher-skilled employment for people do not initially want to commit to a full honours degree. For example, the National Skills Academy for Nuclear, Portsmouth University and the University of Central Lancashire (UCLan) have developed a Foundation Degree in Engineering which meets industry needs and provides progression opportunities for apprentices and other employees (National Skills Academy for Nuclear, 2012).

Other sources of potential employees are people currently in the workforce who wish to retrain, and unemployed people. The RenewableUK case study (see box) is an example of what can be done to help experienced employees retrain to meet the needs of a growing sector.

Meeting the needs of the renewables sector

The challenge

The renewable energy sector is experiencing rapid growth. However, it does not have enough people with the right skills to take advantage of the opportunities offered by the shift towards a low carbon economy. Employers report a shortage of suitable recruits and lack of quality-assured pathways for renewables specialists.

The approach

Meeting this challenge means upskilling the current workforce and providing opportunities for new entrants: apprentices, graduates and experienced people interested in retraining.

RenewableUK, the wind, wave and tidal energy trade association, has established a Renewables Training Network. The network will support highly skilled, experienced workers (such as engineers) wishing to work in renewable energy industries.

"*Over recent years there has been an emphasis on apprentices, college and university graduates and how we bring them into the industry. This is great, but it's only a part of the solution. We need to give experienced people who are currently working in related industries help to access the opportunities renewables presents*,"

says Steve Davies (Chief Executive, National Skills Academy for Power).

The Renewables Training network is sponsored by 14 businesses, including E.ON Climate & Renewables, PPI Engineering Ltd, Siemens, and ScottishPower Renewables.

The benefits

The network offers new and innovative forms of training provision. It allows SMEs to work together to purchase training and so bring down costs. The Network aims to deliver training to 12,000 new entrants by 2016 and provide Continuing Professional Development training to 1,450 employees.

Sources: RenewableUK (2011); UK Commission

Make the sector more attractive to new recruits

There will be substantial increase in sector occupations requiring a first degree and postgraduate qualifications, as well as HE qualifications below degree levels. However, there are still too few students on courses relevant to the sector, such as electrical engineering (Cogent 2010). The sector is dominated by large firms, many of which already have established and close links with HEIs or schools. Companies need to think of innovative ways of increasing the attractiveness of careers in energy and utilities for graduates and talented school leavers.

Employers need to further deepen their involvement in related sector-based initiatives. These include:

- **Initiatives to increase awareness of the benefits of working in the sector**, such as the Think Power campaign, run by the NSA for Power, which aims to promote the attractiveness of the sector to potential recruits 'from all walks of life and of all ages'.
- **Improvements to the provision of careers information, advice and guidance**. For example, the NSA for Power has recently launched a career planning tool to support the current and future workforce needs and to ensure the Power Sector has a sufficiently competent workforce. The tool enables individuals to understand the different job roles in the sector as well as the skills and experience needed to carry out these roles.
- **Encourage existing employees to act as ambassadors** and promote the sector to potential new recruits. For example, the Go4SET scheme encourages employees to become STEM ambassadors. They visit schools to share their experiences with 11 to 14 year old students, and organise visits to nuclear power stations to show young people what working in the sector entails.

Further increasing investment in workforce development

A number of small employers in the sector find it difficult to source and organise training effectively. Just one per cent of sector employers (and all employers) that do not train say it is because trained staff may be poached by another employer (Wilson and Homenidou, 2011). Employees who receive training are in fact more likely to stay with their employer than those who do not (Garrett et al, 2010).

One way of minimising concerns among small employers around the costs of training is through a training levy. Other ways include helping small employers manage training programmes. For example, energy sector employers are working with 'Talent Bank' (see box), which provides a central resource for accessing training provision and accrediting employee competency.

EU Talent Bank – investment in skills for the future

The challenge

The sector has an ageing workforce and needs to recruit and train over 30,000 staff by 2016. In addition, younger workers in the sector are less highly qualified than those close to retirement. This could result in a loss of skills.

Companies in supply chains provide up to 50 per cent of employment on short-term contracts, and are reluctant to take on apprentices when they cannot guarantee future contracts. Employers working in isolation cannot address the sector's skills challenges.

The approach

Enterprise, E.ON, National Grid, Scottish Power, Severn Trent and Viridor are introducing 'Talent Bank'. Based on the Group Training Association (GTA) model, Talent Bank offers a central resource to identify the level of skills demand, deliver training, and support the development of skilled trainees (targeting 400 in the first year). Talent Bank: provides a centralised recruitment and matching service for trainees; commissions and manages training provision on behalf of employers; directly employs trainees, if required; provides pastoral care; and provides industry placements for staff at all levels.

The benefits

Talent Bank will create a sustainable solution to the recruitment and training needs of the sector. By 2014, it will support 400 new Apprenticeship places and the training of 400 highly skilled technicians

Sources: Energy & Utility Skills (2012); UK Commission

7.4 Business Benefits

As outlined throughout this paper, investing in skills development can bring a range of benefits for individuals, employers and the economy as a whole. The possession and acquisition of skills and qualifications is associated with an individual's employment and earnings prospects. For example, there are significant wage premia attached to gaining an apprenticeship, from an individual's point of view and employers recoup any costs they incur in providing apprenticeships in a short space of time (UK Commission, 2010).

BIS has recently undertaken several projects exploring employer investment in Apprenticeships and workplace learning and evaluating apprenticeships from the perspective of the employer and the learner. The vast majority of employers reported benefits resulting from their involvement in Apprenticeships, including improved productivity, staff moral, staff retention and improve profile. Nearly all (97% of

Apprentices in engineering and manufacturing technologies were satisfied with their Apprenticeship (BIS, 2012; and BIS, 2012a).

There are a range of business benefits that investment in training can bring employers. Evidence across a number of sectors suggests that employers who invest in training are more likely to survive than those who don't (Collier et al., 2007). While the energy and utilities sector may have been less affected by the downturn than other sectors, the ability to capitalise on the recovery will be enhanced by having access to the right skills.

The business benefits of training in the sector go beyond company survival. Businesses that are willing and able to innovate will reap rewards through increased sales and turnover, and staff satisfaction and retention. Garrett et al. (2010) found that the productivity effects of training are two to five times greater than any increase in wages associated with that training. Employers therefore stand to gain as much if not more from training than the individual. Productivity gains linked to increased training would help to address declining sector productivity.

Another way of looking at the benefits of training is to consider the costs associated with not developing the skills of the workforce. As pace of technological change intensifies the need to update and refresh the skill base of the workforce will increase. The energy and utilities sector is already suffering from pockets of key skill shortages which are severely impeding new product development and growth. As the labour market recovers, the ability to improve skills through recruitment will only become more difficult. Greater levels of employer investment in the existing workforce provide a cost effective alternative.

Skills Shortage Vacancies in the sector are more than double the UK average, and skills gaps are a concern among managers and professionals. Nearly half of all managers and professionals in the UK's energy sector do not hold a level 4 or higher qualification; ten percentage points higher than the all economy average. The sector faces significant challenges in meeting skills requirements for growth. However, current training levels across the sector are just above average, and much of this training is induction or health and safety related, rather than management training.

The energy and utilities sector supports all other sectors of the economy. Meeting the skills needs of the sector and innovating to provide services more effectively and at lower cost will support other sectors as the economy moves out of recession, and so it is particularly crucial for the energy sector to ensure it is not held back by a lack of appropriate skills. Employers need to act together to ensure that they meet sector challenges and attract the best talent to the sector.

Appendix

Table A.1 Sector employment 2000-2010, 3-digit SIC

Industry group (2010)	Industry group (2000)	2000	2010	Change	in %
05.1 Mining of hard coal	10.1 Min., agg. of hard coal	15,487	5,580		
Coal	**Coal**	**15,487**	**5,580**	**-9,907**	**-64%**
06.1 Extraction of crude petroleum	11.1 Crude oil, gas extraction	20,885	19,009		
06.2 Extraction of natural gas			2,534		
Oil and gas extraction	**Oil and gas extraction**	**20,885**	**21,543**	**658**	**3%**
09.1 Sup. activity for petrol & gas extraction	**11.2 Oil, gas services (not surveying)**	**36,367**	**55,225**	**18,858**	**52%**
07.2 Mining of non-ferrous metal ores	14.1 Quarrying of stone	9,629	539		
08.1 Quarrying of stone, sand and clay	12.0 Uranium, thorium ore m.	431	16,738		
08.9 Mining and quarrying n.e.c.	13.1 Iron ore mining	328	4,674		
09.9 Support activity for other mining & qu.	13.2 Non-ferr. mining (not uranium, thorium)	1,657	2,720		
	14.2 Quarrying of sand ,clay	13,498			
	14.3 Chemicals, fertiliser m.	2,364			
	14.4 Salt production	686			
	14.5 Other mining, quarrying	3,886			
Other mining and quarrying	**Other mining and quarrying**	**32,479**	**24,671**	**-7,808**	**-24%**
38.3 Materials recovery	37.1 metal scrap recycling	3,275	23,330		
	37.2 non-metal scrap rec.	1,183			
Materials recovery	**Materials recovery**	**4,458**	**23,330**	**18,872**	**423%**
35.1 Electric power gen., trans. & dist.	**40.1 electric power generation and supply**	**98,880**	**123,205**	**24,325**	**25%**
35.2 Man gas and distribution	40.2 Gas production supply	35,330	44,047		
35.3 Steam and air conditioning supply	40.3 Steam, hot water supply	2,675	3,437		
36.0 Water collection, treatment & supply	41.0 Water collection, purify., supply etc	61,924	50,917		
Other utilities	**Other utilities**	**99,929**	**98,401**	**-1,528**	**-2%**
Total	Total	308,485	351,955	43,470	14%

Source: UK LFS micro data (2010), IES calculations

Table A.2 GDP Per Capita in selected countries

	GDP Per capita (2008 USD PPP constant prices)				GDP Per hour (2008 USD PPP constant prices)			
	2008	2009	2010	% change 2008-2010	2008	2009	2010	% change 2008-2010
Austria	44,139	42,398	43,208	-2%	52.57	52.20	52.91	1%
Belgium	40,045	38,905	39,695	-1%	59.66	58.91	59.85	0%
Bulgaria	14,732	14,116	14,227	-3%	16.89	16.46	17.35	3%
Cyprus	25,316	24,483	24,184	-4%	33.74	33.66	34.08	1%
Czech R	28,175	27,029	27,705	-2%	27.76	27.93	28.97	4%
Denmark	40,479	38,260	39,014	-4%	48.61	47.80	49.97	3%
Estonia	22,607	19,588	20,181	-11%	23.37	24.01	26.08	12%
Finland	40,173	36,913	37,879	-6%	48.96	47.25	47.84	-2%
France	35,030	33,918	34,279	-2%	55.58	54.87	55.64	0%
Germany	38,436	36,640	37,944	-1%	55.28	54.05	54.63	-1%
Greece	32,475	31,690	30,424	-6%	34.35	35.16	34.62	1%
Hungary	21,238	19,843	20,083	-5%	26.03	25.24	25.59	-2%
Ireland	45,359	41,351	40,858	-10%	53.21	54.27	56.67	7%
Italy	33,075	31,419	31,766	-4%	42.08	41.46	42.04	0%
Latvia	18,746	15,477	15,420	-18%	18.59	18.18	19.07	3%
Lithuania	19,915	17,027	17,295	-13%	24.52	22.96	24.65	1%
Luxembourg	91,183	86,802	88,625	-3%	81.33	81.14	82.94	2%
Malta	23,631	23,080	23,369	-1%	30.80	31.26	31.44	2%
Netherlands	44,281	42,367	42,895	-3%	61.24	59.53	61.22	0%
Poland	19,589	19,922	20,625	5%	23.14	23.48	24.07	4%
Portugal	24,039	23,350	23,632	-2%	25.92	25.81	26.19	1%
Romania	13,061	12,163	11,956	-8%	16.38	15.56	15.39	-6%
Slovak R	24,156	22,998	23,907	-1%	33.29	33.96	35.92	8%
Slovenia	31,992	29,421	29,778	-7%	38.56	36.18	37.44	-3%
Spain	32,072	30,622	30,428	-5%	43.52	44.71	45.52	5%
Sweden	42,450	40,123	41,802	-2%	52.02	50.73	52.55	1%
UK	38,762	36,619	37,054	-4%	52.56	50.92	51.77	-1%
US	47,572	45,923	46,763	-2%	57.99	59.42	61.12	5%
Canada	42,210	40,834	41,705	-1%	47.23	47.59	48.07	2%
Australia	44,509	44,518	45,426	2%	49.98	51.07	51.45	3%
New Zealand	30,669	30,245	30,619	0%	34.51	35.08	35.66	3%
Norway	61,199	60,117	60,205	-2%	76.33	76.64	77.00	1%
Switzerland	45,686	44,677	45,759	0%	46.92	44.97	45.89	-2%
Turkey	13,001	12,221	13,053	0%	23.68	22.47	22.96	-3%
Japan	36,134	34,306	35,583	-2%	40.43	40.26	41.85	4%
Iceland	43,725	40,578	38,850	-11%	41.21	43.20	42.13	2%

Source: Conference Board Total Economy Database, own calculations (2012)

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