ENERGY SKILLS – OPPORTUNITY AND CHALLENGE

A REPORT TO GOVERNMENT BY THE SECTOR SKILLS ORGANISATIONS RESPONSIBLE FOR ENERGY

A RESPONSE TO THE ENERGY WHITE PAPER 2007

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A report from:

Cogent Sector Skills Council
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CONTENTS

1. EXECUTIVE SUMMARY

- 1.1 Origins of this Report
- 1.2 A Bright Future
- 1.3 Challenges Ahead
- 1.4 The Issues We Face
- 1.5 Risks – Challenge of Crisis?
- 1.6 Progress on Developing Skills
- 1.7 Our Recommendations
- 1.8 Our Action Plan

2. INTRODUCTION

- 2.1 The Energy White Paper 2007
- 2.2 Lead Contributors
- 2.3 Background to this Report
- 2.4 Scope of this Report
- 2.5 Trade Union Support for Learning

3. THE ISSUES WE FACE

- 3.1 A Bright Future
- 3.2 The Challenge for the UK
- 3.3 An Ageing Workforce
- 3.4 Skills Shortages
- 3.5 Skills gaps
- 3.6 The Power Gap and New Construction
- 3.7 The Picture Worldwide
- 3.8 Climate Change and Energy Supply
- 3.9 Employer Engagement
- 3.10 Employer and Trade Union Engagement
- 3.11 Image, Attraction and Education
- 3.12 The Progress We Have Made

4 THE AGE PROFILE IN CONTEXT

- 4.1 The UK Population
- 4.2 Nearing Retirement, the Example of Chartered Engineers

5. DEVELOPING A NEW GENERATION – ATTRACTION, EDUCATION AND TRAINING

- 5.1 Sector Attractiveness
- 5.2 Skills Policy and the Leitch Report
- 5.3 Flattening the Age Profile
- 5.4 STEM professionals for the Energy Industries
- 5.5 Drop Out from STEM
- 5.6 Part-Time Learning in HE
- 5.7 Direct Entry for School Leavers – Apprenticeships

5.8 Lead Times – Training and Experience
5.9 Diversity
5.10 Economic Regulation and Investment in Skills
5.11 Social Inclusion – Training for High-Skill Jobs in Safe Industries
5.12 Research and Planning

6 SKILLS – WHAT DO WE NEED and HOW DO WE DEFINE THEM?

6.1 Skills Families
6.2 Science
6.3 Technology
6.4 Engineering
6.5 Mathematics
6.6 Management, Leadership, Business and Administration
6.7 Cross-Cutting Skills

7 MYTHS AND FACTS

7.1 Recruit or Train?
7.2 STEM in Universities
7.3 No Wrong Door for School Leavers
7.4 In-Work Training
7.4 Globalisation
7.6 Leadership, Management, Supervision and Project Management
7.7 Standards
7.8 Agency Workers
7.9 Vocational Qualifications
7.10 Funding Flexibility
7.11 Public Sector
7.12 The Role of Energy, Science and Engineering in Society

8 OIL & GAS PRODUCTION

8.1 A Key Industry
8.2 Oil and Gas Today
8.3 A Vision for the Future
8.4 The Oil and Gas Workforce
8.5 Demographics and Diversity
8.6 Actions to Improve the Skills Supply

9 DOWNSTREAM OIL – REFINING

9.1 Oil into Fuel
9.2 Refining Today
9.3 The Refining Workforce
9.4 The Contractor and Supply Chain Workforce
9.5 Demographics
9.6 Actions to Improve the Skills Supply
9.7 National Skills Academy for the Process Industries (NSAPI)

10 NUCLEAR, INCLUDING NEW BUILD and ELECTRICITY GENERATION

10.1 Decommissioning and Renaissance
10.2 Nuclear Today
10.3 Nuclear Projects in Context
10.4 The Nuclear Workforce
10.5 Skills for the Future
10.6 Improving the Flow of Skills
10.7 Regional and Sector Analysis

11. ELECTRICITY GENERATION, POWER and GAS NETWORKS

11.1 Electricity Generation
11.2 Electricity Transmission and Distribution
11.3 Gas Transmission and Distribution
11.4 The Energy Networks – Resource Modelling
11.5 A Skills Strategy for Electricity
11.6 National Skills Academies
11.7 Young Apprenticeships
11.8 Regional Pressures

12 RENEWABLE ENERGY

12.1 A Growing Sector
12.2 A Skills Academy for Renewables?
12.3 Wind
12.4 A Manufacturing Strategy?

13 COAL, CARBON CAPTURE and STORAGE

13.1 UK Production
13.2 Future Demand for Coal
13.3 Carbon Capture and Storage

14 CONSTRUCTION OF NEW PLANT, INCLUDING ENGINEERING DESIGN AND PROJECT MANAGEMENT

14.1 Building Our Infrastructure
14.2 Developing Skills
14.3 Scale of the Challenge in Context
14.4 Engineering Construction in Context
14.5 Risk and Potential Roadblocks
14.6 What the ECITB Has Done So Far

15. DISCUSSION and CONCLUSIONS

15.1 Demand Exceeding Supply
15.2 How We Got Here – Has the Market Failed?
15.3 Challenge of Crisis?
15.4 Regulation
15.5 What Have Employers and Skills Organisations Done?

15.6 Skills Policy
15.7 Critical Staffing
15.8 Diplomas and Qualifications
15.9 SSC Re-Licensing
15.10 A View from the Trade Unions
15.11 Manufacturing
15.12 A Sector of Opportunity

16 RECOMMENDATIONS

16.1 Strategic Action – Build on our Foundations
16.2 Strategic Leadership
16.3 The Training Landscape
16.4 Economic regulation for the Long Term
16.5 Public Sector Skills
16.6 Policy, Uncertainty and the Long Term vision
16.7 Plan for Investment – Develop Resources in Time
16.8 STEM and Education – Transferable Skills
16.9 Renewables and the Emerging Sectors
16.10 Social Responsibility
16.11 The Role of Industry
16.12 Planning for the Future
16.13 The Internationalisation of Skills
16.14 Other Government Actions
16.15 trade Unions ans ULRs

17 OUR ACTION PLAN

17.1 Collaborative Action
17.2 Oil and Gas
17.3 Downstream Oil – Refining
17.4 Nuclear
17.5 Electricity Generation, Power and Gas Networks
17.6 Renewable Energy
17.7 Coal, Carbon Capture and Storage
17.8 Engineering Construction

GLOSSARY

APPENDICES

1. Power Sector Jobs – Overhead Linesworker Skills Shortages

2. The National Skills Academy for Nuclear – A Case History

3. Engineering Construction – The Historical Perspective

1. EXECUTIVE SUMMARY

1.1 Origins of this Report

The Energy White Paper, published in May 2007 recognised the challenges posed by an ageing workforce, an ageing energy infrastructure and the imperative to reduce carbon emissions. In response to a request from the trade unions that an energy-wide review of skills should be undertaken, the White Paper asked the Sector Skills Organisations covering energy to report on the situation, identify present and future skills shortages and gaps and set out the actions being taken to ensure the UK has a skilled workforce for the future and make recommendations on how the delivery of skills can be improved.

This report has been produced in response to that request. It has been prepared by Cogent (the Sector Skills Council responsible for energy-relevant sectors in nuclear, oil and gas extraction, and the petrochemicals refining industries), Energy and Utility Skills (power generation and transmission, gas transmission and distribution, water and waste), the Engineering Construction Industry Training Board and the National Skills Academy for Nuclear. We also acknowledge advice and support from the trade unions, coordinated by the Trades Union Congress.

1.2 A Bright Future

The energy sector has a bright future, provided that urgent action on skills and infrastructure starts now. Energy is an essential, virtual, networked commodity that is expended in every activity that we undertake as individuals, as an economy, and as a society. Without energy the major advances in the human condition that have been realised through the application of science, engineering and technology will come to no avail. If the car has no fuel, the lights don't come on, or there is no clean water on tap, our economic performance and standard of living will be seriously curtailed. Employment in the production of energy and energy resources is thus of high economic and societal value. This is a skills intensive business reliant on a wide range of occupations and a sustainable supply of professional, technical and operator skills to service electricity production (gas, coal, nuclear, renewables), oil and gas extraction and value-adding activities such as refining, gas processing, petrochemicals and nuclear fuel processing.

1.3 Challenges Ahead

However, the energy sector faces the major challenges of maintaining supplies and reducing carbon emissions. Its key asset, the workforce, reflects the heavy recruitment in the 1970s and 80s and the much reduced intake of the 1990s, leading to a skewed age distribution. Losses to retirement will increase sharply through the 2010s, which means that, not only recruitment and training must be increased, but the underlying capacity to train needs to be expanded.

Moreover, skills gaps, that occur when workers are not fully trained for the job, are increasing as new, unfamiliar, processes and technologies are introduced.

The infrastructure, too, is ageing, with coal and nuclear power stations set to close and facilities, from the refineries to the distribution networks, in need of upgrading. In addition, major new investment is needed to reduce carbon emissions from the energy sector. Thus

new construction will rise sharply. Together, all this means that the future demand for skilled workers will be far higher than today's business as usual.

1.4 The Issues We Face

Despite the excellent prospects for the UK energy sector, the challenge of sustaining the skills base is as significant as the challenge of maintaining energy supplies. The key issues are:

- a globally-mobile workforce, driven by skills shortages worldwide
- an ageing workforce in which today's modal peak will exceed retirement age by 2015
- a huge increase in capital investment across the sector at a time when the underlying supply of new skills is at an historically low level.
- a STEM-reliant skills set for the workforce that is in high demand from other sectors of the national and global economies
- a workforce sector that is now served by sector skills organisations, who are driving up-skilling to retain UK capability and competitiveness
- a fragmented UK energy business chain with the skills resource unbundled across many employers
- a sector in which both formal and informal on-the-job training takes place but is not widely accredited as transferable qualifications
- a sector in which the traditional apprenticeship support structures have withered
- a privatised sector in which the market delivered efficiency savings but at the expense of investment in skills for the future
- a regulated market in which the contract cycles are not conducive to investment in skills for the future
- a safety-critical and heavily regulated sector requiring skills to ensure compliance
- a workforce with skills that are under-utilised in places and is capable of more with investment
- an ageing UK energy infrastructure
- a global sector in which UK companies and engineering know-how have global outreach
- a carbon-intensive industry at a time of increasing environmental regulation
- a carbon-intensive industry at a time when global demand for carbon-based fuels is exceeding supply.

The value of skills to the future capacity and capability of this most important of industries is either explicit or implicit and underpinning in all the above.

1.5 Risks – Challenge or Crisis?

With the workforce now ageing, retirement is set to take an increasing toll. With ever faster technical change and the pool of skills getting smaller, urgent action is required to ensure that the energy sector has the skills it needs for the future.

Our analysis shows clearly that if recruitment and training were to continue at the levels typical of the early part of this decade, skills shortages would become acute, leading to serious risk of forced closure of facilities and of delay coupled to cost escalation for capital investment. In turn, this would reduce the UK's attractiveness to the foreign investors who are vital for delivering the energy infrastructure of the future.

However, our analysis also shows that much of the energy workforce has a modal age in the 40s and that there is time to ensure a succession. There are, however, pockets where the age profile is worse and where serious skills shortages will develop in the early 2010s; which are receiving urgent attention. Skills gaps are also growing but can be overcome by investment in training. There are also external factors, such as competition for skills from both within the energy sector and outside, plus regulatory influence. Overall, in our view, the energy sector is not in a crisis but is in territory where a serious situation could develop if not enough is done in time to develop the next generation of skilled workers.

1.6 Progress on Developing Skills

Since the sector skills framework was formed, employers, and skills organisations have made huge progress. The energy sector has Sector Skills Agreements across most of the footprint, in the Cogent sector; two National Skills Academies are already operating and set to start their first students on courses or apprenticeships now. These have strategic plans to ensure delivery of skilled workers qualified to at least foundation degree level, based on modelling of the workforce and workload over the long term. An employer-owned Academy, also in the Cogent sector, is operating in the offshore oil and gas sector, while the power industry and the ECITB submitted expressions of interest for Academies July 2008. Employers across the electricity sector have joined together to set up a bursary scheme, the *Power Academy*, to support students reading electrical engineering at university. Research and resource modelling by EU Skills has been influential in securing £80 million for apprentice training in the gas networks price control review and we are carrying out a similar analysis for the forthcoming electricity networks review. EU Skills has also successfully piloted a scheme to show that the long-term unemployed can be trained for skilled jobs in the energy sector.

However, the challenge of securing skills for the future is considerable and we need to raise our game yet further to ensure that the energy sector has the skills it needs in the future.

1.7 Our Recommendations

Ensuring that the sector has the skills for the future is not an exact science. Inevitably, judgements and forecasts have to be made. Employers who have a longer-term perspective will be better-placed to make such judgements, assisted by their Sector Skills Organisation with labour market intelligence and advice from training providers. Unions will also be an important source of advice. We will continue to work with employers and other stakeholders to develop our strategic approach to skills and training and ensure the

delivery of skilled workers to the sector. Therefore, our first recommendation is, by some way, the most important. Given the nature of this report, the other recommendations are primarily focused on Government and aim to identify areas where modest changes to existing policy can make significant improvements to our ability to supply skills for the energy sector.

Our key recommendations are that:

1. We need to raise our game in delivering skilled workers for the future. But we have made significant progress over the last few years and have a good foundation on which to build. The Sector Skills Organisations, with their employers, National Skills Academies, unions and other stakeholders, must continue to build on the progress made to date, on the policies and plans that are in place to take forward the action plan; with the specific objectives of raising the supply of skills, engaging new employers and raising their demand for skills, ensuring a skills succession, reducing skills gaps and developing a workforce to deliver and operate the new energy facilities, as defined in our action plans. Employers' engagement with the skills agenda could be further strengthened, possibly through mechanisms such as corporate membership of the Sector Skills Councils and the National Skills Academies.

2. While tactical engagement with employers is good and improving, strategic engagement with skills issues at the top level of employer management is not as good as it could be. To address this, we believe the Sector Skills Organisations, with the help of Government led by the Energy Minister and support of the TUC, should convene a top level summit on energy skills to debate the recommendations of this report; to review the action plan and identify areas where it needs strengthening; to develop a strategy that employers and the Sector Skills organisations can take forward and to help focus Government support to maximum effect.

3. Seen from outside, the training landscape and funding structure is too complex for effective engagement with all the stakeholders. Individual employers are confused, are often sent from pillar to post if they approach the wrong part of the bureaucracy and end up missing out on help through being unable to navigate the system. Sector Skills Organisations are faced with multiple stakeholders and the frequent need, especially in the regions, to pursue the same initiative many times over, often with different results. The landscape and bureaucracy need to look simpler, with easy access routes developed, no wrong doors for entry and services delivered through structures that are clear to understand, even if they are complicated inside. We would specifically recommend that Train to Gain support (in England) should be better focused on employer's and employees' needs and on modular qualifications. RDAs and the devolved administrations need to present a more cohesive approach when dealing with jobs and skills that are required nationwide; thus freeing SSC resource for skills development.

4. Business cycles have a marked tendency to reduce the availability of skills. People who leave in the downturn get work in other sectors and do not come back in the up-turn. Employers focus on the short term and do not invest for the long term. The business cycle imposed by the 5-yearly regulatory price control review is not immune from these effects, while a serious demographic challenge is also developing in the regulated industries. Therefore we recommend that the Regulator, Ofgem, should

use its existing powers to review the impact of the Price Control Review process on the industry's long term investment in skills, including investment by the contractors and suppliers that support the network operators.

5. We are concerned that the public sector, in National and Local Government plus the Devolved Administrations, may develop technical skills shortages and gaps that inhibit the development and implementation of policy. For example, if zero-carbon buildings are to be introduced from 2016, planning and building control departments in Local Authorities will need technical competence to be in place when the planning process starts, say from 2012. The public sector, especially its specialist skills, is not properly covered by the existing SSC network and has fragmented training infrastructure. We believe that this is an area that National and Local Government, with the Commission for Employment and Skills should take a lead in developing a strategy to ensure proper provision for technical skills and training in the public sector.

6. We welcome the UK Government's attention to skills and supply chain issues in policy development for nuclear and renewable energy. However, such attention to these key issues is not universal and, when it comes to developing our physical infrastructure, there is a significant risk of policy objectives being compromised through lack of, or competition for, resources. We recommend, therefore, that policy development in the EU and UK should take account of the available resources to deliver and operate new infrastructure and recognise the time lag inherent in developing new skills capacity, with the objective of helping the supply chain to adapt smoothly and develop resources in a timely manner.

7. The energy sector does not sit in isolation. Transport, defence and the process industries all compete for the same skills and manufacturing resources, while energy projects compete with each other. All projections show UK infrastructure investment growing rapidly and, potentially, faster than the resource to deliver it, while growing global demand for energy investment will impact on the overseas resource available to the UK and potentially compete directly for skilled UK nationals. *Infrastructure development needs, therefore, to be better coordinated by the private and public sector across the economy, perhaps by building on the capital project liaison that already exists, to minimise overload on the skills base and supply chain, reduce the potential for damaging competition for resources and allow skills to be developed in good time.*

8. Energy sector skills are highly transferable, being based on a thorough grounding in technical competence, which can be deployed across many industries, with a top-up of work-specific specialisms. Science, technology, engineering and maths (STEM) education is critical to the future of the energy sector and we believe that the balance of supply and demand will fall short of meeting the needs of the economy. We welcome the Government initiatives to increase STEM education, which must be maintained and strengthened where possible. Key targets should be to increase the numbers of school leavers equipped to enter apprenticeships and to improve the supply of graduates in critical subjects. We will submit our detailed views on this issue to the current call for evidence on STEM education.

9. The skills network needs to develop a stronger focus on the emerging sectors, including renewable energy. However, due to the lack of larger employers to provide

strategic leadership, the large body of small companies in the footprint and the overlap across many SSCs; limited progress has been made to date. In the SSC re-licensing process, we will focus on the cross-sector strategy needed to develop the emerging sectors. We propose that the SSCs should combine to develop and resource a strategic skills solution for the low-carbon and environmental emerging industries.

10. The energy sector has a lot of potential to provide employment for the unemployed, women and minorities. To help meet the need for skilled workers, the energy sector's potential for contributing the Government's social inclusion agenda should be developed, supportive employment policies adopted and welfare to work support targeted accordingly. A strategic plan to improve diversity should be a priority.

11. Our key objective of increasing the number of apprentices and skilled workers is hindered by a lack of training capacity across the UK. The energy sector requires ongoing support to its existing and proposed National Skills Academies so that high-quality training capacity can be increased and the capability of the workforce ensured for the long term.

In addition, Government has a key role in skills development through education and its financial support for training through schemes such as Ambition Energy. We have, therefore, made some more detailed recommendations where Government policy (both central and devolved) can, through modest changes, be made more supportive of our aims.

1.8 Our Action Plan

Our key objective is to ensure that the energy sector has the skills it needs, when and where they are required, that training and workforce development is universally to a high standard, that the qualifications framework is properly matched to the needs of employers and employees, that individuals have the opportunity to realise their potential and that we give clear advice to policy makers at all levels The actions we, employers and other stakeholders will take, which are many and varied, are detailed in Chapter 17. However, these generally fall into a set of key themes:

- We will continue to improve our research and modelling to ensure that our action plans and the advice we give to policy makers are based on the best possible evidence.

- We will ensure that the qualifications framework meets the needs of the sector.

- We will improve the quality assurance of training provision, so that courses are to a universally high standard, wherever they are delivered.

- We will work with employers to promote energy sector careers to young people. As part of this, we will help with the development of the engineering and science diplomas and encourage the take up of STEM subjects. We will also ensure that the learning pathways are clear, that they equip students for a worthwhile career and that individuals can realise their potential, regardless of their point of entry.

- We will promote and develop apprenticeships, Foundation Degrees and graduate training schemes as routes of entry to the sector. We will improve our engagement with Higher Education, to improve the flow of STEM-trained graduates into the sector.

- We will support and work with the existing National Skills Academies and set up new Academies where this can be justified in pursuit of the above aims.

- We will seek to leverage additional funding from all sources, not just to increase numbers in training but to improve the capacity and quality of training provision. In the first instance, we will seek to use Train to Gain funding under Sector Compacts to increase the numbers acquiring Level 2 and 3 skills.

- We will develop our relationship with the Economic Regulators, to ensure that they are fully informed of the skills situation across the regulated industries and their supply chains.

In addition, we will work with employers, training organisations and Government at national, regional and local level to implement tactical measures to deal with specific skills gaps and shortages, for example to improve the supply of safety case writers in the nuclear sector.

2. INTRODUCTION

2.1 The Energy White Paper 2007

The Energy White Paper, published in May 2007[1], recognised the challenges of technical change across the energy sector, and the likelihood of skills gaps and shortages worsening as the ageing workforce moved towards retirement. In response to a request from the trade unions that an energy-wide review of skills should be undertaken, the White Paper asked the Sector Skills Organisations responsible for energy to report on the situation, set out the actions being taken to ensure the UK has a skilled workforce for the future and make recommendations where Government action could make a difference.

This report, which BERR is publishing on behalf of the Sector Skills Organisations covering the energy footprint, has been produced in response to that request. It has been prepared by Cogent (the Sector Skills Council responsible for nuclear, oil and gas refining and the process industries), Energy and Utility Skills (power generation and transmission, gas transmission and distribution, water and waste), the Engineering Construction Industry Training Board and the National Skills Academy for Nuclear.

2.2 Lead Contributors

Many people contributed to this report. Their work was collated by the following lead authors in the Sector Skills Bodies:

Cogent SSC:	Brian Murphy
	Carol Sinclair
	Clive Smith
Engineering Construction Industry Training Board:	David Edwards
	Rakhee Ghadhia
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Energy & Utility Skills:	Sharon McLaughlin
National Skills Academy for Nuclear:	Jean Llewellyn

In addition, we acknowledge valuable advice and critical review from the trade unions; especially from Sue Ferns (Prospect), Charles King (GMB) and Iain Murray (TUC), coordinated by Philip Pearson of the TUC. Within BERR, Peter Christie acted as project coordinator and managing editor.

2.3 Background to this Report

The energy sector in the UK has traditionally enjoyed a well-trained and well-skilled workforce. Historically, the workforce was recruited as school leavers or graduates and trained by the nationalised industries, the oil and chemical companies and engineering manufacturers. Their apprenticeship schemes received significant Government support at the time. Through the late 1980s and 1990s, economic forces, together with structural changes to Government support, reduced recruitment and training dramatically. Apprenticeship schemes were early casualties and many employers stopped them altogether. Graduate recruitment also fell. Employers were able to remain in business by living on their skills legacy and, when necessary, recruiting skilled people from other

[1] Energy White Paper – Meeting the Energy Challenge. http://www.berr.gov.uk/energy/whitepaper/page39534.html

companies. Thus, over the last 15 years or so, the sector has become increasingly dependent on the skills legacy from the past and on a workforce that is ageing.

As skills shortages develop, skills gaps are also growing, as new processes, ways of working and technologies, for which the workforce lacks training and experience, are introduced.

With demand for new investment across the energy sector set to rise sharply, new technologies to be introduced and environmental pressures to be overcome; demand for skilled workers is rising at a time when retirement is set to take an increasing toll and the labour pool is static, or even decreasing. Urgent action is required to ensure that the energy sector has the skills it needs for the future.

The reduced commitment to training since the 1980s can be linked both to the consequences of privatisation and a tight regulatory regime focused on increasing competition and achieving low consumer prices. However, similar reductions in training and recruitment were seen in industries that have not been privatised and in other countries where privatisation has not occurred. Hence deeper socio-economic factors are also at work.

The energy sector now faces major challenges to maintain energy supplies in an era of greater uncertainty; replace infrastructure that is coming to the end of its life and meet strict requirements to reduce carbon emissions. Having workers with the right skills will be critical to all of these.

2.4 Scope of this Report

Since 2000, skills have received increasing attention, from early study of the nuclear workforce led by the then DTI[2], through the sector skills agreements developed by the Sector Skills Councils[3,4] and their client employers, to work undertaken for the development of the National Skills Academies[5,6,7]. As a result, there is a wealth of published information and analysis. It is not the purpose of this report to repeat all of this in detail. Nor would it be practicable to do so; there are over 1000 different job roles in the nuclear industry alone. Instead this report will concentrate on the key issues, what is being done to develop the skills for the future and what more needs to be done.

2.5 Trade Union Support for Skills and Training

Trade unions are key members, with employers, of the SSC boards and play an important part in supporting the activities of the SSCs and in direct support for training through their own organisations. We acknowledge the input and advice provided by trade unions through the TUC in the preparation of this report.

[2] Nuclear and Radiological Skills Study. Report of the Nuclear Skills Group. http://www.berr.gov.uk/energy/sources/nuclear/skills/page22884.html
[3] Cogent Sector Skills Agreement. http://www.cogent-ssc.com/research/SSA_publications_Index.php
[4] Energy & Utility Skills Sector Skills Agreement. http://www.EU Skillskills.co.uk/sector/index.php?pageID=361
[5] http://www.nuclear.nsacademy.co.uk/
[6] http://www.process.nsacademy.co.uk/
[7] http://www.opito.com/index.php?option=com_content&task=view&id=1&Itemid=2

Unions affiliated with each SSC, coordinated by Unionlearn, have worked closely in the development of Sector Skills Agreements, which all include a trade union action plan. Much of the energy sector has a legacy of strong union membership and there is a tradition of collective agreements on training.

2.6 Analysis and Opinion

The energy sector is complex, skilled people change sub sectors regularly, while manufacturers and service providers supply across the whole footprint. It is, therefore, not always clear cut where skills should be categorised. There is undoubtedly some double counting but, we believe, few gaps where workers are uncounted. Given this complexity and the lack of fine detail (and sometimes consensus) on where skills belong, the information and analyses given in the sector chapters (Chapters 8-14) are those of the individual organisations and not of the collective authorship.

3. THE ISSUES WE FACE

3.1 A Bright Future

The energy sector can have a bright future and provide huge opportunities for people to have well-paid and interesting jobs in an industry that is an essential part of the Nation's infrastructure. Energy is an essential, virtual, networked commodity that is expended in every activity that we undertake as individuals, as an economy, and as a society. Without energy the major advances in the human condition that have been realised through the application of science, engineering and technology will come to no avail. If fuel runs out, the lights don't come on, or there is no clean water on tap, our economic performance and standard of living will be seriously curtailed. Employment in the production of energy and energy resources is thus of high economic and societal value. This is a skills-intensive business, reliant on a wide range of occupations and a sustainable supply of professional, technical and operator skills to service electricity production (gas, coal, nuclear, renewables), oil and gas extraction, coal production and the value-adding activities; such as refining, gas processing and petrochemicals; that turn primary fuels into the retail commodities we all use.

3.2 The Challenge for the UK

However, realising the bright future requires us to overcome some significant challenges. The energy sector is changing rapidly to meet two great imperatives – maintaining energy supplies and reducing carbon emissions. The first of these is not just about securing primary energy supplies in an increasingly uncertain world. Much of the UK's and, indeed, the world's energy infrastructure is ageing and will need to be renewed over the next 25 years or so. Some 30-40 GW of generating capacity in the UK has to be replaced by 2030, of which around 15 GW is needed by 2016 and much of the transmission and distribution network will need to be renewed or upgraded. Offshore oil production, although in decline, has many years of production ahead, as specialised techniques are employed to extract more from the reservoir. Moreover, depleted reservoirs or the offshore saline aquifers are prime candidates for offshore carbon storage, so the industry stands to gain a further lease of life adapting existing infrastructure or building new facilities. The refinery industry will need to adapt its processes to accommodate heavier oil feedstocks and redress the imbalance of production between gasoline and middle distillates.

On top of this investment to the energy supply infrastructure, the environmental imperative is driving a move for lower-carbon versions of existing technologies, the introduction of renewable energy at both large and small scale and the development of smart networks to integrate supply and manage demand. Investment in renewables will increase rapidly for established technologies like offshore wind, while major projects like the Severn tidal power scheme are being mooted more strongly. Offshore operations must adapt to the development of carbon storage and exploitation of energy from wind, wave and tidal stream. Set against this, there is increasing demand for engineering and construction skills from other major projects, such as defence, the Olympics and rail, all of which are fishing in the same pool of talent.

3.3 An Ageing Workforce

The uneven rate of past recruitment has produced a workforce with an age profile that is now skewed to older workers. Universally, today, the modal age is over 40 and in some trades and professions it is over 55. This presents the sector with its first major challenge, the increasing loss of skilled workers to retirement. Moreover, we face this challenge at a time when investment in new and existing infrastructure must rise sharply. Almost all projections, where detailed analysis has been carried out, show natural wastage in the 2010s rising sharply above today's levels, as retirement takes its toll. Replacing many of these skills requires lengthy apprenticeships of up to 4 years, or graduate training programmes up to 3 years long. Nor is this the end of the process because many jobs demand high levels of experience and know-how, built up over time. Ensuring that a new generation is trained and that the experience and know-how is transferred is a process that must begin in earnest now.

As well as the peak in older workers, there is a relative scarcity of workers in the 25 to 40 age bracket. This is due to the major structural changes to the energy and industrial sectors over the last 25 years. In part, this was compounded by the closure of the Industrial Training Boards following the 1981 Employment and Training Act and the ending of the support they provided, especially for apprentice training. A key reason for the closure was that the Boards, which were established to support manufacturing, were ill-suited to dealing with the structural change to a service economy. But withdrawing this support also removed support from other industries dependent on a technical skills base. As a consequence, there are reduced numbers of people in today's workforce to provide a succession to the experience and know how that is approaching retirement.

3.4 Skills Shortages

The terms skills shortages and skills gaps are often used interchangeably but have distinct meanings in skills policy. *Skills shortages* occur when not enough people in the labour pool have a skill that is in demand. Employers find it harder to recruit, job advertisements attract fewer applicants and, often, these are of lower quality. In response, employers often respond by increasing their pay and conditions in order to recruit from competitors and, when this proves difficult, by recruiting from overseas. Recruitment and training often goes on in parallel but may only be ramped up to meet full demand when the other methods fail. Once underway, recruitment and training programmes can be difficult to manage and hard to slow down – as we have seen by recent events with junior doctors and physiotherapists where a shortage quickly turned into a surplus. One of our key aims is to manage skills shortages to bring supply and demand into balance as smoothly as possible.

Skills shortages are evident today but most employers are able to manage the situation by competing for staff in the labour market. However, as retirement bites and demand increases, skills shortages will become more widespread unless recruitment and training is increased to compensate. Demand for engineering construction workers and the associated engineers, project managers etc looks likely to generate the most serious shortages if all the proposed capital projects are executed in parallel.

3.5 Skills Gaps

As well as the age profile, the energy sector is faced with a strategic challenge arising from the industry's changing skills needs. Historically, skills gaps were rare in the energy sector, due to the high quality training that was the norm. Today skills gaps are increasing for several reasons. Firstly, there is a view that the training of recent recruits has narrowed – they have skill in depth but lack the breadth to do a range of jobs, for example to work with equipment that ranges in age from new to 60 years old. Secondly, there are major changes in the nature of the job, for example for nuclear workers who are moving from on-going operations to project-based decommissioning, or power station workers faced with flue gas desulphurisation and, over time, carbon capture. Thirdly, the technology is changing, with greater sophistication of the individual components and systems, together with the new processes that are being introduced. Skills gaps are not easy to overcome by recruitment and are usually tackled by in-service training.

Significant skills gaps are also developing in the areas of management and supervision, especially in relation to project-based working. The coming investment in new infrastructure will require a big injection of these skills.

Looking to the future, an energy infrastructure with distributed generation, smart networks and demand management, will require skill sets, both technical and operational, in combinations that do not exist today. It is, however, difficult to predict the timing of technology development and market demand. We believe that the electricity sector will concentrate in the coming decade on the larger scale (nuclear, clean coal, wind) and that microgeneration will come to prominence after 2020.

The business structure has also changed, with fragmentation of the sector creating new business interfaces and the need for informed buyer and contract manager roles. There are both skills gaps and shortages in this area.

3.6 Retention

The sector also has to address the retention of existing staff. Not only is there growing demand for skilled workers from other UK industries requiring the same skills, but energy skills are in demand worldwide. We already see overseas employers recruiting in the UK, even when we ourselves are short of the skills in question.

Moreover, the balance of work and family life can be a significant issue for women once they have a family and can result in a loss of talent to sectors with better work-life policies. The energy sector, with its past history of a male workforce, has to review its offer in this area.

3.7 The Power Gap and New Construction

Closure of coal and nuclear generating plant means that the UK must construct new power stations and other energy infrastructure at a time when there will be very high demand for engineering construction resources from other sectors. At the time of writing, some 14 GW of new power plant was in the Section 36 approval process, or had recently been approved by Government. Much of this is CCGT gas-fired stations, which are needed to bridge the supply gap as old stations close in the 2010s. The industry will also seek to build some new, super-critical, coal-fired capacity, both to hedge against over-dependence

on gas and to provide a flexible output to meet rapid changes in load. New nuclear has a longer lead time, with construction of the first station unlikely to start before 2012 and first power in 2017 at the earliest.

Over time, some coal-fired generating plant using the integrated gasification combined-cycle process (IGCC) is likely to be built. This is, overall, a more complex process than a conventional boiler and turbine system but it can co-fire with a range of fuels, including biomass, and carbon capture is less challenging technically than the post-combustion process.

Power sector projects face competition for construction-related skills from the continuing investment in the LNG terminals and gas storage, the offshore wind programme, a potential up-turn in chemicals and hydrocarbon processing, the aircraft carriers and other MoD programmes, rail projects, Thames Gateway and, possibly, the Severn tidal power scheme. In addition, of course, there is the continuing maintenance (turnaround) activity in the existing power stations, refineries and petrochemical sector. There is also likely to be some fabrication work for the North Sea, to support oil and gas, marine renewables and offshore carbon storage.

3.8 The Picture Worldwide

The ageing workforce is a phenomenon seen across the world; reports of age-related skills shortages from Europe, North America and Australasia are common. Even in China the modal age of the working population is rising. The oil and gas industry worldwide has faced the greatest challenge to date, having started this decade with a badly skewed age profile. Shortage of skilled people has slowed the pace of investment, making it harder for the industry to meet increasing demands for energy. We have already seen from oil and gas that worldwide skills shortages lead to globalisation of the workforce. In turn this creates the opportunity for UK skills to be deployed on overseas projects and many UK jobs exist to service this international business. On the other hand, it creates a challenge for the UK in having to compete for resources against demand from overseas – and not just for graduate skills, craftsmen and technicians are also surprisingly mobile.

Against this background, it is useful to put the UK's investment needs in context. Worldwide, over the next 25 years or so, around 1000 GW of old thermal generating plant will need to be replaced and, in the main, de-carbonised. In addition to this, most projections show that rising demand for electricity will require 1000 GW of new capacity[8,9]. For comparison, the UK's generating capacity is around 80 GW and total global capacity is around 4000 GW. The UK's investment of 30-40 GW by 2030, although large by domestic standards, represents only 1.5 to 2% of the worldwide total.

In addition to this, of course, we will see continuing investment in field development in the oil producing regions, plus the downstream facilities, refineries, gas processing and petrochemicals, needed to make fuels and commodities. The overall level of global activity will lead to worldwide pressure on skills, it will be more difficult for the UK to recruit skills through immigration, from the EU or outside, and others will attempt to recruit from the UK.

[8] World Energy Outlook, IEA, 2008
[9] http://www.eia.doe.gov/oiaf/ieo/electricity.html

3.9 Climate change and Energy Supply

Energy supply, energy use and, in particular, electricity generation are major sources of carbon emissions. Moving to low-carbon energy is a major challenge technically and economically but it is also an opportunity for companies to grow their businesses and for individuals to have rewarding careers.

3.10 Employer and Trade Union Engagement

The Sector Skills Organisations have good and improving engagement with employers at working level, especially with HR managers and directors. However, strategic vision of the issue at the top level of employers' management is more variable and leadership is sometimes lacking. In the hierarchy of pressures on shareholder value, skills have, historically, been low down. However, for the UK generally, skills have climbed to the top of the list of business concerns and the energy sector does not sit in isolation from this sea change. We believe that strategic engagement on skills issues must improve and that Government, through the influence of its Ministers, can play a key role in achieving this.

The engineering construction sector has a national agreement on employment terms and conditions, developed between employers and the trade unions in response to difficult labour market conditions in the past. The National Agreement for the Engineering Construction Industry (NAECI) covers a wide range of matters, from pay to safety[10].

Also, the engineering construction sector has adopted an innovative "Skills and Training Charter" which demonstrates the commitment of the employers in the supply chain and trade unions to work together with other stakeholders to increase training. The initiative was developed initially in Scotland and was launched with the full support of the Scottish Parliament Cross Party Group. It is now being adopted and promoted in England and Wales, bringing employers and unions together to increase the available pool of skilled people.

3.11 Image, Attraction and Education

Crucial to the energy sector's future, and to overcoming the supply and environmental challenges we face, is that people will want to work in it. Over years, the attractiveness of the industry has fallen, from days past when apprenticeships and graduate positions in the energy industries were a career of choice for many, to a perception today that the sector is dirty and polluting, while offering poor rewards and employment uncertainty. Energy & Utility Skills on behalf of the Power Sector Skills Strategy Group (PSSSG) commissioned a research report 2008 entitled "Public attitudes to electricity Industry and the careers it offers"[11]. This clearly showed a very low level of awareness of the electricity sector as a whole, with 80% of interviewees rating their knowledge of the industry as four or less on a scale of one to 10. In the qualitative section of the research seven out of the eight roles envisaged by the participants were male with the only female role being that of 'the call centre girl'. Generally the industry was characterised as being profit focused, highly technical and boring, and only pretending to be green in order to gain a commercial advantage.

[10] http://www.ecia.co.uk/pages/index.cfm?page_id=4
[11] http://www.euskills.co.uk/download.php?id=621.

In addition, the DIUS/Research Councils' survey of UK Public Attitudes to Science 2008[12] and the Engineering & Technology Board survey of Public Attitudes to Engineering 2007[13] both show that the older generation feel scientific/engineering careers are more attractive than younger people. This is a sign of the times in terms of changing career aspirations. It is clear that the sector has to work hard on its image. In turn, this means overcoming the lack of awareness in teachers about the realities of careers in energy, which is already happening to a degree with work on careers led by the Department of Children, Schools and Families (DCSF). Part of this campaign has an example of a career in energy posted on BEBO. We discuss in later chapters the actions being taken to promote the energy industries and improve their attractiveness.

Perhaps more critical, the energy sector is predominantly an employer of science, technology, engineering and mathematics (STEM) disciplines. The decline in STEM in schools is a major concern, although we are encouraged by signs of an up-turn in Higher Education. There remain concerns, however, that even here STEM output subject by subject is not well matched to the demand from employers and that the capacity to deal with increased demand to compensate for retirement could be limited. There are deep structural issues here that are beyond the scope of this report. We can only point out the critical nature of STEM skills to the nation's energy supply. We believe that the engineering and science diplomas may offer a way for the sector to attract more young people to study STEM subjects

The Government has taken a number of recent concerted steps to promote STEM in schools, for example through STEMNET's recently expanded Science and Engineering Ambassadors programme, which is funded through DIUS. Over 19,000 ambassadors from a range of industrial backgrounds currently act as role models within schools, and in May Ian Pearson announced that the Government would support an expansion in the programme to over 27,000 Ambassadors by 2011. STEMNET also manages a strong and growing network of after school science and engineering clubs, on behalf of DCSF. Other DIUS measures include sponsorship of National Science and Engineering Week and support for the BA Crest Investigators programme. These steps are supported by DCSF's STEM communications campaign and measures to improve information, advice and guidance on STEM subjects.

However, the Sector Skills organisations have some reservations about the effectiveness of these measures. In particular, employer engagement on the part of schools is limited in places, while only a sub-set of employers are regular participants. Concerns remain, therefore, that the initiatives are not fully meeting the future need for STEM recruits.

DCSF is providing £140m to support STEM agenda in schools to support teacher recruitment, retention and training (£31m) of science teachers; teacher CPD (£50m which include support for regional Science Learning Centres); boosting the number of students studying STEM subjects and widening access to triple science GCSE (£34m); doubling number of science and engineering clubs to 500 (£9m) and a STEM communications campaign (£6.4m). This is in addition to investment on schemes such as golden hellos to recruit science and maths teachers and support of specialist science and technology colleges. We discuss STEM education in more detail in Chapter 5.

[12] http://www.rcuk.ac.uk/sis/pas.htm

[13] http://www.etechb.co.uk/_db/_documents/Public_Attitudes_to_and_Perceptions_of_Engineering_and_Engineers_2007.pdf

3.12 The Progress We Have Made

Since the Sector Skills Organisations were formed, employers, and skills organisations have made huge progress. The energy sector has Sector Skills Agreements across most of the footprint, in the Cogent sector; two National Skills Academies are already operating and set to start their first students on courses or apprenticeships now. These have strategic plans to ensure delivery of skilled workers qualified up to foundation degree level, based on modelling of the workforce and workload over the long term. An employer-owned Academy, also in the Cogent sector, is operating in the offshore oil and gas sector, while the power industry and the ECITB submitted expressions of interest for Academies in July 2008. Employers across the electricity sector have joined together to set up a bursary scheme, the *Power Academy*, to support students reading electrical engineering at university. Research and resource modelling by EU SKILLS has been influential in securing £80 million for apprentice training in the gas networks price control review and we are carrying out a similar analysis for the forthcoming electricity networks review. EU SKILLS has also successfully piloted a scheme to show that the long-term unemployed can be trained for skilled jobs in the energy sector.

However, the challenge of securing skills for the future is considerable and we need to raise our game yet further to ensure that the energy sector has the skills it needs in the future.

4. THE AGE PROFILE IN CONTEXT

4.1 The UK Population

Demography is the study of population statistics and provides the scientific basis for understanding issues such as the ageing workforce. At first sight, the analysis looks simple. In practice, however, the data is surprisingly open to interpretation – depending on what the analysis is trying to achieve. For example, Leitch points out that 70% of the UK workforce in 2020 is already in the working age population and he uses this argument to justify a major effort on up-skilling. On the other hand, in the energy sector, we see examples where today's modal peak will be past retirement age by 2015. Here, replacement is an urgent necessity.

To set the workforce demographics in context, in Figure 1 we show the UK birth rate (or strictly the number of live births) from 1901 to 2006. If we ignore the birth rate peaks following the two world wars, we see that there is a long-period cycle around 60 years long, coupled to a steady downward trend. In Figure 2, we re-plot this data, showing the numbers of 20 year olds as a surrogate for those entering work (the entry cohort) and the numbers of 64 year olds as a measure of the exit cohort. Obviously, this takes no account of early mortality but this would not materially affect our argument. Nor does it take account of inward or outward migration, for which official statistics are poor. But it clearly indicates a sea change in the 1990s from the entry cohort dominating to the exit cohort dominating. Put simply, on the basis of the UK's birth rate, we are not today replacing the working age population.

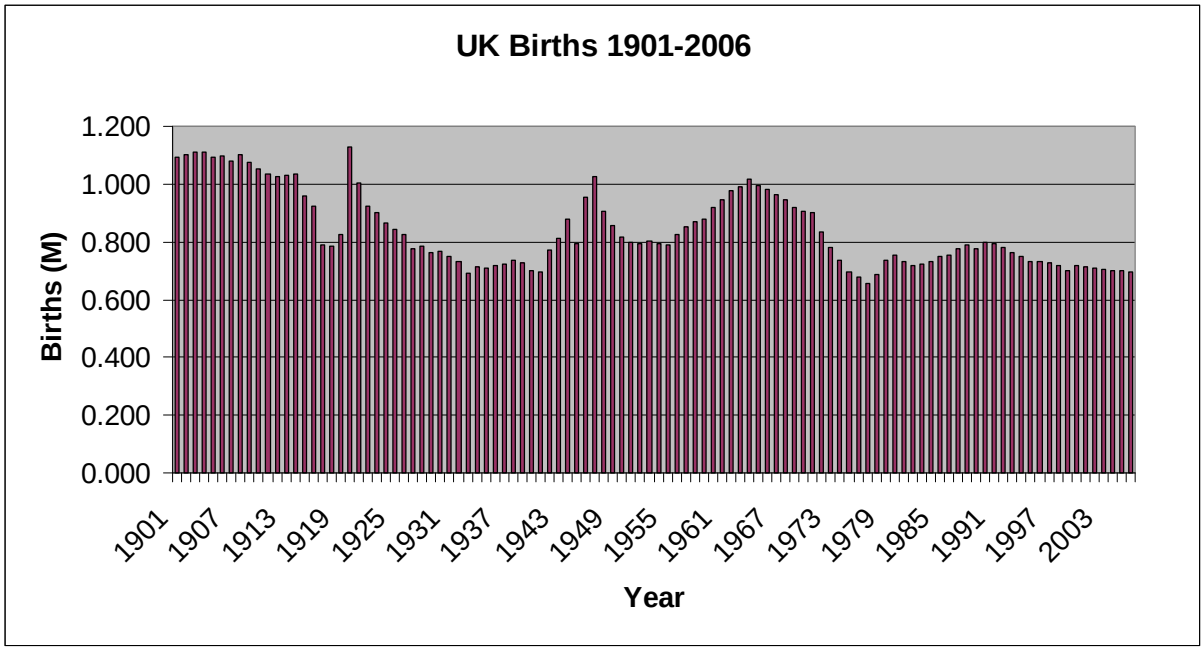

Figure 1. UK Live Births 1901 – 2006. Source: Office for National Statistics

Labour market statistics also show that employment in the UK has a rising trend, creating a net 100 000 new jobs per annum for at least the last three decades. Only in 1984 did the number of jobs in the UK decline. If this is factored in, it shows that the deficit of labour supply versus demand has, with the one exception, been continuous. So how did the UK

manage to fill the extra jobs? Labour market statistics show that most of them have been filled by women who in earlier years would have been home-makers. Also, since the 1980s, the fall in unemployment has filled over a million jobs and, of course, there is net migration, notably from the A10 countries since 2000.

These data give us a very important message. Demographically, the labour market today is a sellers' market, in which those with skills have a choice where to work and employers have to compete. Unless there is a very serious and prolonged economic downturn, this is likely to persist for the long term. Most of today's energy sector jobs were recruited in a buyers' market, where employers could pick and choose. Success will go to those employers who compete effectively in today's changed recruitment market.

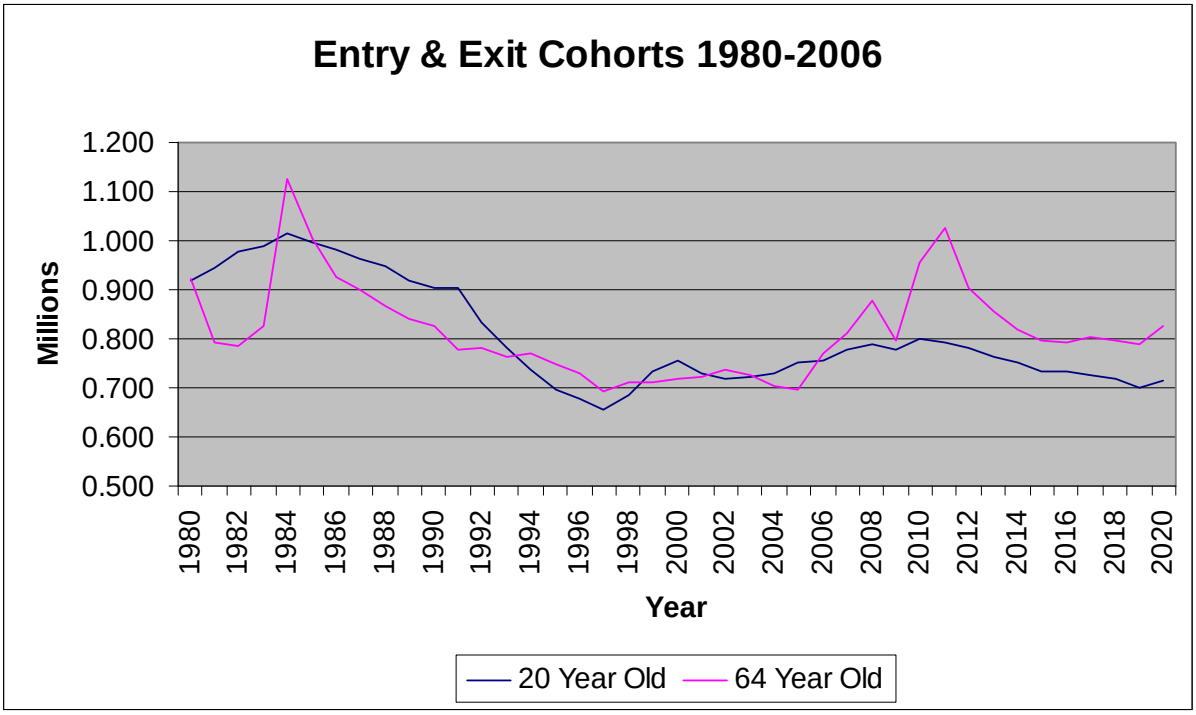

Figure 2. The number of 20-year olds, 64-year olds 1980 to 2020. Based on birth data from the Office for National Statistics

4.2 Nearing Retirement – The Example of Chartered Engineers.

Although the demographic issue is now well recognised, detailed analysis is still rare. The Engineering Council published data in 2006[14] showing that the modal age of chartered engineers had risen from the early 40s in 1988 to the late 50s by 2003. The data for incorporated and registered engineers are almost identical and many energy sector jobs show a similar trend. The relative shortage of engineers in their 30s and 40s creates a serious imbalance, with too few to form a succession when the modal peak moves into retirement.

[14] Available from http://www.engc.org.uk/documents/Engineering%20UK%202006%20-%20Statistical%20Guide.pdf

However, the data does not tell the whole story. It does, for example, not show how many younger people are working as engineers but have not seen value in joining their institution. With many institutions requiring a Masters degree as an entry qualification for chartered status, the entry barrier may be a factor. Nor do the data tell us how many with engineering degrees are working in non-engineering jobs. The latter may be fertile ground for recruitment, especially where people leave other jobs, such as financial markets, in mid career.

5 DEVELOPING A NEW GENERATION – ATTRACTION, EDUCATION AND TRAINING

5.1 Sector Attractiveness

Crucial to the energy sector's future, and to overcoming the supply and environmental challenges we face, is that people will want to work in it. Over years, the attractiveness of the industry has fallen, from days past when apprenticeships and graduate positions in the energy industries were a career of choice for many, to a perception today that the sector is dirty and polluting, while offering poor rewards and employment uncertainty. It is clear that the sector has to work hard on its image. In turn, this means overcoming the lack of awareness in teachers about the realities of careers in energy. We discuss in later chapters the actions being taken to promote the energy industries and improve their attractiveness.

Research carried out by the University of Oslo[15] reinforced this finding, identifying a strong negative correlation between the state of development of a country, as measured by United Nations Human Development Index (HDI), and the interest of 15 year olds in science and technology, as measured by a 40 country survey. In short, the more developed a country the less interested children are in science and technology. This is a clear global phenomenon.

5.2 Skills Policy & the Leitch Report

The Leitch Report[16] set out the challenge presented by the developing economies, with their increasingly skilled workforces, and the implications for skills and training in the UK if it is to have a competitive economy to 2020 and beyond. Leitch, quite rightly, highlights the large numbers of people in the low-skill, low-attainment cycle and shows that, with fewer young people entering work, up-skilling the working age population is essential.

In the energy sector, with a workforce that is often older than the population at large, replacement of retiring workers is a much greater imperative. Leitch has little to say on retirement and replacement, yet, unless there is mass immigration of young people, the modal age of the overall UK workforce in 2020 will be 56. Nationally, the 2020s will see increasing losses to retirement but, due to its older workforce, energy sector will see these losses begin in the 2010s.

The training policy, post Leitch, has concentrated initially on helping the low-skilled attain their first level 2 qualification. *World Class Skills*, the Government's response to the Leitch Review, set out an ambitious goal of shifting the balance of intermediate skills from level 2 to level 3, with 1.9 million more people achieving level 3 by 2020. The Education and Skills Bill currently going through Parliament introduces an entitlement to a fully funded first level 3 for those aged 19-25. The Sector Skills Compacts currently being negotiated with SSCs seek to make Train to Gain funding more flexible to meet the strategic needs of particular sectors, including more funding for level 3 where this fills a particular need. This will aid the energy sector, where level 2 is too low a rung for entry into many jobs. Energy jobs of the future will predominantly be at levels 3, 4 and above. To improve the potential for recruitment from the low-skill pool, we welcome flexibility to link training more directly to job entry. We also need to consider recruiting from the lower-skills pool and training more

[15] Relevance of Science Education (ROSE) project, http://folk.uio.no/sveinsj/APFLT-foreword-Sjoberg-schreiner.pdf
[16] http://www.hm-treasury.gov.uk/independent_reviews/leitch_review/review_leitch_index.cfm

directly on the job, subject to the safety and regulatory issues mentioned elsewhere. Employers need to take on apprentices and trainees, rather than short-term, opportunistic employment that compounds the long-term problem.

5.3 Flattening the age profile

It is clear that if we simply replace today's workforce wholesale with young people, the ageing workforce problem will reappear in mid century. Our aim, therefore, is to achieve a more balanced age profile in the workforce by also recruiting and re-training people in mid career. This will bring in experience and maturity and help to move the sector towards a steady state, with recruitment and retirement balanced over time.

5.4 STEM Professionals for the Energy Industries

The Roberts report made the case in 2002 for the sustainability of strategic but vulnerable provision within science and engineering.[17] The energy industries rely critically on the sustainable supply of a vocational and professional workforce with STEM skills. In an evermore globally connected economy, the UK supply in generic STM, and thereafter specialised graduates in STEM, is a matter of both social justice - ensuring that individuals are equipped with the knowledge and skills to compete with the best in the world - and sustainability of UK industries, through innovation, knowledge creation, knowledge transfer and the skill level of the workforce. National Skills Academies (both current and proposed) seek to address this challenge.

The relative popularities of the fields of Higher Education (HE) study in OECD countries have been analysed[18]. In 2005 17.6% and 13.9% of UK graduates were in the OECD fields of science and engineering respectively. The OECD statistic for the popularity of science in the UK (which includes life and physical sciences) is almost double the OECD average of 9.7%. In contrast, the engineering statistic (which includes manufacturing and construction engineering) severely lags behind the OECD average of 26.9% and, in particular, France and Germany. Physical science is also strategically important and vulnerable in the UK but is not separated from life-science in this study.

[17] *SET for Success: the Supply of People with Science, Technology, and Mathematical Skills,* Roberts G, HM Treasury, March 2002

[18] *The Benefits of HE – A Cogent Digest of 'Education at a Glance 2007: OECD Indicators',* Cogent SSC Ltd, 2007

Percentage of tertiary graduates, by field of education (2005)

Selected economies

		Health and welfare	Life sciences, physical sciences & Agriculture	Mathematics and computer science	Humanities, Arts and Education	Social sciences, business, law and services	Engineering, manufacturing and construction	Not known or unspecified
Australia	A	13.2	6.1	8.3	22.0	43.0	7.2	
	B	14.6	4.1	9.0	10.9	49.4	11.7	0.3
France	A	8.1	9.8	6.1	18.9	45.1	11.9	
	B	21.4	0.6	5.5	3.8	47.9	20.8	
Germany	A	13.1	9.8	7.6	22.3	31.3	15.9	
	B	49.5	2.9	0.5	7.8	20.7	17.2	1.3
Japan	A	6.5	7.9	x(3)	23.5	38.0	20.1	4.0
	B	22.0	0.6	x(3)	20.7	33.5	15.8	7.4
United Kingdom	A	12.0	8.7	7.3	27.3	34.7	8.7	1.3
	B	39.3	8.9	6.7	20.3	18.4	5.2	1.2
United States	A	9.3	6.1	4.3	28.6	45.3	6.3	
	B	31.3	2.2	9.0	3.4	40.8	13.2	
OECD average	**A**	**12.7**	**7.4**	**5.4**	**25.3**	**36.6**	**12.2**	**0.4**
	B	**15.1**	**2.3**	**5.9**	**22.7**	**38.2**	**14.7**	**1.1**

Note: The second column specifies the level of education, where A equals Tertiary-type A and advanced research programmes, and B equals Tertiary-type B programmes.
Source: OECD (*www.oecd.org/edu/eag2007*) *Table A3.3* *http://dx.doi.org/10.1787/068037263103*

Table 1. International Comparison for UK Science and Engineering Graduates

In two recent reports, the Royal Society has analysed the national STEM supply.[19,20] The authors of this report concur with the findings, key points of which are summarised below.

14-19 STM[19]

- A decline of core science and mathematics against a backdrop of growing A Level entries across all STM (1992-2006)
- An attrition of the best of the declining pool of STM into popular biomedical science professions
- The expansion of subject combinations in the 14-19 curriculum and the concomitant effect on the depth of STM studied and readiness for entry to STEM in HE

HE and STEM[20]

- A decline in physical science against a backdrop of a phenomenal 31% rise (1995/95 – 2004/05) in all science degrees awarded; contrasted by major growth in computer science – now declining, subjects allied to medicine, and biological science - with some spectacular subject growth such as psychology (up to 47% share within biological science category in 2004/05)

[19] *A Degree of Concern? UK First Degrees in Science, Technology and Mathematics*, Royal Society, October 2006
[20] *A Higher Degree of Concern?* Royal Society, January 2008

- The potential threat to the global primacy of UK HE through the Bologna process for a harmonised European HE zone for enhanced employability and mobility of professionals and increased competitiveness of European HE
- The decline in STEM and the financial costs of its provision have given rise to HE 'cold spots'; with a potential impact on regional uptake of STEM and the supply of suitably qualified teachers.

In 2006 Leitch[21] underlined the role of SSCs, FE and HE in driving up employer demand for up-skilling of the workforce. This has been reinforced by the FE reform white paper[22], the 'Innovation Nation' white paper[23] and the public consultation on 'Higher Education at Work'[24].

In 2007, Cogent SSC published its analysis of HESA data for first destinations of graduates in Cogent-relevant science and engineering for 2005/06[25, 26]. While accepting the limitations of data that is a snapshot of employment six months after graduation, there is a clear indication that, for graduates of these subjects, manufacturing - of which nuclear, oil and gas and petrochemicals are sub-sectors - is a significant employment destination (18%) for the supply side but that provision in HE had little demand-side employer focus or the flexibility to support workforce development.

[21] *Prosperity for All in the Global Economy – World Class Skills,* Leitch S, HM Treasury, December 2006
[22] *Raising Skills, Improving Life Chances,* DIUS, March 2006
[23] *Innovation Nation,* March 2008
[24] *Higher Education at Work – High Skills: High Value,* DIUS, April 2008
[25] *Higher Education and the Cogent Workforce,* Cogent SSC Ltd, 2008, http://www.cogent-ssc.com/research/Publications/factsheets/HE_Factsheet.pdf
[26] *Higher Education and the Cogent Sector: At a Glance 2007,* Cognet SSC Ltd, 2007, http://www.cogent-ssc.com/research/Publications/publications/HE_at_a_glance.pdf

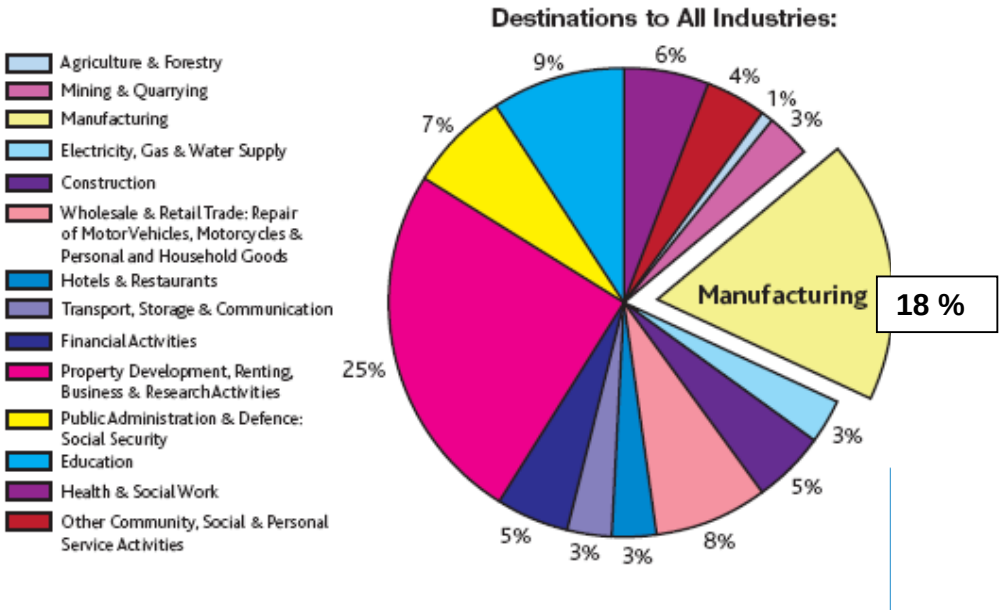

Figure 3. First Destinations of Graduates from Cogent-Relevant Science and Engineering

Although HEFCE policy on employer engagement has significantly motivated the sector to seek employer-facing curriculum development and to extend this to R&D and KTN links with businesses; costing models based on Full Economic Cost for traditional in-house teaching, with depreciation on estate and equipment and the draw on support services, threatens to price work-based learning provision uncompetitively.

5.5 Drop Out from STEM

The largest proportion of drop-out from potential employment in STEM occupations occurs at age 16 when young people have completed their GCSEs or Standard Grades / Intermediate 2 studies and make choices regarding further study at A Level or Higher.

The decline in uptake of both Maths and Physics at A Level and Higher Level has serious implications for the potential entry to higher education for study of STEM subjects as a route into employment in the energy sector. In the last 10 years, across the UK, uptake at age 16-18 has declined, on average, for Maths by 17.6% and for Physics by 18%. Physics A Level has been in even greater decline over the last 15 years with those sitting the exam dropping by 37%, the problem is less severe but still of concern in Scotland with Highers showing a decline over 15 years of 21%.

Although over the last 10 years entries to study first degrees in the STEM subjects of most interest to the energy industries have increased overall, there has been a decrease in relative terms. While there has been a 42% increase in acceptances to study first degrees across all STEM subjects, there has been only a 5% increase in entry to the core subjects of interest for energy.

5.6 Part –Time Learning in Higher Education

The lack of part-time learning in HE is also a concern. A large majority of HE courses are full time and this militates against our strategy of upward progression and open-ended opportunity for workers, regardless of the level of entry. There is also an increasing appetite among employers for a better integration of learning and work experience, perhaps using best practice from sandwich courses, as past experience has shown that competence in the workplace is attained more quickly. This view is also supported by the TUC. Earnings form work placements can also reduce the financial burden on students.

5.7 Apprenticeships

The re-emergence of apprenticeships is of critical importance to provide the hands-on skills the sector needs. The Sector Skills Network and the TUC strongly support efforts to improve the quality of apprenticeships, and believes that they have a crucial role to play in the energy skills strategy.

In January 2008, Government published the findings of an interdepartmental review of all aspects of the apprenticeship programme. 'World-class Apprenticeships: Unlocking Talent, Building Skills for All" announced the Governments strategy for the future of Apprenticeships in England. The strategy details how England's contribution to Leitch's ambition to have 400 000 apprentices in learning in England will be met.[27].

We welcome this report but have some general concerns over the development of apprenticeships, in the light of the training required in the energy sector.

To start with, what constitutes an apprenticeship is not clearly defined. Setting out more clearly what is meant by an apprenticeship is essential if they are to be valued by young people. This should be backed by monitoring of quality which ensures that apprenticeships are being delivered effectively. However bureaucracy must be appropriate; we are concerned about proposals that could add additional duties on apprentices, while trade unions, for example, would oppose any weakening of apprentice rights.

Employer engagement in apprenticeships must be raised. The increased attention to the role of the public sector in promoting apprenticeships is very welcome. However other mechanisms to lever in private sector involvement, for example through targets in Sector Skills Agreements, are needed. Also the encouragement of apprenticeships as a real alternative to the academic route needs to be addressed.

Adult apprentices often have responsibilities such as homes and families and adequate funding is essential. More adult training places are needed and we need to find ways of facilitating this, while also finding better ways of valuing and recognising existing skills and improving the ability to transfer between trades in cases of redundancy or closure. Adult trainees bring with them skills from previous employment and can often become proficient faster than their younger counterparts.

In order to widen employer participation in the apprenticeship programme it is critical that government continues to make appropriate levels of funding available for adult apprentices. Lifting the funding age cap to make apprenticeships an all age programme

[27] http://www.dius.gov.uk/publications/world_class_apprenticeships.pdf

has been of huge value to the sector where the workforce is aging and where insurance and driving restrictions deter employers from recruiting Apprentices in the 16 -18 age group.

Experience has also shown that adult entrants are more loyal and stay with companies longer. Furthermore, adult training is a key route to improving diversity, especially for women seeking a career change or returning to work after raising a family. For this, the whole package - that is funding, flexible hours, child care and school holiday provision - is essential. Current Government policy in this area is piecemeal, at best.

We recognise the key role that trade unions play in working with employers to increase high quality apprenticeships through negotiation, agreement-making and monitoring.

It is welcome that the Low Pay Commission will be reviewing the existing exemption on apprentice pay; the £80 per week floor was set in August 2005 and has not been increased since. This is not only low (it is well below minimum wage) but it limits access for those who cannot find training locally – for example the cost of travel to London from the Home Counties is often over £80 per week. For apprenticeship schemes operating at or near minimum pay, improving pay will make apprenticeships more affordable and accessible and will therefore impact positively on completion rates and perceptions of quality. Boosting pay will also support equality as women are concentrated in the lowest paying sectors. We should also remember that in disadvantaged communities, the apprentice can be the only wage earner in the family and the pressure to take a higher-paid but lower-skilled job can be intense.

Energy sector employers, where there is trade union involvement in apprentice schemes, generally pay apprentices well above the minimum and starting pay of £180, with year by year increases is typical. This is rewarded by completion rates of 84% or more and higher standards of attainment. Trade Unions work with many employers to help bring all apprentice training up to a common standard of excellence, which will not only improve the flow of skills into the industry but ensure that apprenticeships are more highly valued by potential trainees.

At present, there is no clear structure or body for the oversight of apprenticeships. The inconsistency in Apprenticeship strategy and delivery/operation across the four nations makes it difficult for UK-wide employers to engage with the programme. We would encourage the devolved nations to align policy on apprenticeships.

In England, we believe this will be clarified through the establishment of the National Apprenticeships Service (NAS) as set out in *World Class Apprenticeships* which will take on end to end responsibility for delivery of the apprenticeship programme. We are also concerned about fragmentation of the skills system and the lack of a clear fit for apprenticeships in the structure. The NAS should be part of the Learning and Skills Council and the new Skills Funding Agency, and be closely aligned to Train to Gain. The proposed regional staff of the NAS must work closely with the Sector Skills Councils to ensure that all engagement with employers provides a consistent message that is industry specific and takes into account all relevant previous dialogue.

World Class Apprenticeships proposed a series of steps along these lines. In future all vocational qualifications will be included in the new Qualifications and Credit Framework, which will register qualifications and units by size content and level. Learning that is part of

an Apprenticeship will be readily identifiable on the national database, meaning that anyone will be able to see at a glance what learning counts towards an Apprenticeship – and how that relates to the ends of a particular sector. *World Class Apprenticeships* proposed the creation of the National Apprenticeships Service with end-to-end responsibility for the Apprenticeship programme, including ultimate accountability for the national delivery of targets. Initially this will be a distinct service within the LSC. In the longer term, following the Machinery of Government changes set out in *Raising Expectations, Enabling the System to Deliver*, the NAS will be a discreet service, with a Director reporting to the Prime Minister on progress against targets. The NAS will be housed within the new Skills Funding Agency, to reflect the programme's key role in the skills system, and DIUS' responsibility for its development.

Employers frequently raise concerns regarding the time taken to achieve a return on investment (ROI) for apprentices. The current funding structures make any ROI achieved during the apprenticeship programme slow and consequently apprenticeships are an unaffordable training option for some employers, especially SMEs. Whilst the sector on the whole recognises that Apprenticeships are a longer term investment into the future of a business, the ROI must be expedited in order to engage increasing number of employers and boost the supply of apprenticeship places. We would strongly encourage the current government to consider implementing changes to the funding systems as proposed by the Conservative Green Paper "Building Skills, Transforming Lives, a Training and Apprenticeships Revolution"

Finally, there needs to be a clear equality strategy with high-level political ownership. Levers to promote equality in apprenticeships, eg through the use of public procurement and targets for Sector Skills Agreements, should also be implemented.

5.8 Lead Times – Training and Experience

As we mentioned in the introduction, the lead times to produce competent workers are long. Completion of an apprenticeship or graduate programme is a measure of skills and training but competence comes from experience and know-how, gained on the job. Some special competencies - high-voltage cable jointing is a good example - are achieved only after years of practice and have resisted attempts to reduce them to "book learning". Employers generally believe 2-4 years of work experience after training is necessary to achieve an adequate level of competence, occasionally it is longer.

This means that the lead time to competence is long, up to 8 years for a school leaver entering an apprenticeship, perhaps even longer for a school leaver going to university. In some cases there is not enough time before retirement takes its toll and competence will have to be achieved more quickly. One approach could involve fast-tracking the training and experience process, another would be to convert mature workers from other industries, who already have a body of training and experience they can build on. Both approaches feature in our strategic plans.

5.9 Diversity

Overall, the energy sector workforce in the UK is overwhelmingly white and male. Where women are employed, it is often in stereotypically female roles, such as secretaries and office workers. Ethnic minorities are under-represented.

In some measure, this is a legacy from the past. Some jobs in the energy sector were embargoed to women by custom or legislation when most of today's workers were recruited. Moreover, the proportion of immigrants in the population was much smaller. The workforce is, therefore, representative of the 1970s, when many were recruited. Geographically remote centres of activity, for example around Sellafield, also mirror the narrow diversity in the local population.

The under-representation of women and minority workers mirrors a wider pattern of occupational segregation in science, engineering and technology industries generally. This appears to be particularly severe in parts of the engineering and energy sectors. Attracting a more diverse entry is the first step to improving diversity but, it will be also important to have policies and a programme of action to retain workers and ensure all have opportunities for progression in a more diverse workforce.

The industry has made some progress on diversity but this is patchy. In 2007 Energy & Utility Skills carried out a best practise review of diversity in its sector footprint comparing activities with "best practice" companies In the UK[28]. The key findings were that, while there was a great deal of good practice in the sector in terms of workforce equality policies and practices, there was very little evidence of minorities wishing to engage with the energy and utility sector. This suggests that the sector needs to find more imaginative and effective ways of addressing the issue.

For apprenticeships, in particular, white male applicants still predominate. Women are better represented in professional roles. More progress is essential. With a shortage of young people, females and minorities represent over half the potential recruits in the entry cohort. A programme to reach out and attract a more diverse entry is a key component of our strategy for the sector. We believe that adult entry is also an important route to increasing diversity, especially for females returning to work.

A significant problem in many industries is not the lack of applicants, but the lack of employer placements. Young people can often secure training places in colleges but can have real difficulties obtaining employment. Reaching out can only work if it is linked to actual jobs to be filled. Employer-led initiatives to develop quality apprenticeships have a key role to play in addressing the diversity challenge at the heart of the energy skills agenda.

The Government has recognised this, and is committed to addressing the under representation of women in SET in employment, education and policymaking. In 2003, it published *A Strategy for Women in Science, Engineering and Technology***,** aimed equally at academia, industry and public service, to tackle this issue. As a part of the Strategy, a commitment was made to setting up a resource centre for women to provide a strategic focus for initiatives and measures to improve the position of women in SET employment and education.

As a consequence, the UK Resource Centre for Women in SET (UKRC) was set up in 2004. It works with British business to help maximise the opportunities for professional women in SET. The Centre works with women returners through providing support such as mentoring and training, and with employers to try to change the culture of the workplace. The UKRC also works with SET businesses to help recruit and retain women with SET

[28] http://www.euskills.co.uk/download.php?id=591

expertise, playing a key role to help close the skills gap that is damaging UK competitiveness.

Government is also working to get girls involved in related sectors, for example through the WISE (Women into Science, Engineering and Construction) campaign, which collaborates with a industry and education to encourage UK girls of school age to value and pursue STEM or construction related courses in school or college, and move on into related careers.

In all this, we should not forget that the lack of diversity is an opportunity. The energy sector has traditionally recruited from less than half the population. With the opening up of all jobs to all applicants, its recruitment base has widened greatly. Put simply, although the numbers of young people has fallen by around 25% since the 1970s, today's entry cohort, including women and minorities, is around 70% larger. In the UK, only around 25% of women with Science, Technology, Engineering and Maths (STEM) qualifications work in a STEM job. That leaves around 350,000 women with STEM qualifications who are not working in STEM jobs. There is scope, we feel, to improve the energy sector's engagement with UKRC to help improve its attractiveness to women.

5.10 Regulation and Collective Action on Skills

Privatisation of the former nationalised monopolies was intended, primarily, to create competition and increase choice for consumers. Thus electricity, for example, is generated by a diverse range of companies, while customers can chose to buy their electricity from several retail suppliers. But, within this system, there remain natural monopolies – the transmission and distribution systems that connect supplier to customer. The companies that operate these systems are subject to economic regulation by the Energy Regulator, Ofgem[29], in which their costs, prices and investment levels are set at a 5-yearly Price Control Reviews[30] (PCR).

Economic regulation therefore has a strong influence on skills strategy and investment in both the gas and electricity transmission and distribution sectors. Employers feel that the five year regulatory cycle incentivises management to focus on a shorter time horizon than is appropriate for skills development, given the lengthy lead times from recruitment to achieving competence. This has an effect on the whole supply chain, not just the regulated companies themselves.

Until recently, the PCR process has taken little account of skills, the rational being that this is a normal business activity and special provision is unnecessary. However, the skills legacy from the past is running out and investment in new skills is essential. With the recent PCR for gas distribution, evidence of workforce ageing, skills shortages and increasing loss of staff in future years, led Ofgem to allow £80 million for training new workers. While this is very welcome, the very nature of the PCR process, with its five-year cycling of investment, still makes it hard for employers to plan over the longer term that is necessary for effective skills development. Thus the short term planning horizon inhibits the network operators' flexibility to tackle skills strategically. In addition the process does not take account of the supply chain and, so, is blind to key areas of the resource base where, we believe, serious problems could develop.

[29] http://www.ofgem.gov.uk/Pages/OfgemHome.aspx
[30] http://www.ofgem.gov.uk/Networks/Pages/Ntwrks.aspx

The trade unions express another concern – along with the Energy Networks Association - about the recent increase in accidents and fatalities within the networks. They question if, with the squeeze on cost and training generally, health and safety training has been reduced; while pressure to reduce interruptions to customer supplies has increased the need to work on live systems. It is too early to say if the accident rate is a sustained change or a statistical blip; the long term direction for accidents is downwards. Ofgem has a duty to take account of health and safety but, unlike other regulators such as rail and civil aviation, it is not a statutory safety regulator.

Ofgem have recently announced plans to review the 20-year old regime governing the regulation of the gas and electricity networks. The two-year review will examine whether the current approach will continue to deliver customers reliable, well-run networks with good service at reasonable prices amid the growing investment challenges faced by the energy networks in the future.

The current regulatory focus is on facilitating competition, it is now important to shift the emphasis more to sustainability. The review needs to consider how it is possible to provide greater continuity in regulatory funding to:

- avoid peaks and troughs in workload
- incentivise long term investment in skills

It is important to note that utility companies are not asking for direct subsidy or explicit allowances for training programmes, but it is necessary for the regulatory framework to recognise that investment in long-term skills is vital and has to be done well in advance of need. There is, rightly, an increasing acceptance of the need for capital investment in the industry, but training and skills are an opex cost that necessarily must run ahead of capex by several years if the expertise is to be available when needed. This means that opex spend on training and development may need to be made in an earlier PCR period. Indeed, the lead time to competence in the electricity distribution networks is around 8 years, which means that skills development for PCR Round 7 should start in the forthcoming Round 5. Currently there is no mechanism to accommodate this need.

Developing skills within any industry is long term commitment. Support through legislation or regulatory direction is essential to allow the industries to invest in long term sustained recruitment across the whole sector. The skill level required coupled with the additional experiential need to deliver a competent workforce is something that will take several regulatory periods to deliver and consistency of approach throughout is essential.

Regulation impacts in other ways, especially where safety and competence are concerned. The engineering construction industry, for example, is subject to a statutory levy to support training. The Government's Leitch implementation plan *World Class Skills* has proposals to enable SSCs to develop collective action by employers including:

- Streamlining the current training levy arrangements
- Reviewing and coordinating license to practice arrangements
- Developing the use of skills passports

The UK Commission for Employment and Skills is now taking these recommendations forward via a consultation on collective measures to increase employer investment.[31]

5.11 Social Inclusion – Training for High Skill Jobs in Safe Industries

The energy sector workforce is, mostly, well skilled. Few have qualifications below Level 2 and many are at Level 3 or above. The future trend is towards increasing numbers qualified to Level 4 and above. Even so, the energy sector has significant potential to recruit and train people from the long-term unemployed and other disadvantaged groups, including ex offenders.

However, many energy sector jobs (in the nuclear industry or electricity supply sector, for example) are highly regulated by legislation or established practice. This is for good reason; many sites are hazardous and pose risks to both workers and others in the area. Many other sites require skill and understanding if plant and equipment is to be operated reliably. Thus the energy sector must train its people to ensure they are competent and safe before they are allowed to work, even under supervision. This has made it difficult for the industry to engage with Government's welfare to work programmes, which aim to put people into work before they are trained and are, therefore, not well suited to the reality of the energy workplace. Nevertheless, the pilot scheme *Ambition Energy*, described in the box, has shown just how effective the energy sector can be at creating quality employment for the disadvantaged.

Work Skills, published in June 2008[32], set out the vital role that skills play in the welfare system. When someone is on benefit, Jobcentre Plus will automatically check whether a discussion about how to improve their skills is relevant, and will signpost people to the support on offer, or make the appropriate appointment with the adult advancement and careers service for those needing extra help. If necessary, an adviser at the service will then undertake a full face to face skills health check and design a personal action plan setting out the training and wider support the individual needs to get them into sustained employment. In addition, *Work Skills* also stated that it is not acceptable that a lack of skills should prevent someone claiming Jobseekers Allowance from getting sustainable employment. The Government will seek to take legislative powers to require JSA customers to address their skills needs as part of the conditions of receiving benefits. From autumn 2008 this will include testing requiring jobseekers to attend a full skills health check where the screening has identified a need. Where a need for training is identified, attendance at an appropriate course will also be required.

Work Skills also set out how Government can work with employers to help people get back to work through Local Employment Partnerships. In return for signing up to a Local Employment Partnership with Jobcentre Plus, employers will receive tailored support for their recruitment needs, and we will work with local colleges and training providers to develop the skills of local people who are looking for employment, to ensure that there's a pool of job-ready candidates from the local area who have the core skills they need to fill vacancies.

[31] http://www.ukces.org.uk/collectivemeasures
[32] http://publications.dius.gov.uk/workskills/

Ambition Energy – Training the Disadvantaged

The energy sector needs to recruit significant numbers of people and is offering long-term careers to replace those due for retirement. Traditional methods of recruitment are now being supplemented by the recruitment of skilled apprentices and migrant workers from outside the UK.

However, as demonstrated by the *Ambition Energy* programme, there are opportunities to support the social inclusion agenda by recruiting the long term unemployed.

Ambition Energy was a 3-year pilot scheme aimed at training and developing the disadvantaged, mainly the long-term unemployed and those losing their jobs in major redundancies, for jobs in the energy sector. Primarily, although not exclusively, candidates were trained to become gas installers.

The scheme took a holistic approach, selecting candidates with the attributes and attitude to succeed, pre-training in life and workplace skills and training with employers to attain qualifications and, in the case of gas installers, CORGI registration. Over a 3 year period, in excess of 2500 candidates were trained and 81% set up in full-time, sustainable employment, a high success rate for such schemes. Outcomes for those trained for jobs other than gas fitters are given in Table 2.

Ambition:Energy Performance Summary - Jan 2007	**Starters**	**Completers**	**Qual'ns achieved**	**Completers %**	**Job Entries**	**Retentions (Ambition def'n)**	**Ret'n as % of Ambition Jobs (Target 70%)**
Gas Meter Exchange (2 courses delivered via EU Skills contracts)	32	24	16	75.0%	12	9	**75.0%**
Gas Network Operative (60 courses delivered via EU Skills contracts)	780	583	576	74.7%	554	458	**82.7%**
Electrical Overhead Lines (2 courses delivered via EU Skills contracts)	22	13	13	59.1%	13	11	**84.6%**
Pipefitter (2 courses delivered via ECITB contract)	24	21	N/K	87.5%	19	10	**52.6%**
Steel Erector (2 courses delivered via ECITB contract)	20	17	N/K	85.0%	17	10	**58.8%**
Totals All Programmes	**878**	**658**	**605**	74.9%	**615**	**498**	**81.0%**

Outcomes of Ambition Energy

However, despite its success, and positive return to the taxpayer, it was not possible to continue the scheme once the pilot had come to an end. Its completion coincided with a changing role for Job Centre Plus (JCP) and a move towards training being organised through the LSC and the project could not be continued. It is still possible to run individual programmes, relying on the initiative and entrepreneurial spirit of local champions, but by their very nature they would be ad-hoc and not deliver successes on the scale achieved by the *Ambition* programme.

Also *Ambition Energy* was focused on a high employment success rate for jobs that require significant levels of training. Consequently, it did not fit the standard training models because:-

- It was demand led - a programme was not planned until there were enough employers involved.
- It covered more than technical skills - life skills training and mentoring were involved (and a significant period of on-the-job training with employers).
- It required detailed project management to overcome the people, company and institutional difficulties that arise with this group of candidates.
- For safety reasons, the jobs required significant training and competence before people can be allowed in the workplace.
- Employment came at the end of the programme - when the candidates had proven their competence and employers had worked with them and seen them develop.
- It was a national initiative that could be offered wherever there was adequate demand.

Critics of *Ambition Energy* have argued that this route is too costly. Although this type of technical training is expensive, when compared to traditional job preparation training, the very high level of success and long term retention resulted in payback periods to Government of around 55 weeks (joint JCP/EU SKILLS analysis only using direct costs). Moreover, the jobs filled are generally permanent and the skills are in demand, so the risk of a candidate returning to benefit dependency is low.

Ambition Energy not only tackled long-term unemployment and the subsequent child poverty issues, but it also supported the recruitment to the sector of more mature workers to help flatten the age profile.

For the future, it is clear that the energy sector cannot meet all its skills needs from the conventional route of young people entering work. There is considerable potential to train and employ the disadvantaged and therefore help meet the Government's social targets. Since *Ambition Energy*, we have already had notable success with a pilot to train young offenders. We believe that the essence of *Ambition Energy* can be achieved with a greater employer contribution and lower cost to the taxpayer, provided that employers are willing to contribute towards employment costs prior to qualification and the Government input is sufficiently flexible.

Training Support from the Trade Unions - Union Learning Reps

Trade unions play an important role in the skills agenda. They are key members of the SSC and Academy boards and work closely with employers to develop skills and training strategies. Many also provide support of various kinds to their members on training programmes.

Trade unions are highly pro-active in skills development. For example, in addressing the widely diverse range of new and emerging skills required in the energy sector and in gaining direct access to individual workers, workplace Union Learning Representatives (ULRs) have an important role to play. They are ideally placed to facilitate the acquisition of new skills in the industry.

Currently in England, more than 20 000 ULRs have been trained to provide information and advice about learning or training to their colleagues. Many have also have been trained to access learning provision and/or funding, to support or mentor members engaged in learning or training, to run workplace learning centres or even to act as tutors or NVQ assessors. Over 200 000 employers have been helped to access learning or training over the past year. ULRs have statutory rights to reasonable time off and facilities to perform their duties, and the extent of their influence at the workplace is usually only limited by their employers' interpretation of reasonableness. In many workplaces, the rights of ULRs to support learning and the rights individuals to access learning programmes are set out in a Learning Agreement between management and unions.

5.12 Research and Planning

Understanding and modelling the skills situation, so that effective recruitment and training plans can be developed, is a key challenge for the sector skills bodies. There are several areas of uncertainty. The first is the lack of comprehensive information. Since the demise of the nationalised employers, many companies have treated skills as a commodity to be acquired from the labour market and have paid limited attention to training. This had led to a gap in the data, which employers have only started to address in recent times.

The second uncertainty is retirement; many workers have pension arrangements that allow them to retire at 60, whereas recent changes to retirement and age discrimination legislation allow them to retire flexibly. Thus we do not know when workers will leave and, because the changes are recent, there is no body of historical data on which we can build a model.

The retirement issue is compounded by the nature of the work. Some work is physically demanding, transmission lines being an obvious example, and older workers often leave the front line for supervisory or support roles. In theory, there should be data on which this can be modelled, but fragmentation of the industry means that consistent and complete data to determine the national picture is lacking. Moreover, the changing industrial structure and labour market has reduced the training activity of some employers, which also leads to incomplete data on skills.

At the national level, most labour market information is collected and classified in terms of Standard Industrial Classification (SIC) and Standard Occupational Classification (SOC)

codes[33,34]. These are specified by international agreement so that information can be correlated from country to country. We have found SIC and SOC codes to be unhelpful in the energy sector. They do not map to occupations that actually exist and, because changing them is a very slow process, they are always lagging behind the evolution of job roles. In general, therefore, we have had to devise our own classifications and methodology for the research we have undertaken and the information that underpins this report.

Another challenge is the emergence of skills gaps as new technologies and procedures are introduced that are unfamiliar to the current workforce. These are not always easy to measure as recording of skills and competencies is imperfect, at best. Moreover, the older workforce has a range of older qualifications that do not always match the modern framework. The accurate recording of skills and competences is crucial because it allows the workforce to be deployed more efficiently and allows individuals more employment opportunities.

[33] http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14012&Pos=1&ColRank=1&Rank=240
[34] http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=6460&Pos=4&ColRank=1&Rank=240

Measuring the Level of Skill

Measuring skills is a complex subject that needs to take account of both formal qualifications and the attributes of the job. Further complication is added because more than one system is in use. Indeed, 3 systems are in use in England and Scotland uses a system of its own.

When describing skills levels in this report, we are using the National Vocational Qualification (NVQ) System, current in England and Wales [see http://www.qca.org.uk/14-19/qualifications/index_nvqs.htm]. This uses 5 levels of skills, ranked by job attributes. Most authors equate skill levels to the level of formal qualifications that a worker in that job would normally have, but this leads to further complication because it is not always the case that someone doing a level 3 job has a level 3 equivalent qualification. On the other hand, many energy sector jobs are regulated by custom or statute and formal qualification or certification of competence is mandatory.

The NVQ System is:

Level	*Approximate Qualification*	*Attributes*
1		Competence that involves the application of knowledge in the performance of a range of varied work activities, most of which are routine and predictable
2	5 GCSE at Grade A-C	Competence that involves the application of knowledge in a significant range of varied work activities, performed in a variety of contexts. Some of these activities are complex or non-routine and there is some individual responsibility or autonomy. Collaboration with others, perhaps through membership of a work group or team, is often a requirement.
3	3 A-Levels at A-C	Competence that involves the application of knowledge in a broad range of varied work activities performed in a wide variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy and control or guidance of others is often required.
4	HNC, Foundation Degree, First Degree	Competence that involves the application of knowledge in a broad range of complex, technical or professional work activities performed in a variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources is often present.
5	Higher Degree, Professional Qualification	Competence that involves the application of a range of fundamental principles across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsibility for the work of others and for the allocation of substantial resources features strongly, as do personal accountabilities for analysis, diagnosis, design, planning, execution and evaluation.

6. SKILLS - WHAT DO WE NEED and HOW DO WE DEFINE THEM?

6.1 Skills Families

The limitations of the standard labour market classifications (SIC and SOC codes) has led the sector skills bodies responsible for this report to develop alternative ways of handling labour and skills data that better reflect the realities of the workplace. These all, in some way, involve skills families; that is groupings of skills around core competencies, where there are large common elements in training, workforce development and employment. The nuclear sector is well advanced in this approach, having re-classified a thousand or so individual jobs into 96 groups. In turn it is intended to further combine these into just 10 or so skills families.

This approach provides a powerful tool but, as different sectors have developed different schemes, combining the data is difficult. This report will therefore take a broader approach using the STEM classification from the education sector plus an additional category for administration and business practice:

- Science
- Technology
- Engineering
- Mathematics
- Business & Administration

Using this approach, it is possible to look across the sector and include, where necessary, the manufacturers and service providers that are often omitted in energy sector labour research.

6.2 Science

While scientists support the energy sector in their traditional roles in research and development, they are also employed to support on-going operations, in which they have critical functions to carry out. Almost all science disciplines are found in the energy sector, from geologists in the extractive industries to particle physicists in nuclear. The increasing role of new energy technologies and the growing importance of the environment are creating demand for non-traditional subjects, such as the environmental and bio-sciences.

We are greatly concerned about the underlying supply of science-trained school leavers and the numbers reading science at university. For university courses, a high proportion of foreign students, who are unlikely to contribute to the UK economy over the long term, can be symptomatic of a shortfall of UK applicants. Moreover, the way combined degrees are counted can give rise to apparent changes in student numbers that are not real. The Royal Society[35] has expressed serious concern about the UK's ability to maintain its position in research and development. We agree with this view and add that the on-going operation of industrial process, including energy production, together with the development and introduction of low-carbon technologies, risk being compromised by a shortage of science graduates.

[35] Royal Society, State of the Nation Report 2007. http://royalsociety.org/displaypagedoc.asp?id=28496

We welcome Government action in this area. DIUS is leading a study, in collaboration with BERR, DCSF and the Prime Minister's Strategy Unit, to analyse the demand for STEM skills from all employers with a view to improve our understanding of prospective employer and research base needs for STEM graduates. Key Stakeholders such as Research Councils, CBI, EEF, BCB and others including SSCs will be involved in gathering evidence and interpreting its findings. The report will be produced in October 2008.

DIUS have also asked two Vice-Chancellors to provide a report to the Secretary of State on what role universities can play in strengthening the STEM offer in schools and colleges. They are due to report in September 2008.

When it is introduced into schools, we believe the Science Diploma will have much to offer. We discuss the teaching of science and maths in schools in more detail in the section on engineering below.

6.3 Technology

By technology, we mean the craft and technology workforce that is qualified from Level 2 to Level 4 and usually trained via apprenticeships. This is the hands-on workforce that builds, operates and maintains the energy infrastructure.

Where apprenticeship schemes exist, employers report few problems attracting applicants and filling places, albeit that applications from women and minorities tend to be under represented. However, wastage rates can be high. Some recruits lack the commitment and work ethic needed to complete the course but other forces are also in play and the reasons for wastage are complex. Where individual employers do report difficulties attracting applicants, this can be in areas where other employment is available in, for example, call centres, and young people opt for the immediate attraction of a higher wage in an office environment.

The main challenge in raising the number of apprentices is probably not recruitment but training capacity. Classroom teaching can be expanded most easily, although some employers are concerned that experienced workers could be taken off the job to bolster the teaching staff. There are greater constraints outside the classroom; especially with on-the-job training because diverting skilled workers from the task in hand to mentor trainees inevitably impacts on productivity. Moreover, employers do not always value time spent training, especially where remuneration is based on output measures. Conventional wisdom places 1 trainee with every 12 -15 experienced workers and this limits the places available. One employer is experimenting with a ratio of 1:7, but it is too early to say if this will be successful.

On the job training can be further constrained by facilities, for example limited bed space on offshore rigs. Here, employers and rig owners need to balance the short-term difficulties against the growing need for new trained workers.

6.4 Engineering

We have mentioned the age-profile for chartered engineers in the UK. Essentially, the concerns are exactly the same as for scientists – the numbers of science trained school levers and falling undergraduate enrolment in key subjects. Statistics on engineering in higher education can hide a switch in emphasis, for example to information technology at

the expense of electrical engineering or to environmental engineering at the expense of mining engineering. Again, high levels of foreign students can sometimes reflect a shortage of UK applicants.

When it comes to attracting recruits, engineering suffers from lower status in the UK than other professions and the perception of lower pay (although evidence for the latter can be hard to substantiate). There is also a perception of job insecurity, driven by high-publicity redundancies. In the week that this part of the report was drafted, BP's announcement of 5000 job losses was widely reported. That engineers usually find other jobs quickly is not news and does not get equal publicity.

When questioned, major employers who recruit engineering graduates in significant numbers often report that they can fill about 2/3 of their vacancies with UK graduates but that the quality of applicants falls off thereafter. The multi-nationals fill the remaining quota with recruits from overseas, especially from India, where high-quality, English-speaking graduates from prestigious schools are readily available, and from countries where they have operations. Whether this is sustainable strategy, we cannot say, but we expect increasing competition for Indian graduates from the rest of the developed world and from growth in the Indian economy. Also, there will be a point at which supplier nations object to their talent being creamed off.

We believe that the visibility of engineering to young people is a crucial issue. In the 1960s and 70s, engineering had produced, for example, nuclear power, the jet airliner, computers, mass produced antibiotics, space flight and infrastructure projects that were wonders of the age. Engineering was then highly visible, the changes that it made to peoples' lives were tangible and it was celebrated by Governments, famously as the "White Heat of Technology". Today engineering continues to deliver innovation at an ever increasing pace but this is often embedded and hidden from view. Moreover, issues such as carbon emissions and pollution are damaging the reputation of engineering in the public eye. Perhaps also, after 200 years of unprecedented technological development, we have lost our sense of wonder.

It is vital therefore that engineering stops being taken for granted and becomes, once more, a career of choice. We believe that the Engineering Diploma, due to be launched in secondary education this September, is a major opportunity to raise the profile of engineering, to give young people an opportunity to see for themselves what engineering is about and to provide a structured route of entry into work, apprenticeships and university.

We welcome that, through the Government's STEM programme, teachers will have access to STEM directories – managed by the Royal Academy of Engineering. The Engineering directory will give teachers access to a co-ordinated stream of curriculum enrichment and enhancement activities. More than 60% of Science and Engineering Ambassadors are from the engineering professions, thus raising awareness of potential careers in the engineering fields.

Finally, in this section, we will comment on the role of the professional institutions. To maintain the standard as the subject becomes more complex, some now insist on a 4-year M Eng degree as the entry-level qualification for obtaining Chartered Engineer status. This can imply a devaluing the B Eng degree, whose students have less chance of becoming chartered, while increasing the costs to the student. Recent pressure to introduce 4-year

taught MSc degrees in science has similar implications. Committed students, who want to do engineering and nothing else, will take the Masters course. The undecided have the option of a three-year degree leading to a job a year earlier and a year's less student debt.

As with apprentices, young people are price and cost sensitive. We cannot quantify the deterrent effect of 4-year courses where tuition fees are charged, but it must be there. Scotland, with its different approach to tuition fees and its universal 4-year degree, might see a difference, but it is too early to see if this will boost engineering.

Our view of the overall system, from apprentice training to higher education, aligns with Government policy, in that we want to see open-ended progression, regardless of the point of entry, so that everybody can achieve their potential. It was possible to rise from shipyard apprentice to chartered engineer and managing director in the 1950s, it should be the same today.

At the time or writing, the Innovation, Universities and Skills Select Committee is holding an enquiry into engineering skills. All parties to this report have submitted evidence.

Construct your life: Engineer your future
Schools Outreach Roadshow

As part of a strategy to raise awareness of engineering and construction career opportunities, the ECITB delivered an innovative theatre based Roadshow to Year 9 and 10 students in England and Wales and S2 and S3 students in Scotland during an 18 week tour in 2007, following a successful pilot in 2006.

The approach was designed to overcome the misconceptions of engineering and construction as being "dirty, low paid, unsuitable for women and low skilled". Drama and comedy sketches were used to demonstrate the diversity of career and development opportunities that are genuinely open to all. A high level of interaction with the students had direct impact on their stereotypical perceptions.

30,000 young people were reached through 200 performances, in 145 schools, a Young Offenders Institution and performances at the Metro Arena Newcastle and at the Welding Institute Annual Conference.

In parallel, the ECITB launched the *goengineer* website which has careers and training pathways information. Visits to the site grew dramatically following the performances with more than 380,000 total hits between September 2007 and January 2008.

www.goengineer.co.uk

Surveying of students before and after the Roadshow events, showed that initially more than two thirds did not consider themselves to be aware of the variety of careers in engineering construction. Afterwards, there was a significant positive change in perception to careers in engineering from male students and an even bigger positive shift amongst female students.

6.5 Mathematics

Maths underpins all science and technology. A good grounding and competence in arithmetic is a pre-requisite for an apprenticeship, while more advanced maths is essential for the study of science and engineering. It is axiomatic that a failure to acquire competence in maths rules out a career in science and engineering. Therefore maths teaching in school is a critical foundation for the energy sector.

Graduate mathematicians and statisticians are employed directly in the energy sector because their skills are essential to the complex technical and business systems now in operation.

6.6 Management, Leadership, Business and Administration

The energy sector has changed considerably over the last 20 years and the utilities, electricity and gas, have evolved from public-sector monopolies to competing, private-sector companies. It has needed new business and administration skills to make this transition.

Analysis of skills gaps shows an increasing need for management, leadership and supervision skills, especially for project based working. Project management and its associated activities, such as planning, scheduling and front-line supervision is an area where the UK has world-class strength but limited depth. Far more workers need to be given these skills if the UK is to deliver its own investment efficiently.

We believe that demand for new business and administration skills will continue as technical change speeds up. Indeed, this change may not be possible without new business models. One example is micro-energy technology in the domestic environment. No matter how much mass production brings down the price, it will remain expensive compared to a gas boiler. Even in the developed world, those who are poor or retired will not be able to afford the capital cost, without a large grant support. The mass introduction of these technologies may require a new business approach that insulates the customer from the up-front capital cost. In our view, this could lead to the energy companies becoming service providers – supplying warm rooms and hot water rather than gas – but running such a business will require skills that the sector does not have today.

6.7 Cross-Cutting Skills

This subject rarely gets headline attention as an energy skills issue but, for completeness, we point out that the 3 Rs and skills such as IT competence, team working, management, leadership and customer service are required across the workforce.

Prospect pilot with the Open University and British Nuclear Group

Prospect union has been working with the Open University and *Unionlearn* to promote the offer of short courses to workers in two BNG sites; Sellafield and Risley. The Sellafield site has over 10,000 employees and there are 50 Union Learning Reps (ULRs) who support colleagues in a wide range of learning activities and assist the running of a large workplace learning centre that has helped over 1,000 employees to date. Risley is a research facility and a large proportion of the staff there already have higher-level qualifications. However, the ULRs there were also keen to promote the Open University.

The ULR Higher Education Champion at Sellafield

Val Marshall is a ULR who has developed part of her role to become an HE Champion. She comments, “I trained as a union learning rep for my union Prospect in 2006. Then I volunteered as an *Aim Higher* champion on the Sellafield site. I have encouraged union members to sign up to the Open University Courses”. She has helped 20 learners take up OU courses as part of the Trade Union *Aim Higher* project.

Val has worked with the other ULRs, the OU and *Unionlearn* to set up the Union Learning Club at Sellafield for the OU *Aim Higher* learners. The club offers additional support in the workplace for learners taking OU courses as well as networking opportunities for those who have enrolled on them. She added that her role as HE Champion involved the following: “I explained the OU ‘offer’ to learners and the discount for union members. I tell them that they can try a ‘taste’ of the OU and its methods prior to taking the plunge on a half or full unit. I also advise learners on what might be useful to them for their own personal interest or development. The learner’s successful completion of their courses and their plans to progress is testimony to their dedication and motivation to learn. It shows how unions in partnership with the Open University and *Aim Higher* can open windows of opportunity for union learners.”

7 MYTHS AND FACTS

7.1 Recruit or Train?

Most employers express the view that skills shortages and gaps are becoming a key challenge. Some describe it as a crisis. However, further questioning often reveals that the immediate concern is about the lack of trained and experienced people in the recruitment pool and the upward pressure on wages caused by staff churn. Few say they have difficulties with recruiting apprentices or graduates, although drop out from apprenticeships is sometimes high. When pressed, however, employers who recruit significant numbers often report that the applicant pool lacks quality in depth. Recent experience suggests that specific disciplines, such as civil engineering graduates, are in serious short supply.

The main problem, therefore, is the failure of employers a decade ago to foresee and take action to address the need for experienced workers today. However, in their defence, we should not forget that the business climate was poor, with low oil prices and reduced investment across the energy sector. Many employers were not in a position to recruit and train, while the education sector saw a declining market for some STEM subjects.

Employers today are faced with the challenge of replacing a skilled workforce in a relatively short time, over a period when natural wastage will rise by 100-200%, while making provision for a major increase in capital investment. With massive competition for essentially the same people, there are concerns that the stock of potential recruits (school leavers and graduates) will be too small. Thus adequate numbers studying STEM subjects at school and university is an imperative. But this is only half the story, recruits need to be trained and this means increasing training capacity including more trainers and more places for the work-based elements of training.

The turnover of the workforce creates a need for succession planning and the development of knowledge archives, where know-how can be preserved for the next generation. In our view, employers are not giving this sufficient attention.

7.2 STEM in Universities

The STEM data show overall graduate numbers are steady or increasing. However, this may disguise a miss-match in the supply and demand of individual subjects. Forensic science graduates, for example, outnumber the job places available, while physics and some engineering subjects continue to be in short supply. In the energy sector, the replacement demand will rise as retirement takes its toll and it is not clear if sufficient graduates will be available from the UK’s universities. Therefore, we believe a significant increase in STEM education is essential.

Another concern over higher education in particular is the potential for course content to be poorly matched to the needs of the workplace. The professional bodies play a key role here and their imperative to protect the standards of the degrees are fully understood. Nevertheless, the nature of work is changing, cross-discipline skills are increasingly needed and greater employer leadership for HE is essential to ensure that the courses are well matched to the demands of the workplace.

We are uncertain whether the recruitment requirements which employers place upon graduates can influence student choices when making decisions about degree

disciplines. Most employers stipulate a 2:1 degree as part of entry criteria, regardless of subject. There is a perception among some students that engineering is ‘hard’ and this may lead to their selecting an easier subject in the belief that it will increase their chance of attaining a good degree and therefore improve their likelihood of securing a place on an employer’s graduate programme. While evidence for this will take some time to develop, the situation needs to be monitored to see if, in conjunction with a poor perception of the roles on offer at the end of a degree, this factor can act as a deterrent to prospective undergraduates.

The existing education system is adequately funded, but significant resource is directed on non-critical (at this moment in time) occupations. This relates to the above point and is indicative that access to these courses is not differentiated from strategically important subjects, including STEM. In our view, we should be funding individuals on to STEM courses at FE / HE and vocational level.

In this respect, the additional but time-limited funding from HEFCE of £75m to support the high costs of some science subjects, including chemistry, physics, chemical engineering, metallurgy, minerals, and materials engineering is applauded and we would like to see it consolidated as core funding across these subjects..

7.3 No Wrong Door for School Leavers

Schools, rightly, promote university to their pupils and pride themselves on the numbers of students who move on to higher education. Indeed, school funding and standing reinforce this approach. However, this is not the only route into employment in the energy sector or, indeed, to a degree. Other entry routes, and their potential for those who take them, are less well promoted. Simplification of the qualification and progression structure to enable people to achieve their potential is critical and the opportunities need to be better articulated through career advice. This means also that significant changes in school culture are needed to encourage young people in to sector. Teachers / careers advisors need to give guidance on both academic and vocational routes into work with equal vigor. There is no wrong door!

7.4 In-Work Training

It is in work placement that capacity limits are most apparent. Trainees in the workplace necessarily divert skilled workers away from the job. This can be accommodated to a certain extent before productivity is affected and the costs of the job begin to rise. The prevalence of piece work in some areas and the failure of employers to recognise and reward time spent on training also impact negatively.

A major development over the last 20 years is the fragmentation of the energy sector and its employers. This un-bundling of the value chain is seen as a positive step by economists and there have, undoubtedly, been benefits. However, it has not all been positive. The major organisations that provided the critical mass of training in the past are no longer with us. Smaller employers find it difficult to deal with skills strategically and hard to collaborate with others without someone facilitating. Profitability in the supply chain has sometimes been low, reducing investment in skills. National Skills Academies are key instruments in joining up the employer base to tackle skills strategically.

7.5 Globalisation

We believe that power sector projects will increasingly be delivered by a globalised supply chain and workforce, in much the same way that oil and gas projects are delivered today. This presents both challenges and opportunities. Skilled UK workers will be attracted to jobs overseas, while foreign workers will seek to work in the UK. It is probable that specialised activities, such as installation and commissioning services, and some specific skills, will be delivered on a worldwide basis. When these services are needed in the UK, Government will need to ensure that the work permit and immigration process is supportive and the sector skills networks, with the safety regulators, will need to ensure that competence and quality are maintained.

Globalisation is also a major opportunity for the UK. We may not have the manufacturing capacity that we had in the past, but we can build on our world-leading position as a supplier of services to the energy sector. To this end, training for high added-value activities will be essential to position the UK ahead of the competition.

7.6 Standards, Safety and Passports

Setting standards for course content and competence are key to an effective skills strategy. Important also, is to record the training and capability of individuals to facilitate re-deployment from job to job and to help identify and tackle skills gaps. Passports are a critical element of this process.

It is important that there is a common underpinning to this process and that different, incompatible, schemes do not proliferate. We do not want individuals and employers to have to qualify for, and pay for, different passports for each sector. We have already had issues with the safety passport for gas installers not being accepted on construction sites; fortunately now resolved. Moreover, it will be necessary to re-deploy skilled workers from decommissioning to operations in nuclear and from mainstream energy to renewables. Standards and passports should support, not hinder, this process.

7.7 Agency Workers

Agency workers are employed across the energy sector. In the main, these are well-skilled or professional people, usually employed on a contract to provide specialised expertise.

There is concern among employees and trade unions that agency workers are abused and this can be the case in the low-skill, low-wage spectrum of the agency market. In the energy sector, we have not come across agency workers being employed on lower wages, or on poorer terms and conditions. A quick poll of employers during the writing of this report found that employers often resort to agency workers when they cannot recruit the skills they need, when they cannot develop their own people quickly enough or when they have a fixed-term need for specialist skills. All employers spoken to said that their preference is to recruit permanent employees, where there is a long-term need. Permanent staff can be integrated into the business and given specific training to enhance their value. Almost always, agency workers are a more expensive option.

In some areas, such as engineering design for the oil and gas sector, agency rates are much higher than salaries and permanent employees often resign to become agency workers. This is a personal choice and a clear indication that agency work has attractions

over permanent employment. It also creates a pool of experienced agency personnel who can move around the contractors to support the variations in activity as major projects start and finish. However, this is only sustainable to a limited extent. Agency workers do not get the investment in training that is given to employees, so their skills are often not developed. Also, they can depart at short notice, taking capacity and expertise with them. Employers have a limited view of the agency workforce, so are not well sighted on developing problems and are have few means of putting them right.

The situation needs to be monitored to ensure that circumstances where agency workers can be treated less favourably do not develop. Not only would this impact on the employees, it would compromise the flexibility in the UK labour market that is a key strength in our international competitiveness.

7.8 Vocational Qualifications

The Energy Sector needs to raise its profile and focus on developing sector attractiveness to attract and retain the talent it needs for the future. Apprenticeships will form a key part of the recruitment strategy.

New vocational qualifications, such as the 14-19 Diplomas, have the potential to create career paths into the industry. On paper, these diplomas are well-matched to our requirements; however their success depends very much on how well the concept is implemented. While the support of the Government to date is recognised, a stronger role in co-ordinating the implementation is required.

Vocational qualifications still receive a lot of criticism, particularly because they are often perceived as poor relations when compared to more academic qualifications. There is, therefore, still considerable work to be undertaken, with employers, teachers, universities, parents and students, to raise the perception of vocational qualifications as being equal in status to the more academic routes.

EU Skills are running a number of young apprenticeships in both the electricity and water sector. Although in their early stages these look to have potential for attracting young people in the sector. These schemes need to be built on for the future.

The Government itself has a role to play in changing this perception and raising the profile and merits of vocational qualifications to make the transition to apprenticeships easier.

The programme of Vocational Qualification Reform set out in *World Class Skills* should ensure that vocational qualifications are targeted to employers needs. Employers through their Sector Skills Councils have a key role in ensuring that the content of qualifications reflects their needs. The new qualifications accredited to the Qualifications and Credit Framework will be unitised, ensuring that they are flexible, and adaptable to the needs of employers.

7.9 Funding Flexibility

Traditional funding mechanisms are one of the reasons why further education colleges and universities are not fully meeting the needs of the sector.

Too many educational institutions are focused on courses that are easier and more cost effective to deliver, leaving the energy sector short of training places. Further education should be more employer demand led, with funding focused on areas where there are demonstrable skills shortages or gaps.
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This situation is further exacerbated by the confusion amongst many employers in terms of funding available, how to obtaining the funding and routes to training. Moreover, for UK-wide employers, these differ across the devolved Nations.

For a significant portion of the sector, entry level qualifications are well above level 2. For this reason, despite considerable training taking place, there has been minimal Train to Gain spend in the energy sector. Train to Gain would be more effective if geared towards entry level qualifications for each sector. We welcome moves to align Train to Gain with employer demand under the sector compacts. To improve uptake, there is a need to simplify the access to funding mechanisms so that employers better understand options available.

Some of the companies in the sector already offer high standards of internal training (albeit that others do not and training capacity overall is limited). The sector therefore welcomes the pilot on 'in-house' qualifications as a means for up-skilling the workforce. It is important that vocational qualifications also meet the needs of the workforce, especially by supporting long term career progression. In the wider implementation, consideration should be given to updating other government policies and the funding mechanisms, so that they are flexible enough to support this route. Funding could focus on full job competence with the skills verified within qualifications.

7.10 Public Sector

With the key exception of nuclear, where specialists employed by the MoD are factored into our statistics, skills within Local and National Government and the devolved administrations have not been researched. Nevertheless, we hear about shortages, for example of nuclear specialists and the ageing technical skills base to support oil and gas. Energy specialism within Local Government, including the ability of planners and building control to oversee the introduction of low-carbon buildings, are areas where, anecdotally, skills are in short supply and significant extra training will be needed.

Central Government employees fall outside the footprint of the energy Sector Skills Organisations and are the responsibility of a relatively young SSC, Government Skills. Local Authority employees are not covered by a SSC at all, nor are employees of the devolved administrations.

It is clear that Government, at all levels, cannot develop and implement policy effectively if it lacks the necessary technical skills. In our view, a potential weakness is developing that Government is only beginning to recognise. For example, for sound, historical reasons, the HSE Nuclear Inspectorate generally recruit experienced personnel with sound understanding of the nuclear sector and its technology. A general shortage of these experienced personnel within the nuclear sector has made it much more difficult for HSE to recruit people with the necessary skills and experience to interrogate, for example, new nuclear designs. It is recommended that a range of options are considered for these specialist areas of Government, recognising that this may require greater resource and different approaches than used at present. For Government Skills to drill down to the

plethora of specialist skills required by Government is a major challenge. Government (at all levels) as employer should take a lead to develop a solution.

7.12 The Role of Energy, Science and Engineering in Society

The energy networks and infrastructure are critical to the effectiveness and competitiveness of the UK economy. It is in the interests of all stakeholders to address the skills issue and collaborate to bring new people into the industry, in order to maintain and enhance the “word class” performance of these Networks into the future and to ensure security of supply to consumers.

Societal understanding of engineering is very poor. Engineering is a widely-based subject and the popular view of an engineer as a mechanic does not attract high level support from the public. Increasing societal understanding of what engineering does and where engineers operate will create more interest in industry as a whole and encourage more people to consider technical careers.

Minister for Science and Innovation, Ian Pearson, proposed a new vision for science and society in the UK at an inaugural Sir Gareth Roberts Science Lecture at the Science Council on 6 November 2007, stressing his desire that the debate will lead to greater co-ordination in this area - leading to a society that is excited by science, with many more young people taking up careers in the crucial fields of science, technology, engineering and maths. The strategy seeks to establish a shared vision where the effort of everyone who is engaged in and with science contributes towards identifying and overcoming common challenges. DIUS will be launching a consultation on Science and Society strategy in summer 2008, which seeks to achieve a common vision for **‘***A society that is excited about science; values its importance to our social and economic wellbeing; feels confident in its use and supports a well-qualified scientific workforce.’* The consultation seeks to clarify the Government’s and others’ roles with a view to developing a strategy that combines the efforts of all in the scientific community and beyond.

Presentation of engineering to the general public through media sources is poor and understanding of the relationship between technological advance and the engineer’s role is limited. The Government needs to promote engineering and an understanding of its contribution to UK plc to promote a wider interest in a career in all industry.

Research has shown that for Generation Y, that is today’s 20-35 year olds, company social responsibility and the environment play a large role in their decision-making about careers. Employers need to stress their credentials in these areas.

8. OIL & GAS PRODUCTION

8.1 A Key Industry

Oil and gas is a vibrant and dynamic global industry with employment opportunities for the short, medium and long term. Today, there are approximately 30,000 people employed directly in the oil and gas companies and their major contractors in the UK. A further 260,000 are employed in the supply chain and another 190,000 in induced employment. The sector is within the remit of Cogent SSC and OPITO, the Oil and Gas Academy.

Oil and Gas extracted from the UK Continental Shelf (UKCS) provided for 70% of domestic energy demand in 2006, including 96% and 92% of oil and gas needs respectively. At peak, the UK was ranked as the twelfth largest producer overall (oil and gas combined), larger than Kuwait, Nigeria and Indonesia. Today it is estimated that the more-difficult-to-extract reserves in the UK oil and gas basin could contain as much as 25bn barrels of ultimately recoverable raw material - worth well over £1 trillion to the UK economy at recent market values.

Oil and Gas UK (OGUK) reported[36] in 2007 that:

- the UK was expected to produce approximately 3.0 million barrels of oil equivalent (55% oil; 45% gas) per day, benefiting from the activity surge of recent years;
- total annual expenditure is expected to be around £10.5 billion;
- tax revenues were forecast to be around £8 billion.

The UK is home to some of the world's largest oil and gas engineering companies. They have global outreach and draw from the pool of indigenous skills that has been built around a generation or more of extraction from the UKCS.

8.2 Oil and Gas Today

The industry demands skills for a wide range of technical and operational activities as well as business support functions to ensure its continued commercial success.

There are strong indications that the industry is sustainable for some time to come, predicated on change arising from market economics, adaptable technologies for new types of energy capture, global outreach, workforce development and flexibility to up-skilling. Examples are:

- o new discoveries
- o improved extraction technologies
- o conversion of facilities to renewable energy platforms
- o lifetime extensions for existing operations
- o decommissioning activities

For these reasons alone the industry has a sustained recruitment demand and up-skilling requirement. However, the projected retirement profile of the incumbent workforce is

[36] http://www.oilandgas.org.uk/issues/economic/econ07/index.cfm

cause for concern. This serves to heighten the need for long term skills development and a practical form of knowledge transfer at the industry level. Action is required soon before the expertise that has been built over a generation is eroded through age. And the induction periods for recruitment training, up-skilling and competence in what are high engineering and high technological environments can be lengthy (years). Some occupations, such as offshore installation managers and riggers, have age profiles at the older end of the distribution. But it is clear that the current workforce overall cannot maintain the industry into the long-term future. So skills initiatives and funding must be maintained to ensure that sufficient qualified and experienced people are available to support the industry going forward.

Competition from national and international projects has the potential to lead to shortages in oil and gas specialists and the more conventional skills that are required to support ongoing UKCS activity. In particular, qualified individuals from craft to professional level can, and do, sell their skills internationally in this industry.

Industry leaders have agreed that to have the workforce capacity and capability available to respond to changing demands requires short, medium and long-term strategies to be in play simultaneously. These need to be directed by the industry so that they are flexible, responsive and effectively-aligned to changes in the business sustainability model.

The support of Government is vital in sustaining the continued investment of global players in the UKCS region. This places great value on workforce supply and its skills base, through to the offshore licensing regime and support from the industry's Sector Skills Council (Cogent) and the industry's oil and gas academy (OPITO).

8.3 A Vision of the Future

The 'Upstream' oil and gas industry (*i.e.* extraction) operates in a global business community, its product being a commodity that it is traded and hedged across national borders even before it is extracted. Consequently, analysis of UKCS operations, investment, future economic value and requirements for people, skills and knowledge, cannot be taken in isolation of this global dimension. The extent to which the oil and gas reserves of the UKCS are recovered will be determined by a complex set of geopolitical and geo-economic variables.

Attempts have been made to model the future. But, at the time of writing the surge in oil demand from developing economies to the East, and the attendant effect on the price crude oil, demonstrates how fragile these models can be. The Industry Leadership Team Skills Group undertook a "Visioning the Future" project in 2004. This highlighted that, irrespective of which scenario or elements of them are applied, certain core skill sets will be required, e.g. operations, maintenance, construction, moving loads etc. However, the balance between these core functions is likely to change according to the strategic direction taken. By the same token, there will be new skill requirements if the scenario played out requires the introduction of new technologies and working practices – as is most likely to be the case.

It is, consequently, incumbent upon Cogent, OPITO and OGUK to ensure that the regulatory, tax and skills environments are conducive to a flexible and skilled workforce capacity. This requires short, medium and long-term strategies to be in play simultaneously and to be directed by the industry for the industry.

8.4 The Oil and Gas Workforce

A competent and creative workforce will be critical to companies that are maintaining UKCS operations and maximising the recovery of reserves.

This will require new exploration and production requiring: geoscientists to understand complex rock formations; environmental impact assessment to be carried out by marine biologists; new technology to be introduced; existing infrastructure and assets to be maintained to ensure safety and effectiveness well into the future. The industry employs engineers, technicians, drilling and well specialists, geologists and geophysicists, as well as IT experts, telecommunications operators, medics, chefs, stewards, safety and environmental specialists, operations supervisors, and managers. Alongside the technical and operational support functions, the complex businesses need finance and legal experts, communicators and administrative support. The financial and legal requirements of the industry, given its huge capital investment to meet extensive legislative and regulatory frameworks as well as business need, mean that high calibre graduates from a wide spectrum of disciplines from law, business, finance as well as science and engineering are in high demand.

Thus the knowledge and skill sets in demand by other industries are also sought by the upstream oil and gas industry. However, it is the application of skills to the core activities of the business of exploration and production that requires specialist skills in science and engineering. Cogent research (Figure 4) demonstrates that the annual intake of science and engineering graduates to this industry is drawn predominantly from the engineering disciplines.[37] The requirements over the long term are detailed in the following sections.

Geology and Geophysics

These sciences are critical in analysis of the nature of deep geological structures and processes. They are also essential to informing decisions on the safe storage of radioactive waste, the monitoring of nuclear test-ban treaties, natural hazard assessment and mitigation, carbon capture and storage, and the characterization and protection of the world's water resources.

Geotechnical and Geodesy

This covers offshore surveying and positioning analysis. It provides information on where to undertake seismic surveys, position wells, lay pipes, and the safe navigation of mobile rigs and equipment. Aspects include surveying and navigation using GPS, terrestrial surveying, gravity-field determination, satellite orbit determination, satellite altimetry, tidal studies, environmental monitoring through geodetic techniques, and the establishment and maintenance of coordinate reference frames.

[37] http://www.cogent-ssc.com/research/Publications/factsheets/HE_Factsheet.pdf

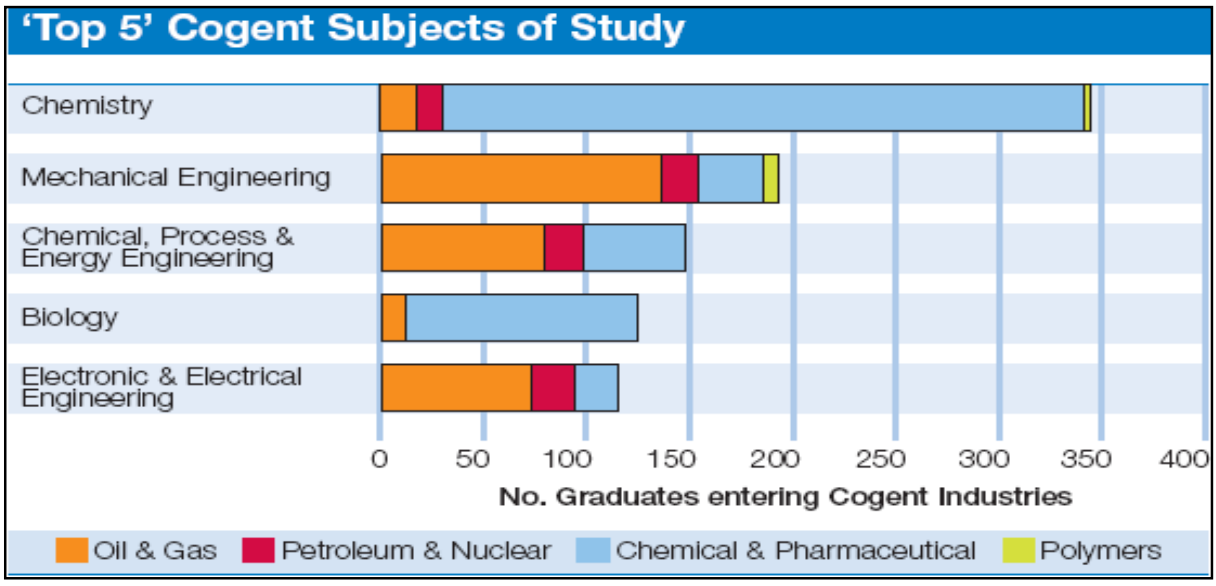


Figure 4. Graduate entry into Cogent sectors by subject in 2005-6.

Well Engineering

This involves the design, drilling and maintenance of wells throughout the life-cycle of an oil or gas field. Well engineers work in close partnership with general engineers, geoscientists and contractors to ensure that the best technical, commercial and environmental methods are used to bring the oil or gas to the surface.

The Subsea Industry

The UK is the world's focal point for the subsea industry. There are many companies with specialist design and operating expertise and the UK is host to some of the largest worldwide operators. In this context, UK companies provide design services worldwide, including Africa, Central Asia, South America, and Russia.

Subsea engineering primarily involves the connection of oil and gas wells completed on the seabed to platforms and floating production units. This requires the design, manufacture and preparation of pipes and equipment, the installation of templates, manifolds control and processing equipment, other subsea equipment, and the repair and maintenance of existing systems. Much of this necessitates operating to depths of 150 m in the North Sea and up to 3000 m deep elsewhere.

Employees of subsea firms help plan and manage complex marine activities many miles offshore around the world. The development of new installation equipment costing many tens of millions (£) is also controlled from the UK.

Equipment, including large mechanical items such as valves, electronic equipment for control systems, complex underwater cables and power lines, is manufactured in the UK.

There are opportunities to work in the production of these items, and to liaise with the project teams responsible for integrating them into the oil and gas fields.

Many of the larger subsea companies have their own training courses which are designed to meet the specific needs of their business. This is supplemented by an extensive programme of training modules available across the industry.

Operations

In order to sustain operations, in a challenging and globally competitive environment, companies must invest in skills and technology to maintain their competitive edge.

Improving the exploitation of mature fields and bringing new fields into production are key drivers in the development of new technologies. Newer discoveries tend to be in deeper waters that are further offshore. The Clare Field, west of Shetland, which was discovered in 1977, is an example of a long-known reserve eventually being exploited through technology advances. Similarly, what was for many years the UK's largest undeveloped gas field, Rhum, is now also within scope for development.

An example of the global demand for UK skills and expertise is provided by the adjacent Elgin and Franklin North Sea fields. This is the largest high-pressure, high-temperature field commercially developed with upward pressure three times the average for the UKCS, and oil and gas at twice the temperature of a conventional field. This was achieved with expertise that is now being applied around the world.

Thus, international demand for the highly-skilled UK workforce in oil and gas means the workforce has a high proportion of mobile staff at all occupational levels. This translates to UK workers on rotational shifts overseas, on the one hand, and an internationally diverse UK-based workforce on the other.

Decommissioning

Decommissioning activity will continue to grow as current fields slowly decline; the UK North Sea having peaked around 1999. OGUK estimates decommissioning costs to be in the region of £15bn (at 2006 prices). This year BERR anticipates 19 decommissioning projects will be underway; this is estimated to peak at 33 projects within ten years, allowing for the likelihood that some facilities will have extended life. Plans for 31 decommissioning projects have been approved for facilities such as platforms, pipelines, floating production systems, subsea systems and flare stacks. Plans include: removal for re-use; removal to shore for dismantling/recycling and decommissioning *in situ*. Although this represents the gradual passing of the North Sea oil and gas resource, decommissioning and switching to new energy platforms will draw from the same pool of skills. Figure 5 summarises the expected off-shore decommissioning projects up to 2035.

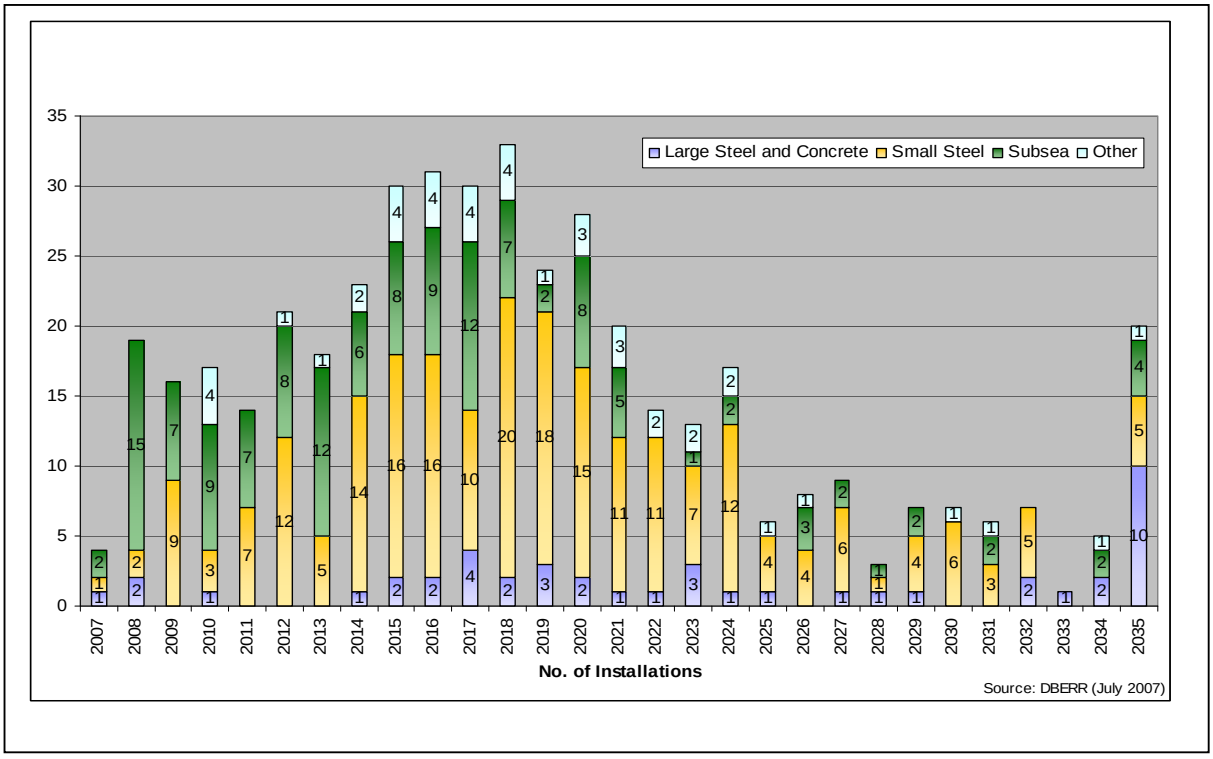


Figure 5. Removal dates for offshore installations as forecast in July 2007

Assumptions:

1. The Chart is based on 2P production figures (i.e. proven and probable reserves)
2. Where four or fewer Small Steels are involved, decommissioning work will be carried out 2 years after Cessation of Production (COP). If there are between 4 and 10 Small Steels involved, work will be carried out between 2 and 4 years after COP and where more than 10 small steels are involved, work will be carried out between 2 and 6 years after COP.
3. An operator will remove a maximum of four Small Steels in a year.
4. A Large Steel (jacket weight in excess of 10,000 tonnes) will be removed 3 years after COP.
5. Concrete structures will be decommissioned two years after COP.
6. Only one Large Steel or Concrete (per operator) can be decommissioned in a year.
7. Anything else (e.g. subsea equipment, floating production vessels etc) is assumed to be removed one year after COP.
8. Multiple numbers of subsea equipment are counted as one.
9. Where subsea equipment is associated with a surface installation in the same field, the subsea equipment is discounted.
10. Cessation of Production (COP) refers to the date that the field is expected to cease production, based on 2P production figures.

8.5 Demographics and Diversity

The workforce has gradually diversified from being predominantly white and male, as originally sourced from heavy industry in the 1970's and 1980's. (Figure 6). It should also be noted that in the early years some jobs were embargoed to women. The gender profile of the oil and gas industry is improving with females making up 20% of the directly employed workforce.

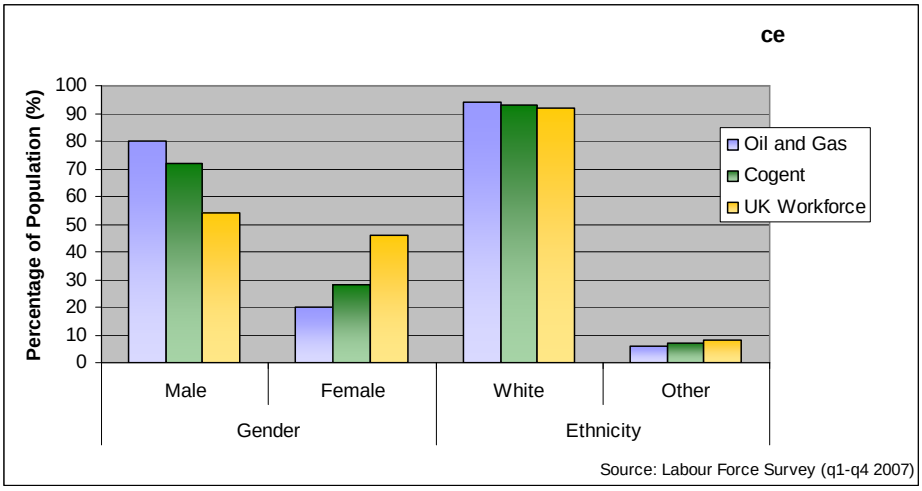


Figure 6. Gender and Ethnicity Profile of the UK Oil and Gas Workforce

The average age of the offshore workforce is 41 while the modal age is in the lower 40s. (Figure 7). But some occupations, such as offshore installation managers and riggers, have age profiles at the older end of this distribution

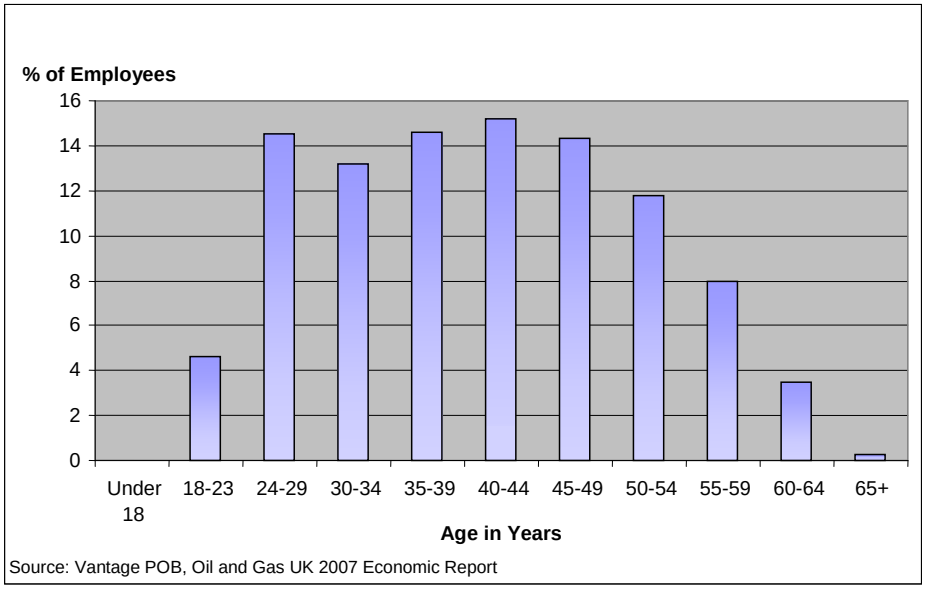


Figure 7. UK Offshore Oil and Gas Workforce Age Profile in 2006

8.6 Actions to Improve the Skills Supply

OPITO – the Industry Oil and Gas Academy

OPITO, the industry Oil and Gas academy arose from the Oil and Gas Industry Training Organisation. It has been established as the Oil and Gas Academy by employers themselves to respond to the need for a safe and effective workforce. In supporting this organisation, employers have bought into the philosophy that having skilled and motivated

people is critical to the continuing success and sustainability of operations in both the UKCS and worldwide.

OPITO exists to:

- Work with employers to identify and agree action on workforce issues that matter to them and are affecting their business.

- Provide an effective link between the industry and those who can provide the best learning and training across the UK.

- Partner with organisations where such joint action would add value to its purpose of building and sustaining the supply of relevantly qualified people into the oil and gas sector.

OPITO partners with the ECITB to increase volume and quality of training for the sector as engineering construction plays a vital role in the industry.

OPITO maintains partnerships in three other areas:

- Education and academia to create a 'Faculty of Learning' to secure the feedstock of new recruits and sustain the industry going forward.

- Learning and training providers to develop the world-class learning supply needed to support a global business.

- Professional bodies, Government and its agencies, trade bodies as well as enterprise agencies and local authorities on issues of shared concern.

Examples of the activity streams to achieve these aims for employers and individuals include:

- **Standards:** development and maintenance of industry standards covering emergency response, safety critical and hazardous activities, and occupations. New standards are developed based on industry demand. As requested by employers these standards can be developed into nationally recognised standards and qualifications e.g. S/NVQ and Modern Apprenticeships.

- **Industry Attractiveness:** OPITO is working with a number of partners to promote the oil and gas industry as an exciting place to work and offering long-term career choices. Examples of activities planned for 2008 include careers and lifestyle road shows, an interactive oil and gas careers experience, promotion campaigns targeting graduates, and a science promotion for 80,000 school pupils.

- **Working with the Learning Supply Chain:** Stringent recognition criteria have been developed for learning providers. This will assure that the learning and development products are fit for the industry's purpose.

- **Company Specific Services:** As a service, the academy can audit company competence and compliance under regulatory environments. Competence mapping

can be linked to National Occupational Standards.

- **Workforce Skills Development:** A web-based tool can benchmark the skills of an individual against industry-approved question banks. This gives employer recruiters/trainers an objective indication of underpinning knowledge in specific disciplines and trades. For the individual this tool provides a fair and objective self-assessment. (www.opito.com/skillsscreening)

- **Information and Influence:** an online information portal with testing to help match and filter potential recruits into areas and disciplines where employers are experiencing shortages. Links are provided directly to recruiting companies. Individuals can also watch video case studies of current industry professionals. (www.oilandgas4u.com.)

- **POL (Petroleum Open Learning):** a flexible, self-learning tool, which enhances technical knowledge and leads to improved skills and performance in the workplace. Each modular examination can be taken anytime/anywhere. (www.petroleumopenlearning.com.)

- **The Upstream Oil and Gas Industry Technician Training Programme:** this programme funds pan-industry action *via* the Upstream Modern Apprenticeship to address the shortage of core crew technicians in mechanical, instrument, electrical and process disciplines. These are crucial roles, not only for production, but also for asset integrity and, ultimately, decommissioning. Their availability impacts on business confidence which ultimately determines investments in the UKCS.

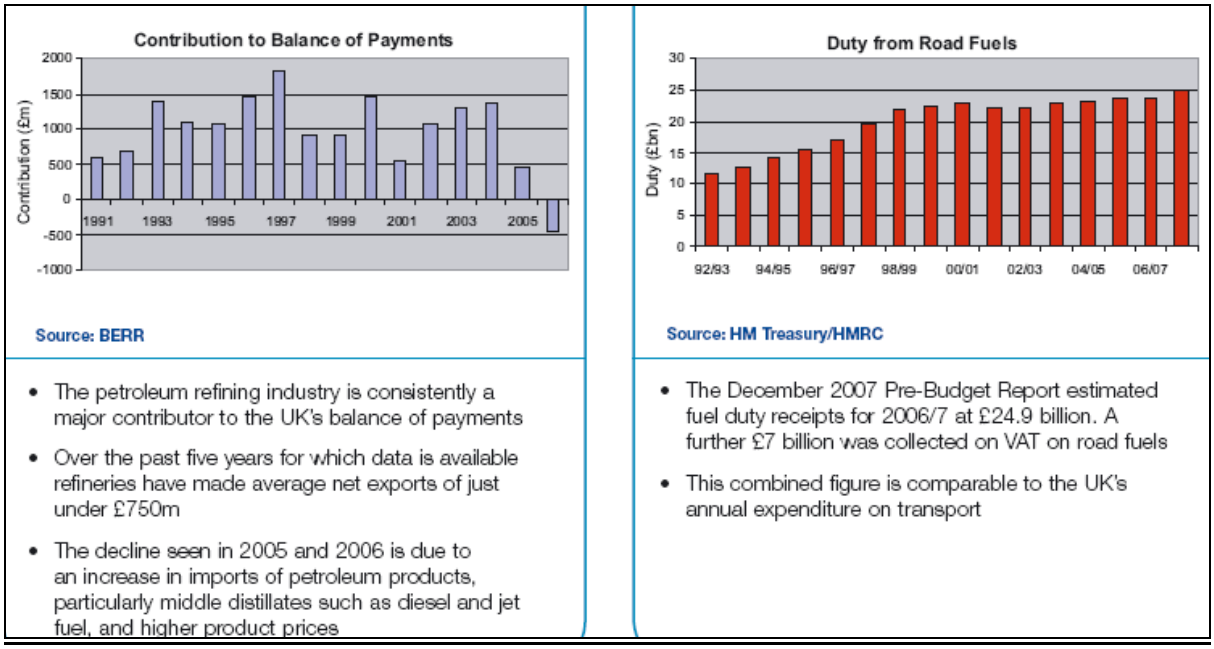
9. DOWNSTREAM OIL – REFINING. BLENDING AND STORAGE

9.1 Making our Fuels

As oil products will be crucial to fulfilling the UK energy demand (especially transport) for some time to come, petroleum refining is a key industry with employment opportunities for the short, medium and long term. Up to 2700 new entrants (apprentices, graduates and career changers) are forecast to be required between 2005 and 2015 to replace those retiring from the industry. This sector is within the remit of Cogent SSC and its sister organisation the National Skills Academy for the Process Industries (NSAPI).

The refining industry employs approximately 9200 workers in 200 companies, including the 9 UK refineries. Gross value added is £1.64bn per year. The UK refineries are ranked 17 out of 26 in Europe for competitive performance. Efforts to improve productivity through development of a skilled workforce are imperative to improving this ranking, which, in turn, is key to securing investment in the industry. Substantial investment has been required to meet emission standards and will be needed in future to process a wider range of crude oils.

The industry has been a considerable and consistent contributor to the UK balance of payments. But recent imports in heavier distillates to cope with rising demand for diesel and jet fuel has moved the industry into the first national trading deficit in over 15 years. (Figure 8) Over £30bn is now collected annually through fuel duty and VAT on fuel (Figure 9)



Figures 8 and 9. Economic Contribution and Refinery Economics (Source: UKPIA[38])

International competition for refining capacity means the UK industry must push to improve competitiveness if it is to secure investment in its ageing refineries. Productivity and

[38] UKPIA, Statistical Review 2008, http://www.ukpia.com/home.aspx

sustainability of the petroleum industry is therefore dependant upon the availability of suitably a competent workforce, capable of operating high technology science and engineering under stringent Health, Safety and Environmental statutes.

The industry has significant medium to high level skills requirements. A major gap being a lack of capacity in the contractor supply chain (ECITB Chapter 14 refers) experienced by many companies who find themselves unable to get
skilled resource for turnarounds and capital projects. Approaching retirement is another factor, which must drive a sustained recruitment demand and up-skilling/training capacity. Skills for compliance feature prominently in the face of stringent environmental, health and safety requirements. The drive to be more sustainable and environmentally friendly by driving up efficiency and driving down waste also has skills implications. Specific gaps are also being reported for instrumentation skills.

As a male-dominated industry, with a legacy of poor ethnic diversity, future recruitment must continue efforts to attract applicants from a broader pool of suitably qualified and skilled people. Efforts are also required from early school age to increase the supply of females into this pool.

Skills initiatives and funding must be maintained to ensure that skilled and qualified people are available to the industry.

9.2 Refining Today

Oil remains the primary energy source for the UK and is projected to remain so until at least 2030. BERR forecasts that demand in the UK for oil products will increase by 13% over the period from 2000 to 2020, with similar increases expected worldwide.

The UK refineries operate and invest in an international arena. Legislative compliance means that the UK has to work under a significant regulatory framework to remain competitive.

Capacity in the UK is the fourth largest in the EU. Nine refineries in the UK presently remain fro a high of 18 in 1974. A new refinery is planned for the North East and is due to come on stream around 2010. BERR statistics show refining output in 1974 stood at 103 million tonnes per annum, while the equivalent for 2006 was 78 million tonnes per annum. To achieve this, the remaining refineries have become larger and more complex over time.

UK refineries process domestic crude oils from the North Sea (approx 70% of capacity) as well as imported oils. Outputs are dependent upon the type of oil being processed and is also constrained by the processing equipment at the refinery. Typically the UK produces an excess of gasoline, which is exported, and a deficit of diesel oil and jet fuel. Overall the UK refining production is moving further out of line with product demand, such as for diesel and jet fuel increases. To redress this trend will require very significant investment in new process facilities. In addition, low-sulphur oil from the North Sea is becoming more expensive in line with prices for light, sweet crude globally.

Product demand and legislative requirements have driven change in the profile of petroleum products. (Figure 10) UK refineries need to be adaptable to changes in oil product demand. This has necessitated both investment and rationalisation. For example,

the technology associated with the production of low-sulphur fuels, which has required considerable investment, has lead to the demise of medium-sized, less-efficient refineries.

Significant capital investment will be required by the industry in: front-end desulphurisation to process poorer quality crude; hydrocrackers to increase diesel production (to meet market demand); residue conversion to reduce or eliminate fuel oil (for which the market is declining); and/or, replacement of the light, sweet feedstocks from the North Sea with imported crude that may be heavier and higher in sulphur content.

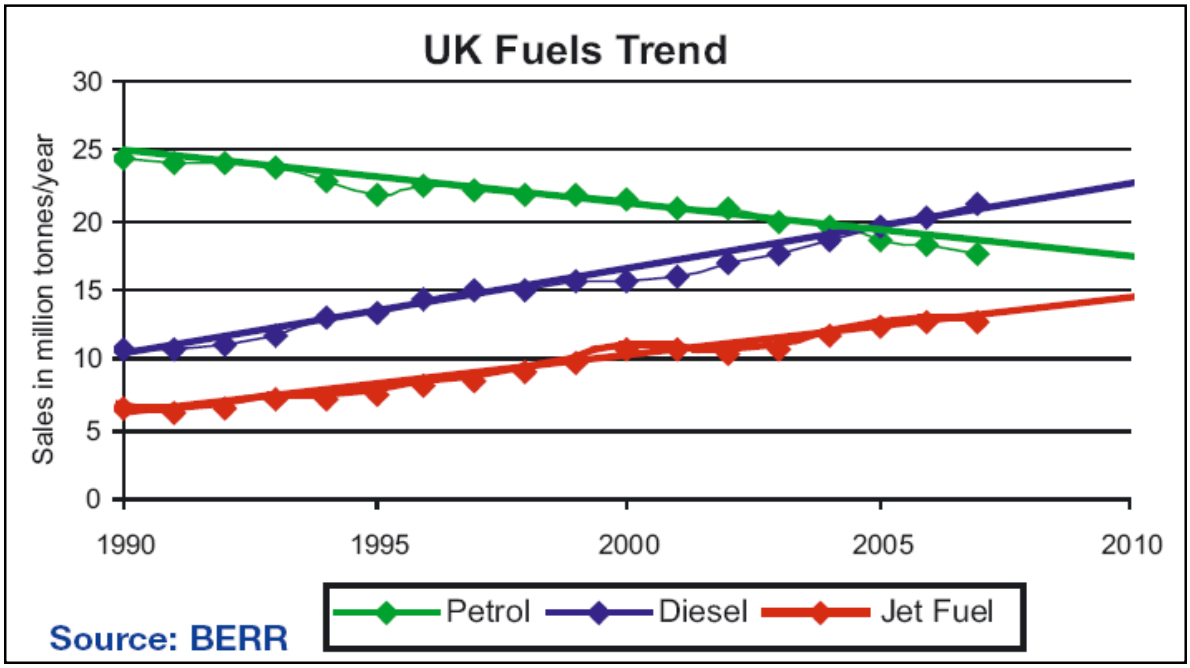


Figure 10. UK Fuel Trends (Source: UKPIA[39])

The sustainability of biofuels has been called into question recently, with concerns over linkage with food production and food prices. It is worth noting that, at the time of writing, process innovation in the UK (linked to new economics around a sustained surge in the costs of fuel production from oil) has improved the potential for general waste biomass to be profitably employed in the production of biofuels. In the meantime, the potential for oil and sugar/starch crops may well be limited. In our view, if regulation on biofuel supplementing stays, second generation technologies will be required to convert whole-crop biomass to fuel to realise the full potential of biofuels. Nevertheless, the advent of biofuels will have a significant impact on refining. It is therefore important that a UK-based biofuel refining capacity is established to reduce the need for imports and to ensure that biofuel is sourced sustainably within the UK. The recent implementation of the Renewable Transport Fuel Obligations on 15th April 2008 has set a target of 2.5% (and up to 5%) by volume of biofuel content in road fuels. Bio-fuels are currently more expensive to produce than petrol/diesel thus increasing costs.

[39] UKPIA, Statistical Review 2008, http://www.ukpia.com/home.aspx

The challenge for UK refineries is to improve their competitiveness in order to attract additional investment. This brings skills development, notably in process optimisation, to the forefront.

9.3 The Refining Workforce

Figure 11 illustrates the occupational profile of the refining industry in comparison to the Cogent sector and the overall UK workforce. Clearly the Refining industry, like the wider Cogent sector, has a higher demand for high level skills than is average across the UK. After management; technicians (level 3/4) and process operators (Level 2/3) are the largest occupational groups.

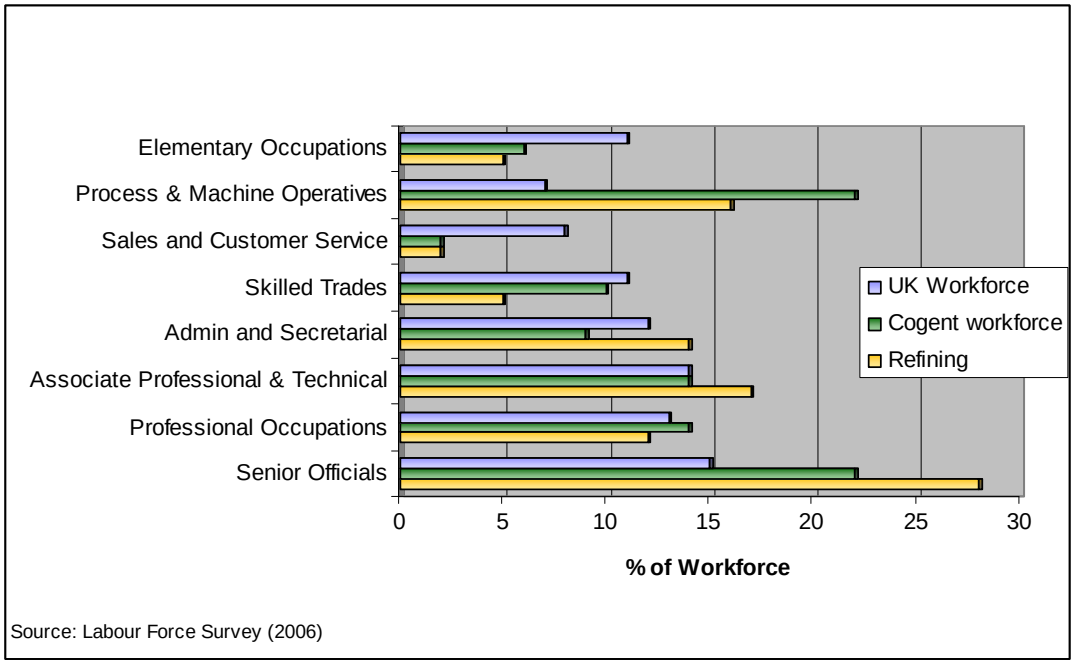


Figure 11. Occupational Profile of Refining

Skill levels within the refineries will need to rise to meet technological change, especially around the introduction of more complex computer control to optimise processes. Optimisation is achieved through real-time interventions in processing. This will move the traditional operator role at skill levels 2 and 3 towards level 4.

Currently the operator workforce is not particularly large (around 1700), so there is 'headspace' for a gradual up-skill ratchet. Refining attracts skill sets from other sector industries. These tend to be geographically linked to pockets of related activity, such as chemical plants.

Specific technical skills gaps cited by employers relate to:

- instrumentation skills
- welding skills for mechanical technicians
- skilled resource for turnarounds and capital projects (see Chapter 14)

9.4 The Contractor and Supply-Chain Workforce

Large numbers of additional manpower in engineering and construction are required for turn-around maintenance in each refinery. The numbers of workers can be up to three times larger than the total number of permanent staff. Refineries experience great difficulty in sourcing and managing this segment of the workforce. This is despite the fact that refineries work co-operatively to ensure that clashing demands on the contractor population are minimised.

Skills shortages in the contractor supply chain are reported, in particular, for mechanical, pipefitting and welding trades. This issue is compounded by the ageing profile within the contracting workforce resulting in an ever-dwindling supply of a hard-to-source skill set. The engineering construction workforce is a prime focus for the ECITB, and is covered in Chapter 14.

Pockets of manufacturing industry using feedstock from the refining process tend to be located around refineries. As refineries are often based in rural areas these supply chain pockets are fundamental to supporting the local economy.

9.5 Demographics

The industry workforce is predominantly white, male and ageing. Females comprise 24% of the overall workforce (Figure 12). While an element of this distribution can be accounted for by the gender profile of science and engineering graduates or, indeed, apprentices, the industry remains unattractive to suitably skilled and qualified women. Of the 5% of employees that work part-time, the vast majority are female.

The ethnic profile of the refining industry is less diverse than the UK working population, though this may in part be an artefact of the location of some refineries, for example on Milford Haven, where the surrounding population is less diverse than the nation at large. Anecdotally, there is a greater degree of diversity within the contractor group as migrants are sought to fill skill shortage job roles.

The age profile is skewed to the mature end of the spectrum with 45% due to retire in the next 15-20 years. This will generate a significant volume of replacement demand for the industry.

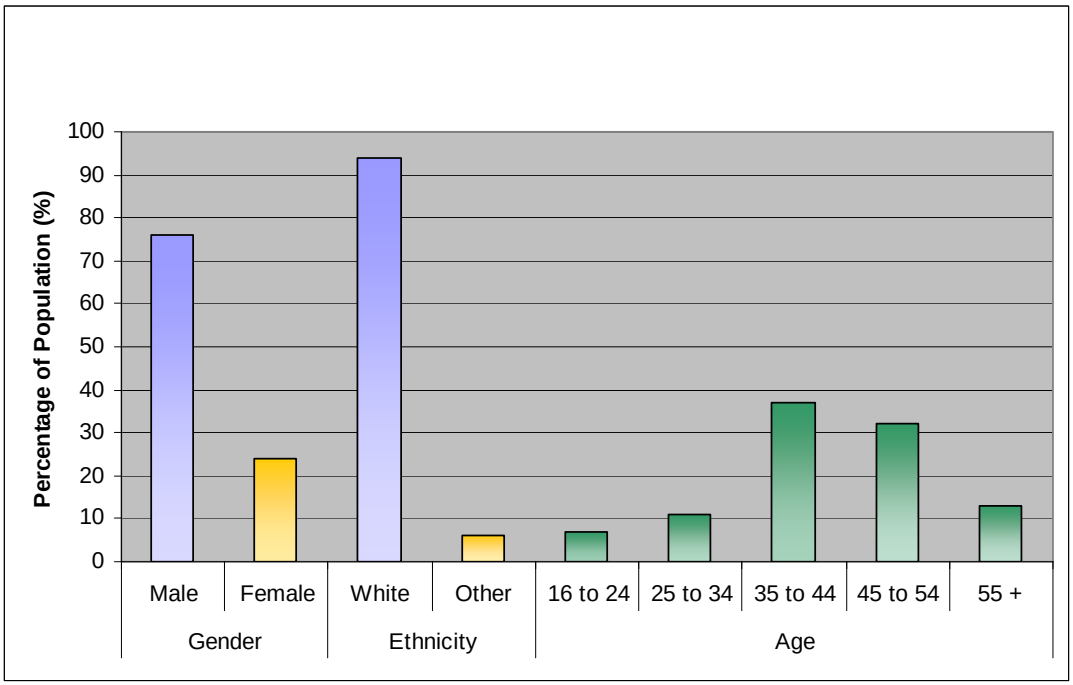


Figure 12. Age, Gender and Ethnicity of the UK Refining Workforce

9.6 Actions to Improve the Skills Supply

Cogent and employers in the Petroleum industry have acted jointly in the development of skills products for the sector as an outcome of the Sector Skills Agreement process. These include a complete review and overhaul of the Downstream National Occupational Standards in Field, Control Room, Bulk Storage and Jetty Occupations.

Cogent SSC engages with employers to articulate their strategic skills requirements. Cogent conducts employment research, liaises with training providers and develops products. The National Skills Academy for the Process Industries (NSAPI) has recently been established. This academy will promote skills accreditation and learning-provider support for skills in refining.

Cogent has focussed on five strategic, sector-wide, 'big ticket' products which are relevant to the refining sector.

- **Upskill -** an integrated approach to both recording and developing industry-specific skills, supported by an IT registry platform. This provides a seamless progression of modular vocational training to Level 4 with appropriate accredited "step off" points that meet the needs of employers and employees. This is underpinned by the Cogent "Gold Standard" which identifies key skills and competency requirements for core roles.

- **Career Pathways -** a web-based careers information advice and guidance product which presents the roles, qualification requirements and career pathways associated with the main manufacturing categories in management, scientific, technical and professional roles across the Cogent sector[40].

[40] http://www.cogent-careers.com/

- **Apprenticeships -** a framework for an industry standard with the appropriate balance of generic and industry specific skills. The Advanced Apprenticeship / Modern Apprenticeship in Process Technology is used by the refineries.

- **Industry Passports –** a sector-wide product to meet employer concerns about the skills-base of the contractor workforce providing a registry of skills.

- **Competence Assurance -** A tailor-made online product with a total systems-check for a sector with a high element of safety health and environmental compliance.

The Gold Standard

The Cogent Gold Standard is a branded product. It is a continuous professional development framework that recognises employer-based training and learning. It can sit at any level and with any job role. It comprises four skills elements:

1. Technical Competence
2. Business Improvement
3. Compliance
4. Functional and Behavior Skills.

The Gold Standard was conceived by the Chemical Leadership Council and developed by the employers across the chemicals industry. It is being introduced across the other sectors in the Cogent footprint. More information can be found at: http://www.cogent-careers.com/.

Foundation Degrees for the Refineries

As part of the *Upskill* agenda, Cogent research with employers found that existing qualifications e.g. HNC /HND, were not always fit for purpose in providing clear work-based pathways for young people, apprentices and other employees operating at Level 3+. The refineries group saw that Foundation Degrees had the potential to provide both a work-based career pathway and opportunities for the delivery of flexible up-skilling for the workforce. Employers are leading the development, in partnership with Cogent, training providers and higher education institutions, of a new Foundation Degree framework for the refineries.

Foundation Degree Framework in Science and Engineering

This is essentially the ‘mother’ framework that the Foundation Degrees for Refineries would sit within.

Employer-led higher education provision in the science and engineering sector is on the verge of extinction. With the expansion of higher education over the last decade there has been a shift away from vocational HE provision as the polytechnics transformed into universities. Vocational HE that has taken hold is in the public sector, where a license to operate or practise underwrites workforce competency. In contrast, industry-standard provision in science and engineering in the private sector is rare, at best, and requires co-operation and collaboration to build capacity and capability in the sector.

Through this science and engineering framework, Cogent is working with partner higher education institutions and stakeholders in England to build capacity and resource for a nationally-recognised, industry-standard framework for science and engineering in the workplace. This will support: knowledge and skills development for science and engineering in industry; skills development in the context of job roles in the industrial environment plus specialist academic and skills development for named pathways in sectors such as petroleum.

Employer engagement is a major strand of the current strategy of the Higher Education Funding Council for England.

It is planned to roll-out of the concept and tailor it to fit the funding and labour market conditions of Scotland, Wales and Northern Ireland.

9.7 National Skills Academy for the Process Industries (NSAPI)

The petrochemicals industry falls into the remit of NSAPI. The current business plan includes the following products:

- **Expansion of Apprenticeship Models -** to encourage growth including a Community Apprenticeship programme.

- **National Vocational Qualifications -** for the existing workforce at levels 2-4.; A modularised system in line with the qualifications reform programme.

- **Foundation Degrees –** (as above) for new entrants and up-skilling of the existing workforce; recognition of existing employer training towards as ASET (Assessment System of Employer Training)

- **Gold Standard –** (see box inset above) to raise the skills bar.

- **Training Network -** building a quality assured and accessible network of training providers.

- **Train-to-Gain Programme –** to develop and roll out a *Train-to-Gain* contract on behalf of the provider network.

10. NUCLEAR, INCLUDING NEW BUILD AND ELECTRICITY GENERATION

Nuclear is a crucial element of national energy strategy.[41] As a strong UK industry it offers some of the world's most advanced engineering solutions to carbon-free energy with early returns on the carbon footprint of build and fuel processing. This skills sector falls within the remit of Cogent SSC and its sister organisation, the National Skills Academy for Nuclear (NSAN). The industry functions include:

- Fuel manufacture and enrichment
- The nuclear deterrent
- Decommissioning and clean-up
- Spent fuel processing
- Power production
- Waste management

Around 17% of national grid supply is produced through nuclear heat generation. Accordingly, the UK has a considerable capacity and capability in all aspects of nuclear fuel processing, electricity production and hazardous waste containment. Capability in the industry is underpinned by science and engineering, with a particular focus on skills at the higher end of the spectrum (Figure 13).

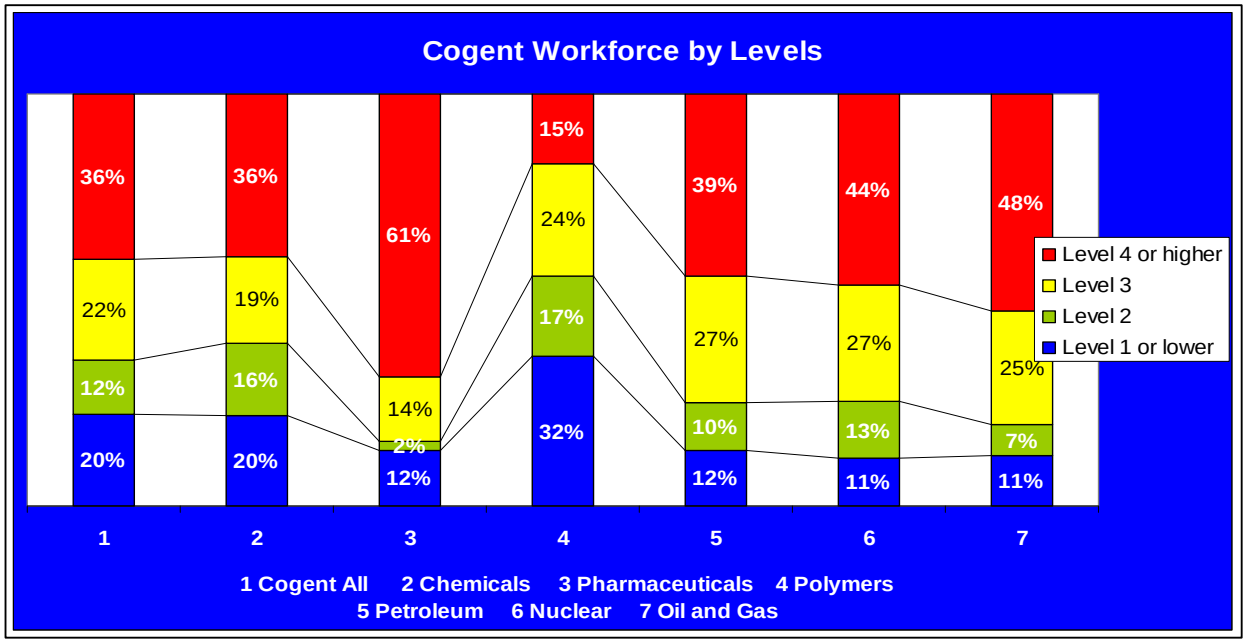


Figure 13. Skills across the Nuclear and Comparator Sectors

Notes

1. Deficit from 100% due to "other qualifications"
2. Source: Labour Force Survey, 2007

With new-build nuclear facilities now sanctioned for bid by the private sector, there is no upper limit to which nuclear power can be expanded, provided:

[41] Nuclear Energy White Paper, Jan 2008

- the market will bear the investment in order to benefit from the return;
- the skills can be sourced; and accepting that,
- the UK requires a mixed and balanced energy economy for the future.

Looking forward it is clear that new-build will overlap with decommissioning giving an extended demand for skills supply and flexibility in nuclear for generations.

There is considerable concern from those experienced within the sector that the limited SIC codes for the nuclear sector do not capture the industry picture adequately.

10.1 Decommissioning and Renaissance

All the Magnox power stations will be in decommissioning after the closure of Wylfa in 2011. The AGR fleet is set to close by 2023, although there is some potential for limited life extension. Without new build, only Sizewell B will then be generating, with closure expected around 2035. New build is expected to start to bring new generating stations into operation from around 2018.

The nuclear industry has around 50,000 employees spread across 200 key employers. Approximately 41,000 of these were employed in STEM based job roles in nuclear in 2005. Under current plans, this will rise to 50,000 by 2010. Up to 16,500 new entrants (apprentices, graduates and career changers) will be required between 2005 and 2015. These figures do not include the conventional construction skills required to build the new nuclear power stations and which are included in Chapter 14 by ECITB. Meanwhile, a major re-skilling step-change from power generation to decommissioning and clean up will see 6000 learners undertake decommissioning-specific courses by 2012. In addition, with the prospect of new build, skills will be needed to support construction and operation in the next decade. The extent of this demand will depend on the intensity of the new build operation which is yet to be determined.

10.2 Nuclear Today

Planned lifetime extensions to existing operations, decommissioning and clean-up, new build and, retirement of the workforce means the industry has a sustained recruitment demand and a requirement for skills training and re-skilling of the workforce. In this regard, productivity, regulatory compliance and sustainability of the sector are dependant upon the availability of suitably skilled, trained, qualified and experienced workforce.

The civil nuclear sector also competes for skills with the defence sector, that is the submarine and deterrent maintenance and build programmes.

Major skill gaps are projected for the nuclear industry. The modal age of the workforce is skewed towards the mature end of the scale. In addition, there are some specific shortages in defined employment areas.

Pinch-points in specialist nuclear job roles are reported in areas such as control instrument and system engineering, health physics/radiation protection, safety case engineering specialists, project managers and experienced nuclear safety regulators. Some specific shortages in defined employment areas (such as HSE inspectors) are already emerging. There are also skill gaps within the nuclear industry, largely caused by re-deployment of the workforce.

The ageing workforce in power generation, coupled with the progressive decline in employment in the existing power stations over the medium term, means retention of these skills within the wider nuclear industry will be critical for successful transition to the operational phase of new build from around 2016 and ensures that up-skilling must give workers flexible and transferable skills that can be deployed where needed

As a male dominated industry, future recruitment demand requires that nuclear must continue efforts to attract potential applicants from the broadest possible pool of suitably qualified and skilled people. Efforts are also required from early school age to increase the supply of females into this pool.

Competition from national and international projects has the potential to exacerbate shortages in nuclear specialisms and those conventional skills that are required to support the UK civil nuclear operations, both decommissioning and the new build programme.

Positive action is being taken by industry, in conjunction with Cogent Sector Skills Council, the National Skills Academy for Nuclear (NSAN) and other bodies, to improve the situation and regularly update the background data on which skills planning and the associated training provision is based. The support of Government is vital in sustaining the skills base, through provision of funding, legislative action and support for the Sector Skills Council and the National Skills Academy. In this connection, the supply of generations of skills crosses the boundaries of schools, colleges, universities and industry will thereby require support from a number of government departments.

Skills initiatives and funding must be maintained to ensure that sufficient qualified and experienced people are available to support all aspects of the nuclear industry.

10.3 Nuclear Projects in Context

Unlike many other industries, nuclear employers tend to have a well-informed view of future activity. Foresight scenarios are presented here in three timeframes: to 2010, 2015, and 2025, using the radar plot (Figure 14 - this illustration is not exhaustive).

Over thirty countries are considering new nuclear power programmes. This could impact significantly upon UK activity and, consequently, on skills demand as well as the timelines for supply of plant and equipment. This presents an opportunity for the UK to export intellectual property and technical expertise to extend a world-leading brand. In parallel, major construction and decommissioning programmes across the UK will also compete for resources and supply of suitably qualified and experienced labour.

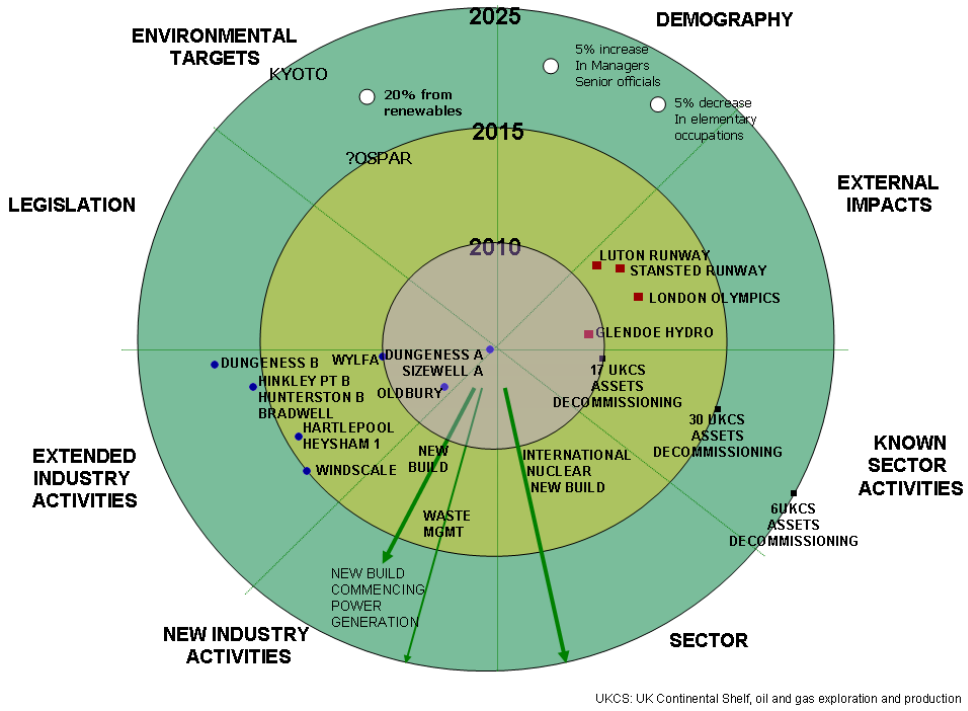


Figure 14. Nuclear Activities in Context[42]

10.4 The Nuclear Workforce

Nuclear Labour Force – All Operational Activities

Projections on least-case, most-case and baseline scenarios have been developed in partnership with industry to identify workforce demand in the short, medium and long terms (Figure 15).

The requirement for new entrants to the industry between 2005 and 2015 are:

- baseline (a conservative scenario) - 3,400
- baseline (with retirement at 60) - 8,500
- most case - 11,500.
- most case (with retirement at 60) - 16,500.

Maintaining the 2005 levels of graduate and apprenticeship recruitment (500 and 300 respectively) means that beyond 2010, workforce supply will be outstripped by demand. NSAN plans are for 2500 apprenticeship entrants over the next five years. It is estimated that a further replacement demand factor of 5% of the total workforce should be added to the net requirement projections to take account of attrition from the industry.

[42] Note: diagram pre-dates BERR Renewable energy strategy

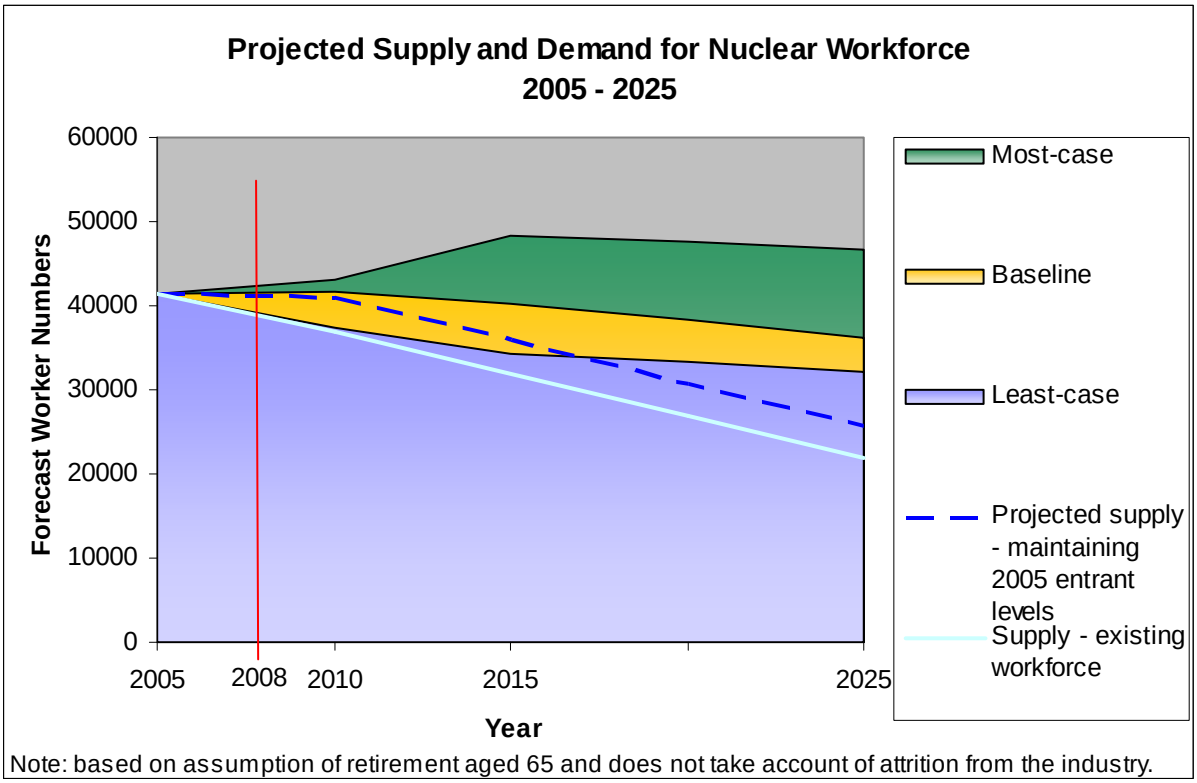


Figure 15. Supply and Demand for Nuclear Workers

Notes

1. Figure 12 includes civil and defence programmes.
2. The *least case* assumes existing assets will cease to operate on original shutdown schedule and, a delayed and staggered new build programme with the first asset commencing operations in 2018.
3. *The baseline scenario* includes life extensions to operating assets (as planned in 2005) and a staggered new build programme with the first asset commencing operations in 2017.
4. The *most case* includes best-case life extensions for all operating assets and new build with new assets commencing operations one per year from 2017.

Nuclear new build will ensure that demand for skills will extend well into the future. The decommissioning workforce will decline over the long term but increasing demands for commissioning and new operation (the new power stations could run to the 2080s) will compensate and retraining will be essential to retain nuclear expertise within the sector.

Nuclear Labour Force - Operational Activities

New build aside, there are currently four main areas of operation:

I. Nuclear Heat Generation and Fuel Handling i.e. power generation and nuclear submarine propulsion.

II. Decommissioning of Nuclear Facilities i.e. decontamination and dismantling, removal of waste from facility for packaging and clearing of contaminated sites.

III. Nuclear Materials Processing and Enrichment i.e. nuclear fuel production and reprocessing, nuclear weapons production and handling, high level waste treatment.

IV. Waste Management i.e. intermediate level waste treatment, low level waste packaging, waste transport and disposal.

Projecting the activities to a 2025 timeframe illustrates the drivers for changing skills demand. In these scenarios, an even plan of decommissioning activity has been assumed. In reality a staggered process or accelerated parallel new build (new build on old sites and new build on new sites) will heighten demand for nuclear-related skills on existing sites.

Critical in the long term for the nuclear labour market is heat generation maintenance for new-build operations. Nuclear heat generation will be in decline prior to new nuclear being operational. Accordingly, labour may migrate to other industries. This section of the workforce has an age profile skewed to older workers and will experience higher levels of retirements than average. The challenge will be to retain and attract suitably skilled and qualified personnel for the new nuclear power stations. It is estimated that 350 operators will be required for each new plant and that new entrants will require training two years prior to start up.

Decommissioning activity will grow to 2015 and will be the most powerful driver of occupational shift. This activity will drive a raised demand for technical and craft skills. The step change from operations will require workforce re-skilling. NSAN estimates 6,000 workers will undertake decommissioning specific qualifications by 2012. Innovation in decommissioning and lifetime extension will require transfer of knowledge and learning from both the nuclear industry's work to date and from other industries, such as oil and gas, which are also going through decommissioning.

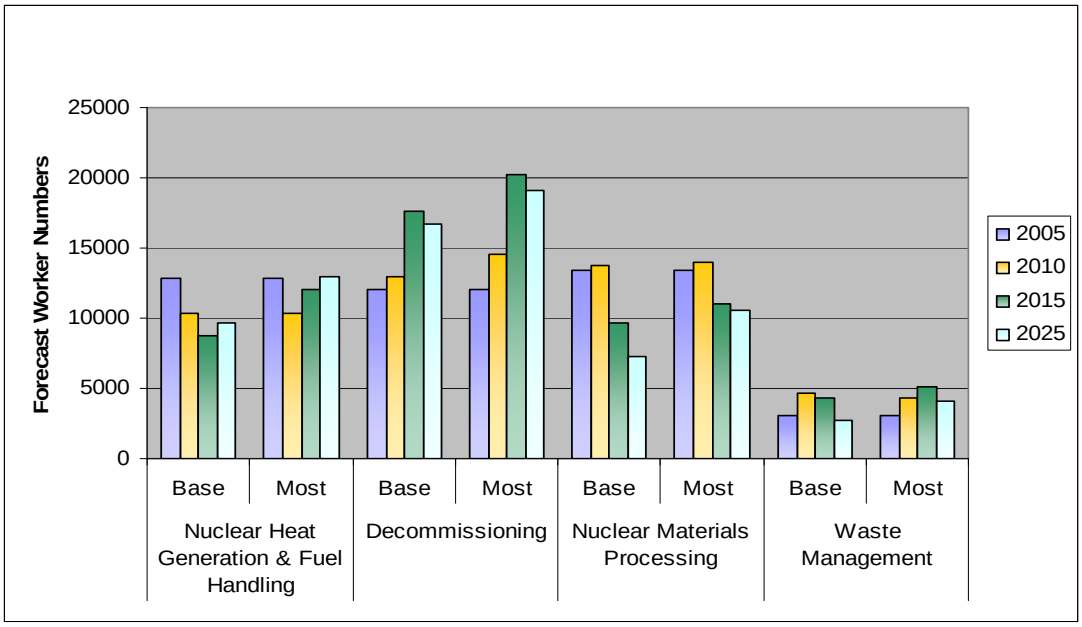


Figure 16. Demand to 2025 by Operational Activity

New-build power will require nuclear specialists in the early years to support:

- licensing; then,
- safety case preparations; then,
- specialist skills to support construction from 2012.

Across the industry, the most-case forecasts predict demand for:

- 2100 process and machine operators
- 3500 in skilled trades
- 2400 associate professional and technical workers
- 8500 professionals and senior officials between 2005 and 2015 to account for retirement alone.

As is the case in the Oil and Gas sector, some specialist roles are unique to the nuclear industry. The low numbers required make these relatively difficult for the education and training infrastructure to accommodate. However, the availability of staff with these particular skills is vital. The roles are:

- computational specialists: stress, thermal hydraulics analysts
- control and instrumentation, system engineering specialists and technicians
- health physics/radiation protection at all levels
- project management/managers
- safety case engineering specialists
- nuclear safety regulators

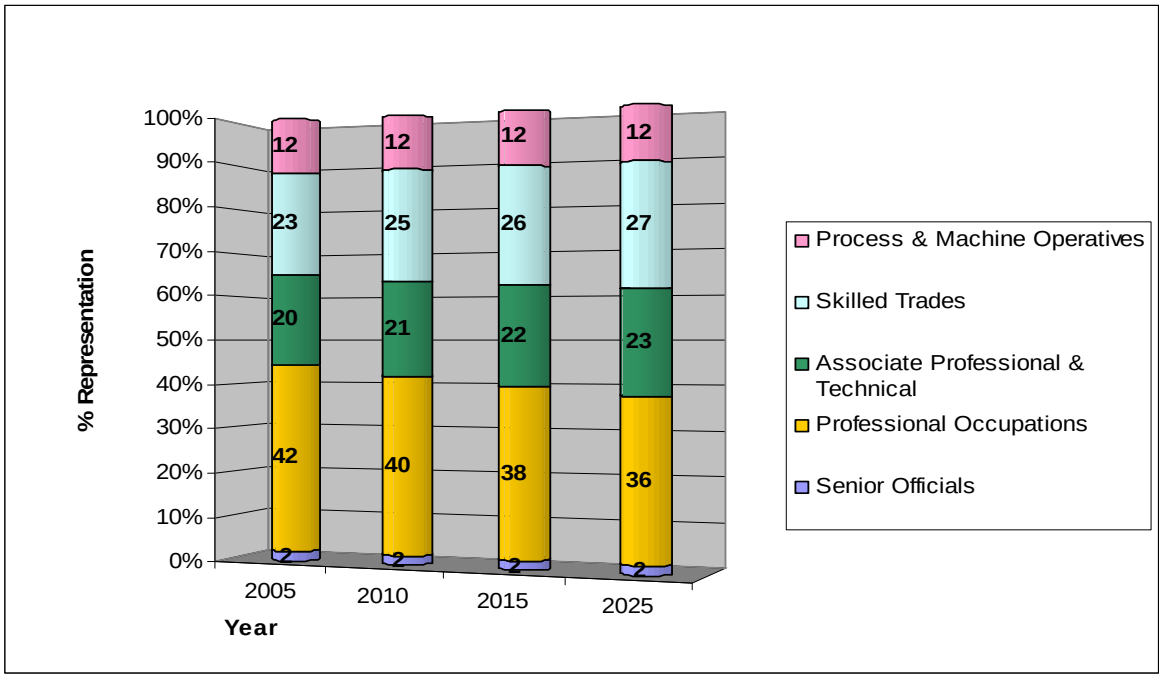


Figure 17. Changes in occupational profile to 2025

Demographics

The workforce is predominantly white, male and ageing. Women make up 18% of the overall workforce, while 12% of the science, engineering and technical workforce is female. While an element of this distribution may be accounted for by the gender profile of science and engineering graduates or apprentices, the industry is patently not proving attractive to suitably skilled and qualified female applicants.

The ethnic profile of the nuclear industry is much less diverse than the UK working population. To some extent this may be an artefact of the geography of the nuclear sites and the lower diversity of the surrounding population.

There are some regulatory barriers to employment. For example, where security residency requirements could preclude the use of non-European Economic Area (EEA) migrants, particularly for the military sector.

Although the age profile of the STEM workforce in nuclear leans towards the mature end of the spectrum, there are some job roles with very mature profiles:

- 44% of Process and Machine Operatives (including environment, health & safety Monitor Operatives) are aged over 45. While overall demand for this group will decline this is outstripped by the rate of retirements.

- If early retirements are significant, one third of the population of nuclear Heat Generation could retire over the next ten years

Anecdotal evidence from within the industry points to a much older workforce than is portrayed by national statistics. This will be an artefact of the SIC codes which do not reflect this strategy industry adequately.

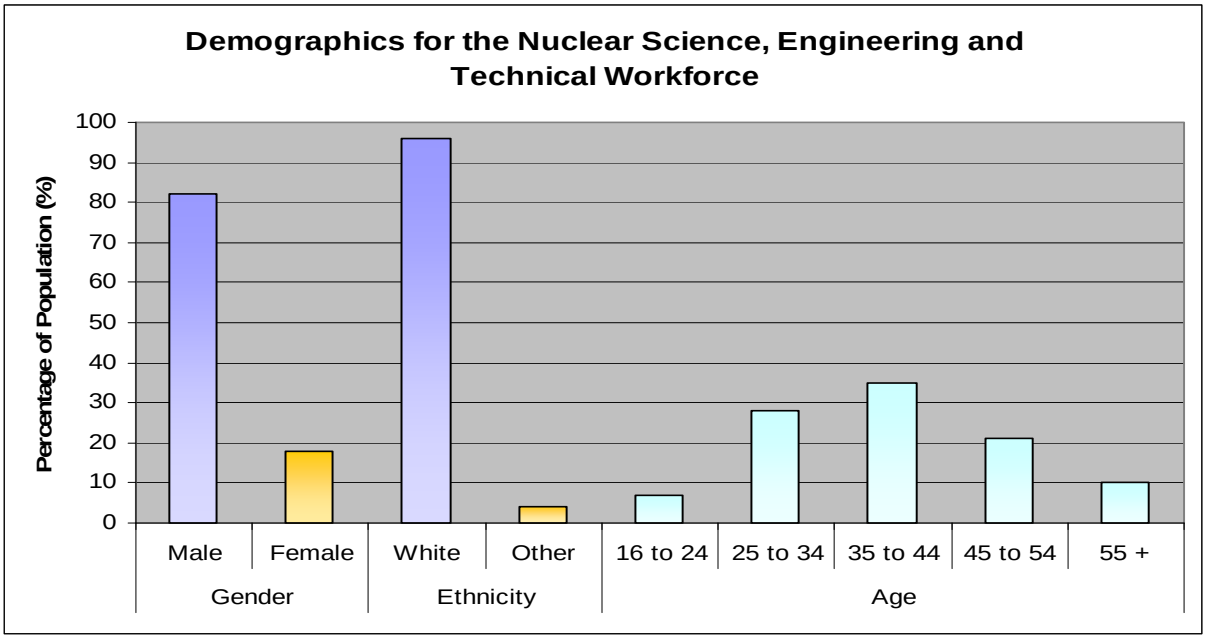


Figure 18. Demographics of the Nuclear SET workforce

10.5 Skills for the Future

Cogent and the National Skills Academy for Nuclear form the sector skills "family" for the industry. Cogent has been instrumental in setting up the National Skills Academy for Nuclear to develop and roll out skills products for the industry. As NASN develops its focus on providers and employers, Cogent will focus on the national picture, labour market research and intelligence, the employer voice, skills qualifications and national skills funding and leverage.

There has been concern in the past that inadequate engagement between employers and learning providers meant that provision frequently did not meet employer's demands and needs. Additionally, there is a paucity of specific training provision, which is in stark contrast to strategic position of the industry and the number of employees. This 'disconnect' between supply (from HE/FE) and demand (from employers) lies in the domain of both. For example, in HE, providers have traditionally focussed successfully on grant-funded student-led demand, while employers have drifted from HE involvement with workforce development often being perceived as a cost of employment, rather than an investment in future capacity and opportunity. The National Skills Academy for Nuclear has been established to address this situation and is now making significant strides in establishing a demand led system with a Quality Assured network of Providers selected by employers to deliver to their needs and to develop appropriate provision.

We welcome the inclusion of employer engagement as a major strand in the current strategy of the Higher Education Funding Council for England.

Cogent has focussed on the five strategic, sector-wide, 'big ticket' products described in the section on refineries.

Apprenticeships

There is now a fully-approved Advanced Apprenticeship in Nuclear Decommissioning accredited by the Institute of Engineering and Technology for registration as Engineering Technician. Cogent is reviewing apprenticeships for England/Wales and the Modern Apprenticeship in Scotland. As part of this review, Cogent will introduce a new apprenticeship framework for the nuclear industry.

Foundation Degree Framework in Science and Engineering

This is essentially a free-standing pathway of the *Upskill* product, in which Cogent is working with partner HE and FE institutions and stakeholders in England to build capacity and resources for a nationally recognised, industry-standard Foundation Degree Framework for science and engineering. This will support: knowledge and skills development for science and engineering in industry; skills development in the context of job roles in the industrial environment; and specialist academic development for sector-based skills pathways, such as Nuclear.

National Skills Academy for Nuclear (NSAN)

NSAN has been established at the request (and financial backing) of employers to address the many and complex skills and training issues facing the nuclear sector as it enters a phase of change and development ranging from decommissioning and clean up, to new nuclear build. NSAN is working across a wide spectrum, from the Foundation Degree qualification level, down to the Key Stage 4 in the schools curriculum[43].

NSAN business plan includes the following products:

- **Energy Foresight** is an integral part of the Key Stage 4 science curriculum in England and is working with schools and other partners to raise the awareness of careers in STEM subjects across the UK.

- **Nuclear Skills Passport** is a common training and skill approval solution for the civil and defence sectors. Includes:

    - **Core Roles** within the nuclear industry as a family of science and engineering-based skills linked to operational activities. (Includes development and roll out of core roles and underpinning training materials).
    - **Nuclear Industry Training Framework** providing recognition of employer-approved training and best practice and accreditation of modular learning.

[43] Information on NSAN can be found at: www.nuclear.nsacademy.co.uk

- **The Award of Nuclear Industry Awareness –** An award for new entrants to the sector, which provides the context for engineering in the nuclear industry.

- **National Vocational Qualifications -** for the existing workforce at levels 2-4.

- **Foundation Degrees -** for new entrants and up-skilling of the existing workforce (including Honours conversion).

- **Train-the-Trainer -** for the support of in-house employer training mentors (includes worker training programme).

- **Placements Programme –** with NSAN brokerage

- **Community Apprenticeships -** to address socio-economic challenges of developing local people for local employment and increasing the numbers of new apprentices in the supply chain.

- **Quality Assured Network of Providers-** to deliver the above products and services to the quality standards set by the Academy

- **Ambassador Programme -** to increase the number of STEMNET Science and Engineering Ambassadors (SEAs) from the nuclear industry and to provide resources for the SEA programme from employers.

10.6 Improving the Flow of Skills

In addition to the schemes being implemented by NSAN as above, the following generic supply actions are in hand.

The Science Diploma

Cogent has contributed to the setting Engineering Diploma and is managing HE consultation on the development of the Science Diploma. These new qualifications will provide a new supply of young people either direct to the industry, where they can continue with work-based learning through apprenticeships, or as new supply to FE and HE, particularly in STEM and SIV areas.

The Energy Foresight programme, mentioned above, will also cover the 16-19 Science Diploma could provide a suitable delivery vehicle for it alongside the Science Ambassador scheme.

Graduate Development Schemes

The NDA has launched a national graduate development programme. Interest in these programmes has increased with the prospect of new nuclear build. As a simple measure of attractiveness of the industry to the graduate community, the NDA programme was oversubscribed by 50:1. However, this does not indicate a uniformly strong flow of graduates. Recent recruitment experience indicates a serious shortage of civil engineers.

Universities

New nuclear engineering first degree courses have been launched recently and Universities are collaborating (for example the postgraduate Nuclear Technology Education Consortium, NTEC) to deliver and accredit nuclear programmes. Currently 11 HE institutions offer masters courses in nuclear subjects.

Cogent and NSAN are developing schemes to set up networks of HE and FE institutions to support and raise demand for employer focussed provision. This ranges from Foundation Degree frameworks and networks to Knowledge Transfer Networks.

10.7 Regional and Sector Analysis

Detailed analysis of skills in the Cogent footprint is available on the web by:

- Region[44]
- Industry[45]
- Higher level skills[46]

Graduates in Nuclear – Linda's story

Linda graduated with an MSc degree in Mathematics from the University of Glasgow and followed it with a Postgraduate Diploma in IT. Linda had never considered a career in the nuclear industry and admits she knew nothing about the nuclear industry before she started. However while at an assessment centre for IBM, another candidate mentioned BNFL. Linda investigated, thought it looked interesting, applied, and was ultimately offered a job at Sellafield on the graduate development programme starting in April 2003.

Linda started in the High Level Waste Plants department on the programme concerned with the return of High Level Waste to overseas reprocessing customers in Japan and Europe. As a mathematician, Linda was accountable for maintaining and developing mathematical models for a variety of purposes from risk modelling of plant processes to the radiological modelling of High Level Waste transport flasks.

As part of the graduate scheme, graduates have to do a three to six month secondment. Linda's secondment was into the commercial department to work as part of a small team leading Sellafield's contribution to the implementation of the Energy Act 2004 and the creation of the Nuclear Decommissioning Authority (NDA). On completion of this secondment, Linda was asked to stay in the commercial department where she has carried out a number of roles including: cost / price analyst, workstream leader in the project separating the Low Level Waste Repository (LLWR) near Drigg from Sellafield Ltd, senior contract specialist for Sellafield's legacy ponds and most recently as the commercial manager for all of Sellafield's functional areas (Environment, Health Safety & Quality, Finance, Information Systems and Technology, Strategy & Transition and Capability).

Aspirations

[44] http://www.cogent-ssc.com/research/regions.php
[45] http://www.cogent-ssc.com/research/Industry.php
[46] http://www.cogent-ssc.com/Higher_level_skills/index.php

Linda plans to stay in the nuclear industry for the foreseeable future, probably remaining in the decommissioning and clean-up area. However, she is all to aware of the range of opportunities that will arise as a result of nuclear new build and is delighted that even more opportunities will be available.

YGN Chair Role

Linda is also chair of The British Nuclear Energy Society Young Generation Network (BNES YGN). The BNES YGN is a national group of over 600 young professionals working, studying or simply interested in the nuclear industry. The YGN brings opportunities to get involved in all areas of the industry though the provision of training, development and networking opportunities. The YGN also responds to consultations on issues that affect the nuclear industry and / or specifically affect younger members. For example Linda, on behalf of YGN recently responded to the NDA's draft 3-year business plan as she does not believe that it adequately addresses issues with skills in the nuclear industry.

Challenges in the Industry

Linda does not believe that being female in the nuclear industry comes with any disadvantages – being 'young' is certainly the biggest issue. However, this is an issue which can be overcome by hard work and determination and Linda believes that once colleagues realise the value that 'younger' members of the industry bring, any lack of acceptance soon disappears.

11 ELECTRICITY GENERATION, POWER and GAS NETWORKS

11.1 Electricity Generation

This sector covers generation in power stations, coal, oil, gas and the conventional parts of nuclear stations.

To ensure that the UK's current and future power demands are met, significant investment in both replacing existing generating capacity and in building additional capacity is currently being planned and implemented.

The Large Combustion Plant Directive will force the closure of the derogated plant – that is 12GW of coal-fired power stations – by 2015. Some of this may close earlier depending on how the plant is used by its operators. In the nuclear fleet, the remaining magnox stations will close by 2011, while all the AGR stations are currently scheduled to close by 2023 (see Chapter 10). These closures will bring about a generating shortfall of around 20GW by 2020, which will have to be met by building new capacity. Of the new technologies, only wind can make a significant contribution by 2020 but wind output falls sharply in periods of calm and conventional capacity is also needed.

The fitting and operation of flue gas desulphurisation plant to the remaining coal fleet and, in all probability, the future installation of carbon capture will create further demand for skilled workers. The industry is also planning new nuclear and supercritical coal stations.

Thus the workforce is faced with major change, including the introduction of unfamiliar plant and equipment. Analysis of the labour force data also shows a challenging age profile, with significant losses to retirement in the 2010s. The workforce is predominantly at highly-skilled technical and graduate level, with long lead times from recruitment to competence.

The relatively poor image that the nuclear and conventional power generation sector has amongst the newly-qualified graduate population means that it has proven very difficult to attract the necessary skilled workforce. As more facilities come on-stream, the need to recruit engineering and science-based graduates and apprentices will increase. However, current un-filled vacancies in the following occupations are now beginning to threaten the industries' continued ability to operate effectively and safely:

- Mechanical Engineers
- Electrical Engineers
- Civil Engineers
- Plant Operations & Safety Engineers
- Planning and Design Engineers
- Control and Instrumentation Engineers
- Chemists
- Physicists

In the medium-term, the generating companies are taking steps to alleviate any potential skills shortages primarily by (i) increasing their Apprentice in-take year-on-year and (ii) by working collaboratively as part of the Power Sector Skills Strategy Group in areas such as sector attractiveness, qualification and career progression and in influencing stakeholders.

For many of these, replacement by recruiting and training within the UK will not deliver sufficient numbers quickly enough and a gap will open up that will have to, in part, be bridged over the short-term by overseas recruitment.

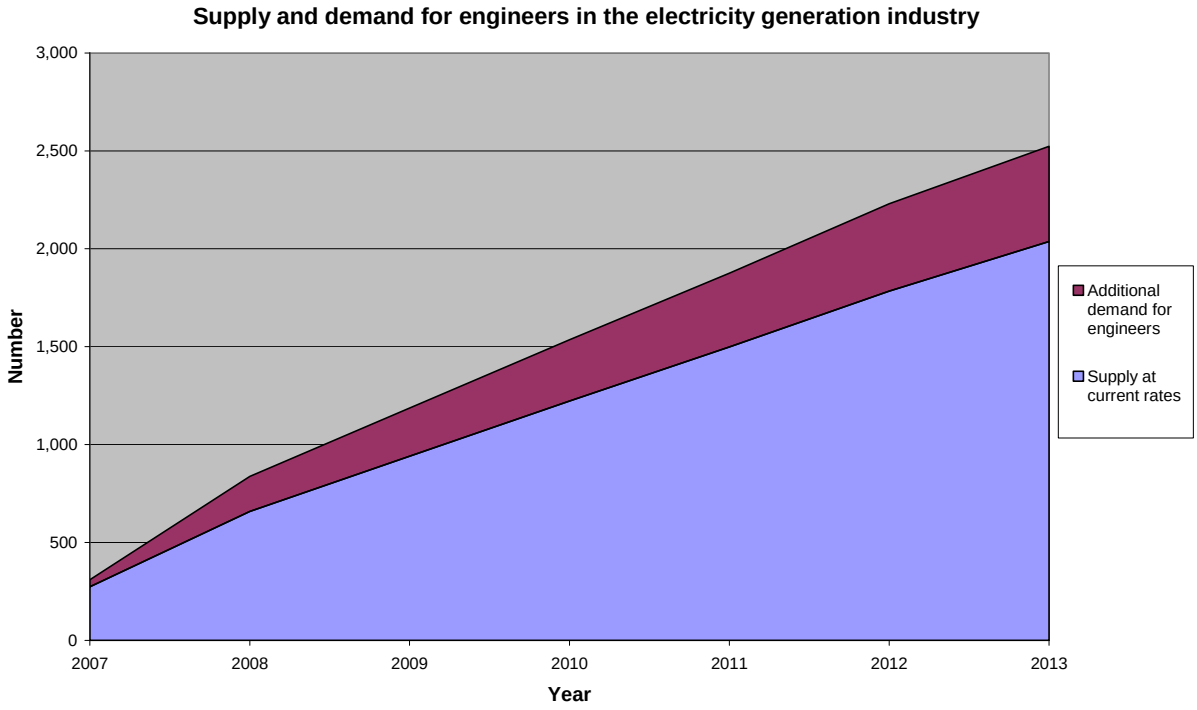


Figure 19. Supply and demand for Engineers in Electricity Generation

As a result of this identified risk, EU Skills has worked on behalf of the generating industry to have these occupations accepted onto the UK's Shortage Occupation List. Through providing workforce, training and vacancy data, the industry has identified the gap between predicted recruitment and training levels over the next five years and the likely demand for labour. Across each of the occupations listed above, there is likely to be a shortfall in available labour that can only be satisfied through recruiting from overseas, mostly from outside of the European Economic Area (EEA).

Although this shortfall will not involve large numbers, due to the criticality of the occupations involved, urgent action is needed to close the gap between the supply and demand of engineering and science-based employees. With the overseas recruitment and increased supply of UK recruits, most projections would indicate a return towards self-sufficiency in the late 2010s.

Returning to self-sufficiency is not just an aspiration, it's a necessity. Evidence points to a rapid increase in international demand for the same skills, so the UK cannot rely on an overseas supply of skilled workers over the longer-term.

11.2 Electricity Transmission and Distribution

Electricity Transmission and Distribution covers the operation and maintenance of the electricity transmission and distribution networks, which convey electricity from the generation facilities through the high voltage transmission network to the regional distribution networks up to (and including) the customers' meter.

The sector faces an increasing workload, driven by the need to renew old infrastructure and make provision to connect new generating capacity, both large power stations and renewables at every scale down to micro-generation. It has the ageing workforce that is common to the energy sector as a whole, with the loss of skilled workers to retirement increasing sharply in the coming decade. Recruitment and retention both present challenges, reinforced by a poor sector image. Training new recruits is a lengthy affair, typically a three year apprenticeship followed by a substantial lead time to achieve competence. Graduate training also lasts for 2-3 years. The outlook, therefore, is of short- and long-term skills shortages. Skills gaps will arise from the range and age span of technologies employed on the network.

The major transmission owner is managing the ageing workforce issue in its field force by investing in in-house training schemes at apprentice, and foundation degree level. The numbers involved are currently manageable, however there is continuing concern that the number of quality candidates applying for training schemes is too small, probably as a result of the relatively small pool of STEM-literate people coming into the labour market. This issue is more marked in London and the South East.

Part of the current strategy is an expansion of the company's training scheme at foundation degree level. This is considered the appropriate mechanism to maintain a supply of suitably skilled people for day-to-day engineering roles in the field and at headquarters. These people need an understanding of engineering theory deep enough to solve tomorrow's problems from first principles, but do not require the depth of academic knowledge typically found at full graduate level. This requirement is potentially at odds with a Government drive toward higher percentages of people going into full time university which in turn may dissuade parents, teachers and careers advisers from promoting this type of route into work. It is worth noting that the industry for many years has worked successfully with many more people educated to HNC or HND level than graduates: this principle is equally true today and going forward.

Staff retention in the transmission field force is not currently a significant concern although employers are aware of future pressures that could change this, e.g. changes to pension arrangements. Retention is more of a concern currently among professional engineers, principally because of competition for scarce skills in an industry on the cusp of major workload expansion. Again, the industry is investing in training at graduate and post graduate level, but is dependent upon the supply of students able and motivated to study engineering generally.

Following the detailed analysis of overhead linesworkers, reported in full in Appendix 1, this occupation was placed on the UK's shortage occupation list, allowing employers to recruit from overseas. This is not, however, a panacea as we expect the global demand for these skills to be high. Immigration will only be used tactically as part of a strategy to return the UK to self-sufficiency in these skills, which we hope to achieve around 2017.

In addition to linesworkers, there is an urgent need to recruit a number of associated occupations which are involved in the design and planning of projects. Employers' feedback mentions the following occupations in particular:

- Project Managers
- Site Managers and Engineers (5+ years experience)

- Design Engineers
- Project Engineers / Managers
- Quantity Surveyors
- Planners

In recognition of the potential skills resourcing problem all the Distribution Network Companies (DNO's) have been working with Energy & Utility Skills to evaluate the current skills resources in the industry and determine the skills needs to 2025. This resource modelling work is covered in section 11.4.

The Key Issues

- All DNOs have Resource Mapped their key technical skills vital for the future running of the DNOs.

- The profile of Leavers over next 15 years increases from the current rate of approx 340 p.a. to over 400 p.a. in 2011-2014 and reaches a peak of more than 700 p.a. in 2021.

- Leads times to competency are significant (between 2 and 5 years depending on the skill level) and as a result skills investment must lead both the capital investment and future retirement.

- The DNOs have recognised the strategic importance of skills investment as a key element in their Business Plans in order to meet future investment needs. The levels of investment are significant. Around 9000 new workers are required in the period 2010-14. Skills investment costs are projected to be over £300 million across all networks for DPCR5.

The skills issue is clearly one of strategic importance to the UK and to UK Government. A recognition of this by both the networks and Ofgem would demonstrate a proactive collaborative approach in finding the most effective and efficient ways to tackle the problems. There must be a clarity and consistency of the treatment of skills funding across the DNOs together with a transparency of recognition and reporting.

Regulatory funding for skills resourcing should be identified as a specific area for discussion during the DPCR5 determination process.
The sector, as a whole, is also keen to widen the diversity of its workforce and has an open policy to all recruits. However, the majority of applicants continue to be white males, indicating that there is scope to attract more applications from women and minorities.

11.3 Gas Transmission and Distribution

Gas Transmission and distribution covers the operation and maintenance of the gas transmission and distribution networks, which transport gas from the processing facilities through the National Transmission and regional distribution networks to the customers' meter.

The gas transmission workforce is comparatively small, but characterised by highly skilled specialist roles. Competition from the petrochemical industry, especially in Scotland, has created challenges in both recruitment and retention.

The transmission operator, National Grid, is committed to a resourcing strategy that includes in-house training schemes at apprentice, foundation degree and full graduate level. Broadly these are sized to deal with predictable losses such as normal retirements, with other losses being replaced by direct recruitment of skilled people in the general labour market. In the gas transmission business the relatively low numbers involved make the 'per head' cost of training schemes seem expensive but currently these are seen as the most effective way of maintaining necessary skill sets.

The major concern is that the recruitment pools for all three levels of training scheme are too small because of the relative scarcity of students with enthusiasm and aptitude for STEM subjects: the industry will invest in training, but needs government and society in general to ensure the 'seed corn' is available.

Gas Distribution Networks are typical of the energy sector generally in having an ageing workforce. The scale of the challenge has been quantified by the collaborative resource modelling work facilitated by EU Skills, see section 8.3.

The networks' 'age profile cliff edge' in their directly employed staff results from historic recruitment patterns and a legacy of workers trained prior to privatisation. Heavy recruitment from the mid 1970s to 1983 and then again in the early 1990's, was followed by a period of regulatory driven manpower reductions.

Therefore, as Ofgem recognised in the current PCR outcome, gas distribution businesses will have to make significant investments in recruiting and training skilled operatives. As an example, nearly 40% of the GDN operational first line managers are due to retire in the next 15 years. Typical training lead times are 4 years to train a new recruit. However, the skills and knowledge of these people has been acquired over decades working in the Networks and experience is harder to replace.

There is also increasing difficulty in recruiting skilled staff (a nationally recognised disparity between UK educational output and UK business need, with particular shortages in Engineering disciplines).

The contractor workforce that supports the sector is also facing the same age related cliff face. Placing an increased requirement on the contractor market will only serve to drive up contractor prices as the market tightens. This will have a two fold impact:

- It will increase the costs of work performed by the contractors;
- It will also make it increasingly difficult to retain staff, who will be attracted away by the higher rates available in the market.

In the UK, there is a high reliance on a small number of contracting partners which gives rise to a reduction in commercial availability and increased training costs. In the short term, networks have used a mixture of contractors and up-skilling plus redeployment of existing resources to meet the emerging gaps in its workforce.

However, there is a need to significantly increase the number of skilled resources, especially given the age profile to 2018 and beyond. Building on the resource modeling work (see next section), GDN's are therefore developing plans to work collaboratively on

issues such as sector attractiveness, increasing the capacity and quality of training and developing more effective routes to competence. In developing a sustainable recruitment framework, it will not only be possible to widen the pool of skilled resources but to grow the future managers and specialist skills needed to operate and maintain the networks.

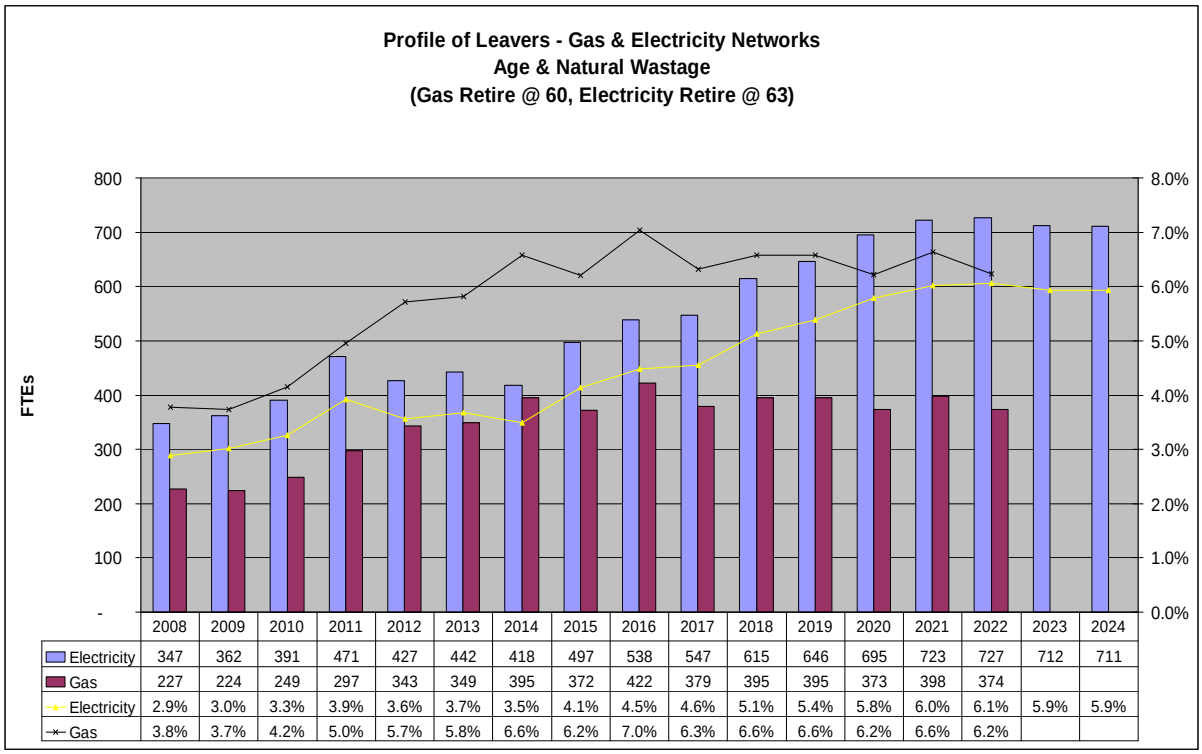
11.4 The Energy Networks - Resource Modelling

Fragmentation of the gas and electricity distribution sectors means that the skills shortages are split across a number of companies. Equally because their requirements are national, they are spread across all regions. The numbers for any one company or geographic region are therefore relatively small, with everyone only seeing part of the picture. It is only when the numbers are aggregated that the size and significance of the issue becomes clear.

Economic regulation has also had a strong influence on the skills strategy, recognising that the regulatory price control mechanisms, combined with lengthy training lead-times, do not incentivise long term investment in skills. Moreover, a tendency to use short-term contracts for external service providers makes their investment into apprenticeships and graduates, which require long lead times, less viable.

EU Skills have developed a resource model, which has been used by Gas Distribution Networks (GDNs) and Electricity Distribution Networks (DNOs) to understand the skills landscape. As a result of this work it has been possible to quantify the skills shortages and in particular the impact over time of an ageing workforce.

For both the GDN’s and the DNO’s the projected increase of leavers over the next few years plus the significant increase in capital programmes for the DNOs gives rise to an additional demand of skilled engineers.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Electricity	347	362	391	471	427	442	418	497	538	547	615	646	695	723	727	712	711
Gas	227	224	249	297	343	349	395	372	422	379	395	395	373	398	374		
Electricity	2.9%	3.0%	3.3%	3.9%	3.6%	3.7%	3.5%	4.1%	4.5%	4.6%	5.1%	5.4%	5.8%	6.0%	6.1%	5.9%	5.9%
Gas	3.8%	3.7%	4.2%	5.0%	5.7%	5.8%	6.6%	6.2%	7.0%	6.3%	6.6%	6.6%	6.2%	6.6%	6.2%		

Figure 20. Age and Natural Wastage in the Gas and Electricity Networks

The way the information was collected enables each company to understand and put into context their specific recruitment and training requirements and facilitates their succession planning.

The initial focus of the modelling was on the networks and on activity that is typically managed in-house, however the model has now been expanded to include work that is outsourced to contractors.

ENERGY NETWORKS RECRUITMENT REQUIREMENTS															
	Year Commencing April														
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Electricity Networks															
Marketplace Recruitment	645	401	388	418	360	214	202	164	210	203	240	225	232	229	241
Upskill internal personnel	282	361	349	323	323	246	226	237	237	278	276	309	286	304	250
Apprentices	180	255	309	318	336	214	224	250	227	275	286	280	282	286	293
Graduate Trainees	74	99	125	110	116	71	82	70	73	80	77	82	89	89	87
Total	**1,181**	**1,116**	**1,171**	**1,169**	**1,135**	**745**	**734**	**721**	**747**	**836**	**879**	**896**	**889**	**908**	**871**
Gas Networks															
Marketplace Recruitment	85	74	83	76	69	63	62	56	70	63	50	65	63	65	63
Upskill internal personnel	49	60	61	79	97	96	86	116	92	79	86	87	110	110	111
Apprentices	209	163	183	190	203	200	183	162	171	146	142	153	155	156	157
Graduate Trainees	32	32	29	41	41	53	53	53	54	54	53	54	52	54	52
Total	**375**	**329**	**356**	**386**	**410**	**412**	**384**	**387**	**387**	**342**	**331**	**359**	**380**	**385**	**383**
TOTAL ELECTRICITY AND GAS NETWORKS															
Marketplace Recruitment	730	475	471	494	429	277	264	220	280	266	290	290	295	294	304
Upskill internal personnel	331	421	410	402	420	342	312	353	329	357	362	396	396	414	361
Apprentices	389	418	492	508	539	414	407	412	398	421	428	433	437	442	450
Graduate Trainees	106	131	154	151	157	124	135	123	127	134	130	136	141	143	139
Total	**1556**	**1445**	**1527**	**1555**	**1545**	**1157**	**1118**	**1108**	**1134**	**1178**	**1210**	**1255**	**1269**	**1293**	**1254**

Table 2. Recruitment requirements for the Energy Networks

Value of Resource Model

The skills gap information is now being used to address skills shortages. For example, the scale of recruitment required means the training infrastructure is inadequate - one of the priorities is therefore focused on increasing the capacity and quality of training available. The electricity and potentially gas sectors are seeking to develop a National Skills Academy to support delivery of this need.

The output from the model has also been used successfully to support the GDN Price Control Review (PCR) process. With evidence from the resource model, Ofgem allowed an additional £80m for recruitment and training. DNO's are also planning to use the data to support the electricity DPCR5 discussions (commencing April 08) with Ofgem.

Following the PCR settlement, EU Skills' regional Skills Solutions Directors are now working with the respective gas networks to support them in securing the appropriate training, accessing regional funding and developing plans for future years.

However, despite the sector having the big picture information available at a national level, progress on resolving the issues is being hampered by the need to break up the data and deal with Local Learning and Skills councils, RDAs and devolved administrations at local and regional level.

In the case of nationwide industries in sectors such as the gas, electricity and water it is important that they are reviewed nationally and from a UK wide perspective to avoid regional and national distortions.

11.5 A Skills Strategy for Electricity

Senior managers from the power sector companies, facilitated by Energy & Utility Skills established the Power Sector Skills Strategy Group (PSSSG) in July 2007 as the power sector-wide collaboration group on skills strategy. Members include major power sector companies, contracting organisations, supply chain companies, Government partners, trade unions, trade associations and professional bodies. In this manner, all industry stakeholders are working together to address the serious skills challenges facing the sector. Members hold strategic positions in their representative organisations and are able to contribute to the strategic debate on skills in the power sector. A senior representative of a major power company, who is also a non-executive director of the industry skills sector council, Energy & Utility Skills, chairs PSSSG and secretariat resources are provided by E&U Skills.

The PSSSG's sole purpose is to develop a strategy to address the strategic skills gaps across the power sector, with particular emphasis on the potential for medium (2-5 years) and long term (5-20years) collaborative action. The PSSSG will support the sector-wide delivery of a long-term, sustainable skilled workforce to meet the environmental, social and commercial challenges of the next 20 years.

Practically, the PSSSG is developing a skills strategy for the sector, including plans for a Skills Academy, but is also involved in important work on skills frameworks, reducing the lead time to competence and improving the sector attractiveness to new recruits.

The specific issues faced differ between companies and between parts of the transmission and distribution sector.

Skills modelling and analysis is currently being conducted by the PSSSG covering the whole of the power sector from generation through transmission, distribution and metering.

11.6 National Skills Academies

The Power Sector companies through collaboration on the Power Sector Skills Strategy Group have identified the critical skills challenges faced by the Power Sector over the next 15 years and believe that to address these challenges a National Skills Academy (NSA) will be required. In July 2008 the PSSSG, supported by Energy & Utility Skills, made a formal bid to DIUS for a Power Sector National Skills Academy (PSNSA)

Vision

The Power Sector NSA will:

- transform the sector, through collaboration and investment to address the critical current and future skills challenges the sector is facing. For the first time employers, through the NSA, will take a national approach to Power Sector skills needs and related provision, identifying gaps and avoiding duplication.
- develop and maintain a network of high quality, employer responsive training providers that together can deliver the volume of learners and specialist skills requirements at local, regional and national level. It will ensure a long-term strategic view of skills needs.
- develop innovative training approaches that will take a fresh look at the traditionally long training lead times and delivery mechanisms.
- address the inconsistencies across the sector, promoting standard qualifications frameworks and consistent and recognised training standards.
- increase the attractiveness of the sector to future and existing employees, learners and trainers, demonstrating clear recognised career and development paths and ‘connecting up’ the promotion of the sector to new recruits and learners through schools, careers advisors and Further and Higher Education.
- maximise the benefits for UK business and jobs by addressing current and future skills shortages and raising the profile of the sector to be the global leader in power, which includes renewable generation, skills development.

The NSA, if the application is successful, will become an essential part of Power Sector operations and will be at the heart of the sector’s future success. It will drive excellence in skills capability and capacity whilst ensuring connectivity across the sector and with other skills organisations and stakeholders. It will be recognised as a key factor in the maintenance of UK security of power supply and ‘keeping the lights on’ whilst delivering the skills required to address the government’s ‘energy challenge’ and support a low carbon and resource efficient economy.

11.7 Young Apprenticeships

Young apprenticeships, which aim to give 14-16 year olds direct experience of work and vocational training, are a new development which we can use to promote employment in the energy sector to young people. E&U Skills is running a number of young

apprenticeships in both the water and electricity sector. These projects place students in work for up to 50 days per year over a two year period. Scottish Power was one of the participants and has just agreed to continue with a second intake of young people this year. Also, this year, another 100 young people have been signed up for young apprenticeships in the water industry. E&U Skills is now in discussion with employers with a view to extending young apprenticeships into the gas sector.

Although in their early stages, these projects have had a good response from employers, schools and students alike. They look to have potential for attracting young people in the sector. The schemes provide a model on which we can build for the future.

11.8 Regional Pressures

Recruitment of craftsperson, technician and professional engineer-grade staff in London and the South East especially is proving increasingly difficult. Utility companies generally offer reasonable salaries compared to national averages and usually offer additional benefits, such as pension schemes that make the overall package attractive in most places. However in London the demand for people with practical skills to service homes and commercial premises is particularly strong. Utilities, particularly those with a national footprint, and therefore national pay scales, find it difficult to compete. This trend is likely to continue as infrastructure expansion and renewal increases in London – not least driven by the 2012 Olympics and Thames Gateway.

We recognise that the Government has considered methods to support ‘key workers’ such as nurses in London, presumably because such people are regarded as vital to public safety and well being and because it is unreasonable either to assume they will commute large distances into the capital, or to pay them substantial premiums above national pay scales. These arguments apply equally to key utility workers, in particular those whose duties involve responding to faults and emergencies. We are concerned that the utilities’ ability to provide adequate response, especially outside normal working hours, is already and a problem may be compromised to unacceptable levels if current trends continue. We would urge the Government to consider extending ‘key worker’ opportunities to key utility staff, and would work with Government to carefully target any help available.

12. RENEWABLE ENERGY

12.1 A Growing Industry

While UK manufacturing has been losing 100,000 jobs a year, there is nevertheless abundant evidence of the emerging strength of the UK's low carbon economy. This was recognised in the CEMEP[47] report, which set out a policy framework to take this strategy forward, in which renewables play a central role.

There are no reliable estimates of current UK employment in renewables or its growth potential, although, given the growing certainty of a policy framework centred on 15% of UK energy from renewables by 2020, such forecasting should now be more reliable.

The contribution to the 2020 target envisaged for wind power, both onshore and offshore, will require about 10,000 turbines to be installed. Given the high level of global demand "it is arguable that a UK manufacturing capability will be required"[48]. This requires policy certainty in area such as planning policy, grid connection and labour supply.

From a skills perspective, renewable energy is a fragmented sector. Only wind energy can be regarded as mature and many other technologies are still in development or emerging into the mainstream. Nevertheless, the sector is growing and getting stronger, with an increasing demand for skills that can be hard to satisfy.

For the Sector Skills Organisations, renewables present some issues not seen elsewhere. Perhaps the most important is the uncertainty around the future demand for skills, especially for those technologies yet to complete their development. The production of competent, skilled workers takes 5-10 years from leaving school but it is not possible to estimate the demand for skills so far ahead with any certainty. The danger of not producing enough skills, hence delaying the introduction of the technology is obvious. But equally damaging would be the production of large numbers of people ahead of demand, as this could lead to a backlash for future recruitment.

The footprint for renewables is also complex. There are 8 SSC's, 9 RDAs and 3 devolved administrations all trying to tackle the issue and there is possible overlap, in total, with 14 Sector Skills Organisations. This includes many for whom renewables is not mainstream, for example the 2 million workers in the construction sector who might occasionally install renewable systems. Energy and Utility Skills takes the lead in coordinating the approach to renewable energy but, to date, a cohesive strategy has proved elusive. There needs to be better co-ordination of effort, with dedicated resources to address the issues more effectively. Government has recently launched a consultation on the renewable energy strategy[49] and this will provide a valuable forum for addressing skill issues. Due to the complexity of the issues, we believe a strong lead from Government will be necessary to catalyse a coordinated programme.

12.2 A Skills Academy for Renewables?

This has been mooted as a way of developing a coordinated strategy for the sector. However, the authors of this report, with experience of developing skills academies,

[47] *Commission for Environmental Markets and Economic Performance*, report, 2007.
[48] BWEA: 2020 vision, 2008.
[49] http://www.berr.gov.uk/consultations/page46797.html

believe that the critical mass of employers is, as yet, lacking. Most of the existing workers in renewable energy were trained in mainstream energy or engineering and we believe the most effective medium-term strategy would be to expand this mainstream training provision to cater for a spin-off to renewables.

Development of a skills strategy for power generation and distribution will create a framework that can accommodate some aspects of renewable electricity, while plans for the environmental industries could encompass energy management and micro-generation in buildings and energy from waste.

12.3 Wind

Wind will bear the brunt of meeting the 2020 targets for renewable energy. Installed wind energy capacity will overtake nuclear for a time in the late 2010s. Therefore, a competent skills base is essential to support growth and maintain the infrastructure. Generally, skills and recruitment are in reasonable shape, but current capacity cannot support the high level of growth in new installations. However, offshore, which is the most important sector for growth, is likely to experience recruitment difficulties, due to the unattractive work-life balance.

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

The British Wind Energy Association has called together key employers to develop a skills plan for the industry, which will also encompass marine renewables.

12.4 A Manufacturing Strategy?

Many thousands of jobs will follow the successful development, manufacture, installation and maintenance of large-scale wind and wave-related technologies – estimates range from between 10,000 and 45,000 jobs in the UK by 2010. In Scotland, 7,000 direct jobs could be created in a diverse marine industry, supported by sustainable research development and skills bases. Marine energy capacity could contribute up to 10% of Scottish energy, as well as supplying major international export markets.

At present, the UK is the world-leader in wave/tidal power technology. While a number of experimental systems are in place in the UK, there are concerns over the relatively low level of initial government support. Ocean Power Delivery not only has a prototype called Pelamis (90% UK-made) operating in the Orkneys, but an order for three full sized plants in Portugal, with an option on more. However, in the absence of UK orders, these additional units may be manufactured in Portugal.

In Denmark, 29,000 people already work in the renewables sector. After 15 years of investment, wind power contributes 16.7% of energy generation and wind technology is a major export industry.

In the renewable energy sector, the German workforce increased by almost 50 per cent between 2004 and 2006, from 160,000 to 235,000 employees, and is predicted to rise to 400,000 by 2020.

The Renewables Advisory Board (RAB) annual report[50] found that "skills and training continue to be barriers to delivering growth in microgeneration technologies". Installer training and developing relevant qualifications are two of the issues RAB is now assessing.

Give the opportunities presented by manufacturing for low-carbon energy; we welcome plans by BERR and DIUS for low-carbon manufacturing to be a key element of the emerging manufacturing strategy.

Ecological Industrial Policy in Germany

The German Federal Environment Ministry believes that Germany is well placed to play a pioneering role in the "third industrial revolution", as the world's energy-efficiency and environmental engineer. It has proposed an innovation-based environmental policy that represents a "New Deal" for economy, environment and employment and will achieve a "double dividend" for the environment and German trade and industry.

It predicts that growth in environmental technology markets will vastly outstrip traditional economic sectors, with a 4 per cent annual growth rate, taking turnover in Germany to €1000 billion (about £700 billion) by 2030.

In the renewable energy sector, the German workforce increased by almost 50 per cent between 2004 and 2006, from 160,000 to 235,000 employees, and is predicted to rise to 400,000 by 2020.

[Sources: Ecological Industrial Policy. Memorandum for a "New Deal" for the economy, environment and employment, Federal Environment Ministry (2006);
Renewable energy: employment effects, Federal Environment Ministry (2006);
Renewable energies create work for 235,000 people, Federal Environment Ministry press release 245/07 (2007)].

Cited in CEMEP report, 2007.

[50] Renewables Advisory Board, Annual report, 2006-06, DTI, 2006.

Skills for a Low Carbon London

The London Energy Partnership report, *Skills for a Low Carbon London*, reviewed the energy efficiency and renewable energy resources and skills gaps in London[51] and recommended ways to address any shortfalls.

The LEP final report summarised both the desk and qualitative research, and provides a number of recommendations for the London Energy Partnership to take forward.

There is a huge array of policies, initiatives and other activities driving the market for skilled workers in the energy efficiency and renewable energy industries. These will have particularly high impact on skills in the next two years.

The main difficulty for the energy efficiency and renewable energy sectors in terms of skills and training is that they are not covered by one Sector Skills Council. Rather, no less than 14 of the Sector Skills Councils have energy efficiency / renewable energy occupations within their footprint to a greater or lesser degree. The study focuses on the six with most direct impact on skills and training for energy efficiency and renewable energy: Asset Skills, Construction Skills, EU Skills, Lifelong Learning UK, SEMTA and SummitSkills. Engineering construction is also critical to the design and construction of the facilities.

The study also identified that specialised skills are also needed outside the energy sector, including local authority planning officers and inspectors. A lack of trainers is a major barrier to improving the skills supply.

There are two key ways in which the Sector Skills Councils can work with employers plus education and training providers to support skills development of the workforce and productivity.

- Sector Skills Agreements, introduced as a way for Sector Skills Councils to exert strong influence throughout their sectors to help shape the supply of relevant training and skills and to raise employer commitment to skills. It is imperative that energy efficiency and renewable energy are included at an explicit level within the Sector Skills Agreements.
- National Occupational Standards: They define the level of competence needed for a particular job role or occupation and provide the building blocks for the assessment of skills and training needs. The research found that there is an extensive range of education and training provision available in and around London for energy efficiency, although provision for renewable energy is not as extensive. Despite this, energy efficiency is often left unstated in National Occupational Standards, and is assumed to be included as a part of 'current, relevant legislation'. In an environment of rapidly changing legislation and policy, some aspects may be overlooked and employers and training providers may be unaware of the need to update the training or assessment procedures. This means that presently energy efficiency and renewable energy are unlikely to be covered adequately.

Also SSC's and existing and potential new National Skills Academies could work together to develop a specialist innovation network to address renewable energy skills[52].

[51] *Skills for a Low Carbon London: Summary Report and Recommendations on the Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London*, London Energy Partnership, 2007.

[52] DIUS Innovation Nations report, March 2008

13 COAL, CARBON CAPTURE and STORAGE

13.1 UK Production

In 2006-07, the UK produced 16.6 million tonnes of coal, and imported 51.5 million tonnes. Of UK coal consumption, therefore, 14% was met from deep-mined production and 12.5% from opencast operations in the UK, with a record 73% from net imports and other sources.

The coal mining industry employs a 5,500-strong workforce.

A preliminary skills assessment from the TUC's Clean Coal Task Group[53] argued that, "given the average age of the workforce in the mining industry, skill shortages are becoming critical. A competent workforce will be a major factor in the industry's survival." Young people will not be attracted into the mining industry with little to no prospect of a long term career and that is where the Government can help by giving a signal that for security of supply we require a deep-mined coal industry.

	Output, million tonnes	Workforce
Deep-mined coal	8.2	3,755
Opencast	8.4	1,656
Total	16.6	5,411

Table 3. UK Coal output, workforce, April 2006-April 2007
Source: Digest of United Kingdom energy statistics, 2007.

The training schedule which exists now in the mining industry requires new entrants to undergo a 20-day course before they are allowed underground and 20 days CPS (Close Personal Supervision) when they commence underground work. This would only allow them to assist trained mineworkers with outbye (away from coal face) tasks or patrol the belts. They are then reviewed monthly with regard to their competency.

For face/development training there is a one-week induction course, 60 days on the face training on all aspects of face work, chocks, loadergate end, tailgate end etc. Development training is a further 40 days, ideally 20 days in a bolted development and 20 days in a steel development, if available.

On the statutory training above it would take 12 months to train a person to face/development standards. On a practical basis it would be a further 3 to 5 years before they would have the practical experience to be a competent mineworker safe to carry out their duties.

[53] *Clean coal in the UK and European electricity mix,* TUC Clean Coal Task Group, a joint industry and trades union initiative; Position Paper - March 2008.

13.2 Future Demand for Coal

Some 85% of coal is consumed by the electricity generating sector. A key determinant of the demand for UK coal is the replacement programme for the UK's coal-fired power installations. This in turn is closely linked to the development of clean coal technology allied to carbon capture and storage.

The Coal Forum considered three scenarios for new coal power plants to replace the 11 GW of coal and oil power plants which are to close by 2016[54]. These scenarios envisage Low (5GW), Medium (10GW) and High (15GW) amounts of clean coal plant being built by 2015, with the balance of the generation gap being filled by new gas plants. A typical power plant with two 800MW units would produce around 12000 GWh of electricity per year. If all of the plants are fitted with CCS by 2025, CO_2 emissions from UK power plant overall would be reduced by 40 %. This could be achieved sooner with the right regulatory and financial framework.

The consequence of the low coal scenario is an increase in dependence on gas for electricity generation to around 52% (58% if no new coal is built).

To maintain the present proportion of coal in the UK power generation mix would require the "Medium Coal Scenario", i.e. 10 GW of new clean coal operational by 2016. This would require 2 GW of projects (at least one new or replacement power station) to start each year (2008 to 2012) to be ready for 2016. It is not feasible for plants to be built faster due to the lead times from the manufacturing industry that supplies the equipment.

The CCTG therefore recommended that the government should decide which scenario for coal in the generation mix (Low, Medium or High) would meet its Energy White Paper objectives of secure, low carbon energy supply and its ambitions for the Coal Forum, and undertake a review of workforce supply and skills issues accordingly. A detailed, scenario-based assessment of future mining skills requirements is urgently required.

13.3 Carbon Capture and Storage

Carbon capture is a chemical process. There are two approaches; the first is post-combustion capture, which is the subject of the UK's current competition for a demonstration project. In this process, the hot flue gasses from the boiler are cooled, particulates removed, sulphur and nitrogen oxides removed by contact with lime slurry and carbon dioxide extracted, usually by contact with an aqueous amine solution.

The second approach is pre-combustion capture. Here the fuel, usually coal, is gasified by reaction with oxygen and possibly some steam, to generate a syngas, a mixture of carbon monoxide and hydrogen. The syngas is then processes by a shift reaction, a reaction with steam that converts the carbon monoxide to carbon dioxide, while generating more hydrogen. The carbon dioxide is separated by amine extraction, leaving a clean hydrogen fuel to run a gas turbine - combined cycle power plant. This gasification element of this technology is less mature than conventional boilers, albeit that it is in use to make syngas for chemical feedstock. The shift reaction is a standard chemical process.

[54] see "Overview of the Work of the UK Coal Forum, November 2006-June 2007" - http://www.berr.gov.uk/files/file41186.pdf

CCS overall involves standard chemical unit processes, while the storage involves pipeline, offshore and oilfield technologies. None of these are new, or exceptional. The need to demonstrate these technologies arises from uncertainties around overall system operability, cost, the amount of energy consumed and the trade-offs, such as whether to dry the carbon dioxide, or install corrosion resistant metallurgy. The skills to design and construct CCS systems will be built upon the skills that already exist to design and build chemical plant, pipelines and offshore installations. However, capacity is limited and competing demand for these resources, especially if there is continuing global demand for chemical process design, can be high.

Industrial Potential of CCS

The successful development of technologies to capture, transport and safely store CO_2 emissions creates major industrial and employment opportunities for the UK. Capture technologies required not just for coal and gas-fired power generation, but for other heavy emitters (steel, aluminium, cement), while transport networks and safe long-term storage facilities are essential to achieve economies of scale and to secure high volume CO_2 capture.

However, to date the UK has yet to undertake an integrated assessment of the combined industrial and employment potential of the sector, nor of the skills challenges involved in its successful development, ranging from science and engineering skills through project management to construction and operation skills.

Strategic Importance of CCS

There is a growing recognition by Governments (and the EU) of the importance of clean coal–fired electricity generation, including carbon capture and storage (CCS) for meeting our security of supplies and climate change targets

Clean coal with CCS is a vital part of the UK's generation mix, balancing renewables, baseload nuclear energy, clean coal and limiting dependence on gas; while providing a flexible capacity to handle rapid load change. Worldwide, coal accounts for 41 % of electricity supply and this is expected to rise to 45% by 2030[55]. Replacing all this plant with a low-carbon alternative in the timeframe for carbon reduction is not possible – the manufacturers could not deliver the equipment. So the retro-fitting of CCS is crucial. Recognition of the global importance of CCS for both coal and gas (see for example the Stern Review[56]) has led to UK government action on R&D, demonstration, regulation, and specification that newly consented power plant should be "capture-ready".

The EU aims to have 10-12 CCS demonstration projects in Europe by 2015 and we expect a similar number in the rest of the world if CCS is to be commercialised and rolled out on the scale necessary from 2020. These demonstrations should cover coal and gas, a range of capture technologies, a range of storage locations and evidence of safe, long-term storage capability. Because of the UK's location and well understood offshore geology, several of these projects should involve CO_2 storage in depleted gas fields or aquifers on the UK Continental Shelf.

[55] see http://www.eia.doe.gov/oiaf/ieo/electricity.html
[56] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_Report.cfm

A regional capture network: the Yorkshire Forward project

Tackling climate change is a critical part of Yorkshire Forward's regional industrial policy. One key initiative is a project to capture, transport and store a large part of the 80 million tonnes of CO_2 emitted from the region's power stations and heavy industry[57]. The project's objectives are:

- To make a massive contribution to the UK's climate change strategy.
- Help secure a green industrial future for the region.
- Develop new technologies to underpin the region's low carbon economy.

The Regional Development Agency has created a CCS partnership comprising representatives from the region's power, oil, chemical and steel industries, with other bodies including the TUC and affiliates. The project aims to develop a CCS transportation network whereby much of the region's CO_2 would be liquefied and piped under high pressure for storage in depleted gas fields in the southern North Sea.

The scheme could sequester up to 60 million tonnes of CO_2 ($MtCO_2$) annually from the 13 heaviest CO_2 emitters alone, and up to 80 $MtCO_2$ if the proposed pipeline were extended to medium-sized plants in the region. The UK as a whole emitted 560 $MtCO_2$ in 2006.

The 13 heaviest emitters have a combined workforce of around 4,300 directly-employed. Another 650-800 workers are employed on contracting services.

The region's trade unions have warmly welcomed the project. It takes forward TUC policy: a composite motion to Congress 2007 reiterated the TUC's support new clean coal technologies such as carbon capture and storage, allied to the exploitation of the nation's massive coal reserves in the best interests of security of supply.

The partnership is looking for support from the Government to help fund the pipeline – demonstration funding, a supportive regulatory framework and other initiatives notably the inclusion of CCS in the EU ETS.

The project clearly has massive industrial and employment consequences for affiliates in the region:

- As a capture network, it will provide a market-based means for industry to safely store CO_2 emissions, thereby helping to secure their long-term presence in the region.
- It is likely to attract energy and industrial investment to the region in a carbon-constrained world.
- It will offer industrial and skills opportunities in its design, construction and long-term management of the network.

The RDA will therefore be assessing the economic and employment benefits of the network in a report expected in 2008.

[57] *A carbon capture and storage network for Yorkshire and Humber,* Yorkshire Forward, 2008.

14. CONSTRUCTION OF NEW PLANT, INCLUDING ENGINEERING DESIGN AND PROJECT MANAGEMENT

14.1 Building our Infrastructure

It is important to understand that the construction of new and the repair and maintenance of any energy facility depends on the skills of the Engineering Construction Industry (ECI) and are within the scope of the statutory Engineering and Construction Industry Training Board (ECITB).

The skills are mostly provided by contractors who work in several sectors, typically working for the client or asset owners that are represented by the Sector Skills Councils who also contributed to this important report.

The ECITB has working links with the Sector Skills Councils (SSCs) to ensure portability of standards across the industry as a whole.

There are several interfaces to understand. For example, in considering the nuclear new build and decommissioning programmes, the ECI is typically responsible for the design and project management as well as the installation, testing and commissioning of the plant and the equipment. The construction industry, represented by ConstructionSkills, typically builds the fabric of the power station and the operation of the power station itself belongs in the footprint of Cogent. Operation of coal or other non-nuclear stations are within the footprint of EU Skills.

In terms of decommissioning, the ECI usually is responsible for the dismantling of the process plant and equipment. The key activities in the ECI are:

(i) On–site construction, repair and maintenance which needs personnel with the following skills,

- Professional Engineering and Technical
- Management & Supervisory
- Skilled Craft & Technician
- Semi-skilled & technical support

(ii) Off-site design, engineering, project management which comprises,

- Senior Management & Project Management
- Engineering Design & Project Engineering
- Administration & non technical support skills

The workforce is relatively mobile, with many personnel moving in response to demand between companies and sites and covering a wide range of sectors, including power generation, oil and gas (offshore), downstream oil and gas, chemical and pharmaceuticals, steel mills, metal smelting and food and drink. There is also a relatively large agency and temporary pool of people that supports the industry.

14.2 Developing Skills

Engineering Construction companies (including for example Alstom, Doosan Babcock, Siemens, AMEC) collectively invest £18 to 20 million per annum in skills via the training levy, based on relevant payroll, paid to ECITB; which then funds training through grants, free training and apprenticeships. There is a well developed strategy for developing skills within the industry by targeting the two main areas.

The first part is aimed at increasing the inflow and increasing the capability of the people, who spend most of their time working ***on-site***. These are mainly craft, technician, supervisory and construction management roles, supported by engineering and project management personnel. The strategy involves:

- Apprenticeships in craft and technical skills (new entrant)
- Up-skilling and modular conversion training for craft and technician skills (existing and new entrant)
- Up-skilling and modular development programmes for supervisory personnel (existing)
- Up-skilling and modular development of site construction management personnel (existing and new entrant)
- Up-skilling and modular development of project management personnel (existing).

Similarly, the second part is aimed at increasing the inflow and increasing the capability of the people who spend most of their time ***off-site*** designing, planning and managing the construction and maintenance projects. These are mainly, technical, engineering and professional engineering, project and project management roles, supported by contract, procurement management and project control personnel. The strategy involves:

- Apprenticeships and up-skilling in engineering design (new entrant and existing)
- Apprenticeships and up-skilling (modular) in project control (new entrant and existing)
- Up-skilling and modular development of project management personnel (existing)
- Graduate entrant development programme to up-skill and progress to professional recognition (entrant and existing).

14.3 Scale of the Challenge in Context

In the UK, the available Engineering Construction skills pool is not meeting the current demand. While importation of skilled people from Europe and further afield is meeting some of the skills shortages at the moment, the consensus is that these people will not be available in the same numbers in the medium term. This will certainly be the case if, as rumoured, Germany relaxes its barriers to A10 immigrants earlier that 2011. Competition for engineering construction skills is also increasing as a result of clients (such as oil and power companies) recruiting to strengthen their in-house capabilities after a period of outsourcing. Major projects, such as the MoD's ship building programme, also compete for skills. Together these are likely to take around 20% of the current on-site workforce employed by engineering construction contractors.

Furthermore, demand is forecast to rise by at least at 5% per year for the next few years and, in critical areas, by as much as 15% in some years. This outlook has led to genuine and growing concerns about the nature and scale of skills for the future. These concerns are being expressed by contractors, clients and trade unions across the industry. A

comment made by a major UK oil refinery executive illustrates the point: “Refineries see the ECI skills shortage as their single biggest issue”.

The international engineering construction market is also buoyant and expected to remain so, affecting the UK based engineering, design and procurement contractors (off-site). They are currently reporting ~3,000 unfilled vacancies in key engineering, technical and project management roles. Unknown, but significant numbers of UK engineers, craft and technician workers are in employment overseas.

A recent analysis by ECITB is predicting a major shortfall in the skilled workforce due to demographics (aging workforce) and growth of business, also the expected new power plant programmes (renewable energy, gas, nuclear, and coal) will need 5,000 extra people by 2014 alone. By the same date the ECITB is predicting a total shortfall of 17,000 skilled engineering personnel. Figure 15 shows the expected profile of activity.

In order to meet demand and replace retirees, overall the engineering construction industry needs to recruit, develop and up skill around 45,000 people by 2014. This is a major challenge but needs to be met to retain the UK’s core capability to design, build and maintain major engineering facilities.

The benefit of achieving this is clear – a larger, more cost effective, self sufficient UK workforce, increased security of supply of people, leading to more effective delivery of major projects and greater plant integrity, giving safer, more reliable operations. The industry will be more diverse and flexible and will develop and retain knowledge in the UK that can continue to generate inward investment and export revenue.

Analysis shows the need to be:

- 5,000 graduate entrants, mainly engineers
- 12,000 apprentices, craft, technician, maintenance, design, project control
- 10,000 current semi-skilled and craft workers need up-skilling
- 8,000 engineers need skill enhancement in project management
- 10,000 mature entrants needed across the skills range

The industry’s current collective plan utilising the training levy of £18-20m per year will focus on apprenticeships, up-skilling and project management skill enhancement and will deliver training to more than 7,000 people each year. New entrants supported in this plan will be around 14,000 by 2014, leaving an overall shortfall of 30,000. 17,000 are in the core engineering and technical skills and around 13,000 in the agency or temporary worker pool which is both engineering and other support personnel. This is illustrated in Figure 16.

It is clear that the existing “business as usual” model cannot meet the future needs of the industry. It is not planned to raise the training levy above the current 1.5% maximum as this is already felt to be a high level of employer collective investment. Attention is needed to:

- Increase training investment in addition to the training levy, possibly on a matched funding basis
- Build capacity to treble the volume of training provision and monitor the quality of delivery.

- Introduce new models for training of skilled craftsmen to facilitate their early use on new build projects.

This will require the cooperation of Government, the industry, the trades unions and the training providers. There is already much in place to build on but urgent action is needed to ensure sufficient people are trained in time.

The conclusion is that additional investment from the whole supply chain and key stakeholders is need urgently. This is so we can accommodate the lead time for skilled people to reach the necessary level of competence and spread the training requirement over several years. This will also make the process manageable and sustainable in the future, smoothing peaks and troughs in training throughput.

Further evidence of these issues can be found in the briefing paper, *Bridging the Skills Gap,* published in September 2007[58], and a second report, *Securing Engineering Construction Skills for the Future* that further analysed the skills demand to 2014[59]. There has been widespread discussion amongst engineering construction employers, their clients, employer associations and the trades unions that are key stakeholders central to the future of Engineering Construction as a thriving industry.

Power Focus

There is a growing skills shortage in the power generation sector due to the demand associated with new power plant – renewable energy, gas, nuclear and coal – on top of the growing demand for repair and maintenance of existing facilities.

According to the UK Energy White Paper 2007, there is a need for approximately 30-35GW of new power generation capacity by 2025. Up to 15GW could be needed by 2015 to replace nuclear and coal plants which are scheduled to close.

The New Build programme will require an increase in the UK engineering construction work force, both on-site and off-site, of around 5,000 by 2014. The precise structure of skills and the distribution of employment across the industry will be dependent on the mix of renewable energy schemes, gas, nuclear and coal, but there is a great commonality in the skills used in these areas.

14.4 Engineering Construction in Context

It is clear from the labour force data that unless there is urgent and sustained action to increase the number and quality of people in engineering construction, there is increasing risk to our ability to build and maintain the industrial facilities that support large parts of the economy. Labour costs are already rising and there is growing evidence that capital investment is being deferred because of the lack of sufficiently skilled personnel.

Demand for engineering construction resources worldwide is expected to rise sharply, driven by the need to replace ageing infrastructure, the rising demand for fuels and feedstocks and the imperative to reduce carbon emissions. We expect the European

[58] http://www.ecitb.org.uk/ecitbresources/104/
[59] http://www.ecitb.org.uk/documents/Securing_Engineering_Construction_Skills_for_the_Future_brief.pdf

labour supply to tighten as barriers in the EU15 to workers from the A10 are removed. Worldwide, there is a mobile, high-quality workforce but to rely on this would mean competing for resource with the Middle East, North America, Australasia and possibly Europe. This would not be a cost-effective option for the UK and we would not be able to guarantee the availability of resources when needed.

Across all sectors, the skills shortages are most prevalent in the skilled mechanical and electrical discipline areas in plant repair and maintenance, in new construction and, importantly, in the project engineering, design and project management skills. Securing these skills for a successful engineering construction Industry will bring enormous benefit to the UK economy by ensuring that we remain a highly productive, leading industry, competitive at European and World levels.

It is in everyone's interest, employers, clients and Government to have a competitive, sustainable UK skills pool that is less dependent on skills from overseas. Taking the opportunity to raise the skill levels in the industry and improve productivity will help to secure sustained investment in maintaining and building new industrial plant and equipment that is essential for the energy and power we need, the chemicals, plastics and pharmaceuticals we use, the food we consume, the water we drink and sewage we treat.

Central to success is close cooperation and support from the clients of the ECI. It is important they increase investment now, thus increasing the number of people being trained. To resolve a key blockage, clients need to be willing to increase access to work opportunities in the energy sector.

By working together in a strategic and planned way now, to increase the available UK skills pool, we have the potential to control the rising costs of the industry and increase the number and share of jobs available to UK workers. We will then retain our current position as a world leading centre of engineering construction expertise and be able to grow export earnings.

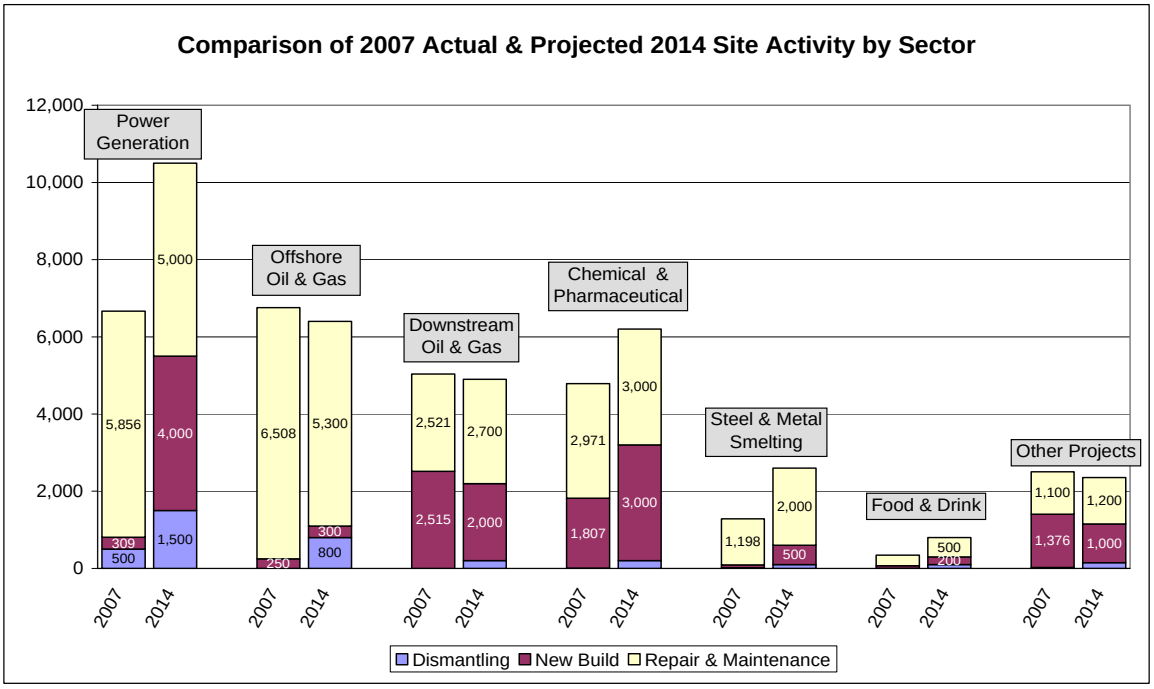


Figure 21. Comparison of 2007 Actual & 2014 projected On-Site Manpower for Repair, New Build and Dismantling

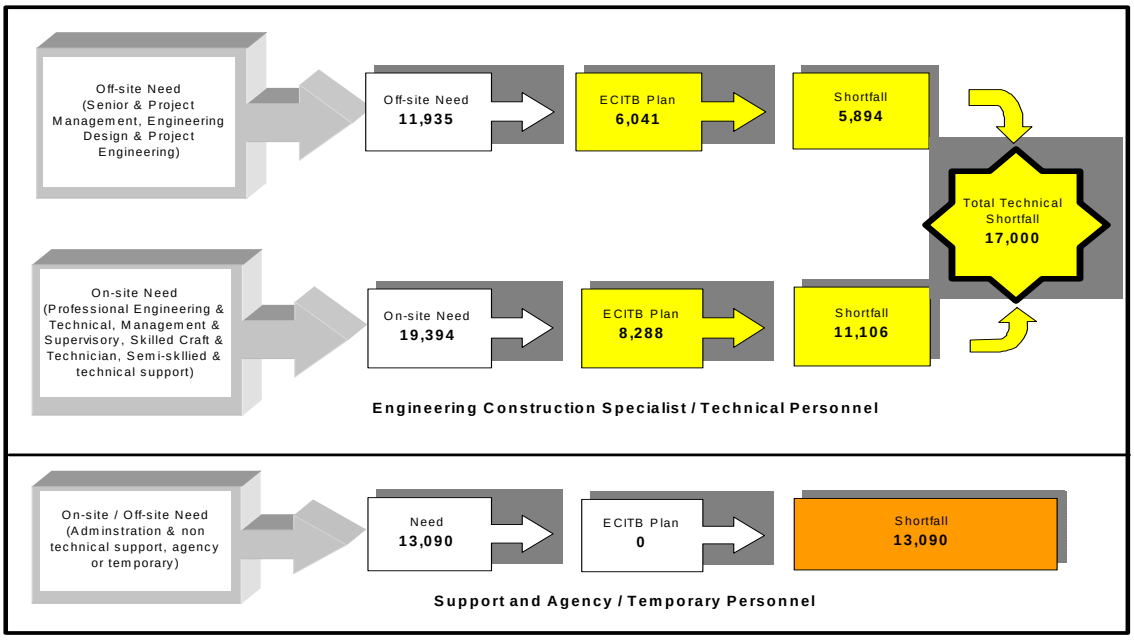


Figure 22. 2007 – 2014 Cumulative Workforce Requirements

14.5 Management, Supervisory and Project Management Skills

When considering cross-cutting issues, leadership and management are always high on the list. Project management and the associated activities such as planning, scheduling, cost control, procurement and supervision are key areas where, as project activity grows, more skilled practitioners will be required.

Improving leadership, management and supervisory skills is recognised by the Sector Skills Organisations, embracing both SSCs' and the ECITB's footprints. There is a great deal of common interest in ensuring we have the effective leadership and management of capital projects that are typical of the energy industries.

Ensuring successful engineering design, construction and maintenance of the energy and processing facilities is also essential for both security of energy supply and safe plant operation. However, the upturn in investment in capital infrastructure is dependent on a limited resource of competent leaders and project managers, including construction managers and site supervisors.

The ECITB sets the occupational standards for project management and other skills essential for successful engineering project delivery, including project planning and control. Supervisory management is also important and an innovative apprenticeship in supervisory skills has been developed.

In recent times, the energy operating companies have begun rebuilding their in-house engineering and project management capabilities, reversing the trend of buying-in these services from the engineering construction companies. Many have already set up their own project management academies to run internal training programs to help maintain their skills base. Whilst this means that there are more career opportunities for engineers, there is a short to medium term negative impact on the contractor workforce as they face this increased competition for skills.

Experienced project planning and control professionals are also in short supply with a shift to self-employed status for these people, where they can often charge more than £100 per hour for their services. New qualifications and apprenticeship programmes have been developed by the ECITB to address the problem. However, additional investment is needed to build capacity in the training providers more quickly.

The current skills priorities fall into the following categories:

- Engineering, design and construction project management.
- Design management, including multi-discipline team leadership and technical leadership.
- Contract and relationship management to ensure effective relationships between the engineering project sponsor and the executing contractor.
- Leadership and supervision of on-site work, including operating plant, construction and maintenance.

14.6 Risks and Potential Roadblocks

The greatest risk is in not taking action urgently or coherently. Delayed or fragmented action will reduce the effectiveness and efficiency of the training and delivery system and we will fail to deliver a robust and competitive workforce for the industry.

The principal roadblock to developing the on-site craft and technician workforce, given the well developed network of ECITB accredited providers, is employers' uncertainty regarding future levels of work from clients. In this respect, we have a reasonable understanding of what is needed but little or no knowledge of timing. Commitment from clients to take a share of the training burden and provide the required volume of on-site training placements would largely remove this roadblock.

More flexibility in training delivery is possible once a critical volume in a region or discipline is reached. Aggregation of demand by cooperation amongst clients and employers has been proven to help this. Also, a willingness from all stakeholders, clients, employers and trade unions to allow different entry points and then support further progression will assist in smoothing the training demand in to a more easily managed system. Some building blocks are there already.

The fragmented and non-uniform funding arrangements between the Nations for support for apprenticeships and (in England) Train to Gain make it difficult for employers and providers alike. Valuable time and effort is spent in attempting to understand the different systems. The industry already benefits from the ECITB, giving a focus and an effective vehicle for orchestrating the industry's training in a coherent plan. Channelling additional resources, perhaps under a sector compact, via the ECITB has the potential to greatly simplify the whole system.

In the short term, the potential recruitment pool for graduate entrants is already fixed for at least the next three years and so engineering construction must capture its fair share of the good people graduating. Up-skilling programmes will be needed for these people very quickly to get them up to standard. In the future, more undergraduate places in programmes relevant to engineering construction, followed by rapid up-skilling will help to ensure sufficient quality people. The number of training places and the ability of employers to provide sufficient in-house mentors will be a potential blockage. Investment in "Train the Trainer" initiatives will help to build capacity.

The lack of entry pathways for mature entrants with appropriate skills and attitude is a cause for concern. There are pockets of potential recruits who are unemployed or in disadvantaged groups. Whilst there is a willingness to train these people, they often need preparatory training. If this was provided, and additional support given for up-skilling, these people could be offered career opportunities that are currently being denied them. Ambition Energy (see above) has already shown what can be achieved.

All of these risks can be overcome with sustained action until 2014 at least. This will overcome the initial step change in of training required. Thereafter, provided there is continued collective and coordinated action by all stakeholders, the industry will be more balanced and largely self sustaining.

14.7 What the ECITB Has Done So Far

ECITB has introduced a new Apprenticeship Model which has allowed a 5 fold increase in apprentices. We have also introduced a modular programme for upskilling. A significant amount of work has been put in to improving other ECITB training services including, Project Control, Design & Draughting and Project Management as well as Site Supervision. In Scotland an innovative Supervisory Apprenticeship has been introduced.

The Schools Outreach Programme has been improved and been delivered to over 30,000 students to promote engineering construction and how it interacts with important sectors.

The ECITB has developed plans for a National Skills Academy to further augment delivery and interlock with other Academies to address the well documented skills shortages and gaps.

Each region has a skills action plan with training volume targets and corresponding budgets that fit within the overall strategy which has three broad themes:

- Attract – school, other industry and university sources, including Youth Offender Programmes
- Develop – provide training pathways for all learners to work towards recognised qualifications
- Qualify – ensure training leads to recognised qualifications to give personal employability and competence assurance for the employer.

This builds on the ECITB's successful employer led regional Model which brings employers into a local network with Accredited Training Providers working in partnership with the ECITB. The network currently consists of over 100 and is an exemplar which some of the emerging National Skills Academies are seeking to follow.

15 DISCUSSION & CONCLUSIONS

15.1 Demand Exceeding Supply for Skills

The skills situation across the energy sector is challenging. Mostly, there is time to act to ensure that skills shortages and gaps do not become critical, but we are close to the edge of the slippery slope that leads to a crisis, so there is an imperative to start a major effort on skills and training in the near term.

In a few cases, the point of no return has already been passed and recruitment of skilled workers from overseas is essential but this must be as part of a strategy to return the UK to self-sufficiency. Engineering construction faces perhaps the greatest challenge from the level of new build anticipated. The use of overseas labour, even for short term peak loading, may face severe competition from the international market. Moreover, competing demand for the construction resource continues to grow, as evidenced by the recent debate about new rail lines. From a skills point of view, we might not be able to do everything when we want.

15.2 How We Got Here – Has the Market Failed?

It is evident that, in places, the lead time to produce competent workers is now longer than the lead time to retirement for the existing staff; which means that some employers did not respond to increase the recruitment and training of new workers at the appropriate time.

The long lead time involved in training staff may well be responsible for a general decline in workforce development over recent decades. While there are some notable exceptions of employers with extensive training programmes, for both apprentices and graduates, the more general malaise in skills development is due (i) to a shortening of the business horizon and associated low profitability, reducing the ability of employers to make long-term investment in skills; (ii) the availability of a skilled legacy workforce and (iii) a legacy of capital investment that was able to meet our needs. In not giving due attention to workforce development, the market has not functioned effectively.

In short, market forces generally have forced short-term cost reduction at the expense of long-term strategic investment. This has been exacerbated by market cycles in which employers have been either experiencing a downturn, or planning for the next downturn.

Markets appear to be poor at dealing with shortage situations, especially where the shortage develops on a timescale that is very much faster than the time it takes to fix the problem. The market's first response is to increase prices and labour rates and we have already seen serious inflation in both wages and factory gate prices across the global oil and gas sector. A similar situation in power generation is likely. It is too early to predict what will happen with emerging, low-carbon technologies as, in the main, the industry is in its infancy.

15.3 Challenge or Crisis

We have no doubt that ensuring an adequate supply of skilled workers is a challenge for the energy sector. Mostly, our research has shown that the demographic profile is not as bad as feared and that there is time to take action and that skills gaps can be tackled

successfully. Where things are more serious, especially where training cannot now deliver skilled and competent people in time to replace those retiring, strategies are being developed to return the UK to self-sufficiency in these skills before 2020. The success of the industry's' National Skills Academies (both existing and proposed) are critical to meeting this challenge.

There are some interesting parallels with the early 1960s, when skills shortages were a huge problem for UK industry. Over the following 25 years, these were overcome and the UK delivered unprecedented investment in nuclear and conventional power, the development of the North Sea, conversion to natural gas, major investment in refineries and petrochemicals, the motorway system, rail electrification etc. Thus the present situation is not terminal. However, there is a tipping point at which skills problems could escalate. We need to expand existing programmes and develop new ones if this is to be avoided.

We should also be aware that skills do not sit alone. They are part of a wider supply side that has known capacity shortages in manufacturing and logistics. Thus skills problems could combine with other shortages to create a more serious situation.

15.4 Economic Regulation

Regulation has enforced cost reduction at the expense of long term planning. While the regulators are now becoming alive to skills and the challenges they pose, they remain poorly-sighted on the supply chain and hence on the underlying capability to deliver the investment and services required. Also, concerns have been raised about recent accidents in the electricity sector and about the potential conflict between the need to minimise customer supply interruptions and the increased risk this inevitably poses to staff working on live sites. Longer term horizon planning, now being introduced, must look at both skills and safety. Furthermore the 5-year price control cycle could produce famine and feast in recruitment and training and runs the risk of locking out investment, especially where it prevents employers adapting their workforce to rapid technical change. There are also un-resolved issues around cost and ability to make quick decisions for regulated employers who wish, for example, to participate in a skills academy.

15.5 What Have Employers and Skills Organisations Done?

It has taken time for the SSC network to establish itself and for employers to shift strategically away from recruitment of the already-skilled and more towards training new people. Even so, a lot of progress has been made in the 4 years or so since the SSCs came into being and the platform for doing even more in the future is well established.

The skills situation is now well understood through research undertaken to support the Sector Skills Agreements – which are now in place across most of the energy footprint. Through Cogent SSC, the energy sector has two National Skills Academies in operation, set to deliver their first students and apprentices in the autumn, while the oil and gas industry has set up its own independent academy, with similar aims. The electricity industry and the ECITB submitted expressions of interest to develop an Academy in July 2008. Energy and Utility Skills has shown, through a substantial pilot programme, that the unemployed and disadvantaged can be successfully trained for skilled jobs in the energy sector.

Engineering construction faces the greatest challenge numerically in having to develop skills for the new investment programmes from a low starting point against a challenging age profile. Apprentice training has been increased radically and capacity to deliver the project management and related skills has been improved. However, the demand for resources is very likely to outstrip supply and a greater effort is required, especially from employers in providing in-work placements.

A great deal has been done to improve course content and achieve high-standards across the sector. Standards for competence have been set and passports developed to aid recording of skills and ease mobility from job to job. This will improve efficiency in the mainstream energy industries and develop a cadre of workers with high-levels of transferable skills that can support emerging sectors.

We have a challenge with renewables and emerging technologies. A cohesive approach to this sector is hampered by the plethora of small companies, which form a fragmented employer base that is difficult to reach. SSO engagement with this sector has had limited success to date and a concerted effort is needed. However, the SSOs have to balance the considerable resources needed against the greater payback available in the mainstream.

There is a danger in all this that winners and losers will emerge, with sectors that have good strategies, or can offer good wages, creaming off the talent. To some extent, we cannot stop this happening. We must ensure, through the SSOs and the Academies, that the underlying skills and competencies are available in sufficient numbers and are transferable, so that workers can move across the sector when the circumstances demand. For emerging sectors, where the critical mass of employers is yet to develop, there may be scope for using the existing academy network to deliver training.

15.6 Skills Policy

Government policy on skills has been based around two primary aims. The first is to up-skill the workforce generally in recognition that around a quarter do not have formal qualifications to Level 2, that a competitive workforce needs to be skilled to at least Level 3 and that low-skill jobs are most vulnerable to being off-shored. The second is to develop a skills base for the new, competitive industries of the future, on which the UK's economic performance will depend. While this is a worthy aim, these industries will not develop without a reliable and efficient infrastructure – energy, transport, education, healthcare, retail, public services and a host of other functions that are essential to a modern economy. Yet these often go un-mentioned in policy documents. The danger with concentration of policy on new industries is that the delivery from education becomes ill-matched to the needs of the wider economy.

The regionalisation and localisation of strategy and delivery for skills, while strong at meeting local needs, is less well suited to the widespread skill sets seen throughout the energy sector. There is a particular danger that small, but strategically critical skill sets - the transmission line sector is a good example - are far too small at individual regional and local level to be on the radar. Yet failure to secure these skills for the future would have national impact.

15.7 Critical Staffing

Many energy sector operations are safety-critical and heavily regulated. There is a safe staffing level below which the unit cannot operate. We saw a clear example of this with the recent industrial dispute at Grangemouth Refinery, where the plant could not be kept ticking over but had to be shut down.

This differs from many other areas of employment, where reduced staff numbers can be tolerated by reducing output. In the energy sector, the impact of growing skills shortages is, therefore, more severe and direct than in other industries. This element of criticality in energy skills generally goes unrecognised in the skills policy arena, yet there are credible scenarios where skills shortages lead to energy supply shortages, with all the attendant social and economic damage that would result.

15.8 Diplomas and Qualifications

At the time of writing, the qualification system in England is about to enter a transition in which a new Qualification Credit Framework (QCF) will be introduced from August 2008, while the existing National Qualification Framework (NQF) will be phased out by December 2010. In schools, Diplomas will offer a new learning and qualification framework in addition to the traditional route of GCSEs and A Levels. While many of the new 14-19 qualifications have been developed within the QCF, they do not fit easily with the NQF. Similarly, older qualifications, such as GCSEs, were devised within the NQF and need significant revision to fit within the QCF. With the two systems in parallel and significant incompatibility between them, there is a lot of scope for confusion and careful management will be required to ensure a smooth changeover.

15.9 SSC Re-Licensing

We welcome the stronger focus on strategic planning and leadership proposed by the Leitch Report. Sector skills organisations across energy have, in developing their Sector Skills Agreements, necessarily had to do much more research and planning for the long term, in response, not just to the age profile of the workers, but to the major changes coming as we adapt to the low-carbon economy. This foresight work is not properly recognised in the current license conditions, nor is it adequately funded. Yet we believe it will become even more important as we move forward.

We would also sound a note of caution. We have set up, or are planning key strategies to deliver skills against a deadline set by the need to maintain energy supplies as workers retire and new skills are required. There is no time to delay these programmes, they must maintain their momentum if security of supply is not to be compromised. Therefore we stress the critical importance of not allowing the re-licensing process to interrupt the training strategies. Moreover, many of our future plans involve collaboration with other SSOs. This takes time to set up and uncertainty slows the process.

15.10 A View from the Trade Unions.

Trade unions are represented on the boards of the SSCs and are key partners in developing our strategies for skills and training.

The TUC and affiliated unions in the energy sector have welcomed the Government's initiative in requesting this review. In providing advice to Government, unions have drawn on their extensive direct experience with employers in negotiating training programmes, on their role as employee representatives on SSCs, and their experience within the growing Union Learning programme coordinated through the TUC's *unionlearn* services.

We hope that this study will mark the beginning of a continuing review of energy skills. The UK is now inexorably in transition to a low carbon economy. This has major implications for UK industry, with the earliest impacts in the energy and energy-intensive sectors. However, initiatives such as the Carbon Reduction Commitment (creating carbon markets in the UK's 5,000 largest service sector employers), and concerns over CO_2 emissions from across the transport and buildings sectors, show that the challenge is by no means confined to the energy sector.

The TUC would therefore urge the Government to consult regularly with unions, industry, the SSOs and other relevant bodies to ensure an ongoing dialogue with key stakeholders. SSOs and trade unions already engage in dialogue with each other on a regular basis and in a variety of fora, and have drawn up joint action plans that include a variety of commitments, including:

- In the Energy and Utility Skills plan, for trade unions to "focus on training and skills as an opportunity to enhance quality of working life and career development",

- In the Cogent action plan, "Trade unions to work with the SSC to ensure that all employers within the footprint are aware of the issues associated with sustainable development and training and learning" and;

- In the SEMTA action plan "To jointly develop and Equality and Diversity strategy for the sector".

- In the engineering construction sector, to make use of the NEACI agreement to set standards for training and safety.

We would also urge employers to fully recognise the role of Union Learning Representatives in helping with sign posting co-workers onto routes to new and greater skills and to work with ULR's and union officers in the industry in identifying skill needs and skills shortages. ULRs are already in post and proving their worth in many parts of the sector, from nuclear to offshore. The latest biennial survey of ULRs shows almost three quarters of them having a positive impact on the level of training taking place at their workplace. Given sufficient facility time and encouragement by their employers, ULRs are the ideal people to support colleagues through periods of change, and, with additional training, to provide mentoring for apprentices and for diploma students.

15.11 Manufacturing Supply Chain

We have not, in this report, given a detailed assessment of skills in the manufacturers that supply equipment (for example turbines) to the energy sector. However, manufacturers who work with us on sector initiatives report many of the concerns given above: an ageing workforce, shortages of skilled workers and skills gaps, set against rapidly increasing order

books. Many manufacturers cite shortages of skills as a key barrier to increasing output or investing in new plant.

Manufacturing falls under the remit of several SSCs, but one, SEMTA has responsibility for the engineering manufacturers that supply equipment for the energy sector. A skills strategy for manufacturing is well developed and a National Skills Academy is now in place. Government is reviewing its manufacturing strategy and a key aim will be to aid the transition to and help companies benefit from the low-carbon economy. Skills will play a key role in this process.

15.12 A Sector of Opportunity

While the skills position is challenging, we must not forget that it is also an opportunity. The energy sector entered the doldrums in the 1980s as the oil price collapse, the ending of the coal and nuclear power station programmes and the uncertainties over privatisation took their toll. Today, for the first time in a generation, recruitment and employment in the energy sector has a bright future.

For companies supplying services and equipment to the energy sector, business opportunities are better then they have been for many years. The UK has a long track record for supplying engineering and project management services and is pre-eminent in executing major projects around the world, such as oil and gas field developments and hydrocarbon processing plant. These skills put the UK in a strong position to win work as the world moves to a low-carbon energy infrastructure. Manufacturers, too, have great opportunities as worldwide demand for equipment will create sustained, long-term demand that the current supply chain cannot meet. The greater business confidence should allow employers in the supply chain to recruit and train new workers, thus ensuring their own skills supply for the future.

The Government sees the global expansion in the market for Low Carbon technology, and the wider move to a low carbon economy as being a key opportunity for the UK. The Government recognises the need to ask a long term, strategic question about the skills that will be needed to support an energy and resource-efficient economy in 2050 and deliver an approach to ensure those requirements are met, recognising that they are hard to predict. A recent consultation event was held in Windsor, to look at a strategic solution to meeting those skills challenges. This supported the CEMEP recommendation that the UK Commission for Employment and Skills should play a central role in coordinating that effort, and that Sector Skills Councils should work collaboratively on the generic skills that are needed for a low carbon economy as well as focusing on the specialist skills needs in their own sectors. There could also be a vital role for National Skills Academies and other specialist networks of training providers, not only in providing skills and qualifications, but in transferring knowledge to businesses and driving innovation.

For individuals, the opportunities now are better than for many years. In the 60s and 70s, the energy sector was a career of choice for young people. The highly visible job losses of the last 20 years, coupled to severe cut backs in recruitment, have created the impression of job insecurity and reduced the sector’s standing with both potential recruits and their career advisers. There is also a perception of low pay and, although this is hard to substantiate in terms of lifelong earnings across all professions, graduate starting salaries are often below those in health, finance, law, IT and accountancy. However, this is changing quickly and some engineering salaries are rising sharply.

16. RECOMMENDATIONS

We are clear that responsibility for skills lies with employers, who, with the Sector Skills Organisations, education and training bodies and the other stakeholders in the skills footprint, must near the brunt of delivering the skilled energy workforce of the future. On its own, the various arms of Government cannot deliver what is required.

Nevertheless, we welcome the efforts and support of Government, at all levels, to improve the supply of skills into the UK economy. This is a vital policy area, where success will pay huge dividends and failure cannot be contemplated.

We are, therefore, proposing a set of themed recommendations that either revise the use of existing Government funds or seek modest extra funding that, we believe, will pay handsome dividends. Although, in this report, we give emphasis to where Government can help, it must be taken as read that employers, with the skills network, will bear their share of the burden.

16.1 Strategic Action – Build on our Foundations

1. The Sector Skills Organisations, with their employers, academies and other stakeholders, continue to build on the policies and plans that are in place; with the specific objectives of engaging new employers, ensuring a skills succession, reducing skills gaps and developing a workforce to deliver new investment.

Recommendation 1a. Long-term foresight and planning is included and properly resourced in the new licenses and the licensing process maintains momentum with the on-going initiatives. The good foundations of employer engagement need to be enhances, perhaps by encouraging corporate membership of SSCs and NSAs.

Rationale

The original license conditions for the SSCs are focused on the present and meeting employers' current needs for skills. The SSCs in the energy footprint, faced with an ageing workforce, wholesale replacement of the infrastructure and the imperative for carbon reduction, have had to develop scenarios for the future and undertake medium and long term planning, even though this is not well supported through their current license and funding. It has not been possible, for example, to give enough attention to emerging technologies. It is our view that all SSCs need to look to the longer term, that this activity should be explicit in the new licence and that it should be adequately resourced.

In terms of action on the ground, we have significant programmes in place or under development in nuclear, oil and gas, the process industries and the power sector. While we do not have a skills crisis across energy, we do not have time to delay these programmes.

Recommendation 1b. In order to provide better data to facilitate analysis and planning, which we can utilise to improve employer engagement, we suggest that a representative set of SICs better aligned to energy sector operations (for example the nuclear industry) be developed to reflect a strategic sector that is not well defined through national statistics.

Rationale

We have commented in the text on the inappropriate scope of the SIC and SOC classifications. We accept that changing then involves international agreement and will be a lengthy process. Nevertheless, we think some revision should be attempted as this will greatly facilitate data analysis and planning for the future.

16.2 Strategic Leadership

2. While tactical engagement with employers is good and improving, strategic engagement with skills issues at the top level of employer management is not as good as it could be. To address this, we believe the Sector Skills Organisations, with Government led by the Energy Minister and support from the TUC should convene a top level summit to review the recommendations and suggestions of this report, and that this conference should endorse an action plan that employers and the Sector Skills network can take forward and that will help to focus Government support to maximum effect.

Rationale

The energy sector is fragmented; competition and un-bundling have produced many small employers who have uneven market horizons, profitability and strategic focus on investment. Strategic leadership, at the level once provided by the nationalised industries, is absent. The effect of market uncertainties and regulation are uneven in their impact and often lead to a focus on the short term at the expense of long-term strategic investment.

The SSCs have made good progress in bringing employers together to develop a strategic approach to skills and training. However, this can only go so far and the differing pressures on the individual businesses limit what can be achieved. Furthermore, differing priorities in the English regions and devolved administrations further militate against a cohesive national strategy. A higher level of strategic leadership is required and Government can play a key role in facilitating this.

16.3 The Training Landscape

3. From the perspective of an employer, the training landscape is too complex for effective engagement with all the stakeholders. Employers are confused, are often sent from pillar to post if they approach the wrong part of the bureaucracy and end up missing out on help through being unable to navigate the system. Sector Skills Organisations are faced with multiple stakeholders and the frequent need, especially in the regions, to pursue the same initiative many times over, often with different results.

Recommendation 3a. The landscape and bureaucracy need to have an easier access route for employers, with no wrong doors for entry and services delivered through structures that are clear to understand, even if they are complicated inside. Responsibility, resources and funding need to be aligned with clear strategic objectives that are, in turn, focused on economic need. SSOs and National Skills Academies can play a key role in providing a conduit for employers to access the system.

Rationale

Fragmentation within the energy sector means that collaboration is required to address skills shortages and gaps effectively. Whereas employers are now starting to collaborate more effectively, eg through the development of the Academies and the Power Sector Skills Strategy Group, they have to deal with a complex landscape of Learning and Skills Councils, Regional development Agencies and other Government bodies at national and local level. This conceals the scale of the issue and fails to deliver a joined up response, leading to duplication and gaps. Moreover, within this complex structure, responsibility and resources can rest with different bodies, with their own conflicting objectives. Attempts to join this up, for example through Local Learning and Skills Partnerships, often lead to bureaucracy and concentration on tactical, rather then strategic issues.

Recommendation 3b. Skills issues are devolved to the appropriate level and national issues are dealt with at a national level. SSOs for their part should examine ways that a national approach can be build from regional and local structures.

Rationale

The devolution of the skills agenda to regional and local level is not always helpful when dealing with energy skills. The skills and the issues are generally the same nationwide and it is not efficient to be tackling the same problem in multiple fora. Even where regional clusters do exist - offshore oil, for example - workers often commute from across the country and the supply chain extends across the whole UK. Engagement at a national level would help facilitate a more coherent approach to energy skills issues and ensure policies and funding mechanisms meet the requirements of the sector. Moreover, national co-ordination across the energy sector would drive scope and scale efficiencies enabling better value for money. It would also help co-ordination of skills issues across BERR, DIUS, ESF and DEFRA.

In this respect, we are also concerned at plans in England to devolve planning and funding for 14-19 education to local authorities. We accept that there is value in having responsibility for 14-19 education and skills in one place and the TUC supported the move for this reason. However, for national employers, this hugely raises the number of stakeholders in the footprint, especially when developing attraction and engagement programmes or trying to influence the content of diplomas. It also increases the complexity of the regional and sub-regional structures and lacks clarity of how key national policies will be coordinated, including the roll-out of Diplomas.

The separate curriculum and qualification standards being applied in the devolved administrations poses a significant additional burden on the Sector Skills Network in having to deal with multiple systems. While this is a key feature of developing the identity of the devolved nations and we would not argue for a UK-wide system, we do argue that for energy jobs, where the skills sets are the same everywhere and where workers routinely cross borders, a common curriculum within the separate systems would enable resources to be diverted to our core role of developing skilled workers.

Finally, there potential to use a collaborative approach across the energy sector to pilot a wider partnership involving employers, engineering bodies and government at a national level to deliver the STEM requirements for the sector. But this depends on the numbers of stakeholders being manageable.

Recommendation 3c. Train to Gain funding in England should be geared under Sector Compacts towards entry level qualifications for each sector and towards specific employer needs, for example to fill skills gaps. Allocations and entitlement should be directed to strategic skills areas under Sector Compacts. The system should accommodate modular learning and fractional qualifications, where these are the most appropriate means of delivering new skills. For the strategic nuclear and energy sectors, SSCs could administer funding gateways, merging training entitlement with strategic skills priorities. Also, Train to Gain should be able to accommodate a sector-based approach, under Sector Compacts, for those skills where the regional focus is inappropriate. Similar provision is needed in the devolved Nations

Rationale

For a significant portion of the sector, entry level qualifications are well above level 2. Moreover, much of the training required is to fill skills gaps, ie to give additional skills, for example a second qualification. For these reasons, despite considerable training taking place, there has been minimal Train to Gain funding spend in the energy sector. The focus on whole qualifications is unhelpful in circumstances where modular learning is most appropriate. Also the regional focus of Train to Gain militates against cohesive, national strategies, and the efficiencies that could be gained, for those sectors where this is a more appropriate approach. Sector Compacts should be developed to address these issues.

Recommendation 3d. It is important that, in the wider implementation, consideration is given to updating other government policies and the funding mechanisms so that they are flexible enough to support employer's internal training, provided that this can be fully accredited within the qualification framework. There is scope for these ideas to be tested in pilot schemes.

Rationale
Many of the companies in the sector already offer high standards of internal training. The sector therefore welcomes the pilot on 'in-house qualifications' as a means for up-skilling the workforce.

Recommendation 3e. Government support for apprentice training should be flexible enough to accommodate a diverse range of mature entrants and mid-career re-training, together with non-traditional apprenticeships (eg women in engineering) where the economic need can be demonstrated.

Rationale

The energy sector needs to recruit mature, as well as young recruits. This is essential to strengthen the body of experience and work-related skills in what would otherwise be a young workforce. It is also important to achieve a better age profile to avoid the ageing workforce scenario repeating itself in the future.

16.4 Economic Regulation for the Long Term

4. The Regulator Ofgem should use its existing powers and the current review of regulation to assess the impact of the 5-yearly price control review on the

industry's long term investment in skills, including investment by the contractors and suppliers that support the network operators.

Rationale

The Price Control Review process imposes a cyclic demand on the skills base and supply chain that militates against a long-term investment framework for skills and capacity.

The recent award of £80 million for apprentice training in the Price Control Review settlement for the gas networks is a welcome recognition by the regulator that skills are becoming an issue for energy supplies. However, the cyclic nature of the review process means that employers and trainers have a year to recruit and develop capacity, three years to deliver and are then faced with a hiatus in the run up to the next review. Cycling capacity in this way will not lead to long-term stability in the provision of skilled people. In fact, cycling always has the opposite effect; that is to ratchet capacity downwards at the end of each cycle, with the lost capacity being hard or impossible to recover in the up-turn. In the prevailing climate, it also runs the risk of UK capacity being committed to external markets in the downturn, and not being available when subsequently needed.

In our view, the PCR process also lacks vision of the supply chain and takes to little account of the skills or manufacturing capacity available in it. Health and safety is also a concern for some. With the certainty of global demand for skills and equipment exceeding supply, the danger of investment not being realised is increasing. Sustainability of the energy industry and its supply chain must be a key objective for regulation from now on.

16.5 Public Sector Skills

5. We are concerned that the public sector, in National and Local Government plus the Devolved Administrations, may develop technical skills shortages and gaps that inhibit the development and implementation of policy. This is an area that is not properly covered by the existing SSC network and has fragmented training infrastructure. We believe that this needs urgent review and that technical skills and training for the public sector needs to be properly positioned within the system, with a lead SSC appointed.

Rationale

Technical skills in the public sector are an issue that has come to light in recent months. Public sector employees (with the exception of nuclear specialists in the MoD) do not generally fall into our footprint and we have not covered the public sector in this report but, late in its preparation, shortages of specialist energy-related skills in the public sector were highlighted in the London Energy Partnership report and concerns have been raised about the ability of Government, at all levels, to meet its own needs. The public gaze has concentrated on nuclear inspectors in the NII but there are wider concerns about the age profile of specialised technical skills across Whitehall, for which the inflow reduced with the closure and privatisation of Government's own laboratories in the 1990s. Moreover, the ability of local authorities to handle the climate change strategy plus planning and building control issues posed by low-carbon developments is uncertain. If zero-carbon houses are to be introduced from 2016, local authorities need to be equipped to deal with the technical issues from 2012, when the planning process will begin.

16.6 Policy, Uncertainty and the Long-Term Vision

6. Policy development in the UK and EU should take account of the available resources to deliver and operate new infrastructure and recognise the time lag inherent in developing new skills capacity, thereby helping the supply chain to adapt smoothly and develop resources in a timely manner.

Rationale

The Nuclear White Paper in 2008 broke new ground in its attention to the supply chain and skills required to deliver the new build programme. The setting up of the Office of Nuclear Development and the recently announced initiative for renewable energy, with their specific remit to address supply chain and skills issues, is very welcome. However, in our experience, few policy announcements, from Government or the European Union, take account of the resource implications, especially to deliver major capital programmes. Yet allowing time for the supply side to develop the necessary capacity and avoiding damaging competition for resources could improve the efficiency, speed and cost of delivery to the advantage of all.

16.7 Plan for Investment – Develop Resources in Time

7. Infrastructure development needs to be better coordinated by the private and public sector across the economy to ensure skills are developed in time, minimise excessive overload on the skills base and supply chain, reduce the potential for damaging competition for resources and create the environment for the supply side to invest in new capacity.

Recommendation 7a. Government should work with all stakeholders to increase the long-term business horizon, so that companies can invest in people and capacity.

Rationale

Skills and competencies have a long lead time. It is necessary to begin the recruitment and training process up to 10 years ahead. Many employers find the short term nature of the energy markets and their tendency to cycle from low to high activity makes it impossible to plan effectively for the long term. Also, economic cycles, both sectoral and geographical, are tending to converge into a global cycle, with project activity likely to increase rapidly in parallel, so the opportunities to mitigate a down-turn by switching sectors or selling into overseas markets, or to meet a peak in demand with resources from overseas are ever more limited. It is, therefore, increasingly important to improve long-term business visibility, so that employers can plan for the future. The Energy Markets Outlook and longer-term planning with the Regulator are welcome steps, but more certainty about what and when across the whole investment footprint is needed.

16.8 STEM and Education – Transferable Skills

8. STEM education is critical to the future of the energy sector and the momentum of Government initiatives in this area must be maintained and strengthened where possible. Key targets should be to increase the numbers of school leavers equipped to enter apprenticeships and to improve the supply of graduates in critical subjects.

Recommendation 8a. After basic education in the 3 Rs, STEM is given the highest priority in education at all levels.

Recommendation 8b. HE and FE funding should have a higher level of employability audit and a greater focus on economic need. Extending/enhancing a science and engineering 'premium' on teaching grant support per student should be considered. Strategic development funding for higher education developments in employer-engagement should be maintained and enhanced where possible. Priority should be given to workforce development and involving SSCs in the strategic science and engineering sector.

Recommendation 8c. The provision of part time HE education needs to be reviewed. We support reform and reinvigoration of structured work experience in the education process, capturing the benefits of 'sandwich' course provision through, perhaps, co-funded internships, with appropriate tax incentives for employers to take on this form of training.

Recommendation 8d. The professional institutions should lead a review of HE and professional qualifications with the core objectives of enabling individuals to realise their potential and ensuring that the economic needs of the country are met.

Recommendation 8e. Government gives highly-visible support for apprenticeships and is even-handed in promoting them alongside higher education.

Recommendation 8f. A rigorous process is required to ensure that the 14-19 diplomas are developed to deliver skills needed in the workplace and provide a smooth transition into apprenticeships, FE or, indeed, HE.

Recommendation 8g. Further education should be employer demand led, with funding focused on areas where there are demonstrable skills shortages or gaps. Higher education finding should be better focused on economic need.

Recommendation 8h. Greater clarity and simplification is needed for FE funding, which should be targeted on employer demand.

Rationale

We welcome Government initiatives in this area and SSCs, with their client employers and Academies will play their part in promoting STEM. But we still see demand outstripping supply. The most important message concerning education is that the energy sector and, indeed, the economy more widely, needs increased numbers of young people with education in STEM subjects.

We believe that funding for STEM in HE and FE should be smarter and more focused towards economic need. One size fits all capitation fees will inevitably put pressure on colleges and universities to promote those degrees that are inexpensive to teach; whereas STEM subjects, with their reliance on expensive workshop and laboratory training, will become harder to provide. We have seen too many closures of science and engineering departments in recent years.

The growth of university provision of softer (ie non-mathematical) subjects is also a cause for concern, especially as it is unclear whether there are employment opportunities to

match the numbers being produced. In large measure, HE still sees students as the customer, yet it is unclear that this offers best value to either the taxpayer or the student. Employers, through the SSC network, feel that a greater influence over HE provision would enable output and demand to be better matched, giving graduates better career opportunities.

The growth of specialised, vocational qualifications in both HE and FE is also a concern in that the in-depth study of a narrow subject could be at the expense of more general knowledge and transferable skills that allow these students to work in other jobs.

We can give a concrete example of miss-matched funding in FE. Many colleges teach welding, but only for steel-based materials. We have a severe shortage of high-pressure system welders (we need to recruit from outside the EU) but the colleges cannot teach these skills because the nickel-based materials needed are 35 times more expensive than steel and the trainers can earn far more working as welders than they can training. This is a clear example of a barrier to producing these skills, yet some flexibility in college funding plus support from employers could make a real difference.

Almost all education above Foundation Degree level is full time. This was not the case in the past, when the Polytechnics offered part time courses up to Honours, and sometimes Masters Degree level. This imposes a barrier to those who wish to progress their education whilst remaining in employment. Moreover, our sounding of employers has found an increasing appetite for better integration of undergraduate study and work, perhaps by taking some of the best features from the sandwich courses of the past, which have disappeared in more recent times.

Universities offer 3-year B Eng and 4-year M Eng courses to undergraduates. Increasingly, the engineering institutions are setting M Eng as the minimum education requirement for achieving chartered status. At least one institution has pondered the concept of a 5-year degree. This means that entry to the top of the profession is associated with longer learning and increased cost. It is too early to say what the impact of this will be but it would be surprising if it did not have some effect. Students have a choice and the lower debt plus early income from a fast-track science degree is likely to be attractive to some who might otherwise have studied engineering. It will be interesting to compare England with Scotland, where university courses and funding have a different structure but it will be some years yet before we have enough data for reliable analysis.

Employers have taken steps, through bursaries offered under the Power Academy scheme, to improve the supply of graduates in electrical engineering. We believe employers will have to take similar steps with other subjects. We may need conversion training to convert scientists to engineers. We may need to go beyond this with schemes to train non-STEM graduates for technical jobs.

We see an emerging miss-match between the desire of the SSCs, employers and Government that people should be able to achieve their potential, regardless of point of entry – for example that an apprentice can rise to Chartered Engineer – and what is actually happening. For example, some institutions are raising the barrier to chartered status for those who lack an M Eng degree.

We are concerned that the status quo could lead to damaging market developments, with STEM talent in short supply and increasingly going to the highest bidder.

Vocational qualifications still receive a lot of criticism and are often under-valued when compared to more academic qualifications. Government has, on occasions, created the impression that they are second-class compared to degrees and the marked reduction in direct entry to the public sector for school leavers has reinforced the message. Therefore, there is still considerable work to be undertaken, with employers, teachers, universities, parents and students, to raise the perception of vocational qualifications as being equal in status to the more academic routes. Government needs to do more itself to help change this perception and raise the profile and merits of vocational qualifications.

The Energy Sector needs to raise its profile and focus on developing sector attractiveness to recruit and retain the talent it needs for the future. Apprenticeships will form a key part of the recruitment strategy. Vocational qualifications, such as the 14-19 Diplomas, will be crucial to providing career paths for young people.

Conceptually, these diplomas are well-fitted to our needs. However, their success depends very much on how well the concept is implemented. While the support of the Government to date is welcomed, a stronger role in co-ordinating the implementation is required, to ensure the right focus on skills that are needed in the workplace.

Traditional funding mechanisms incentivise Higher and Further Education to deliver cost-effective courses to large numbers of students. This militates against the higher-cost, laboratory- and workshop-based training required for STEM subjects. Higher Education, although producing quality in STEM graduates, is not producing them in the numbers needed, nor is output well matched to demand, as evidenced by the shortage of physicists and electrical engineers against the glut of forensic scientists.

Employers seeking training services from Further Education colleges find the system confusing, with a lack of clarity about the funding available, how to obtain funding and routes to training. Cost constraints, especially capitation fees that fail to reflect the cost of training, can prevent colleges from offering courses that are in demand.

TRANSFORMING EDUCATION IN STEM SUBJECTS

There is a wide range of actions that can be taken in partnership between employers. SSCs, Higher Education Institutes and Government; including:

- Transformational change in HE and FE to support workforce development and flexible provision of training
- Industry Champions appointed to HE and FE to lead work-based learning accreditation and improve links between employers and education providers
- Expand national Foundation Degree frameworks produced in conjunction with SSCs and NSAs for science and engineering in industry
- HE funding models that can handle and accredit modular ‘bundles’ rather than whole qualifications
- SSCs as coordinators of employer demand and co-purchasers of funding allocations
- HE financial models of STEM overhead costs for work-based students re-worked to allow course cost transparency for co-funding employers
- Train-to-Grain funding directed through SSCs and ring-fenced for science and engineering up-skilling
- SSC partnerships with HE for IAG products to promote sector careers

- SSCs and NSAs as brokers for a reinvigorated placement scheme for science and engineering (HE subscription?)
- Core funding supplement for SSCs to engage more widely with HE
- HEI funding priority for STEM activity directed at employer engagement
- SSCs working with HEIs, devolved administrations and RDAs for innovation in the regions
- Encouragement of more students into STEM
- Science and Engineering SSC links to HE subject and STEM centres
- Single body coordination of the many STEM initiatives
- Set up a Cogent–NSAN Knowledge Transfer Network for Nuclear

16.9 Renewables and the Emerging Sectors

9. The skills network needs to develop a stronger focus on the emerging sectors, including renewable energy. However, due to the lack of larger employers to provide strategic leadership, the large body of small companies in the footprint and the overlap across many SSCs; limited progress has been made to date. Direct Government help might be necessary to catalyse this activity and to help the mainstream to train workers who can transfer to the emerging industries.

Recommendation 9a. The SSCs should combine to give a greater focus on emerging technologies, should recognise that these may cut across traditional industrial boundaries and should set aside a dedicated resource for developing the collaborative structures necessary to support these developing businesses.

Recommendation 9b. Resources should be available to the existing skills training network to make capacity available to support emerging industries.

Rationale

With the exception of wind, which is maturing as an industry, renewable energy is highly fragmented, with a plethora of small players, many of which are still developing their technologies. Employer engagement would be hard to achieve and matching skills supply to demand would be extremely difficult with new technologies, for which the timing and extent of deployment is highly uncertain. Engagement with renewables is further complicated by the wide SME footprint and by the number of bodies, all of whom have a legitimate interest in renewables skills issues. There are 8 SSC's, 9 RDAs and 3 devolved administrations all trying to tackle aspects of renewables and meet the guidelines set out in the Energy White Paper. Potentially, there is overlap with even more SSCs. While the Sector Skills Network is making efforts to accommodate renewables, it is not resourced to deal with such a complex network of stakeholders.

Little is known about the origins of the existing workforce in renewable energy. A snapshot of the wind sector suggest that many came from traditional sectors – nuclear, oil and gas, the engineering industries. This indicates that there is a high level of transferable skills inherent in training across the energy sector and its supply chain. In our view, we should not tackle renewable energy skills issues head on at this time, and that a dedicated SSC for renewable energy is inappropriate at this stage. The possible exception is wind, where an employer-led skills strategy is under development. For the rest, we believe the short-term approach should be to ensure that the existing training schemes have the capacity to support renewable energy until it matures and can take on this responsibility for itself.

16.10 Social Responsibility

10. The energy sector has a lot of potential to provide employment for the unemployed, women and minorities. To help meet the need for skilled workers, the energy sector's potential for contributing the Government's social inclusion agenda should be developed, supportive employment policies adopted and welfare to work support targeted accordingly. A strategic plan to improve diversity should be a priority.

Recommendation 10a. Welfare to work needs to be reviewed to support people into higher-skilled employment, where employer demand and economic benefit can be demonstrated.

Recommendation 10b. Supportive employment policies and the support of employers on work-life balance are needed to ensure the retention of staff (especially women) as they raise a family.

Recommendation 10c. Consideration is given to granting key worker status to essential network staff.

Rationale

The energy sector has had considerable success with training the unemployed for long-term skilled jobs with good earnings potential. Young offenders have also proved to be fertile ground. But energy sector workplaces are hazardous with, for example, gas and high-voltage electricity. Access to the workplace is highly regulated, with specific levels of training being mandatory. Thus the energy sector needs to train people before they can work, whereas the welfare to work programme generally requires a work placement first. We believe this should be reviewed and that, with employers willing to play their part, a cost effective scheme for the taxpayer can be developed. Past experience has shown how successful the sector can be at training the disadvantaged, with positive returns to the taxpayer.

Energy employers have not been as effective as some other sectors at developing the work-life balance policies to ensure the retention of women through the family-raising years. This poses the risk of skills being lost to more supportive sectors.

Government has taken steps to help key workers, such as nurses and teachers, find affordable housing. Yet other essential infrastructure workers get no help. Significant problems are developing for the utilities, especially in London and the South East, where recruitment and retention of staff is increasingly difficult, with a growing risk of a deterioration of infrastructure reliability.

16.11 The Role of Industry

11. Employers and their clients through the contracting structure must support a greater level of work-based training. Regulation must also support this objective.

Rationale

Employers have the most important role to play in developing the future skills base, both through their own training programmes and through their influence on education and training provision. For the last 15 years or so, employers have been able to rely on the legacy workforce in the labour market and have been able to meet their needs by recruiting the already-skilled. This is no longer possible because, with a diminishing pool of skills, churn and wage escalation will run out of control.

Employers must, therefore step up their efforts to develop a new workforce. But classroom work is not enough. Work placements are essential and the barriers to providing them must be reduced. In particular, the time that skilled staff spend on training and helping trainees must be valued as an asset, not a cost.

16.12 Planning for the Future

12. Employers must give more attention to succession planning and capturing know-how.

Rationale

Succession planning and knowledge capture has not received enough attention. Retiring workers do not just take their qualifications with them, they take away a lifetime of know how and experience that takes years to install in a new generation. This must be captured and transferred to the new generation.

16.13 The Internationalisation of Skills

13. The work permit system must adapt to the new ways that capital projects will be delivered in future.

Rationale

Increasingly, capital projects, such as nuclear power stations, will be delivered from a global supply chain, with much greater use of pre-assembled units, or modules. Not only will some be supplied from overseas, but specialised crews will come with them to undertake the installation. This is crucial to maximising efficiency in a world where demand for investment exceeds to capacity of the supply chain to deliver. This is not a threat to UK jobs; in fact the UK could be a key player in this market. But we must not impose barriers that delay our investment and make it more expensive. In the worst case, if it gets too difficult, investment will go elsewhere.

16.14 Other Government Actions

In addition to the above, there are other Government initiatives aimed at encouraging young people into STEM careers. We work with these and encourage their continued support.

- Information, Advice and Guidance (IAG) funding could be used by SSCs, NSAs trade unions to aid the promotion of sector careers, career pathways and *Upskill* programmes.

- There should be continuity of funding for Science Learning Centres and support to develop energy sector exemplar case studies and materials for teachers.

- The campaign to encourage women into science and engineering through WISE should continue. Other initiatives around diversity are welcome.

Skills initiatives and their associated funding must be maintained to ensure that sufficient qualified and experienced people are available to support all aspects of the energy industry and associated public sector roles. Employers will play their part and all energy companies should be encouraged to work with SSCs and national Skills Academies. Nevertheless, the support and leadership of Government is vital in sustaining the skills base, through provision of funding, support for the education system and legislative action.

16.15 Trade Unions and ULRs

The TUC should hold a joint seminar between ULR's, union representatives, and training specialists in the energy industry to review skills issues. This would provide a valuable opportunity to consult with the "experts' and hear first hand the concerns of the workforce in regard to training and skill shortages. Cogent has made an excellent start, by consulting with ULRs and other union officials in order to produce a tool-kit tailored to be accessible and relevant to the reps, who invariably have a limited amount of time to conduct their activities.

17 OUR ACTION PLAN

17.1 Collaborative Action

The Sector Skills Organisations, with the help of Government led by the Energy Minister and with the support of the TUC, will work to convene a top level summit on energy skills to debate the recommendations of this report and to review the action plan. A Steering Group should convene by the end of November with a view to holding the summit in the New Year. In support of this:

- Sector Skills Organisations, with key employers, will develop and resource a collaborative strategic energy skills solution to inform the Conference by Jan 09.

- We will engage with and include a delegate from the European Commission to help inform EU policy development with knowledge of the available resources to deliver and operate new infrastructure across our borders.

In addition, the Sector Skills Organisations will use their Sector Compacts to engender a national approach to skills development.

17.2 Oil and Gas

Cogent SSC and OPITO, the Oil and Gas Academy, will co-operate to forecast the national skills needs for the industry.

OPITO will work with employers to identify and agree action on workforce issues that matter to them and are affecting their business.

OPITO will provide an effective link between the industry and those who can provide the best learning and training across the UK. In particular:

- Education and academia to create a ‘Faculty of Learning’ to secure the feedstock of new recruits and sustain the industry going forward.

- Learning and training providers to develop the world-class learning supply needed to support a global business.

We will work with professional bodies, Government and its agencies, trade bodies as well as enterprise agencies and local authorities to address issues of shared concern.

17.3 Downstream Oil – Refining

By end of 2009, Cogent SSC will produce a comprehensive stock-and-flow model of the skills required by the Refining Industry, taking account of fuel production, fuel logistics and plant maintenance.

In 2009, Cogent SSC will publish a suite of national occupational standards covering the industry to support new apprentices.

Cogent SSC in consultation the National Skills Academy for the Process Industries will roll out a Foundation Degree framework for the industry.

Cogent SSC will work in collaboration with ECITB to ensure that a sustainable and efficient workforce for plant maintenance is available.

Cogent will work with employers to ensure the industry becomes an attractive proposition for the STEM supply of qualified young people. This will draw from Cogent's "Career Pathways" webtool and developments with HE and FE.

Cogent SSC has established a Downstream Advisory Council representative of HR, production, training and SHE managers, which will inform and influence and direct the skills development programme.

17.4 Nuclear

By end of 2009 Cogent SSC will produce the first comprehensive stock-and-flow model of the skills required by the Nuclear Industry, taking account of new civil build, nuclear heat generation, nuclear decommissioning, nuclear safety regulation, plant maintenance and defence. This model will involve strategic linkage, *inter alia*, with the NDA estates, the BERR Office for Nuclear Development and the Nuclear Industry Association

Cogent SSC will continue to develop vocational qualifications for the nuclear industry including support to the National Skills Academy for Nuclear for Foundation Degree developments.

The National Skills Academy working closely with the nuclear sector employers aims to start up to 1200 apprentices through the Skills Academy's quality assured provider network to meet the sector's skill requirements between now and 2011.

The Community Apprenticeship Scheme has been well received by employers working in the nuclear supply chain and is encouraging SME's to take on apprentices for the first time, or grow their apprenticeship numbers. This scheme aims to support up to 75 apprentices over the next 3 years.

By 2011 the Skills Academy aims to have 35 quality assured providers as part of its network, delivering the world class training and skills required by employers.

By 2011 the Skills Academy aims to have a fully developed Nuclear Skills Passport which will record the details of quality-assured, industry-recognised training for individuals across the sector. The vision of the Passport is "Working together to develop and sustain a quality, mobile workforce with transferable skills for a world-class nuclear industry". Once finalised, this will be rolled out across the sector. The Academy aims to have awarded Passports to circa 10,000 individuals by 2011.

Having worked with employers to develop some innovative Foundation Degrees that focus on the needs of this developing and fast changing sector, the Academy will focus on increasing up-take of these programmes, while ensuring that there are clear career progression routes across the sector. The target is to have circa 150 individuals enrolled on programmes by 2011.

17.5 Electricity Generation, Power and Gas Networks

Working with the Power and Gas Distribution Networks, EU Skills has designed and built an effective resource modelling tool for the sector. This tool has enabled the companies to understand and forecast their skills needs over the next 15 years.

To date the modelling work has focused on the regulated companies. In 2009, EU Skills will therefore develop the resource model to enable other companies in the sector, including those in the supply chain, to:

- Understand and quantify age profiles by skill set
- Determine the skills challenges and investment required over the next 15 years
- Provide effective input into the development of the National Skills Academy

This will provide robust skills data covering the whole sector.

Understanding the skills landscape is step 1 in the plan. However, it is important that this information is then used to drive solutions that will address the skills challenges. Both power and gas employers have identified the following priorities:

- Maintain and further develop Sector Skills Intelligence
- Develop and implement an effective Sector Qualifications Strategy
- Improve Sector Attractiveness
- Increase Training Capacity & Quality
- Ensure Government & Regulatory Policy meets the needs of the sector.

To deliver these outcomes, EU Skills has facilitated the creation of the Power Sector Skills Strategy Group ('PSSSG'). The employers in this group, which include all asset owners, contractors, major manufacturers, trade associations, trade unions and Government bodies, have looked at their skills investment needs over the next 15 years and agreed the need for further qualifications development, closer collaboration with Government and improvement of the attractiveness of the power sector.

Having formed this collaboration, the employers have also made a significant commitment in time, strategic focus and financial investment to establish a Power Sector National Skills Academy ('PSNSA'). The creation of the PSNSA will provide a strong platform for the industry to deliver real solutions to its skills issues and a tool for Government to work closely with the sector.

The Gas Distribution Networks are currently evaluating their skills investment needs as a result of the new price control. EU Skills is working with the companies to determine how they can build on the successful resource modelling collaboration. During 2009, action plans will be developed together with specific outcomes relating to the sector priorities outlined above.

In addition, during 2009 / 2010 EU Skills will undertake the following development work, to implement frameworks that will support the increased recruitment and training required by the sector. Specific deliverables are:

- The development of the QCF, with the intention of supporting our employers skills needs with a more modular approach to skills development.

- Support for the introduction of Diplomas to increase the take up of STEM related subjects in secondary education.
- A number of pilot programmes testing the use of workforce development techniques in conjunction with Higher Education Institutions.
- Delivering outcomes from the collaboration with Foundation Degree Forward.
- Increasing the uptake of apprenticeships in the industry.
- Roll out of an online tool for testing literacy and numeracy skills.
- A possible Compact to improve usage of Train to Gain and support employers in up-skilling their employees.

In addition, we will undertake further work to source longer term funding, to enable EU Skills to deliver strategic additional, employer-focused national skills initiatives for the sector.

17.6 Renewable Energy

EU Skills, Cogent, SummitSkills, Construction Skills, AssetSkills, SEMTA and ECITB (Lantra to be confirmed) met on 25th September 2008 to discuss the potential for collaboration on addressing renewables skills issues.

The SSCs and sector body listed have agreed a shared commitment to create a skills strategy to support the renewables agenda and will develop an action plan to achieve this and present it to Government, as a follow up to the EU Skills and Summitskills' responses to the Renewable Energy Strategy (RES) consultation, which ended on the 26th September. The final RES is expected to be published in Spring 2009, so the aim is to submit the action plan, together with an indication of the resources required to support action, in January 2009 and have indicated this in the EU Skills' consultation response.

The action plan will identify what knowledge and qualifications already exist and what needs to be done to produce a robust skills strategy. This will be fully costed. The component parts are anticipated at this stage to be:

- An analysis of skills required to meet the renewables agenda, building on existing research from Sector Skills Agreements, and focusing on:
    - The unique skills required;
    - Cross-sector skills requirements;
    - Transferability of existing skills.

- A gap analysis resulting in skills solutions that will address any gaps identified, building on work already in place in each region and nation of the UK.

Alongside the development of the action plan, a full scoping of the renewables "sector" will be undertaken, based on work already underway by EU Skills and partner bodies. This will facilitate a common understanding of the industries that make up the "sector" and the interdependencies and the linkages across the SSC / sector body footprints. It will also be based on a number of assumptions about the growth of the market for renewable energy.

17.7 Coal, Carbon Capture and Storage

The skills demand for coal mining is outside the core remit of this report, but we note that it will depend on external market factors, such as the competitiveness of UK-mined coal and the amount of coal-fired plant in the generating mix, both of which are uncertain at the present time.

Once the technology has been demonstrated and the design parameters determined, carbon capture and storage requires, in the main, skills that already exist. That is engineering construction skills to design and build the capture plant, offshore and oilfield skills to install and operate the storage infrastructure and process operating skills to run the plant. These skill sets are covered in detail in the relevant parts of this report. The key issues will be around capacity to build the plant and associated infrastructure, espcially if a major roll-out is attempted at a time of high demand from other sectors, and the need for the power generators to come to terms with operating chemical process plant - skills and expertise they lack today.

17.8 Engineering Construction

The overarching need is to double the volume of recruitment and training in key areas. To achieve this, the ECITB and employers will work to:

- Deliver concerted action at each stage of the education and training delivery process. The first step is to encourage more school students to select the courses that give the preparatory knowledge and skills for the energy industries, such as the new Diplomas as well as maths, science and technology, but with a balance of business, environment and leadership.

- Develop a clear and understandable set of pathways for students to progress their learning or career. Students on these pathways, whether university, college of apprenticeship, will be assured that their course will equip them for a worthwhile career. Stronger linke will be forged between what the programmes deliver for the student and what the employers need in terms of skills and knowledge. We will improve cooperation amongst employers to articulate demand and ensure training provision meets the necessary standards, in every region and within local supply chains.

- Avoid proliferation of programmes, as this confuses employers and students alike and, in the worst case, reduces cost effectiveness of training delivery.

- Ensure that, once in employment, individuals and their employers can continue learning and development, especially in the technologically demanding energy industries. Quality and relevance assured programmes will to be developed, again aimed at delivering up-skilling to the necessary standards.

- Work to secure additional investment in the training and delivery system, particularly for apprenticeships, which need more and better quality equipment to support the extra volume. This may be best organised in centres of excellence in strategic points in the country, which can be focal points that many training providers use. The CATCH Centre in Humberside is an excellent example.

- Seek a new mechanism, possibly a professional institution, for recognition and development of supervisors within the energy industries to afford them the same recognition and support that exists for craft and engineering skills. Effective supervision is vital to deliver the capital projects in the energy industries and many supervisors migrate around the supply chain. Increasing the overall capability and body of supervisor expertise will be a critical success factor for the future, ensuring effective leadership and management at the delivery level.

In addition, we will work with all parties across the energy sector to improve the supply of project management skills.

GLOSSARY

Literature on skills, training and education is liberally endowed with jargon and acronyms. We have, of necessity, used these but have tried to explain them when they first appear in the text. For the convenience of readers, they are listed below.

BEBO	A social networking web site
BERR	Department for Business, Enterprise and Regulatory Reform
BNES	British Nuclear Energy Society
Capex	Capital expenditure
CEMEP	Commission for Environmental Management and Economic Performance
CCGT	Combined-Cycle Gas Turbine (a power generation technology)
Cogent	SSC for oil and gas, nuclear, petroleum refining, chemicals, polymers and pharmaceuticals
DA	Devolved Administration (ie Northern Ireland, Scotland, Wales)
DNO	Distribution Network Operation (for electricity)
EU Skills	Energy & Utility Skills (the SSC for electricity, gas and water utilities, plus waste management)
ECITB	Engineering Construction Industry Training Board
FE	Further Education
FEC	Full Economic Cost (including overhead costs)
GDN	Gas Distribution Network
HE	Higher Education (usually delivered by universities)
HEFCE	Higher Education Funding Council for England
HEI	Higher Education Institute
HNC	Higher National Certificate
HND	Higher National Diploma
HSE	Health and Safety Executive
IAG	Information, Advice and Guidance
IGCC	Integrated Gasification & Combined-Cycle (a power generation technology)
JCP	Job Centre Plus
KTN	Knowledge Transfer Network
LSC	Learning and Skills Council
NAECI	National Agreement for the Engineering Construction Industry
NAS	National Apprentice Scheme (Proposed)
NDA	Nuclear Decommissioning Authority
NII	Nuclear Installations Inspectorate
NQF	National Qualifications Framework (for England)
NSAN	National Skills Academy for Nuclear
NSAPI	National Skills Academy for the Process Industries
NTEC	Nuclear Technology Education Consortium
NVQ	National Vocational Qualification
OGUK	Oil & Gas UK
Opex	Operational expenditure (running cost, maintenance etc)
OPITO	Offshore Petroleum Industry Training Organisation
OU	Open University
PCR	Price Control Review (Ofgem)
QCF	Qualifications and Credit Framework (for England)
RDA	Regional Development Agency in England
SIC	Standard Industrial Classification
SEMTA	Sector Skills Council for Science, Engineering and Manufacturing

	Technologies
SET	Science, Engineering and Technology
SETNET	A network organisation promoting SET education in schools
S/NVQ	Scottish National Vocational Qualification
SOC	Standard Occupational Classification
STEM	Science, Technology, Engineering and Maths
SSC	Sector Skills Council
SSO	Sector Skills Organisation (Includes SSCs and Training Boards)
UKCS	UK Continental Shelf
UKPIA	UK Petroleum Industry Association
ULR	Union Learning Representative

APPENDICES

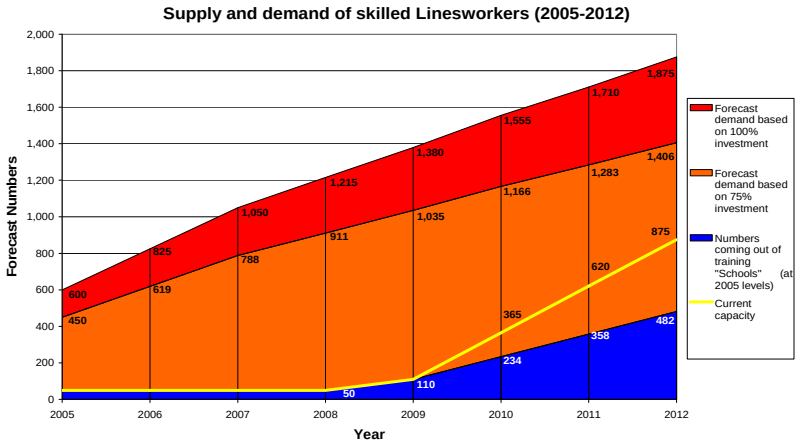
APPENDIX 1
POWER SECTOR JOBS – OVERHEAD LINESWORKER SKILLS SHORTAGES

In 2005, National Grid with its three principal contractors, Amec, Balfour Beatty and Eve Group, began to review, with Ofgem, the future workload for the high voltage transmission system. This showed an increasing need for investment to replace life-expired systems and, while the Government decision on new nuclear was still in the future, it was clear that new generating capacity of one sort or another would have to be accommodated.

This led to concern about the workforce. Skills shortages were already apparent and the workforce was ageing - 12% of lines-workers, 21% of chargehands and 38% of foremen were aged over 50. Given that this is physically demanding work, which workers tend to leave before state retirement age, this indicated that serious losses of staff would occur at a time when investment was increasing.

Modelling Supply and Demand

The employers, working with the sector Skills Council, Energy & Utility Skills, developed a model of supply and demand, starting with the existing workforce, factoring in recruitment and training capacity and estimating leavers from historical data. Two demand scenarios were used, firstly the industry estimate of the work needed and, secondly, that estimate reduced by 25% as a surrogate for work that is not found to be essential and for efficiency gains.



The model showed that the situation was more serious than suggested by the basic data and that the gap between supply and demand would widen on both scenarios. In this model, training capacity is a significant factor; apprenticeships are long, up to 4 years, and many of the skills come from practical learning that is resistant to fast tracking. Moreover, the capacity to train is limited, by the availability of training infrastructure and teachers. In the short term, training more people means diverting resources from the front line to bolster the teaching effort and only so much of this is possible.

The model shows that the status quo of 2005 recruitment and training will never close the skills shortage, compromising both investment and future electricity supply. Recruiting up to the limit of the then training capacity (the yellow line on the graph) begins to close the shortfall from 2010 but it will be around 2017 before supply comes into line with the 75% demand scenario.

APPENDIX 2

THE NATIONAL SKILLS ACDEMY FOR NUCLEAR – A CASE STUDY

Following many years in the doldrums, the UK nuclear industry is currently going through a period of renaissance with a dynamic approach to decommissioning and waste management and now the drive for new build. However, this exciting opportunity also creates some fundamental challenges, particularly on the skills agenda. As the global interest in nuclear power generation and new build increases so the competition for a skilled, competent, safe and professional workforce will become ever more apparent across the world. The employers and government in the UK have made a bold move to address this challenge by the establishment of the National Skills Academy for Nuclear, this case study outlines the role of the Skills Academy in addressing the challenges outlined in this report.

Developing the Skills Academy

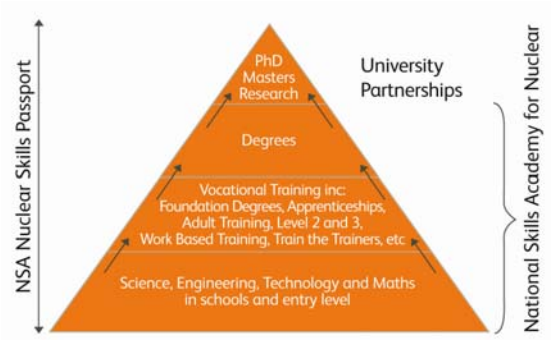
The Business Plan for the National Skills Academy for Nuclear was developed by a dedicated Project Team under the guidance and direction of an Employer Shadow Board during 2007. This plan was formally approved by Government on the 24th September 2007; the Skills Academy was established as a Private Ltd by Guarantee Company on the 9th November 2007 and was officially launched by Government Ministers at the Science Museum in London on the 31st January 2008. It is an excellent example of a Private/Public Partnership with funding from both employers and government.

The Skills Challenges

The Skills challenges are clearly outlined in earlier chapters of this report; this Skills Academy has been developed by employers as a direct response to these issues and challenges. The Skills Academy will focus primarily on the development of **technical and vocational skills**, enabling the development of a workforce with the technical skills and knowledge to address the challenges of:

- Fuel Cycle
- Decommissioning and clean up
- Defence
- Power Production
- New Nuclear Build
- Waste Management

It is essential to ensure there are clear career pathways and opportunities for skills development throughout the skills pyramid, the area of focus for the Skills Academy is portrayed below, links and partnerships with HEIs are now being established to ensure these opportunities exist throughout the whole Skills Pyramid.



Employer Action – The Vision

Employers in the UK reviewed the issues they were facing and then worked together to form the National Skills Academy for Nuclear as the organisation to work with them to address the above challenges. The Vision of the Academy is:

"To create, develop and promote world class skills and career pathways to support a sustainable future for the UK Nuclear Industry"

Remit

The Skills Academy is an enabling organisation that will work via a network of quality assured providers to deliver the right training, of the right quality, at the right time and place, to meet employer needs.

National Coverage

The Skills Academy will have a focus in the five key regions shown opposite, in each region there is:

- A Regional Manager
- An Employer Steering Group
- An Action Plan for the Region
- A network of Quality Assured Providers to form a Regional Training Cluster

Union Commitment

The nuclear trade unions have, for many years, been at the forefront of demands for up skilling existing employers and a joined up strategy to encourage new entrants to the industry and the provision of high quality training for existing and new staff.

They strongly support the employer demands highlighted in the Business Plan for the Skills Academy and are committed to encouraging demand from staff for training and will encourage participation from all staff by working closely with their employers to up skill and improve their employability.

The trade unions are clear that training and skills are not just about numbers but are more importantly about a national framework that will provide consistent, high quality training at all levels and delivers common standards which encourages flexibility and transferability.

The nuclear trade unions are committed to working with the employers to make the Skills Academy a success.

Outputs

The National Skills Academy for Nuclear will develop and implement a range of products and services as requested by employers. The content and development of all of these will be informed by the employer Board and Steering Groups.
Examples of some of the products and services are:

- **Nuclear Skills Passport:** This scheme will be rolled out across the industry and will record peoples' competences in a high-integrity transferable record.
- **Nuclear Industry Training Framework:** This will be developed within the Passport and will be a nationally recognised system to record and give a value to the training and skills development undertaken by an individual working in the sector.
- **Energy Foresight:** An interactive set of DVDs to raise awareness of the sector in schools and to support science teaching.
- **Award of Nuclear Industry Awareness:** A programme developed to up-skill and prepare individuals for working in the sector, this could be used as part of an Apprentice programme for example.
- **Foundation Degrees:** To provide career development opportunities for people both in and whishing to enter the sector.
- **Bursary programme:** Available to support individuals on higher education programmes that may lead to work in the nuclear sector.

Next Steps

<u>WANO (World Association of Nuclear Operators)</u>

The Skills Academy is working to ensure that all training and skills development delivered is of the right standard to help employers and individuals operate to WANO standards.

Formal links now need to be made with WANO, especially as the UK moves into a period of New Build.

Links to Other National Skills Academies

The NSA for Nuclear is taking a lead role in the development of a National Skills Academy Strategic Network, to ensure the sharing of best practice and joint working across the Academies.

For further information visit: www.nuclear.nsacademy.co.uk

APPENDIX 3

ENGINEERING CONSTRUCTION – THE HISTORICAL PERSPECTIVE - WHY WE ARE WHERE WE ARE

There are some potentially valuable lessons from the industry's past as today we are experiencing some of the same issues that were faced around 30 years ago.

Engineering Construction emerged as a discrete activity in the 1960-70s when there was a great deal of investment in major power station, oil refinery and chemical plant and in oil and gas production from the North Sea. The capital investment then was on a massive scale and happened quite quickly. There were difficulties that were highlighted in government reports at the time where projects ran very late and cost much more than originally planned. Virtually all of these projects were important to the UK economy.

A significant factor was poor industrial relations that exacerbated management failings and contributed to cost increases. There were skills shortages, wage inflation and importation of personnel from overseas in attempts to solve the problems with some successes but also many failures.

Around this time, training of people increased dramatically and a large pool of people began to be created. Heavy manufacturing and shipbuilding industries were useful pools of skilled people and there was a high degree of sharing the skilled workers. Industrial relations were stabilised by collective national agreements.

Work levels reached a peak in the 1980s, then suffered a downturn before reaching a second peak around 1990-95. They then declined further until around 2004/5. We are now experiencing an upturn because of increasing oil prices, the need to control carbon emissions and, most importantly, the UK electricity industry needs to replace or upgrade the vast majority of its coal and nuclear powered stations.

There are striking similarities with the market conditions in the industry today as the capital investment levels are rising and there are too few people readily available to meet the need. Whilst the industrial relations structures remain largely in place today, they have come under increasing pressure in the last five years as the levels of capital investment have increased at the time of skills shortages.

Importation of people from the EU and elsewhere has eased some of the issues but is not believed sustainable going forwards.

There are also some very important differences. With the decline of heavy engineering, manufacturing and large shipbuilding there is overall a smaller pool than previously of people with relevant skills. It is believed strategically important for the country to increase the size of this critical skills pool.

Also, capital investors (eg power generators) are much more diverse following the UK's round of privatisations and the break up of major industrial companies. This means that it is more difficult to get the coherence of action and cooperation that was the norm previously. There is a significant risk that uncoordinated action could lead to damaging cycles of demand, compromising the UK's ability to secure investment in its infrastructure. Strategic direction and coordination are crucial to efficient and cost effective projects.