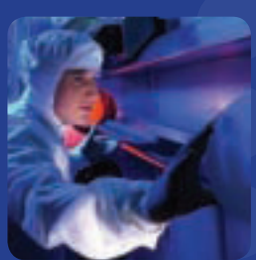



Investigation into high-level skills shortages in the energy sector

ERP
Energy Research Partnership

Energy Research Partnership

Assessment of high level skills shortages in the energy industry

Is there a current or future skills issue in the energy sector?

EXECUTIVE SUMMARY

There is a growing body of evidence about the progressive, long term decline in the numbers of "next generation" scientists and engineers available to support UK industry and academia. At the same time it is evident that there are highly material challenges inherent in meeting national energy policy goals (supply, infrastructure and asset renewal, security of supplies, etc) and for climate change mitigation and adaptation. Technology innovation and commercialisation are the key to achieving both sets of inter-twined goals. These in turn are dependent upon having a cadre of high calibre, committed and practising scientists and engineers.

Against this background, the Energy Research Partnership (ERP) has been established to provide a high-level forum that brings together key funders of energy research and innovation from government, industry, academia and other bodies with relevant interests. The Partnership works towards shared goals and acts as a sounding board for, and generator of, ideas and addresses issues across the full research and innovation spectrum.

One of the initial objectives of the Partnership was to 'Address the high level skills shortages in the energy sector', where high-level skills are taken to mean those required to contribute to the research and development chain that provides innovative new solutions to the challenges the UK energy industry faces - and to deploy them effectively.

The agreed specific aims for this work were as follows;

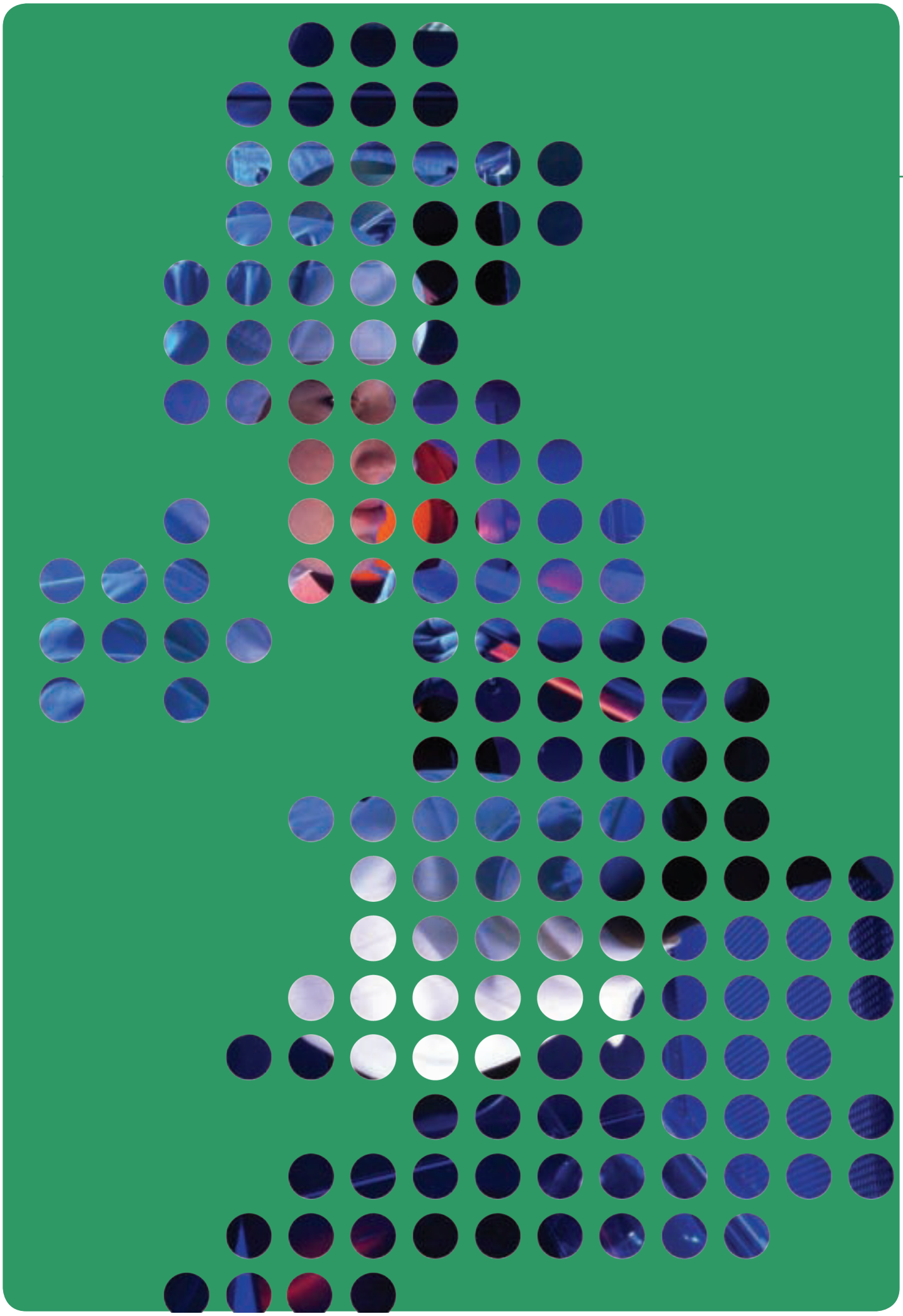
- To map high-level skill deficiencies within the energy research and innovation chain
- To identify both the reasons for, and options to address these high-level skill deficiencies.

In response, this report utilises both the substantial research work already undertaken by various bodies, supported by the views and data provided by the members of the Energy Research Partnership.

The key findings of the study are:

- Skills shortages are causing recruitment problems in the sector.
- It is specifically technical skills that are in short supply.
- The problem is only at its early stages – without intervention this situation is anticipated to worsen to a severe shortage, particularly when the extent of energy innovation and infrastructure replacement that is required is taken into account.
- It is the shrinking pool of graduates that is at issue rather than any concern that their quality is degrading.
- Organisations are looking abroad for skilled resource, in part a direct response to worsening problems in recruitment.
- The sector is seen to have a poor image among young people, however it is recognised that we are at a turning point in the sector with some very powerful tools to change this.
- A significant 'outreach' initiative could influence future career choices among young people.
- When skilled labour leaves an organisation, it tends to remain within the energy sector.
- Energy sector pay compares favourably in engineering, but it is recognised this will never be a competitive advantage versus other areas such as financial services.
- There is no evidence of post-training attrition; retention rates in the sector compare very favourably with those in other sectors.
- The sector has strong competitive advantages, the projects going on are engaging and exciting and, once recruited, labour does not tend to leave the sector.
- A key recommendation of the report is that harnessing the above advantage by interacting with young people at a very early age could make a significant impact on the number of recruits coming through, and improve general public perceptions.
- It is recognised there are individual organisational efforts, but the scale of the problem is likely to require additional activity, the form of which will need careful design and implementation.

This study is a first step, highlighting the type and scale of problems the UK is likely to face with no further action. To drive this forward the report is to be used by the Energy Research Partnership to discuss and put ownership onto the next steps, through engaging with key stakeholders and defining the actions required to make sure the UK has the capability to deliver on our energy and climate change policy goals.



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APPENDICES

The ERP aims to provide a high-level forum which brings together key funders of energy research and innovation from government, industry, academia and other bodies with relevant interests.

1. INTRODUCTION

The Energy Research Partnership (ERP) has been designed to give strategic direction to UK energy research, development, demonstration and deployment (RDD&D), in the context of the Government's Energy Policy and especially with regard to the aim of increasing national research and development expenditure. The ERP aims to achieve this by bringing together key public and private sector funders of UK energy RDD&D, which promote a coherent approach to addressing UK energy challenges, set within an international context, and increase long-term energy-related activity and investments in the UK.

The ERP aims to provide a high-level forum which brings together key funders of energy research and innovation from government, industry, academia and other bodies with relevant interests.

The Partnership works towards shared goals and acts as a sounding board for, and generator of, ideas and addresses issues across the full research and innovation spectrum.

It aims to take a visionary lead on research and innovation, seeking to influence the development and deployment of new technologies and to enable timely, focused RDD&D investments to be made. It does this by influencing members in their respective roles and capacities and by communicating views more widely to other key stakeholders and decision-makers as appropriate.

The ERP will work to improve the impact of funding for energy research and innovation, including funding from the science budget, government departments, the Carbon Trust and business. In addition, the Partnership will help ensure that the UK gains maximum benefit from European and international programmes and funding.

The initial objectives of the Partnership have been separated into three workstreams:

1) To establish strategic objectives and priorities for energy RDD&D in the UK and identify approaches and technologies to accelerate carbon reduction while maintaining security of supply at an affordable price;

2) To consider the 'big picture' of UK support for energy RDD&D and options to enhance the coherence, effectiveness and value of future programmes to achieve a step-change in the rate of energy innovation in the UK;

3) To address the high level skills shortages in the energy sector.

2. BACKGROUND

Given the remit of the ERP ('To address the high level skills shortages in the energy sector.'). The agreed specific aims for the work of this group were to:

- To map high-level skill deficiencies within the energy research and innovation chain.
- Identify the reasons for, and the options to address, these high level skill deficiencies.

These aims have been addressed through the compilation of this report, which aims to answer the question of whether there is a current or future skills issue, and the causes for this. This report utilises both the substantial research work already completed by various bodies, supported by the views and data provided by the members of the ERP.

It was recognised that other bodies have already undertaken significant research into skills shortages in the sector.

The findings of this research are a key part of this report.

3. METHODOLOGY

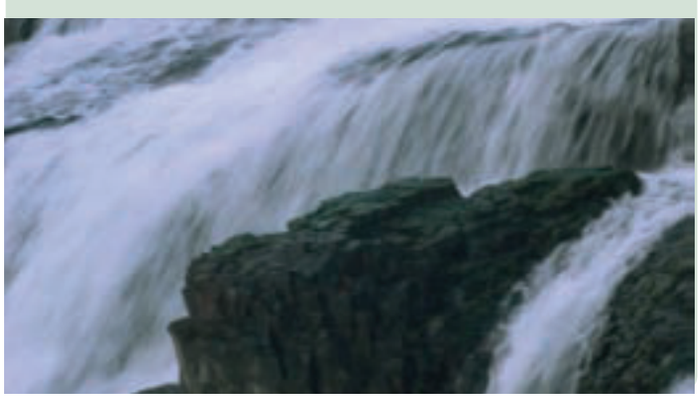
We believe the value that the ERP can bring to discussions on skills shortages is the opinion and data sharing from key organisations with the support and interaction of senior members of staff.

A framework for assessing the extent of a skills shortage was developed, with hypotheses based on current research publications.

This was used to create a questionnaire (Appendix 1) which had focus on the energy sector elements.

In order to pull these two inputs (current research and the ERP's interviews) together. The format of this report is a series of 12 assertions.

These are backed up by any support from completed research projects, and a measure of agreement from the industry interviews, highlighting any additional key points raised.



SUPPLY - Pipeline of appropriately skilled resources			**DEMAND**
Schools	Universities	UK Energy Market	
	• Profile of renewable energy encourages people to do relevant courses. • Market mechanism will lead to better career prospects and therefore supply.		• Increasing pressure of efficiency reducing overall staff numbers.
Traditional recruitment route to skilled roles			
• Worsening standard of numeracy. • Poor view of a career in engineering. • Increased direction to 'easy' subjects.	• Declining popularity of engineering/technical degrees. • Less take up of the power focussed modules. • Increased direction to 'easy' subjects. • Declining stock of skilled teachers due to poor financial rewards of staying in academia (and other...).	• Poor perception of energy sector. • Loss of talent to other sectors due to financial reward (or other). • Lack of available training. • Employees returning to native country. • Increasing industry requirements for enabling skills.	• Need for new recruits to fill spaces left by retirement. • New technologies.

EXTENT OF SKILLS SHORTAGE

3.1 DETAILS OF INTERVIEWEE ORGANISATIONS

Interviewees - Public sector organisations

Organisation	Nature of activities	
DEFRA	Department of Environment, Food and Rural Affairs	HM Government Department dealing with, among many other things energy issues in relation to the environment.
EPSRC	Engineering and Physical Sciences Research Council	HM Government's leading funding agency for research and training in engineering and physical sciences.
SEEDA	South East England Development Agency	Development Agency representing the South East Region.
DTI	Department for Trade & Industry Energy Unit (2 interviews completed)	HM Government Department dealing with energy related matters from production to supply.
IMechE	Institution of Mechanical Engineering	The UK qualifying body for mechanical engineers.
EI	Energy Institute	Leading professional body for the energy industry.
RAoE	Royal Academy of Engineers	Britain's national academy for engineering.
ITI Energy	Intermediary Technology Institutes for Energy	Fund and manage early stage research and development programmes across the energy spectrum.
DCLG	Department for Communities and Local Government	HM Government Department promoting community cohesion and equality, housing, urban regeneration, planning and local government.

Interviewees - Private sector

Organisation	Nature of Business
ALSTOM	World leader in transport & energy infrastructure, developing and providing equipment and services for power generation and rail transport.
Arup	Global design and consultancy firm involved in the energy chain from generation through to business design.
BP	One of the world's largest energy companies, providing fuel for transportation, energy for heat and light, retail services and petrochemicals products.
Carbon Trust	The Carbon Trust helps business and the public sector cut carbon emissions, and supports the development of low carbon technologies.
Ceres Power	Ceres develop and exploits its patented fuel cell technology through producing core fuel cell components in-house, and working with partners to integrate such components into finished products for end-users.
Doosan Babcock	Multi-specialist energy services company, providing innovative technology that supports and enhances the service life of energy assets.
E.ON UK	The UK's largest integrated energy company, generating and distributing electricity, and retailing electricity and gas.
National Grid	Owner, operator and developer of the high-voltage transmission network in England and Wales and Great Britain's principal gas transportation system.
Ofgem	The regulator for Britain's gas and electricity industries.
Scottish & Southern	One of the largest energy companies in the UK, they are involved in the generation, transmission, distribution and supply of electricity.
Shell	A global group of oil, gas and petrochemical companies with a broad renewables based portfolio.

Additional interview with Rothschild & Son undertaken for case study.

The primary source for new recruits to technical roles is graduates in six of these companies, in five it is experienced hires.

3.2 KEY REPORTS CONSULTED

ENERGY SECTOR SPECIFIC

- Energy Institute (2006) report

'Research into Leadership Skills Shortages for the Energy Industry'

This report used survey results from 300 energy companies (51 responses), and another survey sent to 2,400 individuals (over 1,300 responses). Interviews were also conducted with 10 HR personnel.

- Energy & Utility Skills (2004) report

'Employment and Skills study of the UK Electricity Industry'

This report reviewed available information from other published sources, along with a survey to 11 of the key energy sector companies.

- Energy & Utility Skills (2003) report

'Exploring the Skills Requirements of the UK Renewable Power Industry to 2010'

This report is based on quantitative information gathered through a questionnaire and qualitative information gathered from visits and telephone interviews with employers and other interested parties in the sector. 42 companies participated in the project.

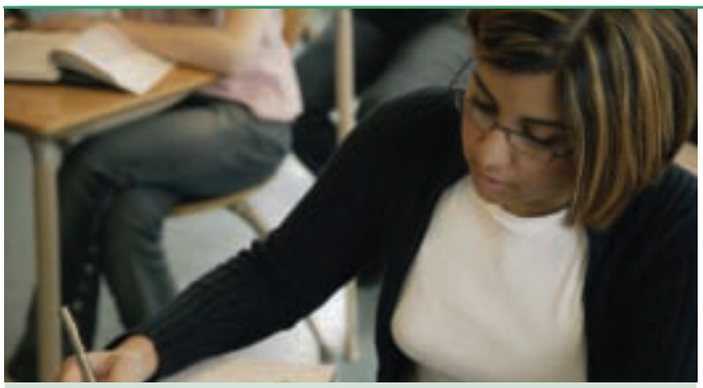
- Energy & Utility Skills (2001) report

'Employment and Skills Study'

This report is based on quantitative information gathered through a questionnaire and qualitative information gathered from visits and telephone interviews with employers in the sector. Thirteen companies participated in the project.

All reports available from www.euskills.co.uk

Assessment of high level skills shortages in the energy industry



ENGINEERING

- Institute of Engineering and Technology (2006) report

'Engineering and Technology Skills and Demand in Industry'

This report summarises 113 responses to an Internet based survey, 17 of these from energy sector companies.

- Henley Report for the Royal Academy of Engineering (2006) report

'Educating Engineers for the 21st Century; The Industry View'

This report used 21 interviews with engineering companies (8 had significant involvement in the energy sector) and 13 SMEs to develop a questionnaire which was sent to 8,000 companies and 444 responses were received.

www.raeng.org.uk/henleyreport

- GTI 'TARGET' Graduate Trends Survey (2006) report

50 graduate recruiters in the engineering sector completed a data request on current and future recruitment.

- Engineering UK (2005) report

'A Statistical Guide to Labour Supply and Demand in Engineering and Technology'

This annual publication provides extensive statistical data on:

- The pipeline of engineers through from secondary education to higher education and vocational training.
- Graduate recruitment, including salary levels
- Professional registrations
- Public perceptions of engineering (including in schools)

- Royal Academy of Engineering (2003) report

'The Future of Engineering Research'

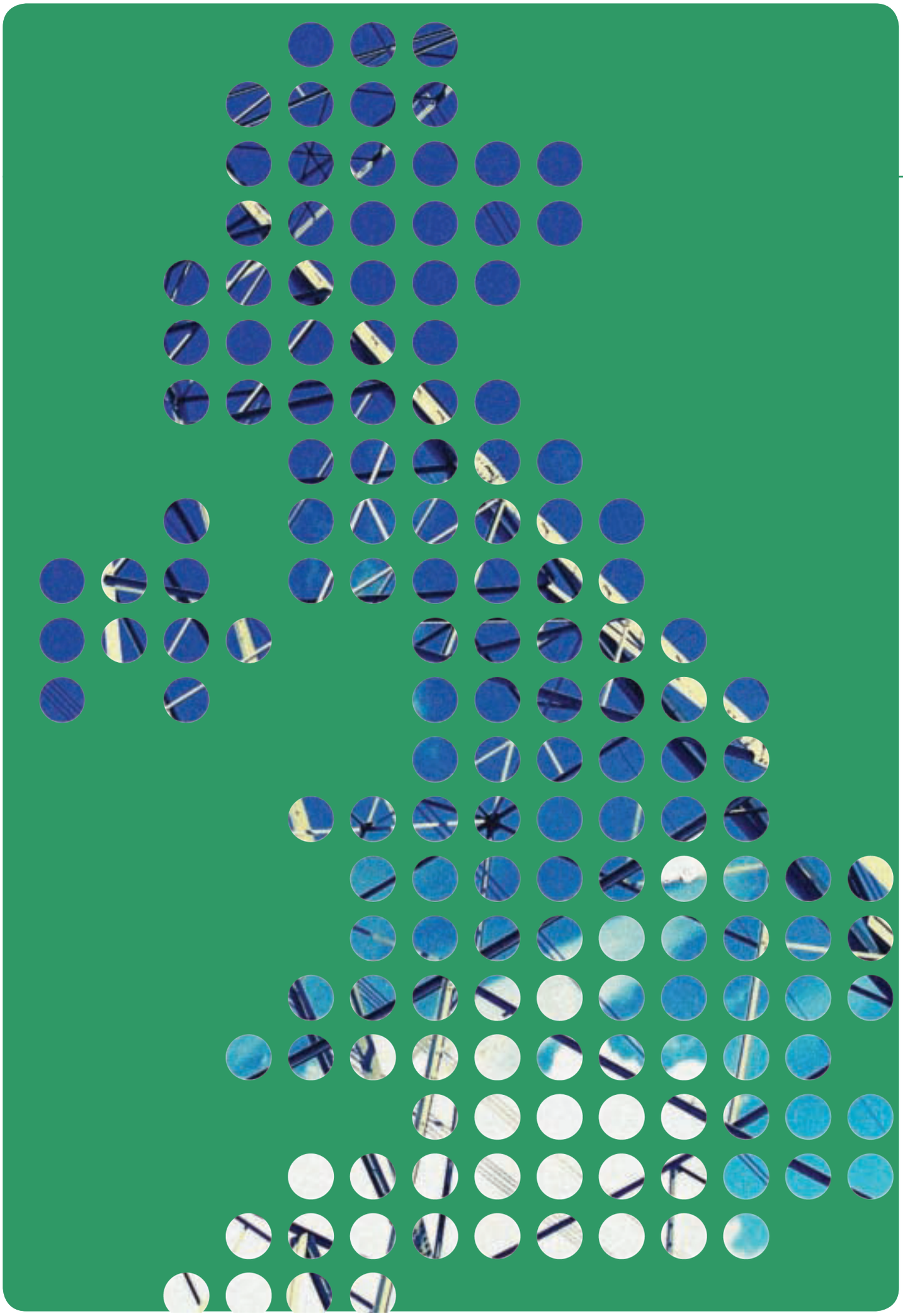
This report discussed the future of research into engineering topics, including assessment of issues such as the changed nature of industry research, looking at the new research institutions, questioning the role of, and hurdles facing academia, and how to safeguard the supply of skilled graduates.

4. SUMMARY OF KEY FINDINGS

12 assertions are presented below with an assessment of the evidential research from both previous reports, and the interviews with ERP members, which are presented within this report.

	Assertions	Assessment based on current research	Assessment based on ERP member organisation interviews
1. Existence and Extent of shortage			
1	Skills shortages are currently leading to difficulties in recruitment	Numerous reports which conclude a skills shortages to varying extents.	Currently some firms are managing to attract a wealth of applicants through either brand, reputation or salaries offered. However these are the exceptions in a clearly tight market, with some firms experiencing significant problems in recruitment. Attraction of women is also proving problematic.
2	It is a shortage of technical skills specifically that leads to problems in recruitment	High end technical skills are in short supply, although research evidence placed more significance on a shortage of 'softer skills' which was not clear from interviews. Specific areas mentioned were consistent with interview evidence.	Technical Skills clearly ranked highest, with no clear significant concerns over other areas. Some concern over the reduction of core skills in schools. 'Multidisciplinary' candidates were mentioned in a number of interviews, with a recognition that the technologies of the future will require candidates with a good mix of skills as well as specialisms. Shortages of 'Craft' skills also flagged.
3	This situation is anticipated to worsen in the future	Although some counter arguments are discussed, research evidence primarily suggests a worsening skills shortage in the sector.	Almost all respondents believe skills shortages will worsen, with specific examples of future increased demand for talent both within the energy sector and the engineering industry more generally.

2. Supply of skilled labour			
4	The quantity and quality of graduate prospects from relevant disciplines is causing problems	There is widespread concern over the declining number of engineering/ science/technology students. Discussions on quality were rare, but centred on numeracy skills and declining degree quality for grade awarded.	A shrinking pool of graduates was the major problem, rather than an issue of quality. This was attributed in almost all cases to a lack of public awareness of the sector and little promotion in schools. One concern flagged was the relative funding awarded to relevant degree programmes, compared to the courses where supply outstrips demand.
5	Organisations are looking abroad for skilled resource	Little discussion other than a recognition that this is a strategy firms with skills shortages are adopting.	All companies interviewed look abroad to some extent, but sometimes this is a business strategy rather than a need for skills lacking in the UK.
6	Graduates have a poor perception of working in the energy sector	Widespread recognition that perceptions of the 'brand' of the sector effect career choices. The current view of the sector is poor, however if efforts are made to improve the perception and attractiveness of the sector then this is a powerful tool.	Most respondents believed that graduates have a poor perception of the sector. However, in line with research evidence, many also believed that we are at a turning point in the sector, with some extremely interesting projects. Those projects, if promoted, could swing perceptions significantly. An involvement at school age is thought to be critical.
7	Starting salaries in the energy sector are discouraging for graduates	Statistics presented are mixed. It is recognised that salaries are uncompetitive against financial services. However, in the more general market they compare favourably. There are some concerns there is a low ceiling to top end salaries.	In comparison to the engineering sector as a whole our respondent salaries compared favourably. Again an issue flagged was of perceptions of the sector pay, and that more can be done to address this.



3. Loss in skilled labour			
8	The age profile of the workforce is indicating an impending skill shortages problem	A widely discussed issue with differing views varying from it being a critical 'haemorrhage' through to an easily remedied problem and noting that the industry will never be one where youngsters prevail.	Data gives a mixed picture. Only one company ranked retirement most highly as a loss of labour, and relatively few interviewees came across as significantly concerned. The concern is not so much with impact on head count, as to how the leavers' knowledge is transferred.
9	When skilled labour moves, it tends to leave the energy sector completely	Little research has been undertaken on this issue, although what exists is positive – stating a relatively high retention rate in both engineering and energy once a recruit has come into the sector.	Key loss of labour is to other energy companies, implying churn within the sector rather than a movement to other areas. There are concerns over the immediate 'post degree loss', but no evidence that this is a worsening problem.
4. Training of skilled labour			
10	Post-graduate study is encouraged and rewarded appropriately by the ultimate job offering	Little research has been undertaken.	Most organisations offer a different entry and pay level if the applicant holds a post-degree qualification.
11	Students leave employment after completing a desirable training scheme	Little research has been undertaken.	Very few problems experienced with post training attrition, again highlighting that once in the sector retention is very good.
12	The quality and quantity of training opportunities in the UK is sufficient to supply the demand for skilled staff	The energy sector has an excellent record on training and development. Within Universities there are concerns that the courses do not match the needs of industry. Therefore more practical application and 'modernisation' of courses is needed.	Mixed view among interviewees. All graduate employers offered a comprehensive training scheme. Concerns were centred around the quality of University courses and whether the institutions have recognised and reacted to the increased worldwide focus on the criticality of the issues in the energy sector. Concern in public sector interviewees that engineering courses are losing out to 'easier' degrees.

All interviewees felt that skill shortages are an issue of concern to some extent.

CASE STUDY

One member commented that recent visits to electricity distribution companies have highlighted that some are not utilising their full Innovation Funding Incentive – not due to a lack of ideas, but lack of qualified engineering staff to manage the projects. While not a comment on the availability of new skills, it is an example of the direct impact on research capability a skills shortage can create.

CASE STUDY

Arup currently sees few issues in attracting applicants. They attribute this to two factors:

1. They are ranked in the 'Times Best Places to Work' report. This has a significant measurable effect on recruitment costs.

2. Their reputation is enhanced and promoted through their involvement with Universities, reflected in the EPSRC ranking of companies with collaborative university activities, where they have always been leaders in their sector.

5. DETAILED STATEMENT ANALYSIS

1. Skills shortages are currently leading to difficulties in recruitment

Research evidence

Research on the existence of a skills issue is extensive, and all report some skills shortage to varying extents. Key report conclusions were:

- The Henley report concluded that "Overall, respondent firms report that they are neither satisfied nor dissatisfied with their ability to recruit appropriately skilled engineering graduates from UK Universities. There is some evidence, however, both of skills shortages (where there is a lack of appropriately qualified graduates available to be recruited) and skills gaps (where deficiencies in the skills of those graduates that are available) in the UK graduate engineering labour market, although the picture in the latter case is rather mixed".

- In the 2001 EU Skills survey of skills issues '46% of employers report the existence of some gaps, which are having a significant impact on business performance. This compares with only 13% reporting significant gaps in 1999'. They also found that '77% of employers report difficulties in recruiting graduates… compared with 56% reporting difficulties in 1999'.

- The 2003 EU Skills study of the renewables sector requirements found that 'applications are generally plentiful although there is competition within the industry for the highest calibre people'– although as recognised later in this report 'Renewables' is an area particularly attractive to graduates.

- There are extensive reports of difficulties attracting women into the sector, although the ETB UK Engineering Report 2005 is seeing a slow but steady increase.

Private Sector Interviews

Most companies were aware of an industry message that there is a skills shortage, and two described that their reaction has been to increase recruitment efforts to ensure they are not affected.

When interviewees mentioned initiatives such as the Power Academy (see appendix 6) they were talked about in a very positive manner, however they were seen to be preservative measures, rather than growth of the skills pool.

The companies who do not report a current skill shortage were questioned on why this is, with the nature of the work they do being cited as the biggest reason. They also believed themselves to have good brands and global awareness of their business activities.

Public Sector Interviews

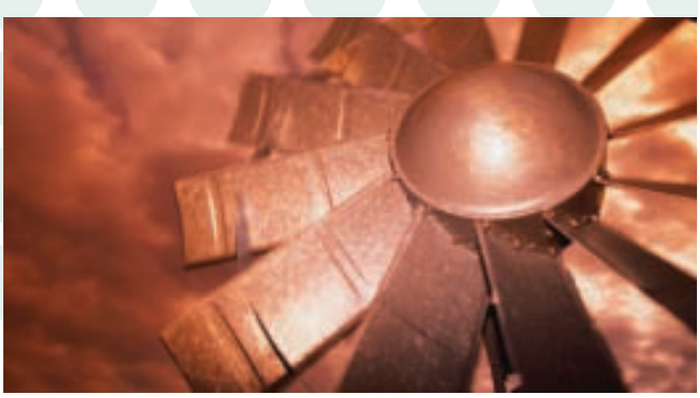
All interviewees felt that skill shortages are an issue of concern to some extent. Shortages were identified at both the high-level (the scope of this report) and also at the lower level. Those who mentioned low-level or 'craft' skills (such as technicians and installers) were concerned that these underpin R&D and felt them to be of equal importance.

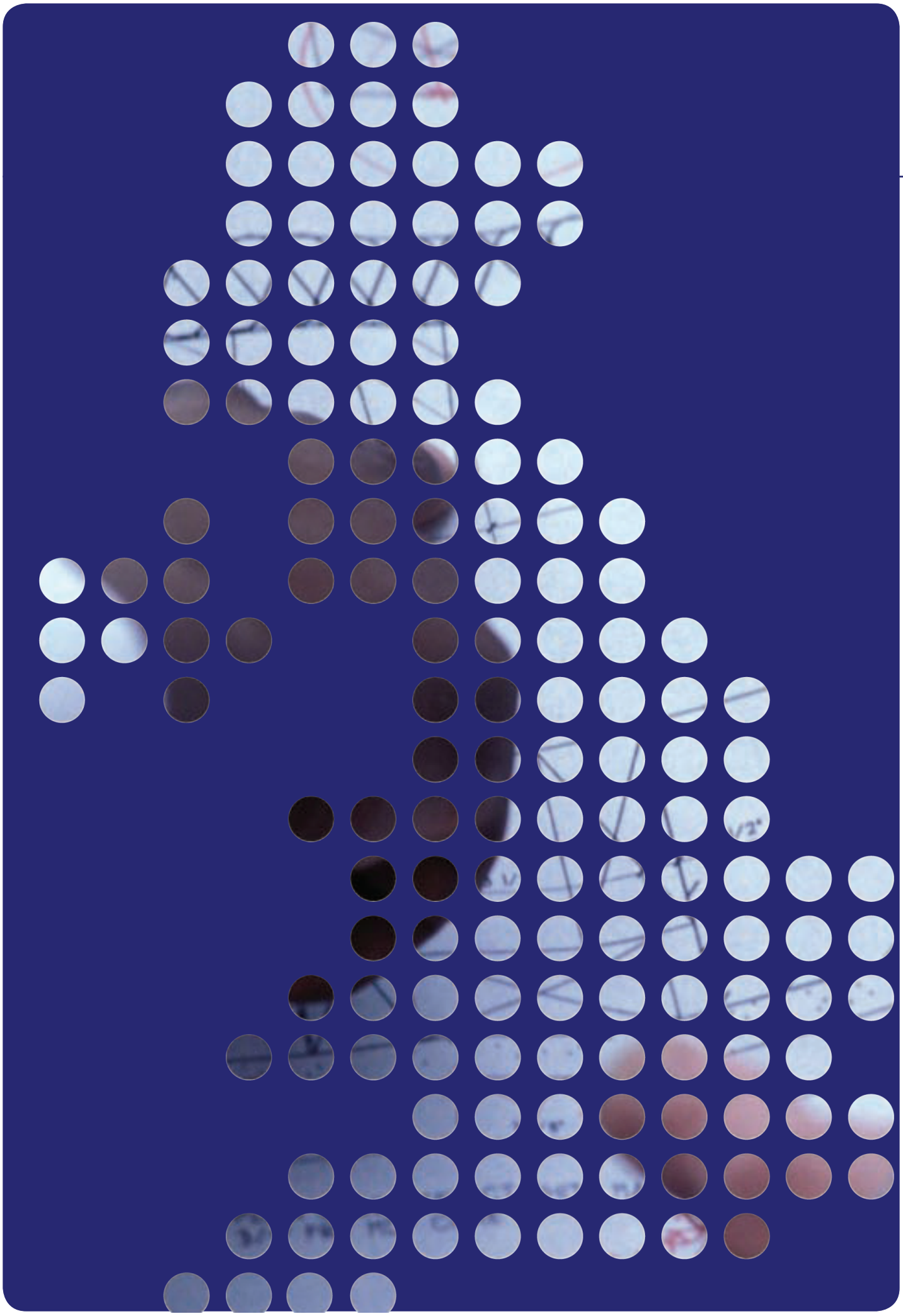
One interviewee felt that market forces had created the shortages and that they would over time solve the issue, but most felt that more needs to be done to address the issue in order to avert a serious crisis in future.

Three respondents gave an unprompted view that attracting women into the sector was a well publicised and evidenced problem, and they have seen no signs of this improving.

Four interviewees expressed concerns about the failure to attract significant volumes of women into engineering and the energy sector and that more needs to be done to attract them. The image of the industry and the 'selling' of engineering courses needs to be adjusted to appeal more to female applicants.

More is being done by some organisations to address the issue – the Energy Institute mentioned a programme called 'Women in Science and Engineering' (WISE) and SEEDA mentioned computer clubs for girls, to attract more girls to take up IT skills at schools (one of the core skills relevant to the engineering industry).





2. It is a shortage of technical skills specifically that leads to problems in recruitment

Research evidence

The EUSkills survey of skills issues in the electricity market asked for specific information on what skills were lacking, 'Specialist Engineering Skills' were found to be in shortest supply followed by 'Engineering/ Technology skills', far outweighing craft and technician skills, core skills and 'enabling skills' such as team-working.

In an assessment of skills needs undertaken for the Department for Education and Employment the author found that 'A number of engineering employers are experiencing difficulties in filling vacancies, mainly because of a shortage of people with relevant skills and experience. Skill shortages are apparent at all levels but especially at the higher end of the technical spectrum….The main skill gaps are in technical and practical skills areas' (Connor, 2000).

The Energy Institute report into leadership skills found that over three quarters of respondents said that technical skills were their main shortage.

Some of the specific areas mentioned were in chemical, electrical power, petroleum, alternative/ renewable energies, metallurgists, and industrial energy efficiency.

Private Sector Interviews

Technical skills were ranked most highly, and most important, by all companies. No major issues were flagged with the other skills groups.

Some example areas were flagged which are seen as in short supply.

Example skills shortages areas		
Combustion Engineers	Environmental Engineers	Renewables
Control & Instrumentation	Bioscientists	Boiler Engineering
Completions Engineers	Metallurgy	Skills needed for deployment of protection systems on electrical networks
‘Gas to Liquids’ Engineering	Structural Integrity	
And some new skills issues	Engineering	

These areas highlight the need for not only engineering skills but applied scientists and mathematicians.

Generally the other skills ranked in the questionnaire were seen as ‘easier to train in-house’.

Two companies flagged that ‘softer’ skills (such as communication, teamwork and organisational skills) had started to have increased importance. However, they now see that technical skills are highly valued.

One interviewee had evidence of their previous employer recognising that softer skills were preventing highly technical applicants being employed, and so developed a ‘dual stream’ approach – with a separate route for technical recruits currently lacking other skills that could be trained.

Public Sector Interviews

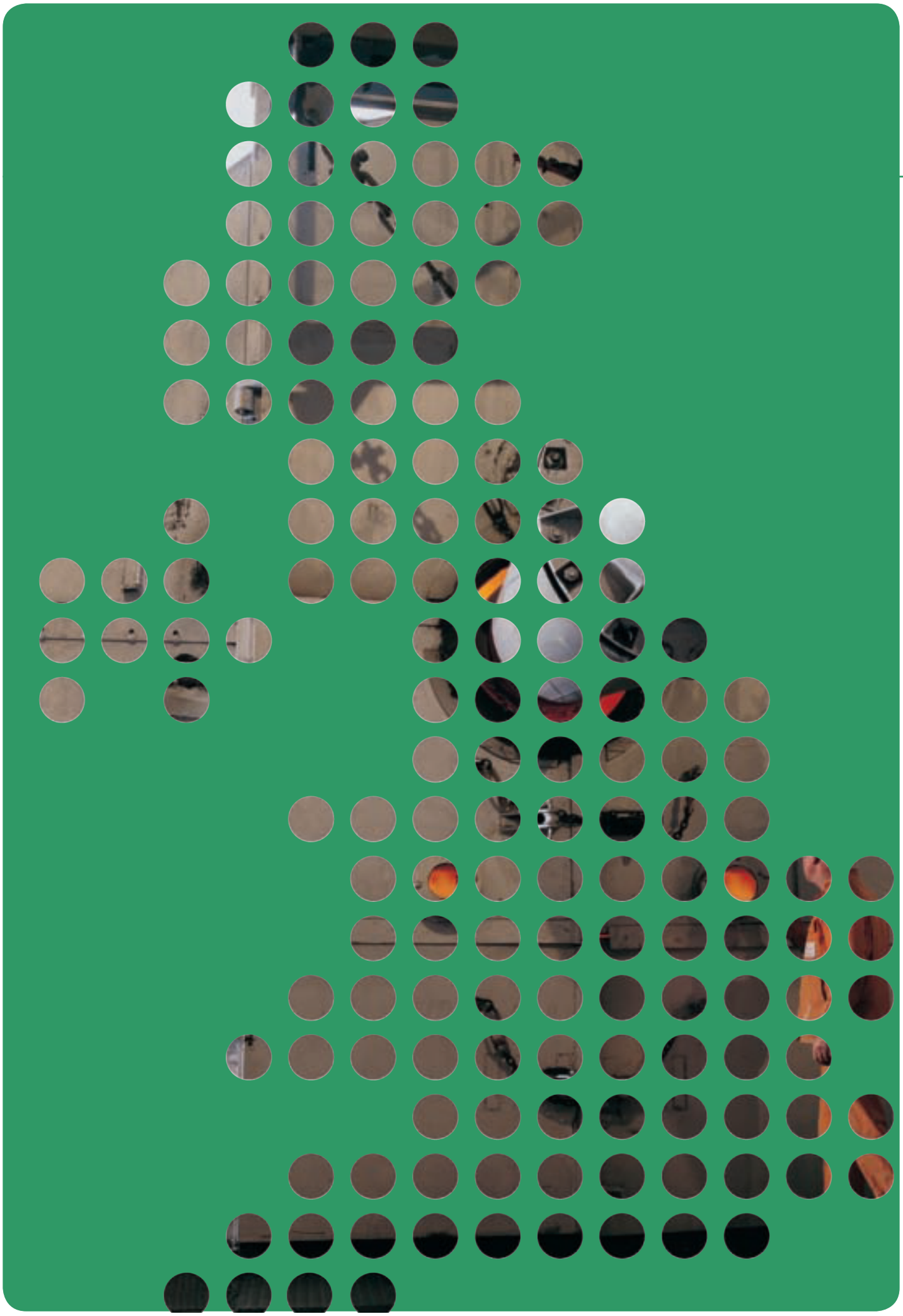
Example skills shortage areas		
Technical Skills	Leadership Skills	Managerial Skills
Mechanical Engineers	Project Management	Chemical Engineers
Electronics Engineers		

Some interviewees felt that core skills such as numeracy, physics and IT skills were not being acquired at school, leading to a reduction in numbers of students qualified to begin a graduate course in engineering, and hence a reduction in the numbers of students entering engineering, and energy careers. (To illustrate the problem DCLG mentioned that the level of A-level physics passes has halved since 1984).

It was commonly felt that skills shortages are an issue for all engineering sectors, not just energy, and it was also felt by some that the situation was a global one, given the ever increasing demand for engineers globally.

A further view expressed was that flexibility of skills is an issue to be addressed, and one correspondent suggested that given the multidisciplinary nature of the industry what is needed is a level of engineer with skills across the spectrum - for example embracing chemical, mechanical and civil engineering.

The EPSRC felt that increasing emphasis on developments in green energy would create differing demands for specific skills which have to be responded to, probably through special courses to develop multidisciplinary teams.



3. Skill shortages are anticipated to worsen in the future.

Research evidence

The Henley report found that 'The responses to the survey question which asked participants to give an overall assessment of whether the proportion of engineering graduates in their workforce was likely to increase or decrease over the next ten years, On a scale of 1 to 5, where 5 was 'increase significantly', the mean score returned was 3.70 which suggests an expectation that the proportion of graduates will increase in the future….This finding also confirms the impression gained from interviews, where some respondents expected to recruit more graduates in order to meet future business challenges, or to address problems of an aging workforce.'

One particular area noted in research was getting enough power engineers to work on the large number of new connections to the distribution network, for example in the EUSkills report on the renewable power industry. They reference that Distribution companies already state skills issues are already a key factor in explaining the length of time it takes for generators to gain connection.

A Department for Education & Skills report into Supply and Demand of SET students found that "The projections of stock of science and engineering graduates suggest(skills shortages in the industry) will rise substantially by 2014".

The IET report on E&T Demand found that 'many areas of the engineering and technology sector are still growing (78% recruiting graduates, 40% citing business expansion or diversification as the reason for recruitment)'. They went on to say that '35% of the companies did not expect to be able to recruit enough suitably qualified technical staff this year, a figure that rose to 40% when asked about four years time'.

The 2004 EUSkills report 'suggests that skills deficiencies may have worsened since 1999: more companies are reporting gaps, and the numbers reporting recruitment difficulties have increased'.

However, there are some suggestions that demand for UK engineering specialists may decrease, such as the Henley report which states that 'there has been a growth in 'offshoring' with the shift of activities to lower cost countries. Of course this has been a feature of manufacturing for many years but it is increasingly happening in all areas of engineering' and they continue to cite examples of 'centres for analysis' in India expanding operations, where the cost of new graduates is thirty percent of salaries in the UK (with comparable skills)'.

"11 out of 11 respondents believed that skills shortages in the sector will worsen"

One member suggested that there are many new challenges ahead for networks – created by the increasing need for end of life asset replacement and the demands of new forms of generation, both of which challenge the established architectures of power systems. An interaction is needed here across the whole energy chain, requiring end to end understanding of the grid and its engineering fundamentals.

Private Sector Interviews

The causal supply side issues are assessed in further detail in separate sections of this report.

On the demand side, all companies believed developments in the sector will increase the demand for skilled labour, with a general feeling that there is a 'revving up' in the sector with increased expenditure, and some companies providing specific examples that are anticipated to require a lot of skilled resource.

Increasing demand project examples
Nuclear
New conventional power station builds
Renewables
Cap.Ex. Programme
Non-Energy Sector skills demand; Olympics, LNG terminals, PetroChem investment.

CASE STUDY

Shell believes there will be problems meeting future demand – particularly when looking at a global market. Shell has experience that in some overseas markets such as Nigeria and Canada there is a 'Bottomless pit of demand' for quality, skilled engineers.

Public Sector Interviews

One interviewee mentioned that the developing green energy industry will require up-skilling and more multidisciplinary working in the energy industry of the future. In addition, there is increasing activity (such as exploration) in traditional sectors such as downstream oil and gas which continues to require additional posts. In the near future large infrastructural projects such as the forthcoming Olympics will suck in large numbers of engineers. Add to these issues the problem of a 'flight out of the engineering industry' cited by one interviewee, and it appears inevitable that the shortages would continue to grow if the issue is not addressed. In fact SEEDA estimated that there needs to be another 600 training annually in the South East alone for the next ten years to meet the R&D spending aspirations in the DTI ten year Science and innovation strategy.

One interviewee sees the issue of one of market forces, which will resolve itself over time as pay rises to match demand. While there is no evidence brought forward that the market won't correct this position, this is likely to take many years because of the very long supply chain back into schools. In the meantime a severe shortage may arise. Two interviewees highlighted this by stating that there is a critical need for a significant outreach effort to create awareness of the industry and its potential.

4. The quality and quantity of graduates from relevant disciplines is causing problems

Research evidence

Quantity

The Henley Report states that 'Despite rapid growth in the total undergraduate population, acceptances on undergraduate engineering and technology courses have kept fairly static at around 24,500'. They also flag a concern that the grade of degree awarded can be a poor indicator of a graduate's actual abilities.

A 'dwindling popularity of engineering degrees' is described in the Royal Academy of Engineering report (2003) as an extreme concern. 'In 1991 engineering attracted 10.7% of all accepted domestic higher education applications processed by the Universities and colleges admissions service - by 2-1 this figure had fallen to 5.3%'.

'One explanation for the falling numbers(taking engineering courses) is the popularity of computing and IT degree courses where the number of students has risen significantly' (ETA/EUskills 2003 report).

In terms of home student quantity the DTI Economics Paper 16 highlights that 29% of new engineering and technology graduates are foreign nationals, compared to 8% in physical sciences, with the implication they may be less likely to remain in the UK economy long-term.

However, the figures on unemployment 6 months after graduation (see Appendix 2, taken from Prospects.ac.uk survey) are an indicator of how tight the market for graduates is – civil engineering is the only one that is clearly 'tight'. Even if this data is subject to a selectivity effect of respondents, this is a worrying message to be providing to students making degree choices.

Again conflicting information is provided in the GTI 'Target' Graduate Trends survey which states that "the average number of engineering vacancies per organisation has continued to decline, with a significant decrease to 76 from 90 vacancies last year. Despite falling numbers of vacancies, recruitment remains competitive with the average number of applications received up again from 1949 to 2226".

Quality

Comments on declining graduate quality are rare but mostly centred around numeracy skills. A recent survey of UK Deans of science conducted by Save British Science indicated that on 70% of undergraduate physical science courses, less than 50% were considered to possess the required level of mathematics skills' (RAENG, 2003) and University degree quality (see statement 12) . The Henley report also highlighted a concern that the grade of degree awarded can be a poor indicator of a graduate's actual abilities.

Private Sector Interviews

All of the respondents citing an issue with quality spoke in the context of a declining degree quality rather than declining ability of potential recruits, although there were some concerns over the numerical skills of students.

All 10 graduate employers saw evidence of decreasing numbers of graduates coming through relevant disciplines.

This was attributed to the promotion of engineering both to the general public and schoolchildren/students. (See statement 6 on perceptions of graduates).

SCOTTISH & SOUTHERN

"We do see a shortage of high calibre candidates but as part of our resource planning process we maintain a constant conversation with Universities, and we are very encouraged by the statistics on intake to relevant degrees this year".

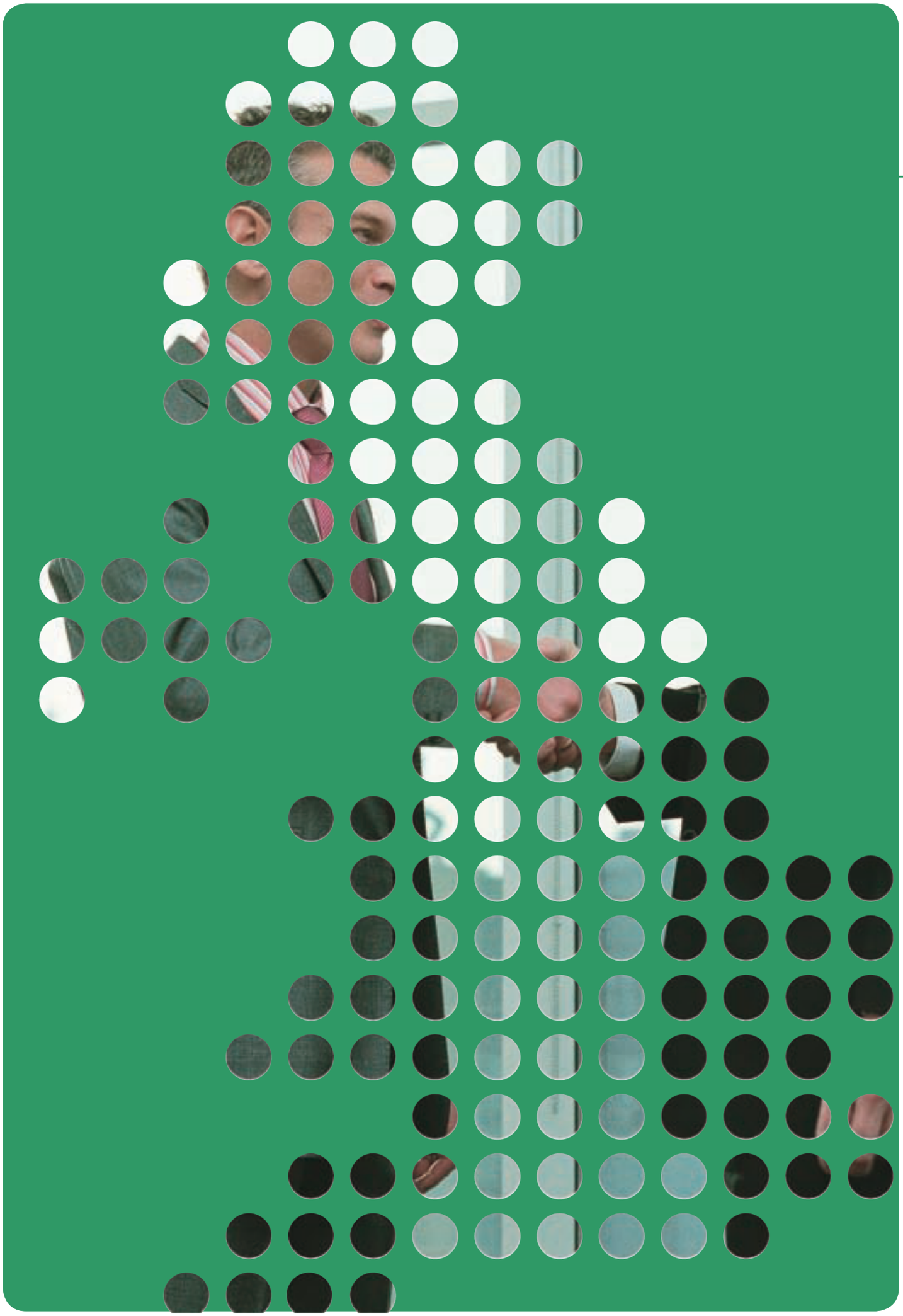
Public Sector Interviews

One interviewee expressed concern at the glut of courses in issues such as media and dance and the apparent ease with which Universities appear to obtain funding to run such courses. There appears to be little consideration about the economic need for courses that are offered at Universities leading to a glut of less useful or respected courses, which in turn leads to students who do not have the qualifications sought by engineering employers.

In addition they had concerns over the quality checks on courses; and the likely negative impact on engineering graduate numbers of 'fast track' courses which are likely to be developed over the next few years which are likely to attract even more students to a 'quick win' degree.

Two interviewees felt that a more appropriate skilling route for some students is the traditional apprenticeship scheme and sandwich courses.

One interviewee reported that Universities have commented on the poor quality of students entering University, who often lack practical skills. These practical skills have been reduced at schools because of reduced budgets and increasing difficulties meeting H&S requirements, and have led to what one interviewee described as 'school science training amounting to little more than learning how to use a pipette'.



5. Organisations need to look abroad for skilled resource

Research evidence

The Henley report research 'shows that firms recruit engineering graduates from overseas universities both as a response to specific skills shortages and in order to support their overseas operations in terms of quality, the research concludes that the best UK graduates are probably broadly comparable globally, although it notes the high quality of those engineering graduates from overseas universities that UK firms do encounter'.

Private Sector Interviews

11 out of 11 respondents are recruiting abroad to fill skilled roles.

In four of these this is a business strategy due to the global nature of the business, in nine it was due to a lack of available skills in the UK.

In three of these companies this was a recent (up to three years ago) move due to inability to fill roles in the UK.

This was also the experience of two companies in their research involvement; Two companies stated that they look abroad due to a shortage in a particular niche area, an example given being boiler engineering.

However, as discussed in statement 11, this is so far not seen as significantly problematic for retention, and indeed one company recruits a significant number of non-home students and believes this is a sustainable, reliable source of very skilled labour.

Public Sector Interviews

Public interviewees cited little evidence of this although one felt that engineering is increasingly becoming a service that can be conducted on-line and so can be outsourced to cheaper markets – particularly the mathematical side. That interviewee went so far as to suggest that by 2025 it is possible that all high-end engineering might be taking place in India.

One interviewee felt that despite the difficulties, there did not appear to be a significant overseas recruitment drive, although multinationals do increasingly recruit locally to fill international posts.

CASE STUDY

ALSTOM power Technology Centre target Cranfield University to recruit high quality engineers into technical roles. Their recruits are currently approximately 60% non-home students. The quality of these students is very good and they have no experience of students leaving to return home.

NATIONAL GRID

"In our University research sponsorship programme 9 out of the 10 current projects are being completed by foreign nationals. They are completing the research but we believe they are unlikely to continue working in the UK market in the future".

One of the key recommendations made in the Energy Institute report was that 'The energy industry is an exciting career option for young people and offers some of the biggest challenges – to individuals and the world – that lead to a valuable and worthwhile job offering real responsibility to young engineers and others. The industry needs to be well presented to young people as a prime career choice'.

6. Graduates have a poor perception of working in the energy sector

Research evidence

The ETB Engineering UK report undertook comprehensive research on perceptions of the engineering industry. This highlighted the poor word associations with engineering and, worryingly, said that 'teachers also saw engineering as a dirty, old-fashioned and predominantly male orientated career'.

The Henley report worryingly states that 'Of those graduating as engineers, less than half will actually take up an engineering career'.

It also found that 'one aspect of this(concern over the pipeline of future engineering graduates) is the problem of mathematics teaching. Other worries were around the image of the industry and its ability to attract talented youngsters from school onto engineering courses and into the industry'.

'The experience of periodic recession may also have lasting effects on labour supply to the extent that the willingness of young people to seek training opportunities in engineering is reduced by negative advice from older generations about the insecurity attached to employment prospects in the industry' (Mason, 1999).

ETA/EU Skills highlighted a positive side to the image of the sector in that (the renewables sector) is generally attractive to potential recruits (ETA/EUSkills, 2003).

One of the key recommendations made in the Energy Institute report was that 'The energy industry is an exciting career option for young people and offers some of the biggest challenges – to individuals and the world – that lead to a valuable and worthwhile job offering real responsibility to young engineers and others. The industry needs to be well presented to young people as a prime career choice'.

And the Henley report concluded that ‘interview participants appeared to acknowledge that they would have to continue, and even strengthen, their efforts with both universities and schools in terms of identifying talent, encouraging good people into engineering, and supporting the teaching of science and technology. A range of programmes was mentioned by respondents, including the Year in Industry scheme, the Power Academy (see apendix 6), and Outreach programmes’.

Private Sector Interviews

"7 out of 11 respondents believe graduates currently have poor perception of working in the energy sector".

However, four of these seven respondents gave an unprompted response that this perception is changing, due to the changing nature of the market and the raised awareness of energy issues within society.

Renewables particularly was highlighted as a ‘buzzword’ for current students that could be used advantageously to encourage moving into the energy sector.

The impression from the interviews in summary was that once in engineering, the energy sector had an increasingly attractive image. This is the competitive advantage the sector can use to ensure a pipeline of new recruits in a highly competitive market for engineering students.

The conversations frequently extended beyond the attraction of the energy sector, to the preliminary stages of our framework of supply;

Pipeline of Recruitment				
Schools	→	Universities	→	Energy Sector Companies

Schools

Six interviewees gave an unprompted view that the causal issue was a lack of promotion and interaction in schools, which seemed to exist in the past.

One interviewee gave anecdotal evidence of how young people can indeed be encouraged into engineering by interaction with them at an appropriate age.

The concern with three of the interviewees was that there is no single body with this remit, and despite the good work by the institutes, it needs the engagment of an employer group.

Universities

Interviewees were aware of statistics on declining numbers of engineering students.

Across both of these groups it was recognised that a poor general public opinion of the energy sector and engineering will strongly influence the choices of young people.

One respondent highlighted that a lack of understanding from the adult generation leads to a negative feedback loop where there is a further lack of encouragement to the younger generation. This includes the role of teachers in schools.

All comments on the general public opinion were focussed on one of two issues:

1. A lack of public exposure to tangible projects (examples given were the Apollo programme, Concorde).
2. A perception that electricity is taken for granted.

Several interviewees felt the energy industry does a poor job of selling itself.

There is a potential 'outreach' role for companies to engage much more actively with schools to develop awareness among pupils of the opportunities the industry offers.

Interviewees commented that the perception of the energy industry is generally negative - it is usually seen as dirty, tired and old fashioned. In addition, it was widely felt that there is a perception that the industry is poorly paid. These perceptions are considered as contributory factors to skills shortages by interviewees.

The majority felt the problem of skills shortages begins at a very early stage, and for a number of reasons. It was felt that the industry is poorly understood by teachers, career advisers and parents – all the likely 'influencers' on young people undertaking a career choice. Some interviewees cited poor careers guidance at schools as a major contributory factor to the failure of the engineering industry to attract more personnel, and one interviewee commented that the energy industry looses out to other engineering sectors (such as aerospace), as it is less glamorous and exciting. However, SEEDA commented that in pockets where energy research is well established (such as Southampton) there appeared to be a better understanding of the opportunities.

CERES POWER

"Energy is increasingly topical, and has never had such a high profile. The image has changed, with renewables being an example. 5 years ago the public association was with dirty power stations. We expect this to filter through to improve recruitment prospects over the coming years".

ARUP

"Our concern for the industry is getting people into engineering, and making sure there are qualified people to train them, then ensure encouragement to get them into energy. With everything going on in the sector at the moment the third part should not be an issue".

Several interviewees felt the energy industry does a poor job of selling itself, and the DTI commented on the large number of fragmented and uncohesive engineering bodies doing a poor job of both selling the industry and co-operating in order to ensure cross-discipline working. DTI felt there is a potential 'outreach' role for companies to engage much more actively with schools to develop awareness among pupils of the opportunities the industry offers. EPSRC felt that once actually enticed into the industry, students do see it as an interesting and rewarding career choice.

DCLG commented that the ERP could usefully commission an outreach programme and book aimed at highlighting the energy industry, its benefits to society, the issues (including environmental) surrounding the industry and the solutions that are being worked towards. In this way a greater awareness and understanding of the industry might be created, leading to a greater inflow of personnel.

In terms of preparing for a career, it was commonly felt that students thinking about future careers see engineering as a 'difficult' career choice. Students prefer to avoid the relevant core subjects at school age in favour of those perceived as easier and don't have the skills to allow them to follow an engineering university career.

ITI ENERGY

In general, (graduates) see the industry as mature, staid, boring – particularly Oil and Gas power. However, there is, I think, a more idealistic group emerging that has a high interest in renewable energy and carbon reduction that wants to make a contribution in an area now perceived as being of critical importance.

7. Salaries in the energy sector are discouraging for graduates

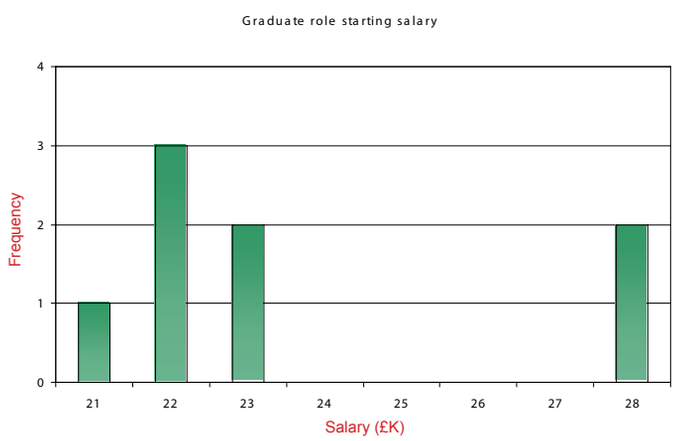
Research evidence

Some comparative data is presented in the interviews section.

There is much data on the relatively uncompetitive starting salaries of engineering roles, however 'six out of the top twelve graduate starting salaries are attributed to engineering disciplines' (ETB, 2006).

There is also a relatively low ceiling for skilled experts. Data presented in the Engineering and Technology board 2005 survey of registered engineers, which put the average annual gross earnings for chartered engineers in 2005 at £53,000. Whilst the median Chartered Engineer salary in 2005 was £45,500 (ETB, 2006).

Private Sector Interviews

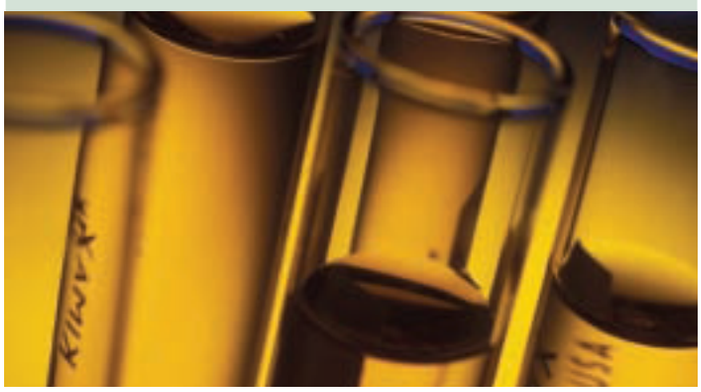


This suggests a relatively narrow band of salaries.

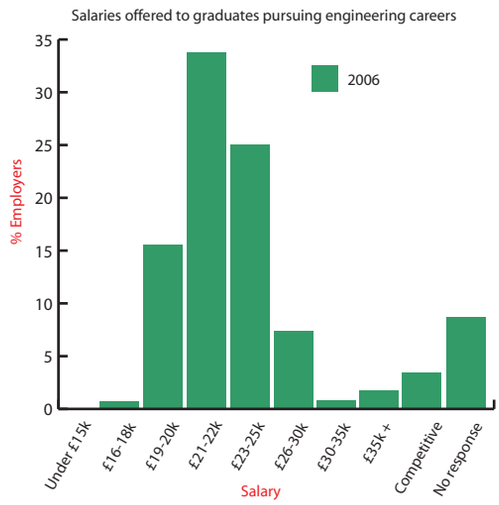
From comparison with the Rothschild case study this is under half the average starting salary available to graduates in investment banking.

Pay was generally perceived as an issue.

It was acknowledged that institutions such as the city and consultancy firms are always able to attract top quality engineering graduates with extremely enticing pay offers.

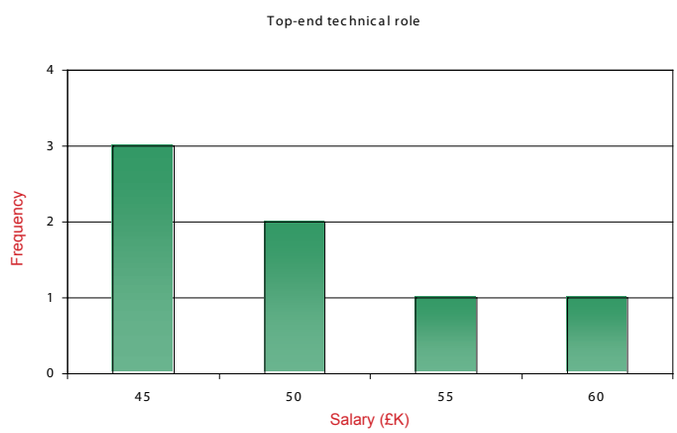


However, these salaries compare relatively favourably against the average graduate salary from the engineering sector:



Data taken from gti 'TARGET' Graduate trends survey 2006

Seven organisations provided a top-end salary for a technical specialist:



Only one of the interviewed companies gave an unprompted view that salaries in the industry needed to increase to attract top talent. Other interviewees who expressed an opinion on the topic believing that non-monetary tools were the competitive advantage of the sector, and that it will never be salaries.

Public Sector Interviews

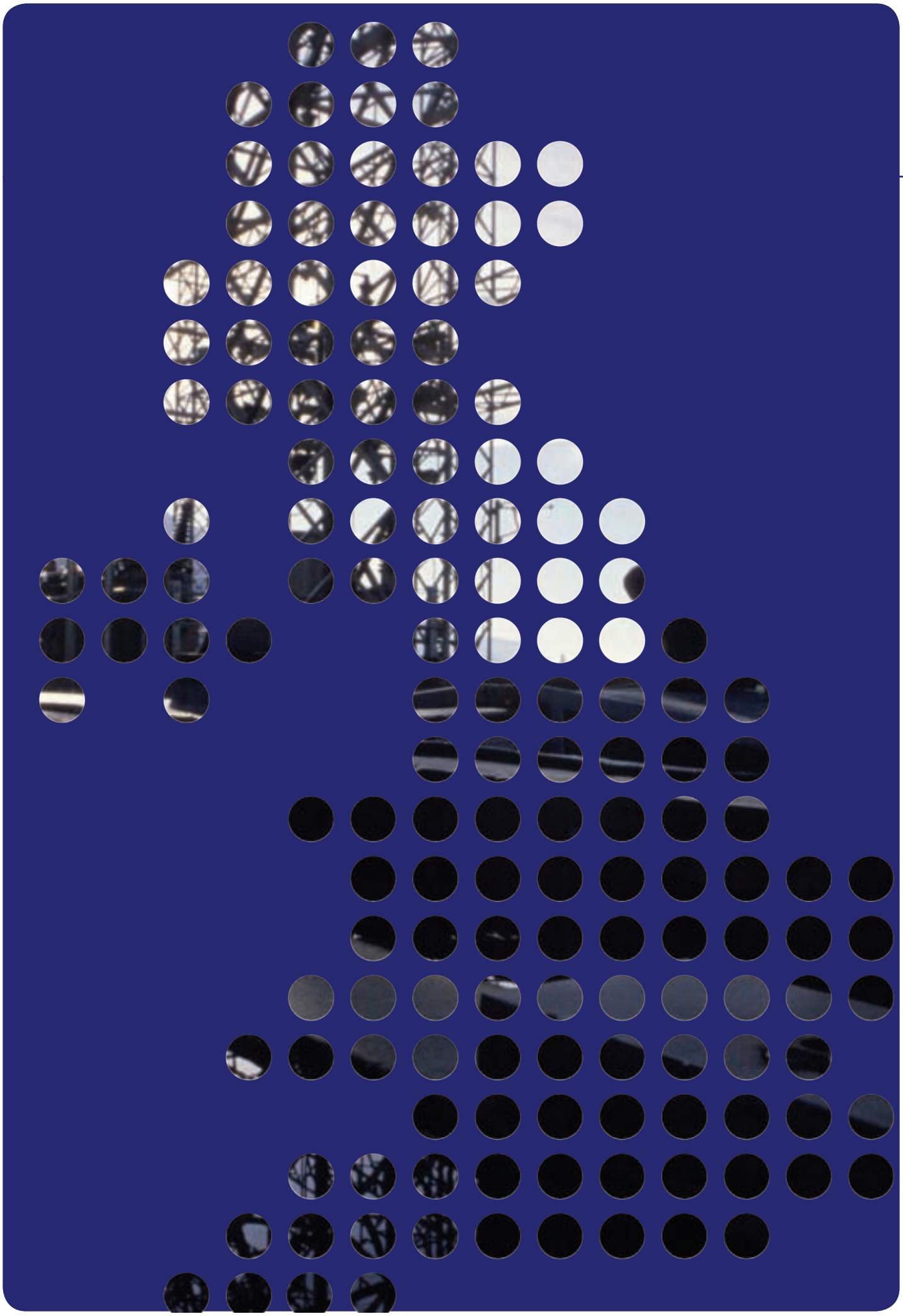
Pay was generally perceived as an issue. While one interviewee felt that the industry needed to do more to make the industry financially attractive, DTI and Royal Academy of Engineering commented on the poor perception of pay standards, which may not necessarily reflect reality. One interviewee actually felt that the median pay for engineers actually compares favourably to median pay for accountancy and law.

ImechE felt that if there is a current wage deficiency, the issue will resolve itself through market forces – rising demand will eventually (and inevitably) result in wage offers rising and attracting more people into the industry.

It was acknowledged that institutions such as the city and consultancy firms are always able to attract top quality engineering graduates with extremely enticing pay offers, and the Energy Institute commented on the trend for graduates to leave salaried industry positions for more lucrative consultancy posts.

EPSRC felt that their stipends (which are fairly flexible in their application) are quite generous, and should be attractive to students.

Student debt (a pay-related factor) was cited by two interviewees as an issue of concern. They felt that debt either leads graduates to cut short their training or to take better paid city jobs rather than engineering jobs. Countering that argument however, one interviewee felt that students would see the cost of undertaking a degree as a good investment if it nets a better paid job than one not requiring a degree, and the level of debt incurred would be seen as little more than an add-on to the eventual £200k+ mortgage they would one day take on.



8. The age profile of the workforce is indicating an impending skill shortage problem

Research evidence

A large focus of Hodgson's article on 'The Engineers of Tomorrow' is focused on the issue of an aging workforce. Based on the research it suggests that 'the total number of chartered engineers is likely to be less than 100,000 by 2010 and could fall to 50,000 by 2020. Chartered engineers represent the 'cream' of the profession, and the loss of two-thirds of them, if the haemorrhage is unchecked, will severely damage the technological capability of the UK'.

The EUSkills survey of skills issues (2001) report found evidence of an increasingly aging sector, and that is clearly a high age profile in comparison to UK Industry. However, in the 2004 report they found that although '40% of the workforce is aged between 45 and 59. Encouragingly the study findings reveal that the proportion of young people has risen from 4% to 8% of the workforce since 2001' and they go on to says that 'whilst many in the industry express concern about high age profiles and the low recruitment of young people over the last decade, it is perhaps unrealistic to have age distributions markedly skewed towards younger workers. The industry is not, and probably never will be an industry where youngsters predominate'.

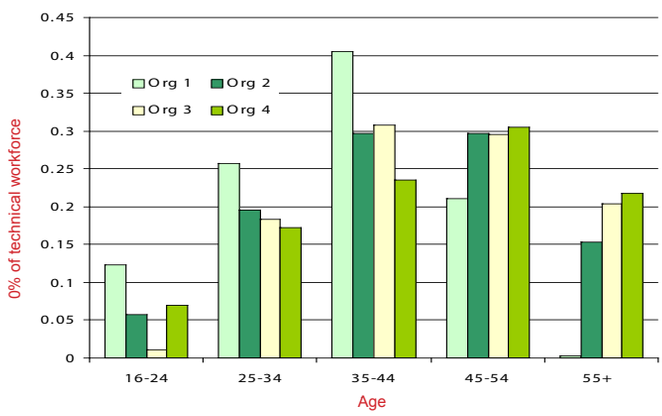
Public Sector Interviews

The Energy Institute cited findings from their leadership skills survey last year, which showed evidence of a developing problem within leadership due to retirements leaving experience gaps. In addition, they perceive a critical shortage of skilled personnel in some areas such as oil and gas as experience is lost through retirements. Within consultancy experienced industry personnel who have continued to apply their knowledge to the industry retire and are not passing on that knowledge.

The DTI felt that the craft level – installation, maintenance and technician positions, are also suffering from a net loss of skills through the effects of retirements and a lack of suitable recruitment to replace them. The nuclear industry is an illustration of this problem.

Private Sector Interviews

Detailed age profiles were obtained from five of the interview companies, which show varying degrees of an impending skills shortage due to an aging workforce. In interviews two organisations expressed concern over this issue, and four specifically stated that they do not perceive there to be an issue. Only one company rated this as the top ranked loss of labour. There are contrasting experiences with an aging workforce, as evidenced by the age profiles below:



One member suggested there may be a less visible problem with the pool of older skilled labour in the sector;

"A significant number of engineers left the companies in the early stages of privatisation and became a 'grey resource' available as consultants. These are competent, very valuable, expert resources. The problem now is that they are starting to retire, and because they are in part freelancers they haven't made any provision for knowledge transfer or succession."

A recent survey by the IET has highlighted that the way engineers in the sector interact has changed. The people now leaving the resource pool are the ones with not only a good cross-sector knowledge, but also excellent 'Professional Engagement' skills (see IET report reference). A subtle challenge ahead is to not only recruit new skilled staff, but also equip them to interact effectively with peers across the sector. The IET survey identified systemic barriers to this interaction, arising from today's work pressures and the focus on short-term deliverables.

Public Sector Interviews

The Energy Institute cited findings from their leadership skills survey last year, which showed evidence of a developing problem within leadership due to retirements leaving experience gaps. In addition, they perceive a critical shortage of skilled personnel in some areas such as oil and gas as experience is lost through retirements. Within consultancy experienced industry personnel who have continued to apply their knowledge to the industry retire and are not passing on that knowledge.

The DTI felt that the craft level – installation, maintenance and technician positions, are also suffering from a net loss of skills through the effects of retirements and a lack of suitable recruitment to replace them. The nuclear industry experiences this problem.

9. When skilled labour moves, it tends to leave the UK energy sector completely

Research evidence

The Energy Institute positively reports that 'Almost 90% of our under 35s expected to remain in the energy industry for more than 5 years'

And more generally The ETB report Engineering UK 2005 highlights the comparatively high graduate retention in Engineering; 70% of initial recruits after 5 years, in comparison to just over 50% for a FMCG company.

There were some comments on the leakage after University, but this did not prove to be a major concern.

'Whilst engineering and technology sees 25% of its graduates enter the finance and business sector, it is similar for history graduates (24%) and language graduates (24%) – the drain to finance and business is therefore not a phenomenon peculiar to engineering and technology' (ETB, 2006)

It also seems that the flexibility of an engineering degree is one of the factors making the degree an attractive choice; ''[interviews with current engineering graduates suggested) that engineering provided a good all-round degree which enabled the graduate to keep their career paths open – it provided the opportunity to 'change at any point – banking, more scientific roles, you can skill change at a later time' (Spinks et al, 2006) – suggests there will always be post degree leakage.'

Private Sector Interviews

Only 2 companies rated moves to other sectors higher than moves to other energy companies.

There were also surprisingly little concern or anecdotal evidence about moves to other industries, including the much publicised 'poaching' of engineers.

However, it was recognised that in the case of graduates perhaps this is a pool of 'lost labour' that is never seen by private companies through the application process, as students have already decided that they will not enter an engineering role. This has been evidenced by Universities known to one member interviewee.

This is seen as an inherent loss that is not worsening, or obvious once a recruit has joined an energy company - see statement 11 on post attrition training which implies that once in the sector, skilled labour tends not to move too much.

10 respondents ranked their loss in skilled labour.

Eight companies ranked 'Other Energy Companies' as either the greatest (five companies) or second greatest (three companies) loss of labour.

This implies a churn within the industry rather than loss to the sector completely.

Public Sector Interviews

One interviewee felt that losses in skilled labour through retirement or leaving the industry completely are becoming more common and difficult to replace.

A further loss is graduates leaving salaried posts in the industry for consultancy or city financial posts, and although this is of concern to some, it was generally acknowledged that the financial industry in particular would always be in a position to offer the best remuneration and poach the best candidates.

The Royal Academy of Engineering pointed out that the Henley report shows that around 50% of graduates with engineering and technology backgrounds leave the sector to work in either manufacturing or finance and business.

The knowledge base needed as energy needs broaden will require special action to orientate students towards the energy sector.

10. Post-graduate study is encouraged and rewarded appropriately through the ultimate job offering from industry

Research evidence

There was little research information available on this topic.

The Henley Report stated that, 'there was no clear message regarding whether employers preferred to recruit engineering graduates at Masters or Degree level…just under half expressed no preference (between Masters and Bachelors)), 21% of respondents recruited primarily masters, and 23% recruited primarily Bachelors. Five percent recruited exclusively Masters level graduates'.

Private Sector Interviews

"7 out of 10 respondents offer a different entry and pay level if the applicant holds a relevant post-degree qualification"

Relevance is key to this statement, with four of the recruiters offering a premium for a post graduate qualification, where as the other three judged post-graduate study as a form of experience – and so if it's a relevant topic to the role that is being offered, then it will command a higher salary and entry level, however having this qualification will not by necessity mean a higher pay level.

Two interviewees flagged potential problems recruiting PhD students, in that sometimes they do not have the 'real world' skills needed in business, and also are sometimes too focused on their niche area to see the big picture.

In the public sector there was little response to this line of questioning.

However, one interviewee felt that Masters degrees would become increasingly important as energy needs broaden. The knowledge base needed as energy needs broaden will require special action to orientate students towards the energy sector.

Public Sector Interviews

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A further loss is graduates leaving salaried posts in the industry for consultancy or city financial posts, and although this is of concern to some, it was generally acknowledged that the financial industry in particular would always be in a position to offer the best remuneration and poach the best candidates.

The Royal Academy of Engineering pointed out that the Henley report shows that around 50% of graduates with engineering and technology backgrounds leave the sector to work in either manufacturing or finance and business.

ARUP

"To work in engineering design it's not necessarily good to have detail in a narrow field, we generally favour Engineering Doctorate qualifications, which results in the recruit being able to tackle issues in doctorate depth and thinking, while having a broader view".

See statement 12 on UK training capabilities and accompanying case study detailing the EngD qualification.

11. Students leave companies with a desirable training scheme once they have achieved the necessary skills.

Private Sector Interviews

> "Only 1 out of 10 respondents experienced a problem with employees leaving after completing their training scheme"

Very few problems are witnessed with post training attrition, with almost all companies saying that they experience a very high retention rate.

The one respondent company which did see some problems stated that it was not an immediate loss, but witnessed in the 1-to-2 year time frame after training was completed.

The cause was frequently what they describe as a 'culture shift' whereby on completion of training, young recruits see it as almost natural that they should look for new opportunities. A particular problem (increasing in severity at a significant pace) is employees taking a 'gap year' to travel, happy to take the risk of not returning to their original employer when they return.

There was no evidence that this issue was more prevalent in the case of non-home students.

However, unprompted, four of the respondent companies expressed concern that an increasing proportion of research posts in Universities are undertaken by non-home students, and they did expect to see problems with this resource returning home.

This is thought to be due to both the declining number of UK engineering students, and also to the lack of financial reward.

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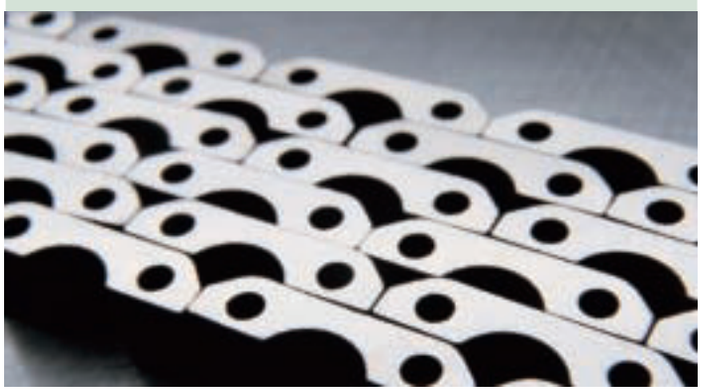
Public Sector Interviews

There were some suggestions from the public sector interviewees that a traditional approach to recruitment for smaller companies which do not have the resources to train students on the job was to recruit employees of larger firms who have developed the necessary skills through formal training programmes.

Only 8% of employers mentioned a lack of training or commitment to training as a reason explaining skills gaps.

More needs to be done to ensure that Universities work more closely with industry and that industrial needs are reflected in the curriculum.



12. The quality and quantity of training opportunities in the UK is sufficient to supply the demand for skilled staff

Research evidence

Training

Only 8% of employers mentioned a lack of training or commitment to training as a reason explaining skills gaps (ETA/EU Skills, 2001).

'The industry has an excellent record on training and development of both young people and adults within the workforce. 48% of the workforce is covered by the 'Investors in People' recognition; the number of training days delivered is above the national average; a high proportion of staff receive training; and a variety of training opportunities are offered by companies. The majority of training, particularly technical training is delivered in-house using internal training expertise and companies did not report any significant difficulties in sourcing external expertise when necessary' (ETA/EUSkills, 2001).

Universities

The Henley Report finds that a key skill shortage is the practical application of engineering theory, attributable to the University courses. 'Some participants suggested the lack of practical application(In Engineering courses) might be down to budgetary constraints, in the case, for example, of projects not being taken beyond design stage. It was also suggested that University lecturers were often hired for their research capability and their ability to generate income for the University, with teaching seen as almost secondary to this'.

It goes on to say 'more needs to be done to ensure that Universities understand the needs of industry, and that these needs are reflected in the curriculum…some respondents referred to what they saw as examples of best practice, principally in the form of degree courses or modules that had been jointly developed between industry and university'.

RAENG also cite modernisation of degree courses as critical to safeguarding the supply of skilled graduates. 'At the degree level, modernisation of University degree courses through the incorporation of the subjects such as business and communication skills into the syllabuses could help to broaden the appeal of engineering, as well as producing more rounded graduates'.

Private Sector Interviews

"6 out of 11 respondents believe that the UK has the necessary training opportunities to supply the demand for skilled staff "

- In-House Training

All graduate employers interviewed were offered a comprehensive graduate training scheme, usually lasting two years.

All employers offered lifetime training to all employees, and (unprompted) four employers stressed promotion of achieving chartered engineering status.

- University Courses

The key issue was the relevance to the current environment of course offerings, with a belief that University courses have not evolved or been adapted at the same speed as the changing nature of the power market.

CERES POWER

"The UK system has only begun to get revved up about the energy sector very recently so there aren't a plethora of energy training courses, university courses etc. that focus on this area. There is a natural time lag that will hopefully be plugged quickly. Renewed energy is only just beginning to trickle through with specialist degree programmes and training courses".

There were some concerns over the lack of practicality and application of engineering in courses.

One interviewee was concerned by an example where an engineering course with power related modules was actually focussed on the commercial side such as power markets, rather than teaching technical skills.

There was widespread recognition of the centres of excellence in the UK and that there are niche energy market courses, but the feeling was that a step-change in supply of these courses is needed to meet the future demand of the sector.

One company expressed serious concerns over the future supply of teachers. This supply predominantly comes from research facilities, and in the interviewee's experience over the last 15 years this has increasingly been formed from non-home students, of whom very few stay to teach.

One company was very keen that more 'EngD's (see details below) be offered with a focus on energy, as these have been found to get candidates very well prepared for employment.

- Industry training

General opinion was that there are enough third party courses on offer.

One company stressed a need for 'cross training' opportunities to be developed, in order to convert engineers (or candidates other disciplines) to the required resource by skilling as appropriate.

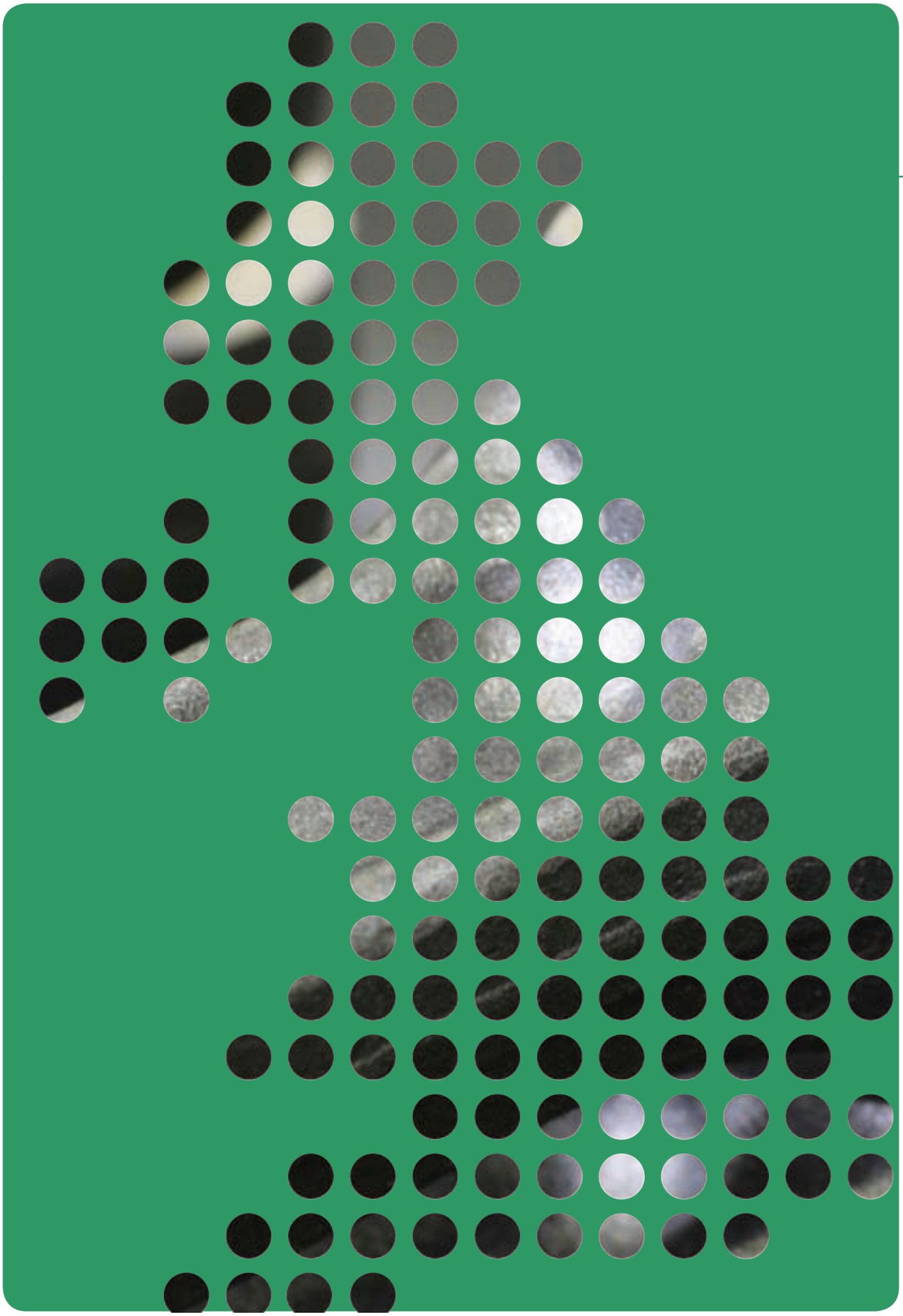
ENGINEERING DOCTORATES

EngDs – postgraduate research offering real-world application.

The Engineering Doctorate (EngD) is a four-year doctoral research programme involving a significant taught component. It provides ambitious and able research engineers with the technical, business and personal development competencies needed to become the senior research managers of the future. Researchers must be sponsored by a company with a research and development base in the UK. A key element of the programme is the close link with the sponsoring company, where REs spend approximately 75% of their time undertaking research into real industrial problems.

A move towards offering energy specific EngDs can be witnessed at Southampton University (see appendix 4) where an energy themed programme is being proposed in their re-accreditation next year.

The University of Surrey is another example offering a similar qualification with specific energy modules.



Public Sector Interviews

One interviewee expressed concern at the quality of some university courses and, in particular, was worried about what quality checks were in place to ensure the maintenance of a suitable standard. He felt that the expansion of the university network means that there are now too many universities competing for students and, as a result, they often offer a large number of courses, often soft courses that are not relevant to the economic needs of the country. In particular he had concerns over some of the mixes of courses, such as taking chemistry with accounting. The overall effect has been to produce a two-tier system of universities in which only a select number are respected by the industry. He also felt that the UK has lost a sensible way of gaining skilled personnel in the demise of the old-fashioned apprenticeship schemes and sandwich courses.

Another interviewee felt that there is no need for a dedicated energy degree as anyone with an engineering discipline is suitable for energy companies to take on and train

DEFRA

DEFRA commented that currently, too many specialised engineering courses are producing graduates who have narrow skills and lack the flexibility vital to the energy industry as it increasingly needs to supply the low-carbon heat, power and light critical to tackling climate change.

A shake-up is needed in universities so that industry can access many more high quality general engineering graduates. Universities can contribute strongly by providing specialist course modules that reflect the needs of modern industry and also meet young people's interests in greener engineering.

Despite the loud warning coming from the academic sector on the dangers of climate change, few university modules with significant sustainability content are deployed into engineering and other courses that are training our young people for the low-carbon future we need and desire.

RESEARCH ACADEMY

Another initiative set up to match equipping students with the skills needed by industry is the Institution of Engineering and Technology (IET) Power Academy. The Academy was launched in 2004 to ensure that there is a steady stream of good power engineering graduates to address the current shortage of electrical engineers and to meet the future manpower needs of the partner Electricity Network Companies.

As part of the scheme scholars receive:

- A bursury for each year of study
- Mentors from industry and academia
- IEE Membership
- University fees paid
- Training during summer vacations
- An annual conference.

The Power Academy will help ensure there are sufficient engineers entering the industry to meet future needs, by co-ordinating cooperation between the electricity network companies and university engineering departments

For more details on the Power Academy please see Appendix 6.

Appendix 1: Questionnaire used for interviews

Questionnaire for Skills Survey

Jonathan Spencer (DTI UK) and Karen Speight (E.ON UK)

Organisation

What is your organisation's involvement in the energy industry?

Views on skills shortage

1. Do you perceive there to be a skills shortage in the energy industry at present, what leads you to believe this?
2. What skills specifically are lacking that mean you cannot fill vacancies?
   (Please rank 1 - 4, 1 as the most severe shortage):
   - Technical skills (for example engineering qualifications)
   - Core skills (Numeracy, IT skills)
   - Managerial (financial management, strategic awareness)
   - 'Enablers' such as teamworking and communication
   - Other?
3. How relatively important are each of these skills to success in a role within your organisation?
   (Please rate 1 - 4, 1 most important).
4. Has the relative importance of these skills changed/are they likely to change?
5. Do you see evidence of these shortages worsening (in general or for a specific skill group)?
6. Are graduates your main source of recruitment to technical roles?
   (If available what % of recruitment is from Graduates/post-graduates vs. Experienced hires).
7. What is your success rate in recruiting graduates/post-graduates to high-level technical roles?
8. Has there been an obvious trend in this rate?
9. Does your organisation perceive a shortage of graduates, or specifically graduates of high calibre within the energy industry?
10. What proportion of your staff do you recruit internationally? How has this proportion changed in recent years? (Is this through a need for resource, or proactive approach because of location/skills).
11. What perceptions do graduates/post-graduates have of the energy sector?
12. What starting salaries do you offer to high calibre graduates/post-graduates and what top-end salaries do you pay to engineers in a technical role?
13. Do you differentiate salaries between graduates, post-graduates and post docs?
14. Do you anticipate resource/recruitment problems for any particular roles/levels in the future?
    Are there any specific major developments which will have an impact on the demand for skilled labour?

15. Please can you give an indication of the ranking of the following sources of loss in skilled labour? (please rate 1 - 4, 1 as greatest loss):
    - Other energy sector companies
    - Other engineering/technical roles not in energy sector
    - Non engineering/technical roles not in energy sector (e.g. Banking)
    - Retirement
    - Moves abroad
    - (other?)

Training

1. What training do you currently offer/support to ensure a supply of skilled labour for the energy industry?
2. What is the level of take up of this training, and is this increasing or decreasing?
3. What proportion of students/trainees continue to work in the energy sector following this training?
4. Is this a more severe problem with students from overseas?
5. Do you think training opportunities in the UK are sufficient in quantity and quality to supply the demand for skilled staff? (If not what scale of investment do you think is needed to bring the provision of training to the appropriate level)?

Other information sources

1. Who else should we be talking to about skills issues in the industry?
2. What other reviews should we be consulting?

If possible please provide the following data

1. An indication of number of roles to fill, application rate, offers made, and acceptance of these offers, on an annual basis.
2. Age distribution of current staff.
3. Age of those leaving employment with the organisation

Many thanks for your continued support, we look forward to meeting you to assess your view on these issues.

Appendix 2: Post Degree statistics on engineering disciplines

The following data shows the destination of graduates from a survey conducted by the graduate recruitment website www.prospects.ac.uk

Statistics

Numbers graduating (survey respondondents)	Number in survey	Entering emloyment (%)	Entering further study/training (%)	Working and studying (%)	Unemployed at time of survey (%)	Other (%)
Architecture and building	4,040	67.5	8.6	14.9	3.3	5.7
Law	8,605	36.6	40.2	12	3.8	7.5
Civil Engineering	1,290	71	7.2	12.3	3.9	5.6
Sports Science	3,945	62.5	17.1	8.2	5.1	7.1
Geography	2,530	59.3	18.1	7.3	5.2	10.1
Psychology	7,775	58.7	15.6	11.2	5.4	9
Modern languages	7,050	59	19	8.3	5.8	7.9
Chemistry	2,110	49.6	31.2	6.1	5.8	7.2
Mathematics	3,630	48.7	22.9	13.5	5.8	9.1
Business and Managment Studied	17,060	70.2	6.6	8.9	5.9	8.5
Performing arts	5,560	61.9	17.1	8.3	6	6.7
English	8,125	57.2	20	8.6	6.2	8
Environmental and physical Geographical sciences	3,530	60.5	17.7	6.6	6.2	9.1
History	7,240	54.3	22.5	8.4	6.3	8.4
Economics	3,785	55.3	15.2	13.9	6.4	9.2
Accountancy	2,715	51.5	7.9	26.7	6.5	7.4
Sociology	4,440	64.4	13	8.2	6.5	7.8
Biology	3,490	57.4	21.4	6.8	6.8	7.7
Politics	3,320	55.7	18.9	9	6.8	9.6
Marketing	2,525	74.4	4.5	4.8	6.9	9.4
Mechanical Engineering	2,130	67.1	10.1	8.1	7.1	7.5
Physics	1,660	42.2	31.9	8.2	9.1	8.5
Media Studies	3,665	71.3	6.2	5.6	9.2	7.7
Art and Design	11,730	64.2	8.2	7.5	10.3	9.7
Electrical and electronic engineering	3,080	63.3	12.3	7.1	10.7	6.6
IT	13,070	64.7	10.9	6.1	10.7	7.7

Appendix 3: Interview with N.M. Rothschild & Son

Case Study

An interview was undertaken with N.M Rothschild & Son, to provide a contrast for comparison to the issues facing the energy sector.

Key findings were:

- No skill shortage was perceived
- They have evidence of skilled engineers in employment with them, which is not the result of a particular targeting strategy on their part.
- They witness a problem common to engineering in attracting and retaining women.
- As a global company, their recruitment strategy is to employ a high proportion of non-home students.
- They see very little problems with post-training attrition, recognised that London is the most attractive place to be when working in finance.
- Their graduate starting salary is very attractive in comparison with engineering roles.

Appendix 4: Engineering Doctorates at Southampton University

Case Study

“The(EngD) scheme was established to provide ambitious and able research engineers with the technical business and personal development competencies needed by the senior managers of the future”.

Southampton started offering Eng.Ds in 1999 – specialising in two of the current research strengths of the University - transport and transport infrastructure and knowledge/systems engineering.

The aim of the scheme is to facilitate PhD level research, while equipping students with the technical, management and generic skills needed to be a leader in industry. The result is highly qualified researchers with the ability to forge a very successful career in the sector.

There are clear benefits for both student and employer. The employer typically pays between £7-10k per year in sponsorship, to have quality research undertaken (with the brief developed according to the needs of the employer), access to the University expertise, and the opportunity to effectively mould the candidate into a new recruit who will rapidly make significant impact on the business. Typically a student receives a package of ~£20k tax-free, which compares very favourably to undertaking a traditional PhD programme.

Appendix 5: Further Recommended Reading

Southampton currently has 40 students on the 4-year course.

The University is now branching out into energy systems due to the overlap with transport – for example one student is currently working on hydrogen systems.

The University plans to offer a third distinct energy themed course when it is re-accredited, in addition to the two current schemes.

Further details and case studies can be obtained from www.soton.ac.uk/engd/ or by contacting Dr R. Neil Richardson, EngD Director
+44 (0)23 8059 7705, engdsoton.ac.uk

In addition to those sources listed previously.

CONNOR, H et al (2000) 'An Assessment of Skills Needs in Engineering' Nottingham, Department for Education and Employment.

HODGSON, A et al (2004) Going, going, gone… The Engineers of Tomorrow. Engineering Management.

MASON et al (1999) 'Engineering skills formation in Britain; Cyclical and Structural issues' Skills Task Force Research Group.

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Unknown Author 'The Supply and Demand for Science, Technology, Engineering and Mathematical Skills in the UK Economy'(2006) Research paper for Department for Education and Skills.

ERS Market Research 'The Engineering and Technology Board 2005 Survey of Registered Engineers'

Unknown Author 'Factors Influencing Year 9 Career Choices' Report conducted by the Engineering & Technology Board (etb) available from www.etechb.co.uk

Unknown Author, DTI Economics Paper No.16 'Science, Engineering and Technology Skills in the UK' (2006).

Pappie, D. (2006) 'Searching for critical resources: the recruitment challenge at shell' Hydrocarbon Engineering, July 2006.

Appendix 6:

Power Academy launched for future generations

7 June 2004

The IEE, the UK's electricity network companies and three leading engineering universities are joining forces to combat a serious shortfall in the number of power engineers in the UK with today's launch of the Power Academy, backed by the Government.

Around 25 per cent of the industry's most experienced and senior engineers, who keep the country's electricity networks running, will retire within the next 5-10 years, with little sign that they are being replenished. This will create a potentially serious deficit if more young people are not attracted into the profession. In addition, the network companies face significant challenges to upgrade the country's ageing network and accommodate small renewable generators onto the system to deliver the government's new energy policy.

The IEE and the network electricity companies are launching the Power Academy to reverse the decline in students opting for degree courses in 'power engineering' disciplines.

In its first year, the Power Academy will recruit around 40 undergraduates, rising up to 60 students in a year's time, who will be sponsored throughout their course by the network companies. Benefits will include tuition fees being paid, a £2000 bursary, £250 to spend on course materials, an IEE membership, vacation training and a summer school in business related issues designed to enhance students' career prospects.

Stephen Timms, UK Energy Minister, said:

"We are committed to maintaining reliable and secure power supplies and that means ensuring that the people who manage this process are of the highest calibre. We have a global reputation for expertise in the energy supply field but we must continue to set new standards and ensure there is a large enough pool of talent on which to draw. The Power Academy will prove an invaluable asset in identifying and nurturing expertise in the electricity generation field. It will have a key role to play in helping to power the nation in coming years and I am pleased to give the Power Academy my unreserved support in this venture."

The power networking companies backing the Power Academy are Central Networks, Scottish and Southern Energy, EDF Energy, Scottish Power, Western Power Distribution, CE Electric, United Utilities and National Grid Transco as well as EA Technology, the R&D arm of the networking companies. The universities involved are the University of Strathclyde, the University of Southampton and the University of Manchester Institute of Science and Technology (UMIST).

Energy & Utility Skills, the Sector Skills Council for power, gas, water, waste and utility contractors, has welcomed this initiative to address the higher education skills gap in electrical engineering and is delighted to be a partner in the programme. The Energy Networks Association and the industry regulator OFGEM are also supporting the initiative.

Power engineers are responsible for the design and implementation of large-scale infrastructure projects that power the nation and are employed by, amongst others, the major electricity network companies. The Power Academy will help ensure there are sufficient engineers entering the industry to meet future needs, by co-ordinating cooperation between the electricity network companies and university engineering departments.

Academy gets successful start on addressing the power sector skills shortage

18 April 2005

The IEE is commencing the second year of the highly successful Power Academy, an initiative by the IEE, the UK's electricity network companies and leading UK universities to address the critical skills shortage in the power-engineering sector.

Around 25 per cent of the industry's most experienced and senior engineers, who keep the country's electricity networks running, will retire within the next 5-10 years, with little sign that they are being replenished. This will create a potentially serious deficit if more young people are not attracted into the profession.

The Power Academy aims to attract more students to power engineering courses with an attractive mix of financial incentives, technical training and business education. Southampton University, one of the partnering universities, has already seen a 31% increase in students applying for power engineering courses. The Academy will also promote the opportunities for an exciting and rewarding career in the power industry.

UK Energy Minister Mike O'Brien said: "I am very encouraged to know that since my predecessor Stephen Timms launched Power Academy last June, there has been a marked increase in applicants for power engineering courses.

Skills in the electricity industry is a crucial issue due to the dependence society places on a reliable and secure electricity supply. The Power Academy should help to address a potential skills shortage in the electrical power industry - particularly amongst graduates. The Government is keenly following the progress of the Power Academy as well as other initiatives that have a remit on broader skills at all levels."

Bob Taylor, Managing Director of Central Network, believes that the Power Academy is integral to the future of power engineering: "We are entering an investment phase in the power sector and this initiative will form a key source of future power engineers for the network businesses and for those that supply and support them."

The Academy has been so successful that already the project is expanding to bring in new partners. ABB, Atkins Power, Areva, Queens University in Belfast, Siemens, VA Tech, and Viridian have already committed. In addition, key employers in Northern Ireland are expected to join.

They join an impressive list of supporters including CE Electric, Central Networks, EA Technology, EDF Energy, National Grid Transco, Scottish and Southern Energy, Scottish Power, United Utilities, Western Power Distribution and the Universities of Manchester, Southampton and Strathclyde. Energy & Utility Skills, the sector skills council, is also a major supporter.

Power engineers are responsible for the design and implementation of large-scale infrastructure projects that power the nation and are employed by, amongst others, the major electricity network companies. The Power Academy will help ensure there are sufficient engineers entering the industry to meet future needs, by co-ordinating cooperation between the electricity network companies and university engineering departments.

For more information about the Power Academy visit www.iee.org/poweracademy

For media enquiries contact:

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