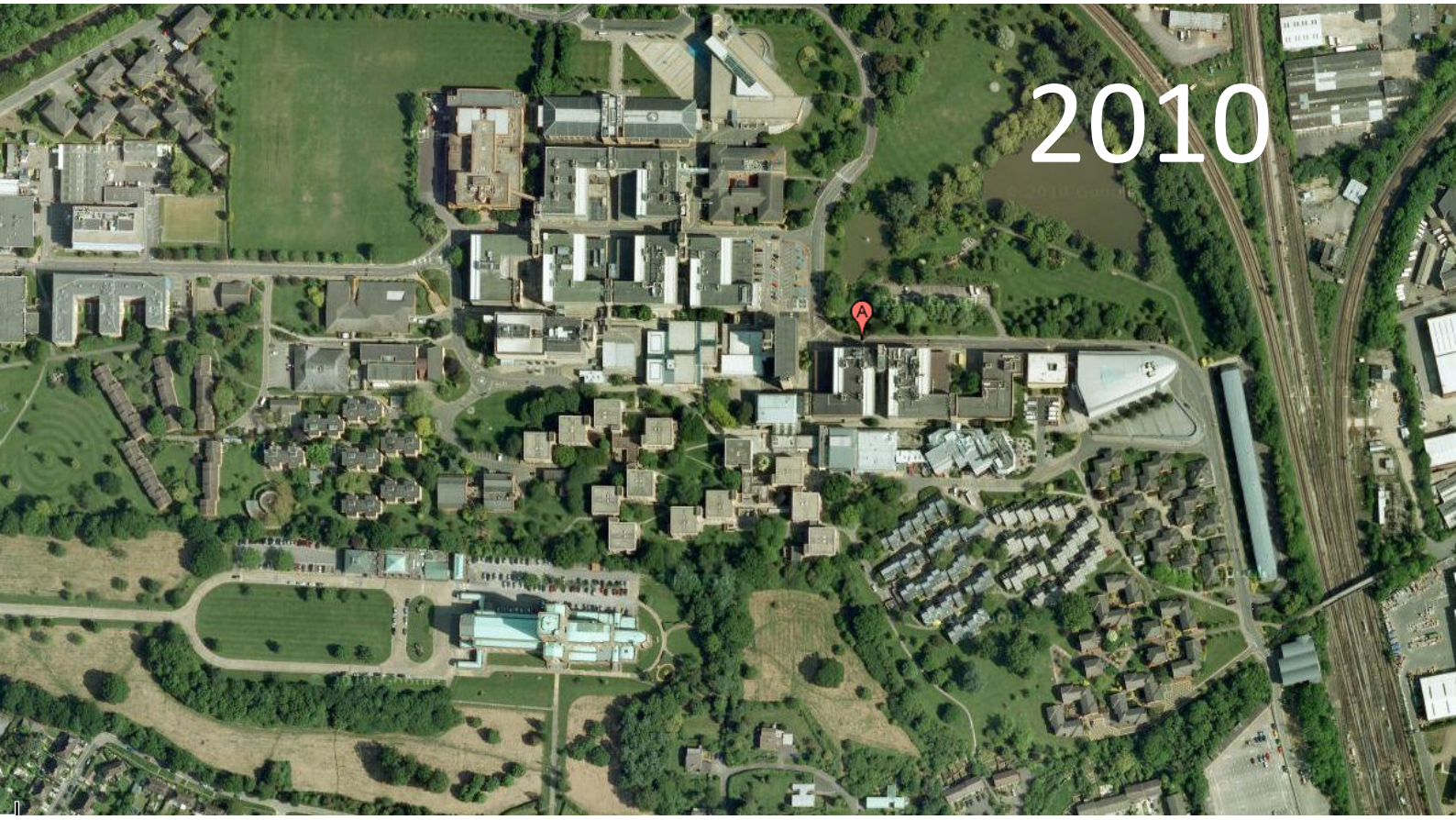
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University of Surrey Engineering Doctorates Market Review

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Introduction

The Centre for Environmental Strategy at the University of Surrey has commissioned a market review of its Engineering Doctorate in Environmental Technology. There are three main objectives for this work:

1. To give an overview of the market for taught course provision, which CES can use for strategic decisions about future provision.
2. To provide input to the University's periodic review of the EngD in SEES in February 2011.
3. To better understand the position and potential of CPD as part of the taught portfolio in CES.

The CES also wants to explore two key issues linked to expected changes in higher education over the next five years:

1. How will changes in UK policy affect HE postgraduate courses in sustainable development? (e.g. student numbers, etc.)
2. How much interest is there from UK employers in courses on sustainable development, and is this expected to grow?

The University also seeks answers to four specific questions relating to the Eng D:

a. Are there specific bodies or learned societies the University should persuade to accredit the EngD (e.g. IEMA, who already accredits the taught programme; Institute of Biology)?
b. What competing courses are on offer in the UK?
c. What are the EngD's 'unique selling points'?
d. Are there gaps in the market for postgraduate courses that Surrey could exploit?

The review has been divided into five components:

Stage 1: Literature search – Government and Research Council policy

A literature search to examine how likely such policies could affect postgraduate courses on sustainable development, primarily using internet searching.

Stage 2: Internet review – Competitor courses

Information has been assembled on postgraduate by research courses with taught elements related to sustainability the fields of construction, energy, environment, water and transport. The latter are fields from which the EngD in Environmental Technology repeatedly recruited its Research Engineers and so other 'professional doctorate' courses now offered in these could be expected to act as direct competitors for students with the SEES.

Stage 3: Internet review – Chartered status requirements of professional institutions

Information has been assembled from professional institutions using Internet searching. Their requirements for Chartered status have been documented and links investigated between their requirements and what is offered the EngD. This included attempting to discern the skills they say they expect from people completing post-graduate courses like the EngD.

Stage 4: Internet review – requirements of employers' groups and job advertisements

Websites from trade associations, unions, employers' groups (including the CBI) have been searched in order to identify what skills they are looking for from potential recruits from post-graduate courses. These are compared to likely skills sets belonging to EngD REs. In addition, we searched websites containing advertisements for (post-)graduate job opportunities. Our objective was to identify the skills and experiences sought by organisations recruiting people completing post-graduate courses on environmental or sustainable engineering.

Stage 5: Telephone interviews with Careers Advisors

Two sets of telephone interviews have been conducted. First, five interviews with University Careers advisors, to assess what prospective Eng D students look for when selecting post-graduate courses. Second, five interviews with major engineering and environmental employers – to assess what skills and experience they are looking for from people they recruit from post-graduate courses.

The findings from these stages have been written up in a form suitable for circulating to the Eng D Management Meeting, backed up by a longer explanatory text with an appendix containing all the tables constructed from information collected in Stages 1 to 5.

This report is the first part of a wider study, which will cover the Eng D, CES's MSc's, and its CPD courses. The aim is to complete all three components, and a summary of all three, by Christmas 2010.

Stage 1: Government and Research Council policy

This section reviews recent (post-2007) literature in order to identify the likely impact of government and research council policies on postgraduate courses by research with taught elements (on sustainable development - covering solely the fields of construction, energy, environment, engineering, water and transport).

General policy background

Until very recently there was little government attention on postgraduate education. This is no longer the case. In 2009 John Denham, when he was the Universities Secretary under the previous Labour Government, stated that postgraduate policy had "fallen through the gaps" because science and education were previously split between different government departments. He said there was a lack of clear public policy in taught and research postgraduate studies.[1] Business Secretary Lord Mandelson addressed this gap later in 2009, by appointing Professor Adrian Smith to lead a review of postgraduate provision in the UK[2], see the One Step Beyond report below.

The terms of reference for the recent Browne Review (2010) on Securing a Sustainable Future for Higher Education also directed it to consider the funding and student finance issues for postgraduate students as well as undergraduates. But its scope did not include research funding and it considered taught postgraduate provision but not postgraduate research[3]. It noted that it is possible that, in the future if students are paying higher fees to enter undergraduate education, they will be less likely to participate in postgraduate study. It recommended that trends in postgraduate study should therefore be monitored carefully, including after the introduction of any further changes to funding and student finance. However, it also concluded that:

> "Postgraduate education is a successful part of the higher education system and there is no evidence that changes to funding or student finance are needed to support student demand or access."

This has been criticized as complacent by the National Union of Students whose own 2010 survey has identified that funding is already a significant barrier to postgraduate access[4]

The Chancellor's Comprehensive Spending Review was announced towards the end of October 2010[5]. This has been seen as lacking in statistical detail so that universities are still trying to divine its exact financial impact. By contrast, the structural implications for higher education in England are seen as clear. The sector will now be shaped by thousands of individual consumer choices rather than by direct public subsidies to universities.[6] So there are expectations that the sector will have changed radically in ten years time. (For instance, it has been suggested that undergraduate courses will probably run for no more than two years in most universities. Many of the former polytechnics will have closed or become a cross between colleges of further education and technical colleges - not universities even in name.) Quite how such changes, if they occur, will impact on postgraduate education and research-based degrees is unclear.

British universities have been rapidly expanding the recruitment of overseas postgraduates who pay higher fees, but growth in the number of domestic postgraduates is far slower. An analysis by the Higher Education Policy Institute and the British Library (2010) urged the Government to make PhDs more attractive to British students to arrest the erosion of the UK's research base. The report found that the number of UK first-year postgraduates grew by 3 per cent between 2002-03 and 2007-08. However, the number of postgraduates from other European Union countries rose by 11 per cent, and the number of non-EU postgraduates - who pay higher fees - increased by 39 per cent. In 2007-08, the last year for which statistics are available, 44 per cent of doctoral and research masters students came from overseas, along with 50 per cent of taught masters students. Institutions are not subject to a cap on the fees they charge to overseas students of all levels, or to domestic and EU postgraduates, all of whom represent increasingly important sources of income.[7]

Growth in the provision of postgraduate courses in the UK

During the lifetime of the Eng D in Environmental Technology, the provision of postgraduate courses in the UK has grown enormously. As the recent One Step Beyond report (2010) to the Department of Business, Innovation and Skills on 'Making the most of postgraduate education' observed[8]:

> "Over the last twelve years, the number of people undertaking postgraduate education in the UK has grown 36% – faster than the growth in the undergraduate sector over the same period. Now, almost a quarter of students in UK Higher Education Institutions (HEIs) are studying at postgraduate level and half of international students studying in the UK are taking a postgraduate qualification."

Financially, the report says, the growth in postgraduate numbers has benefited universities enormously. Taught postgraduate provision alone brought in income of over £1.5bn for universities in 2008-09. The UK is seen as benefitting from a diverse postgraduate system, in which a wide range of postgraduate qualifications and modes of study have evolved to meet the needs of different stakeholders.

No data is routinely collected on taught postgraduate tuition fees, although details are usually available on individual institutions' websites and there have been some efforts to collate information on fees charged. A survey of fees charged by English HEIs in 2007-08 found that on average, fees had risen 48% (in nominal terms) since 2001-02, but that this varied by mode and subject of study, see Appendix, Table 1.

Many employers are seen as benefitting from postgraduate skills, and not just those in knowledge- intensive industries. The report cites research indicating that that employers value postgraduates who combine their advanced knowledge with wider employability skills such as good communication and team-working[9].

In response to Roberts' Review (2002), *Set for Success*[10], UK Research Councils have been providing HEIs with dedicated funding for wider skills training for postgraduate researchers. The One Step Beyond report notes that evaluation has shown this to be extremely effective. Taught postgraduate courses provide people with the skills they need to work in a range of careers and play an important role in translating postgraduate research into practice. Increasingly, postgraduate level continuing professional development is being developed with and for employers and delivered in flexible ways. This model of responsive and tailored postgraduate provision is seen as having to play an important role in 'upskilling' and re-training the UK workforce.

Postgraduates are also seen as benefitting because they are highly employable and, on average, earn more than individuals whose highest qualification is an undergraduate degree. They are also more likely to enter professional and managerial occupations and to earn more over their lifetime – although this varies considerably by subject and mode of study. However, according to the report, feedback from students and from employers also suggests that there are areas in which more could be done to ensure postgraduates get maximum benefit from their investment in a postgraduate education and are well equipped to succeed in their chosen career. For instance, postgraduate students need appropriate support, information and advice to get the most from their experience. The National Student Forum's second annual report[11] argues that, while progress has been made, the consistency and sometimes the level of support postgraduates receive still lags behind that given to undergraduates.

The One Step Beyond report recognized that, over the past twenty years, there has been a substantial growth in professional doctorates. These doctorates are now offered in a variety of professional fields including engineering (EngD), nursing (DNursSci), veterinary medicine (VetMD), education (EdD), business administration (DBA) and clinical psychology (DClinPsy). In the case of the EngD, for example, doctoral students conduct PhD-equivalent research whilst also undertaking taught business courses and working alongside an industrial partner. This kind of 'experience-led' learning has, the report concludes, proved extremely popular with employers.

The report provides wide recommendations related to the economic and social value of postgraduate study, working with employers, widening participation, student experience and choice, funding and provision, quality assurance and researcher development. In particular, it recommends that:

- HEIs should ensure that transferable skills training is embedded as standard in the funding and design of all postgraduate research programmes.
- HEIs should continue to ensure that their masters level courses are compatible with the Bologna Process through the use of credits and learning outcomes.
- HEIs should work together with the Research Councils to develop more multi-disciplinary Doctoral Training Centres (DTCs).

The RCUK gave a qualified support to the One Step Beyond report's recommendations, endorsing those where it is already active, such as[12]:

- The Vitae Programme which provides careers advice to postgraduate researchers and helps drive HEI's to provide their postgraduates with the employability skills they need to succeed, and
- The lead RCUK has taken in developing Doctoral Training Centres many of which cover interdisciplinary areas.

Growth in IDCs and other forms of Professional Doctorates

The development of more DTCs could prove a challenge to existing centres such as SEES and this challenge may be accelerated in response to the Open Step Beyond recommendation. However, this was already apparent from policy changes within EPSRC. The Research Council's Engineering Doctorate Centres Programme, launched in 1992, has been internationally recognised as highly innovative[13]. When EPSRC reviewed the Programme in 2007, its review panel reported[14] that it was:

> "… convinced of the value and performance of the EngD Scheme, the quality of the intake and outputs, and the contribution it makes to EPSRC strategic objectives by providing high quality Knowledge Transfer through people. The Panel believes that there is significant scope to build upon this excellent foundation by promoting the experiences of the significant numbers of participating employers and research engineers and through a more effective and distinctive branding for the Scheme overall."

The success of EngDs led the review panel to recommend the establishment of Industrial Doctorate Centres. These are a subset of EPSRC' Centres for Doctoral Training (CDTs). IDCs provide the same training environment and features as CDTs whilst also incorporating a strong industrial focus[15]:

> "IDCs are an evolution of the Engineering Doctorate Centres (EngD) scheme operated by EPSRC since 1992. As part of substantial expansion of the CDT scheme, in 2009 EPSRC decided to both expand the scope of the previous EngD scheme (to cover the entire remit of EPSRC) and to seek to refresh the portfolio of Centres being supported (to allow new priority areas to be identified and supported - in energy for example). Thus, the cohort of 19 IDCs represents a mixture of new Centres and continuations (albeit in an evolved form) of a number of EngD Centres."

CES's SEES is an example of such continuation, in evolved form, of one of the original Engineering Doctorate Centres (originally established jointly with Brunel University to provide an EngD in Environmental Technology). Table 2 in the Appendix lists all of the IDCs currently funded by the EPSRC.

As a result of this policy decision, SEES already faces much more direct competition for students, especially from those IDCs – such as those at Loughborough, Southampton, University College London, and Nottingham – which cover industry sectors in which SEES has recruited in the past (see Stage 2 below to for further information). This competition can be expected to grow if more IDCs, or their correlates, are funded in response to the policy recommendations outlined above.

But, as well as this direct competition from other IDCs, SEES will also have to face challenges from broader policy developments in higher education such as the proliferation of other forms of professional doctorate. Professional Doctorates have been around in the UK since the early 1990s. The aim of such programmes is to find novel approaches to integrating professional and academic knowledge. For instance, according to the UK Economic & Social Research Council (ESRC), students undertaking a professional doctorate are expected to[16]:

> ".... make a contribution to both theory and practice in their field, and to develop professional practice by making a contribution to (professional) knowledge."

This "contribution to both theory and practice" has been, of course one of the underpinning objectives of the EngD in Environmental Technology from its inception, carried forward into the SEES. The on-line information source, ProfessionalDoctorates.com, explains that the majority of students undertaking professional doctorates are experienced and practicing professionals so most study for the degree part-time but comments:

> "There are, of course, exceptions - most notably the EngD which, in most cases, is only offered as a full time course."

If such information is accepted, it might make other forms of Professional Doctorate seem more attractive to some prospective candidates than a "full time" (SEES) EngD.

Growth in private sector provision of postgraduate courses

The UUK has recently (2010) published a report[17] illustrating how the private higher education sector is emerging as a growing force in the UK as well as elsewhere in the world. It concludes that this growth will presents a range of potential opportunities and challenges to traditional forms of higher education in the UK. It identifies, as a potential policy threat, that government might see teaching contracts with private sector providers as a way of reducing the cost to the Treasury. A recent report from the CBI's Higher Education Task Force endorsed this when it recommended that 'greater involvement by for-profit providers of higher education should be welcomed, provided that they meet the same demanding standards for quality and value for money'[18].

The UUK report suggests that the threats and risks from private sector providers vary in nature and proportion. They include:

- Loss of domestic market share and full-scale loss of particular domestic professional markets (such as in postgraduate law, see Table 2).
- Loss of international students due to providers offering degree programmes at lower cost.
- Loss of some offshore markets due to price competition from the private providers and their ability to enter such markets more rapidly.

The report also identifies as challenges to traditional providers:

- Technical or professional qualifications offered by companies such as Microsoft or Cisco alongside higher education awards.
- Content provided by companies such as Pearson that includes tutorial material and teachers' notes, as well as interactive links to assessment systems.
- Partnerships between higher education institutions and private organisations in the development of teaching material for students on degree programmes or continuing professional development programmes for paying clients.

Table 2 in the Appendix shows examples, selected from the UUK report, of UK private sector provision that include postgraduate courses with taught course elements. None of the examples cited in the UUK report touch directly on the market areas of interest to the CES. But, in time, they are likely do so. For instance, University of Wales Institute, Cardiff already validates for the Centre for Alternative Technologies in Machynlleth a taught masters course in Ecological Building Practices whose Research Methods module it uses as an entry requirement for its related Professional Doctorate[19].

Stage 2: Competing courses

The information below has been assembled on postgraduate by research courses, with taught elements, in the field of sustainability relating to construction, energy, environment, engineering, water and transport. The latter are industry sectors from which the EngD in Environmental Technology repeatedly recruited its Research Engineers and so other 'professional doctorate' courses now offered in these could be expected to act as competitors for students with the SEES.

Internet searching identified 14 'competitor' courses, 10 IDCs funded by the EPSRC and 4 other Professional Doctorates - 3 at Million+ (post-1992) universities (Anglia Ruskin, Hertfordshire, UWIC in association with the Centre for Alternative Technology) and one at Salford University, see Appendix, Table 4.

Four of these courses do not reveal on-line how many students they recruit (per annum). The ten that do indicate that jointly they recruit 101 students – in comparison to the SEES which states 12 students per annum. Typically courses recruit 10 or 12 students. Southampton recruits two or three times as many on to its Civil Engineering, Environmental Engineering and Environmental Sciences course. All of the IDC courses are four years (full time). The four Professional Doctorate courses are each three years (full time) and up to eight years (part time).

The Professional Doctorate courses, which are aimed specifically at those already in the workplace, all state that recruits are expected already to be 'professionals' or 'working in (built environment/engineering) professions'. The IDCs do not specify 'previous' professional experience but list instead the work experience that recruits can expect once on the course. This varies considerably. Typically IDCs (SEES included) state that recruits will spend 75% of their time with sponsoring or collaborating companies: Loughborough states 70-80%, while Bath only suggests that "some time will be spent with external partners where appropriate" and Reading 'a lot of their time'.

Table 5 (Appendix) summarises and compares the skills which the competitor courses say students will acquire with those stated by the SEES. The bottom row of Table 5 shows how frequently particular skills are cited. This information is represented in Table 6 below, rank ordered in terms of frequency of mention. Where a skill is also cited by the SEES, this is shown in the table.

Table 6 Skills mentioned as being acquired on competitor courses as compared with SEES, ranked by frequency of mention (n = 15)

Skill acquired	Frequency of mention	Rank order	Mentioned by SEES
Research methods	15	1	✓
Management	11	2	✓
Sustainability concepts	10	3	✓
Technical skills	9	4	✓
Leadership	8	5	✓
Transferable skills	5	7=	×
Organisational/time management	5	7=	×
Teamwork	4	9=	×
Communication	4	9=	✓
Reporting/publishing	4	9=	✓
Environmental law	3	12	✓
Critical thinking	1	13=	(✓)
Risk management	1	13=	✓

As Table 6 shows, there is only one skill – research methods – that is being taught on all of the courses, SEES included. Most (two-thirds or more) also teach management and sustainability concepts. About three-fifths of them also claim explicitly to teach technical skills and leadership. But only about a third of them make reference to transferable skills and organisational/time management (which SEES does not). And less than a third of them explicitly mention teamwork (which SEES does not), communication, reporting/publishing, and environmental (including SEES). One cites critical thinking (to which SEES does not explicitly refer even though it has been stressed in interim and final reviews of Research Engineers' work on the Environmental Technology EngD). Only SEES makes explicit reference to risk management.

As this rank ordered list of skills shows, the SEES shares many common ambitions about the skills that it is seeking to impart with other IDC and Professional Doctorate courses. Indeed, in competition terms, there is more similarity than difference. This means that, in terms of the skill set offered, the SEES does not have a USP (unique selling point) or clear market niche position or differentiation. From the perspective of a prospective student comparing the IDC/Professional Doctorate courses via the information offered on their websites, the SEES is just one of a number of courses apparently offering a similar set of skills via its taught course elements and research training.

Stage 3: Requirements of professional institutions

Information has been assembled from 10 professional institutions, selected in discussion with CES, about their requirements for achieving chartered status, with special attention to sustainability:

- Engineering Council
    - Chartered Institute of Building Services Engineers (CIBSE)
    - Chartered Institution of Water and Environmental Management (CIWEM)
    - Energy Institute
    - Institution of Chemical Engineers (IChemE)
    - Institution of Civil Engineers (ICE)
    - Institution of Engineering and Technology
    - Institution of Mechanical Engineers (IMechE)
    - Institution of Structural Engineers (IStructE)
- Institute of Environmental Management and Assessment (IEMA).

The Engineering Council is the UK's regulatory body for the engineering profession[20] and holds national registers of 235,000 Chartered Engineers (CEng), Incorporated Engineers (IEng), Engineering Technicians (EngTech) and Information and Communications Technology Technicians (ICT*Tech*). The Engineering Council sets and maintains the internationally recognised standards of professional competence and ethics that govern the award and retention of these titles.

The engineering profession in the United Kingdom is regulated by the Engineering Council through professional engineering institutions (PEIs, see indented institutions above) who are licensed to put suitably qualified members on the Register. It published the first version of the 'UK Standard for Professional Engineering Competence' (UK-SPEC) in 2003[21], see Figure 1.

Figure 1 Extract from UK-SPEC on the Commitment and Competence Standard for Chartered Engineers

The Competence and Commitment Standard for Chartered Engineers.	Guidance – These are examples of activities which could demonstrate that you have achieved the CEng criteria.
Chartered Engineers must be competent throughout their working life, by virtue of their education, training and experience, to:	
A Use a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology.	
A1 Maintain and extend a sound theoretical approach in enabling the introduction and exploitation of new and advancing technology and other relevant developments. This could include an ability to: • Identify the limits of own personal knowledge and skills • Strive to extend own technological capability • Broaden and deepen own knowledge base through research and experimentation.	Engage in formal post-graduate academic study. Learn and develop new engineering theories and techniques in the workplace. Broaden your knowledge of engineering codes, standards and specifications.
A2 Engage in the creative and innovative development of engineering technology and continuous improvement systems. This could include an ability to: • Establish users' needs • Assess marketing needs and contribute to marketing strategies	Lead/manage market research, and product and process research and development. Cross-disciplinary working involving complex projects.

Table 7 in the Appendix lists the eligibility criteria for registering for the Engineering Council, its PEIs - and for the Energy Institute and IEMA. The table also indicates the skills sought (at various levels of status up to full institutional membership) and the evidence for these and for the experience sought.

The Engineering Council recognizes both an academic pathway to CEng status via accredited undergraduate and postgraduate education and a non-academic pathway via career history and education and training record[22]. The skills sought are unspecified but are to be delivered by initial (academic) professional training and subsequent Continuing Professional Development. PEIs, such as IMechE, require those with the lowest level of (Associate) chartered status to be graduates with suitable degrees in engineering or a STEM subject (Science, Technology, Engineering and Mathematics).

Neither the Engineering Council nor most of its PEIs list out in detail the skills required of their CEngs (in the form shown in Table 6). However, at associate and member level, CIBSE does list the skills it is seeking:

> "Associate: Be engaged in technical and commercial leadership and possess effective interpersonal skills.
> Member: Ability to develop appropriate solutions to engineering problems, using new or existing technologies, through innovation, creativity and change. Analytical and problem-solving skills."

The experience sought by the Engineering Council is of professional development. It states that this generally takes place in the working environment, building on knowledge and understanding acquired through formal education. But such professional development is not necessarily separated from education and can, for instance, derive from work-based degree programmes. Individual PEIs are more explicit about the form of experience required by them for CEng status. For instance, the IChemE requires evidence of at least four years working in an environment where the CEng is using chemical engineering principles. But the IChemE is currently alone in explicitly stating that a completed EngD will count for at least one of these four years, depending on course content.

Neither the Engineering Council nor its PEIs make explicit reference to sustainability or sustainable development in their high level specifications on their websites of their institutional requirements. However, the Engineering Council does have a dedicated page on sustainability on its website, accessible from its home page[23] which leads to its Sustainability Guide[24], see Figure 2.

Figure 2 Principles enshrined in the Engineering Council's Sustainability Guide



The guidance is presented as compatible with section E3 of the UK-SPEC which also makes direct reference to sustainable development, see Figure 3 and the skills– such as 'understand and encourage stakeholder involvement' and 'carry out environmental impact assessments' need to implement this.

Figure 3 UK SPEC reference to sustainable development

E3 Undertake engineering activities in a way that contributes to sustainable development. This could include an ability to: • Operate and act responsibly, taking account of the need to progress environmental, social and economic outcomes simultaneously • Provide products and services which maintain and enhance the quality of the environment and community, and meet financial objectives • Understand and encourage stakeholder involvement in sustainable development.	Carry out/contribute to environmental impact assessments. Carry out/contribute to environmental risk assessments. Manage best practice environmental management systems, e.g. ISO 14000. Work within environmental legislation. Adopt sustainable practices. Contribute to "triple bottom line" (i.e. social, economic and environmental) outcomes.

However, although the Guide makes explicit the role of professional engineers in sustainability, and elaborates each of the six principles they should seek to practice, neither it nor the UK SPEC refer directly to the other skills that they require in order to be able to do so (indeed, in the latter document, the vocabulary of 'skills' is restricted to the development of 'social' and 'interpersonal' skills.)

Unlike the Engineering Council and its PEIs, the IEMA does refer directly to sustainable development in its statement of the skills required to become a Chartered Environmentalist:

> "Use knowledge and understanding of the environment to further the aims of sustainable development. Analyse and evaluate problems from an environmental perspective and develop sustainable solutions."

It also makes explicit reference to the need for other skills cited by the IDCs, see Table 6 above:

> "Demonstrate leadership in sustainable management of the environment; demonstrate effective interpersonal skills."

Upon completion of the taught programme offered by the SEES, Research Engineers are eligible for Associate membership of IEMA. In order to achieve chartered status, candidates have to submit a comprehensive report with supporting evidence and undergo a professional review interview with two Chartered Environmentalists.

Stage 4: Internet review – employers' groups

This section reviews websites from trade associations, unions, employers' groups (including the CBI) to identify what skills they are looking for from potential recruits from post-graduate courses in order to compare the skills sets being offered by the SEES.

Policy background

The House of Commons Environment Audit Committee reported (2010) on government policy on green jobs and skills in March of this year.[25] It recommended that the Government establish a leader for the 'green skills agenda' to deliver the skills needed for the low-carbon transition of the UK economy. This was seen as necessary in order to co-ordinate removal of barriers in the current system and to maintain focus on current environmental skills. However this document makes no specific reference to postgraduate education as a vehicle for delivering these green skills. (Nor, more broadly, does the National Skills Strategy (2010) indicate how postgraduate education in general is being expected to help deliver a "future … built by educated, enterprising people with the right skills"[26].)

The Environmental Audit Committee recommended that the new Skills Funding Agency[27] should assess demand and prioritise sectors for extra funding and that the Government put employer participation at the heart of its changes to the skills system.

In its very recent (November 2010), BIS has set out, in its Business Plan for 2011-15, its vision for growth in the UK[28]. It defines BIS's role as:

> "… to help define a new model: one that delivers sustainable growth across the country and international competitiveness in low carbon economy no longer reliant on a narrow range of sectors. This requires developing our human capital, through our universities and skills system, and science, innovation and technology development."

This Business Plan identifies that the Coalition Government has priorities for structural reform that include:

- Safeguarding the UK's long term growth by promoting skills and by turning knowledge to commercial use
- Building an internationally competitive skills base
- Creating a dynamic and efficient skills system with informed, empowered learners and employers served by responsive colleges and other providers in their areas
- Supporting universities, science and research in building a strong, innovative economy
- Establishing a higher education, science and research framework that promotes world-class competitiveness in teaching and research
- Ensure progression, fair access and better quality for students, and
- Strengthening links between universities and industries and support innovation and technology development.

Under its Business Plan, the Coalition intends to create, from April 2012, a national network of Advanced Technology Centres to support growth, increase UK translational capability and position the UK to take advantage of emerging global markets.

It is clear from the Business Plan that the Government will be expecting employers to participate, at least in part through their support for postgraduate education, in order to achieve its strengthened links for achieving innovation and technology development delivered via a highly skilled workforce.

Review of advertisements for employment opportunities

Our review of the job advertisements in the environmental/sustainability sector set out to identify what skills and experience sets employers are explicitly looking for. Eighteen job advertisements in the fields of environmental, sustainable or energy engineering were examined. We found that specialist knowledge in the field relevant to the job is a requirement of almost all recruiters. The other most commonly asked for skills are project management and communication skills, both written and verbal.

An interest in and knowledge of sustainability is also very commonly required for these jobs, although not all specifically ask for it. Leadership and team-working skills are also commonly asked for. In terms of experience, most recruiters ask for experience in the relevant field (although only one specifies exactly how many years of experience are required). None of the job advertisements we examined requires research skills. Our detailed analysis of the skills sets mentioned in job advertisements is summarised in Table 8 of the Appendix.

Interviews with employers

We also carried out five telephone interviews with large employers of postgraduate students, all of whom employ people that have completed EngDs. To summarise, a majority of these employers say they are looking for skills relating to:

- Environmental legislation.
- Ability to work as self-starters.
- Ability to get on with others.
- Communication skills.

The interview questions and responses are included here as Table 9 in the Appendix.

As to the question of whether interest in courses on sustainable development is set to grow, there are almost no data available on long-term trends in recruitment from sustainability courses. However, in the short-term there is significant evidence that fewer employers will recruit staff with skills in sustainability because of the Comprehensive Spending Review. This means that many government agencies that have in the past recruited postgraduate students from such courses are very unlikely to recruit in the next two years – Natural England, for example, has announced that it has ceased all recruitment.

Stage 5: Telephone interviews with Career Advisors

To supplement our survey of employers and to gain an understanding of how those advising graduate students on their options for further study see postgraduate courses, we carried out five more telephone interviews with university Careers Advisors. These are reported in Table 10 of the Appendix.

All five of the universities consulted have some students who go on to further study after they graduate. The proportion who go on to postgraduate studies ranges between 18% and 30%, but at present a higher-than-usual proportion of students is continuing in education – partly due to the recession.

Careers advisors perceive a significant demand for courses in environmental and sustainable engineering because they see good employment opportunities in this sector.

There was a polarized response to questioning about what students are looking for. Two HEIs said that many graduating students understand they need to make themselves as employable as possible by getting professional experience and building up commercial understanding. However, one of them said their students have only a limited 'commercial' focus, and often don't appreciate what prospective employers are likely to look for.

One interviewee believed that demand for courses in environmental technology and sustainable engineering was likely to grow over time.

Appendix

Table 1: Change in tuition fees for UK/EU students on taught postgraduate courses in English HEIs, 2001-02 to 2007-8

	2001-02	2007-08	% Change
Average full-time	£3,664	£4,955	35%
Average part-time (full-time equivalent fee)	£4,797	£7,655	60%
Subjects Allied to Medicine	£3,008	£5,145	71%
Business	£6,242	£9,855	58%
Combined	£3,074	£7,530	145%
Creative arts	£3,236	£4,520	40%
Education	£2,526	£3,985	58%
Humanities	£3,686	£5,060	37%
IT	£3,777	£5,655	50%
Laboratory Based Science	£4,302	£6,650	55%
Languages	£2,694	£3,835	42%
Law	£4,602	£7,085	54%
Medicine	£4,528	£6,075	34%
All	**£4,271**	**£6,300**	**48%**

Source: HEFCE

Table 2. EPSRC's Industrial Doctorate Centres

Association of Engineering Doctorates (AEngD) AEngD is a 'shared service' organisation that supports Industrial Doctorate Centres (IDC), funded by EPSRC UK and sponsored by various Industries across the UK.
Centre for Digital Entertainment University of Bath, University of Bournemouth
Innovative and Collaborative Construction Engineering Loughborough University
Large-Scale Complex IT Systems Universities of Leeds, Oxford, St Andrews and York
Virtual Environments, Imaging and Visualisation University College London
Bioprocess Engineering Leadership University College London
Systems University of Bristol and University of Bath
Micro & Nano-Materials and Technologies University of Surrey
Nuclear Engineering Imperial College London, University of Manchester
Optics and Photonics Technologies Heriot-Watt (lead), Glasgow, St Andrews, Strathclyde and the Scottish University Physics Alliance
Transport and the Environment University of Southampton
Molecular Modelling and Materials Science University College London
Urban Sustainability and Resilience University College London
Biopharmaceutical Process Development Newcastle University
STREAM Cranfield University, Imperial College London, University of Exeter, University of Sheffield, Newcastle University
Systems Approaches to Biomedical Science University of Oxford
Technologies for Sustainable Built Environments University College London
Formulation Engineering University of Birmingham
Efficient Fossil Energy Technologies The Universities of Nottingham, University of Birmingham, and Loughborough University

Table 3. Examples of UK private provision of postgraduate education

The College of Law The college is a registered charity that was once an arm of the Law Society. It is now governed by 12 trustees who meet six times a year. It provides a full range of law programmes from its seven locations in the UK. These include undergraduate and postgraduate level qualifications, specialist short courses, the Bar Vocational Certificate and continuing professional development for practitioners. The college charter limits its operations to legal education.
EThames Graduate School This is a small private higher education institution based in two office blocks in Ilford. It was founded in 2004, but has grown steadily and now has over 1,000 enrolled students, with numbers still rising. The college has four intakes per year, and attracts mainly MBA or postgraduate students. (23)
Study Group Pty Ltd This was created in 1998. The company's roots are in the UK, with Bellerbys College in Brighton having been in business for 50 years. Study Group's first international study centre with a UK university opened at Sussex in 2006 and there will shortly be 11 centres in the UK. These partnerships offer pathways to undergraduate and, in some cases, postgraduate Master's degrees.
University of Wales Institute, Cardiff's (UWIC's) and the London School of Commerce This relationships was established in 2002 and covers a range of educational activities including undergraduate and postgraduate programmes in business studies (franchise or top-up), management consultancy (jointly validated and delivered in Cardiff and London), computing (validation), hospitality and tourism management, and computing. It also franchises doctoral programmes (PhDs and professional doctorates) in the same subjects to the London School of Commerce.

Table 4. Competitor IDC and other Professional Doctorate Courses (related to sustainability in the construction, environment, energy, engineering, water and transport sectors)

University	Course	Skills*	Industrial Experience*	No of Students*	Course Length*
Surrey	Sustainability for Engineering and Energy Systems (EngD) website	Research Methods, Leadership, Writing Scientific papers, environmental auditing and management, environmental economics and communication.	Majority of students' time (75%) spent with sponsor company.	12	4 years
Anglia Ruskin	Professional Doctorate in the Built Environment website	Gain an internationally recognised Doctorate qualification, Add greater value to your organisation and enhance your career prospects Make a significant contribution to the development of your profession Research an area of particular interests to you and your employer Raise your profile and gain recognition within the industry Expand and strengthen your professional network.	Expected to already be a professional.	Not specified	3-8 years
Bath	Sustainable Chemical Technologies (EngD) website	Training to supplement their undergraduate knowledge, as well as training in sustainable chemical technologies (SCT) and transferable skills. Training in research skills.	Will spend some time with external partners 'where appropriate'. This will be different for each student.	10	4 years
CAT/UEL/UWIC	Ecological Building Practices website	Research methods, computer simulation, and understanding of ecological building technologies. Training will enable students to make a contribution at doctoral level to professional knowledge, products or processes	Expected that students will already be working in built environment professions. Course based largely around practice.	Not specified	4 years
Cranfield	Environment and Natural Resources (PhD/EngD (STREAM)) core skills website subject website	Core research skills and training programme to suit individual circumstances	Dependent on subject. Only with STREAM is the majority of students' time spent with sponsor company.	Dependent on number of sponsors	4 years
Hertfordshire	Professional Doctorate(EngD) in Engineering website	Develop critical thinking skills and awareness of the application of technology into organizations. Develop research and management skills, such as leadership and change management, necessary to deal with the complex issues in today's and future engineering business activities. Enable the effective management of innovation. Provide a supervisory environment that helps give guidance, review and advice on the development of your portfolio, specialist technological skills and the research process	Expected that students will already be working in engineering professions.	Not specified	3-8 years

Loughborough	Innovative and Collaborative Construction Engineering (EngD) website	Development of innovative thinking, while tackling real industrial problems Continual broadening, by gaining and applying new knowledge from a modular taught programme A chance to work in a real industry environment Offers a combination of research and commercial skills	The Research Engineers are expected to spend a large proportion (typically 70-80%) of their time at the premises of their collaborating company, depending on the nature of the project.	10	4 years
Manchester / Sheffield	Advanced Metallic Systems (Sustainable Technology) (EngD) website	Training in transferable skills for leadership, business and research management and core materials topics	The majority of the research project will take place at the industry partner's premises.	12	4 years
Nottingham/ Birmingham/ Loughborough	Efficient Fossil Fuel Technologies (EngD) website	Students will be thoroughly versed in cutting edge energy research and capable of operating in multi-disciplinary teams, covering a range of knowledge transfer, deployment and policy roles and with the skills to analyse the overall economic context of their projects and to be aware of the social and ethical implications. They will be prepared to work in multi-disciplinary teams, to function as effective members of complex organizations, to analyse the overall economic context of their projects and to be aware of the social, ethical and environmental implications of their design and construction decisions.	Bulk of the students' time will be spent with the industry partners.	10	4 years
Reading	Technologies for Sustainable Built Environments (EngD) website	A culture of applying sustainable solutions to engineering systems Expert knowledge of a particular engineering area Project management skills, and planning and control against realistic time-scales Team-working and leadership skills Communication skills: oral and written, technical and non-technical Technical organisational skills and the ability to apply skills and knowledge to new situations The ability to seek optimal, viable solutions to multi-faceted engineering problems and to search out relevant information sources	Each research project is supported by a company or organisation, where the student will spend a lot of their time.	13	4 years
Salford	Professional Doctorate in the Built Environment website	Research skills and methodologies, presentation skills	Students expected to already be built environment professionals	Not specified	3-8 years

Southampton	Transport and the Environment (EngD) website	Research skills, people and presentations skills, reporting and publishing skills.	75% of time spent on the industry partner's research project.	10	4 years
Southampton	Civil Engineering, Environmental Engineering and Environmental Sciences website	Students learn techniques for research and advanced academic enquiry, the ability to conceptualise, design and implement a project, adjusting the project design in the light of unforeseen problems. Also, the course promotes time management skills, presentation skills and independent thinking.	None necessarily	25-30	3 years
STREAM (Cranfield University, Imperial College London, Sheffield, Newcastle, and Exeter)	Industrial Doctorate Centre for the Water Sector (EngD) website	Postgraduate-level Training, Transferable Skills and Engineering Leadership, Research skills.	Majority of students' time (75%) spent with sponsor company.	Dependent on number of sponsor companies	4 years
UCL	Urban Sustainability and Resilience (EngD) website	Aims: The development of the student into a confident, business-aware, tool building, problem solving researcher ready to step out into industry to effect change and to lead research groups and The realisation of the project aims - that is, bringing about a positive change for the industrial partner.	A research project takes up 75% of the time. The research component will take place within the university and on site with the industrial partner.	6 (depends on number of industry sponsors)	4 years

* Information taken directly from Professional Doctorate websites

Table 5 Skill sets listed as being acquired by students on competitor IDC and Professional Doctorate Courses as compared with SEES

		Skills being acquired														
University	**Course**	Research methods	Transferable Skills	Sustainability Concepts	Critical thinking	Management	Technical skills relevant to course	Commercial	Leadership	Teamwork	Communication	Organisational/time management	Presentation	Reporting/ publishing	Environmental Law	Risk Management
Surrey	Sustainability for Engineering and Energy Systems (EngD)	X		X		X	X		X		X			X	X	X
Anglia Ruskin	Professional Doctorate in the Built Environment	X														
Bath	Sustainable Chemical Technologies (IDC)	X	X	X		X	X					X	X			
CAT/UEL/ UWIC	Ecological Building Practices	X		X			X								X	
Cranfield	Environment and Natural Resources (PhD/EngD (STREAM))	X		X		X						X	X	X		
Hertfordshire	Professional Doctorate(EngD)	X			X	X	X		X							
Loughborough	Innovative and Collaborative Construction Engineering (IDC)	X		X		X		X	X		X					
Manchester / Sheffield	Advanced Metallic Systems (Sustainable Technology) (IDC)	X	X	X		X			X		X					
Nottingham/ Birmingham/ Loughboro'	Efficient Fossil Fuel Technologies (IDC)	X	X			X	X			X						
Reading	Technologies for Sustainable Built Environments (IDC)	X		X		X	X		X	X	X	X			X	
Salford	Professional Doctorate in the Built Environment	X											X			
Southampton	Transport and the Environment (IDC)	X		X		X			X	X			X	X		
Southampton	Civil Engineering, Environmental Engineering and Environmental Sciences	X					X					X	X			
STREAM (Cranfield etc),	Industrial Doctorate Centre for the Water Sector (IDC)	X	X	X		X	X		X	X	X	X	X	X		
UCL	Urban Sustainability and Resilience (IDC)	X	X	X		X	X		X					X		
Totals		15	5	10	1	11	9	1	8	4	4	5	6	4	3	1

(Table 6 is included in the main body of the report, on page 8.)

Table 7 Institutional requirements for chartered and other forms of status

Institute	Eligibility for Registration	Skills	Evidence	Experience	Evidence
Engineering Council					
Chartered Engineer (academic pathway)	Member of and Engineering Institution. An accredited Bachelors degree with honours in engineering or technology, plus either an appropriate Masters degree accredited by a professional engineering institution, or appropriate further learning to Masters level. or an accredited integrated MEng degree. Can demonstrate the required professional competences and commitment UK-SPEC	Initial professional development and continuing Professional Development	Through structured development schemes or can be self-managed. A Professional Review where applicants demonstrate how they intend to meet their obligations to CPD.	Professional development generally takes place in a working environment and builds on knowledge and understanding acquired through formal education. It is not necessarily separate from education and the two processes may be integrated, eg in work-based degree programmes or Advanced Apprenticeships.	
Chartered Engineer (non academic pathway)	Member of and Engineering Institution. Submit a career history and education and training record, including any records of experiential learning, to a Licensed Member for assessment	Skills and experience gained through the non academic pathway are the same as the academic pathway			
IEMA					
Student	Proof of student status, no exams or assessments, and no need to be nominated.				
Graduate	Those who have graduated within the last two years. Existing IEMA student members will automatically be upgraded upon graduation.				

Affiliate	No qualifications necessary. Entry level in the IEMA membership hierarchy.				
Associate	Approved Training Course or Associate Open Book Assessment	Demonstrate a clear understanding of the principles and practices of environmental management and assessment.			
Full Member	Must be an Associate member with three years' environmental experience or an Affiliate with seven years' environmental experience	3 – 7 years environmental experience	3 – 7 years full time (or equivalent) experience in the workplace	Professional standard of knowledge, understanding and experience in the fields of environmental management and assessment.	Submit evidence of CPD (Continuing Professional Development) on an annual basis. At present IEMA is not prescriptive on the amount of CPD required, but it does require evidence of CPD undertaken. CPD submissions will be monitored and recorded
Fellow	Must be a Full member with seven years' environmental experience. A written submission and a peer assessment.			Demonstrated substantial achievement in the environmental management and assessment field	Written submission and an assessment undertaken by two Fellow Membership Assessors.
Chartered Environmentalist	Submission of a comprehensive report of supporting evidence and a professional review interview with two Chartered Environmentalists			Use knowledge and understanding of the environment to further the aims of sustainable development; Analyse and evaluate problems from an environmental perspective, and develop practical sustainable solutions; Demonstrate leadership in sustainable management of the environment; demonstrate effective interpersonal skills;	

				Demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment.	
IMechE					
Student	Undergraduate engineering students				
Associate (chartered)	Graduate with a suitable degree in engineering or a STEM (Science, Technology, Engineering and Mathematics) subject.	Professional engineers	Graduate degree in STEM subject	Continued commitment to their career	Continued CPD
Member	Existing Chartered and Incorporated Engineers who are registered with the Engineering Council can apply for IMechE Membership or Fellowship			Demonstrate that their professional engineering experience meets the competences set out by the Engineering Council's UK-SPEC.	
Fellow	The focus is on the qualities required for Fellowship rather than on the UK-SPEC competences which have already been demonstrated to gain Membership and Professional Registration.			Demonstrate exceptional commitment to and innovation in mechanical engineering.	Hold a position of senior responsibility and/or significant autonomy: Promotion of engineering to developing engineers and potential engineers: Leadership qualities: Involvement in policy and strategy making decisions: Structured approach to CPD (evidence of presentations, published papers, etc)

IChemE					
Student	Students studying chemical engineering or a related subject				
Affiliate	Individuals working in the process industries – energy, chemicals, contracting, pharmaceuticals, food, water, Or those who manage or hire chemical engineers				
Associate	Chemical engineering undergraduate degree at Bachelors level with Honours (or higher) or a young chemical engineer working in chemical engineering or a closely related field.				
Member (Chartered) Additional info	Fulfil IChemE's academic educational requirement. Have sufficient relevant training and experience.	Work, or have worked, in a responsible position in chemical engineering	A supervisor, mentor or trainer of other professionals: Approve the work of other professionals: Manage your own budget	At least four years working in an environment where they are using chemical engineering principles.	IChemE accredited industrial sandwich year: PhD: completed PhD will count as 1 year: EngDoc: completed EngDoc will count for at least 1 year depending on course content: Pre-graduation experience. Mature students or distance learning students may have worked at an appropriate level before starting their course.
Fellow	An existing IChemE Chartered Chemical Engineer (MIChemE).		Engineering professional of distinction, making significant contribution to the profession.		Demonstrate technical excellence and leadership of peers

ICE					
Student	Currently studying at school/college or working towards a first undergraduate course (for qualification up to MEng) at university or a pre-university student who is on a year in industry placement				
Graduate	Hold a qualification that is accepted as meets the educational base for ICE membership. National or Higher National Certificate/Diploma: Foundation Degree: BSc or BEng: MEng	Develop the special skills and acquire the specialist knowledge and competence needed to practise as a civil engineer or technician	Initial Professional Development (IPD). Satisfied by: ICE Approved Training Schemes, Self Managed Training (Career Appraisal) or ICE approved NVQ/SVQ	Increasing responsibility and consolidation of experience	Professional review
Technical Member	Engineers practicing in the broad area of civil engineering, with BTEC National Certificate or Diploma in one of the Construction Pathways, or an approved Scottish/National Vocational Qualification (S/NVQ) - level 3	Develop the special skills and acquire the specialist knowledge and competence needed to practise as a civil engineer or technician	IPD, satisfied by completion of one of the following: ICE Approved Training Schemes, ICE Approved NVQ/SVQ, Self Managed Training & Experience (Career Appraisal)	Increasing responsibility and consolidation of experience	Professional review
Associate Member	Individuals who are engaged in a profession that directly supports or is closely allied with the work of a civil engineer operating in the built environment. UK Bachelors degree or equivalent in any subject	Use engineering knowledge and understanding to make the most of existing and emerging technology: Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems: Provide technical and commercial management: Demonstrate effective interpersonal skills:	IPD, satisfied by completion of one of the following: ICE Approved Training Schemes or Self Managed Training & Experience (Career Appraisal)	Increasing responsibility and consolidation of experience	Professional review

		Demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment			
Member (level 1)	Engineers practising in the broad area of civil engineering who have satisfied all the requirements of the Member Professional Review (MPR)	Exponents of today's technology who apply and manage its application within the broad field of civil engineering.	Initial Professional Development		Professional review
Member (level 2 Chartered)	Engineers who have satisfied the requirements of the Chartered Professional Review (CPR)	Ability to lead teams in developing holistic solutions to engineering problems	Initial Professional Development		Professional review
http://www.ice.org.uk/Membership/Membership-grades-and-how-to-join/Fellow	Member, Associate Member, Technician Member of ICE or engineers engaged in a position of responsibility in the promotion, planning, design, construction, maintenance or management of important engineering work	Making a major contribution to Institution affairs	Involved in debates on issues in the public interest and in the maintenance of standards of qualification.	Engaged in a role of significant responsibility	Experience at a senior level and able to demonstrate significant achievement
Affiliate	No qualification is required to become an Affiliate Member. Membership is open to those that work or have an interest in the built Environment. Engineers who work or have an interest in the field of the built and natural environment and wish to take part in the Institution's activities.				
Companion	Individuals who work at the same level as a Fellow, but in a field relating to civil engineering, rather than in civil engineering itself. Part of an				

	organisation which is on the periphery of civil engineering or a sole practitioner who provides specialist services.				
IStructE					
Student	Aspiring structural engineers who are studying on civil and/or structural engineering courses, either full-time or part-time or have completed a NC, ND, HNC, HND, foundation degree or the equivalent and are training to progress to a professional grade of membership				
Graduate	Engineers who have completed an accredited structural and/or civil engineering degree or the equivalent. Engineers who have an academic qualification from a course that is not accredited by the Institution or noted under a mutual recognition agreement must apply for an academic assessment				
Technical Member	Hold a recognised academic or vocational qualification: National Certificate or Diploma in Civil Engineering or Construction or the equivalent. Practising engineering technicians with appropriate knowledge and skills but without formal academic qualifications may still be eligible	Sound understanding of core structural engineering principles	Professional member of a design team. Successfully complete the IPD programme, including 12 core objectives set to bridge the gap between education and becoming a qualified Technician Member	Experienced structural engineering technician	Professional Review Interview

Associate Member	Hold an Institution accredited Bachelors (ordinary degree) or the equivalent e.g. a HND plus Associate-Membership Examination.	Solve structural engineering problems and contribute to the production of viable structural design solutions using appropriate methods of analysis, and able to exercise independent technical judgement and management.	Integral part of any design team. Successfully complete the IPD programme including 13 core objectives set to bridge the gap between education and becoming a qualified Associate-Member		Pass a Professional Review Interview (PRI) and the seven hour Associate-Membership Exam
Chartered Member	Hold an Institution accredited MEng degree or the equivalent e.g. a BEng (Hons) plus MSc or Technical Report Route or a degree from an EU member state equivalent to at least a BEng (Hons).		IPD programme. This training programme includes 13 core objectives set to bridge the gap between education and becoming a qualified Chartered Member.		Attend and pass a Professional Review Interview (PRI) and the seven hour Chartered Membership Exam.
Fellow	Chartered Members of the Institution with at least five years senior professional experience, and in most cases will be at least 35 years old		Responsibility for important structural engineering projects, or have made a significant personal contribution to either research into structural engineering or the teaching of structural engineering		
CIBSE					
Student Affiliate	Anyone studying, or in some other way involved in, building services engineering, whether or not they eventually expect to become qualified as building services engineers. Be registered on an approved				

	course of study in Building Services Engineering or related discipline: Be working towards Licentiate, Associate or Member status: Provide a Sponsor who must be your course tutor or a senior lecturer				
Affiliate	Be a contributor to the art, science or practice of Building Services: Be interested in the promotion of Building Services. Or in the process of completing the education, training or experience stages for another grade of CIBSE membership				
Companion	Experienced practitioners in a separate discipline, who have made a contribution to the promotion of building services engineering, have had at least 15 years of experience within the field of building services engineering and hold a senior position.				Companion is the senior of the grades of affiliated membership and is open to those who are not academically qualified building services engineers.
Licentiate	Must hold one of the following: BTEC National Certificate or National Diploma in Engineering or Construction and the Built Environment: An approved qualification in engineer or construction at level 6 in the Scottish Qualifications and Credit Framework: The City and Guilds Higher Professional Diploma in Engineering: A technical certificate as part of an approved Advanced Modern: Apprenticeship	Involved in applying proven techniques and procedures to the solution of practical engineering problems	Have supervisory or technical responsibility	Able to demonstrate competence within the field of Building Services Engineering	Submission of a work experience report, organisation chart and development action plan

	Programme: An approved level 3 NVQ or SVQ: A work-based learning route approved by a licensed professional engineering institution: Overseas qualifications or a combination of qualifications approved by the CIBSE Individual Case Procedure Panel. Or go through an interview assessment				
Associate	Academic requirements BTEC HNC in Building Services Engineering (with no less than 8 level H units including a maths unit and a project) plus a period of further learning to degree level or any ECUK listed BEng degree. Or those with appropriate professional experience and technical expertise	Be engaged in technical and commercial leadership and possess effective interpersonal skills	Maintain and manage applications of current and developing technology: Undertake engineering design and development: Be engaged in engineering manufacture, construction and operation.	Demonstrate analytical and problem-solving skills: Evaluate evidence, arguments and assumptions: Reach sound judgements: Communicate effectively: Demonstrate competence within the field of Building Services Engineering:	Submit an Engineering Practice Report, work experience listing, organisation chart and development action plan: Participate in an Interview
Member	Engaged in technical and commercial leadership and possess effective interpersonal skills	Ability to develop appropriate solutions to engineering problems, using new or existing technologies, through innovation, creativity and change. Analytical and problem-solving skills:	Develop and apply new technologies: Promote advanced designs and design methods: Introduce new and more efficient production techniques, marketing and construction concepts: Pioneer new engineering services and management methods.	Evaluate evidence, arguments and assumptions: Reach sound judgements: Communicate effectively: Demonstrate competence within the field of Building Services Engineering	Submit an Engineering Practice Report, work experience listing, organisation chart and development action plan: Participate in an Interview
Fellow	Professionals who have been engaged in a position of responsibility in building services engineering for at		Senior members of the profession who have reached a position in which they carry full	Reached a position of superior responsibility: Accountability for decisions on the design,	Engaged in an operations or maintenance role: Leader of a research or

	least ten years, of which period for not less than three years have been engaged in a position of superior responsibility		responsibility for decisions on the design, management, and financial implications of engineering projects. A Fellow may also be in an operations or maintenance role, a leader of a research or development team or a practising academic teaching to degree level	management and financial implications of engineering projects: Proven expertise in one or more specialist sectors: An understanding of the broad field of building services engineering	development team: Practicing academic teaching to degree level: Develop and apply new technologies: Promote advanced designs and design methods: Introduce new and more efficient production techniques, marketing and construction concepts: Pioneer new engineering services and management methods.
CIWEM	**CIWEM is licensed by the Engineering Council to award Chartered Engineer (CEng), Incorporated Engineer (IEng) and Engineering Technician (EngTech) status for suitably qualified applicant**				
Student	No relevant experience needed but must be on a full or part time course				
Graduate	Honours Degree or equivalent qualification			No relevant experience needed but must be in or seeking, relevant employment	
Associate	Relevant acceptable qualification. Non-honours degrees post 1991 are appropriate for Associate membership. Candidates with appropriate academic qualifications, but insufficient experience, are admitted to the grade of Student as a 'holding' grade				
Member	Honours Degree or equivalent qualification.			Relevant professional experience	

Fellow	Honours Degree or equivalent qualification			Experience at an appropriate senior level	
IET	**The IET is licensed by the Engineering Council to award the professional engineering qualifications defined in the UK Standard for Professional Engineering Competence (UK-SPEC) and the Information and Communications Technology Technician (ICTTech) Standard.**				
Student	Individuals working toward a career in science, engineering or technology whether at university or on an apprenticeship scheme				
Associate	No need to need to hold an engineering qualification. Individuals working in a related field or simply have a passion for engineering and technology.				
Technician Member	Individuals working in the science, engineering or technology industry with appropriate qualifications. UK Foundation degree; UK HNC/HND; UK National Diploma; UK Advanced Modern Apprenticeship; City & Guilds Higher Professional Diploma in Engineering; City & Guilds 236/2360, parts 1, 2 and C (electrical installation or similar); Qualification at Level 3 in UK National Qualification Framework (NQF); Qualification at Level 6 in the Scottish Qualifications and Credit Framework (SQCF); UK Construction Skills Safety Scheme CSCS Gold Card.				

Member	Individuals working in the science, engineering or technology industry with appropriate qualifications. Pass/Ordinary/Honours degree in an appropriate subject e.g. BSc, BTech, BEng(Hons), HTI, MEng, MSc, PhD; UK Construction Skills Safety Scheme (CSCS/ECS) Platinum Card; UK NVQ/SVQ at level 4 or 5 in an appropriate subject. Or the following qualifications with a current CV showing evidence of work at graduate level: Postgraduate diploma, professional qualification; Other Honours degrees or higher degrees e.g. BA(Hons); CISCO systems CCNA, CCNP or CCIE; City & Guilds 2391. Or the following qualifications with a current CV showing evidence of work experience (between two to 12 years dependant on the qualification) and work at graduate level: UK Foundation degree in an appropriate subject; UK HND in technology; UK HNC in technology; City & Guilds 236 (electrical installation).				
Fellow	Individuals must clearly demonstrate successful leadership or outstanding service to the profession over an extended period, normally not less than five years			Operational and strategic responsibility for substantial programmes and resources. Personal responsibility for significant technological innovation. Original research resulting	

				in international recognition. Successful creation and development of a business in a sector of relevance to the IET. Recognised leadership in academia or the armed services. Outstanding service on national and international professional bodies. Enhancement of the profession through public service	
Honorary Fellow	Persons distinguished by their work in any engineering discipline falling within the objects and purposes of the IET, or distinguished individuals whom the IET desires to honour for services rendered to the IET or whose association is of benefit to the IET				
Energy Institute	**As a licensed body of the Engineering Council, the EI is able to offer Chartered, Incorporated and Engineering Technician status to engineers. The EI is also licensed by the Science Council to award Chartered Scientist, and by the Society for the Environment to award the title of Chartered Environmentalist.**				
Student	Free membership for students whose university department is a Learning Affiliate member, otherwise there is a small cost				
Graduate	Graduates with an Honours Degree, HND/HNC Advanced, GNVQ, NC/D or an assessed academic equivalent with little or no practical experience. Or those with a first degree who are still studying e.g. for a Masters or PhD				

Professional/ Chartered	At least five years' experience in positions of senior responsibility in an energy-related role and operate at a senior level to oversee and pioneer new techniques, services and concepts through innovation, creativity and change. Hold an Honours Degree and/or postgraduate qualification, or an assessed academic equivalent.				

Table 8 Skills expected by companies seeking applicants for environmental sector jobs

Job Title	Company	Experience	Research methods	Transferable Skills	Sustainability Concepts	Critical thinking	Project Management/ Business	Relevant technical skills/ specialist knowledge	Commercial/ Finance	Leadership	Teamwork	Communication	Organisational/ time management	Presentation	Written Communication -Reporting/ publishing	Environ-mental Law	Risk Management
Environmental Consultant	BSV Consultants	Industry experience					X	X				X	X		X		
Offshore Wind Structures Engineer	Amida Recruitment	-						X	X			X		X	X		
Sustainability Consultant	Amida Recruitment	Industry experience			X		X	X	X	X	X	X	X	X	X		X
Senior Sustainability Consultant	Amida Recruitment	Industry experience			X		X	X	X	X	X	X	X	X	X		
Senior Sustainability Consultant	Amida Recruitment	Industry experience			X		X	X	X	X	X	X	X	X	X		
Sustainability Training and Education Project Manager	UK Green Building Council	Industry experience			X		X	X	X	X	X	X	X				
Sustainability Consultant	Amida Recruitment	2 years Industry experience			X		X	X				X			X		
Supply Chain Analyst	University of Hertfordshire	Industry experience			X		X	X		X		X			X		
Project Engineer	Waste Recycling Group	Industry experience						X				X		X	X		

Networks Engineers and Nuclear Science Engineers	EDF Energy	Industry experience			X		X	X	X			X				X	
Sustainability Co-ordinator	Aster Group	Industry experience			X			X									
Climate Change Officer	Cambridge City Council	Public Sector Experience			X			X	X	X		X					
Environment Advisor	Train Operating Company	Industry experience			X					X	X	X			X		
Content Manager	The Carbon Trust	-			X		X	X				X			X		
Environmental Consultant	National Grid	Industry experience			X		X	X				X	X		X	X	X
Water Design Engineer	Match Tech Agency	Industry experience						X				X			X		X
Energy Management Consultant	Penguin Recruitment	Industry experience					X	X				X			X		
Project Planning Engineer	Environmental Recruitment Solutions	Industry experience			X		X	X		X			X		X		X
Totals			**0**	**0**	**13**	**0**	**12**	**17**	**7**	**8**	**5**	**16**	**7**	**5**	**14**	**2**	**4**

Table 9 Skills expected by large environmental sector recruiting companies

Company	• **Galliford Try**
Interviewee's job title	• Environmental Group, Business Unit Manager
1.Do you employ EngD's	• yes
2. Skills and experience	Experience • Legislation (environmental) • Auditing experience • Ideally has worked on a construction site • Bid preparation (see full transcript for detail of skills) Skills • While being pragmatic i.e. can translate the law which states A, B, C onto the construction site. • Attitude and personality • The ability to apply knowledge to give realistic advice to enable compliance.
3. Differentiate between MSc's and PhD's	• Yes, (he would employ a PhD when the issue was technical research, but has so far employed MSc's).
4. Awareness of Surrey course	• No not aware
Company	• **URS – Scott Wilson**
Interviewee's job title	• Head of HR
Do you Employ EngD's	• Yes
Skills and experience	Skills • How well they could make the transition from study to work. • The potential they saw in them. • Their 'behaviour' i.e. if they we're a self starter. • Verbal reasoning • Communication skills both written and verbal. • Good English, irrespective of their background as it's the international business language. • Judgment i.e. exercised when planning their main thesis, which is a complex project and can explain how they came to their decision. • They tend to employ logical thinkers more than creative types • Self awareness i.e. that they understands their own performance and their strengths and weaknesses. Experience • Would to some extent assume it was present from work experience and the 4 year EngD.
Differentiate between MSc's and PhD's	• MSc above a PhD, especially if the MSc is specific to the required field and that often the PhD's often don't really fit the work they do.
Company	• **WSP**
Interviewee's job title	• Recruitment Manager for UK, Europe, Asia, and Middle East.
Do you Employ EngD's	• Yes
Skills and experience	Skills • They do place a high degree of importance on communication skills. • Commutations skills important. Then they get them into and then onto their training course.

	Experience • Preparation of bids, proposals, tenders and quotes important. • Law especially commercial property transfer not so important, but planning legislation yes important. • Risk assessment, very important as it comes into nearly all of their work, but not so much financial risk assessment.
Differentiate between MSc's and PhD's	• He sees the PhD's and the MSc as being on a level playing field, especially if the PhD had relevance and they could transpose that knowledge to the job. Yes they could advance more quickly due to having a PhD.
Company	• **Buro Happold (Bath)**
Interviewee's job title	• Innovation Director of Engineering (i.e. R&D Director)
1.Do you employ EngD's	• Yes
2. Skills and experience	Skills • No specific skills or experience as he would hope to sponsor then. So it really happens • The only case he could think of where it might be relevant is when someone has been sponsored and then moves company, which again is rare. Experience • For example, research into how a concrete slabs behave in a fire, then they would sponsor a PhD student as its not urgent, or • They would also sponsor someone to research solar cells in a facade, so they can tender and say they have an expert in that subject. But they also have to a good consultant, and he finds that most good consultants are naturally outgoing people with good communication skills.
3. Differentiate between MSc's and PhD's	• Employs both, but would naturally assume the PhD student is more advanced that the MSc as they tend to be naturally older and have a deeper knowledge of their subject.
4. Awareness of Surrey course	• Surrey is one other their preferred Universities
Company	• **ERM**
Interviewee's job title	• Senior consultant, Bristol office (14 staff) Specializing in Impact assessment re. the remediation of contaminated land.
1.Do you employ EngD's	• yes
2. Skills and experience	Experience • Ideally project work on land remediation, i.e. research in a specific field which would then enable them to bid stating they had an expert on the team. Especially as it's an emerging field. • UK guidance legislation 1990 re. contaminated land Skills • None specifically, more their character, re. their fit into the team.
3. Differentiate between MSc's and PhD's	• In depth knowledge of key technologies would outweigh their qualification, but if their PhD was relevant then 'yes' it would mean that they had greater depth of knowledge so would be ahead of the MSc.
4. Awareness of Surrey course	• No not specifically

Table 10 Skills expected by university Careers Advisors

University	• **Newcastle University Careers service**
Interviewee's job title	• Guidance manager, and head advisor.
1.What percentage go onto higher degrees	• 18% (includes MSc's, PGCE's, EngD's etc.)
Background information given by interviewee	The North East has been part of the country where there are many employers in this environmental field e.g. the Joseph Swan Institute. Therefore Newcastle University runs a lot of courses in this subject. Levels of unemployment from survey of engineering students (after first degree, survey had 80% response rate) Electrical = 0% Civil = 12.1% Mechanical = 3.6% Chemical = 10.2% She runs workshops (including mock interviews with actual employers) to increase students job prospects; her specialism is how to understand what employers want, what you have (i.e. PhD) and how to market that. What she has found is that a lot of students that are doing these higher-level degrees do not think about what skills and experience they need to gain to get a job. They have a great interest in their sector of the technology. But don't really think too much about their employability. Often they don't think about their really useful everyday work based skills and need help to become more aware of them. The same also applies to their commercial awareness, which she says is often very low and they focus on their knowledge more than their skills. She went onto say that, the point when they realize that this process is key, is like a 'light-bulb' going on and from that point on they stand a much better chance of being able to market themselves and their PhD.
2 and 3	N/a
4. What SKILLS and EXPERIENCE are they looking for when choosing Environmental or Sustainable Engineering post graduate degrees such as the EngD?	They (Newcastle University) have a high demand for these courses, for several reasons; the (perceived) high number of jobs in this environmental sector in the northeast and the increasing interest in (this subject) and our futures. So the reasons they want the skills from these courses are many. The word 'perceived' is used because of the northeast's reputation as a major UK hub for renewable energy which could disappear due to government cuts. One problem they have (re. finding placements and jobs for these students) is with the smaller companies, where a catch-22 situation appears to exist. These smaller companies want experience and the students want to gain experience, but sponsorship is not a realistic option due to the smaller firms' restricted l budget. This is a real problem for undergraduates. Newcastle University on-line careers service had 419 job vacancies for graduate engineers in 2008/09 and this went up to 496 vacancies in 2009/10. They had 40 engineering employers attend their October job fair.
University	• **Cranfield University**
Interviewee's job title	• Head of careers
1.What percentage go onto higher degrees	• N/A as 100% postgraduate courses
2 and 3	• To progress their career with more skills and knowledge
4	• Hope to gain increased knowledge in their area of interest. Also because there are more jobs now available in this area. The higher degree (PhD, EngD) so they are ahead of the pack and make themselves more marketable.
University	• University of Sheffield
Interviewee's job	• Careers Service

title	
1.What percentage go onto higher degrees	• 30% thought to be due to the recession, usually 22 to 25%
2 and 3	• A common reason is to increase their employability or job prospects in the subject they are interested in furthering, especially re. research.
4	• Specifically technology as it opens up jobs that would otherwise not be an option i.e. where you have to have a PhD to apply for the job i.e. research and consultancy.
University	• **Imperial college London**
Interviewee's job title	• Careers advisor
1.What percentage go onto higher degrees	• 30% includes UK and EU
2 and 3.	• Not necessarily done anything related, but have developed an interest in a specific field and wish to gain specialist knowledge
4.	• Two areas; 1) in environmental solutions (i.e. the more technical aspects) and 2) in policy and strategy, so the course they would choose would be dependent on the area they wanted to go into i.e. on the job they wanted, be it technical or the (softer skill based) policy and strategy course.
University	• **DeMontfort University**
Interviewee's job title	• Employability officer
1.What percentage go onto higher degrees	• Have not had many students asking about this type of course. Is of the impression that some might have a question mark against doing the course due to the cost of doing the course versus the benefit and might be thinking that work (or a placement) might be a better means to enter that field. • But they have had the odd inquiry when the job i.e. research requires that you have the PhD.
University	• Cambridge University Careers service
Interviewee's job title	• Most relevant person in this field
	• Could not get hold of him in time available
University	• Oxford Brooks careers service
Interviewee's job title	• careers@brookes.ac.uk no response. • 01865 484670
Actions taken	• Have emailed questions but no response, would need to follow up with calls

Footnotes

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