Business, Innovation and Skills/UK Commission for Employment and Skills

The Engineering Construction Industry

Strategic Skills Cluster Report

December 2009

Cluster Membership

asset skills	Asset Skills	ECITB Engineering Construction Industry Training Board	Engineering Construction Industry Training Board	proskills	Proskills
construction skills	ConstructionSkills	energy&utility skills	E&U Skills	semta	Semta
cogent	Cogent	GoSkills	GoSkills	Summit SKILLS	SummitSkills

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1. Executive Summary

1.1. Introduction

The aim of this report is to assess the medium to longer term strategic skill needs within the Engineering Construction Industry (ECI) and inform the appropriate policy response to meet future challenges. In it, we present an overview of the ECI and, having a clearer picture of the anticipated demand, forecast how the skills needs of the workforce will change. From this understanding of the industry, we draw out the actions required to address the skills issues that are identified during the course of our research.

The Cluster Report addresses the following areas:

- In Section 2, entitled "The Engineering Construction Industry", we answer the questions "**What is the ECI?**" and "**What drives the demand for skills?**" We define the industry, describe the critical success factors for companies operating within engineering construction and explain its contribution to the UK economy.
- In Section 3, we answer the question "**What is the current demand for skills?**" We define the existing workforce by considering the current demand from existing clients, the make up of the current workforce and external trends such as productivity and globalisation.
- In Section 4, we answer two questions "**What is the current supply of skills?**" and "**Where is this mismatched?**" After describing the main training routes and quantifying the numbers of people passing through each route, we set out the skills issues that currently concern employers.
- In Section 5, we look to the future and answer the questions "**What will drive future demand?**", "**What will be the future demand for skills?**", "**What will be future supply of skills?**" and "**Can the current supply meet that demand?**" After presenting data from the Cluster on demand, we use analysis from the ECITB[1] to translate that demand into the number of people required. We close the section with a review to show the 'as is' scenario i.e. the impact of continuing the current approach to developing the future workforce.
- In Section 6, we set out a future strategy that is based on the current plans of the ECITB to meet forecasted demand and include some new ideas for skills development.

The report has been prepared by ECITB with considerable input from a Cluster of Sector Skills Councils (SSCs) that include Asset Skills, ConstructionSkills, Cogent, E&U Skills, GoSkills, Proskills, Semta and SummitSkills.

1.2. What is the Engineering Construction Industry?

The UK's engineering construction industry (ECI) is established, distinctively cross-sectoral and defined by statute. It embraces the design, construction and maintenance of process plants for owner operating clients and is an essential prerequisite to the infrastructure of major economic sectors and other economic activity. These include oil and gas, water, environmental, steel and metal, cement, brick, glass, brewing and distillation, food, power generation, nuclear material reprocessing, pharmaceutical production, petrochemical and chemical sectors.

It leads in Europe and is second only to the US in size. Domestically, the £16 billion industry is fundamental to the economy, supporting up to 20% of GDP (in terms of underpinning wider activity) and in 2008 employed approximately 74,700 in the UK (100,000 workers worldwide). The workforce comprises of business managers, project managers, engineers, scientists, and construction workers. Many have highly specialised skills, for example, in a particular chemical process, cost and programme control or offshore welding. All have a high awareness of safety issues. Most are in demand.

[1] The Engineering Construction Industry Training (ECITB) is the employer led and funded skills body for the ECI

The size of the future workforce is shaped by:

- the expected high level of investment required to sustain the UK's power generation capacity;
- continued global growth in the use of oil as a prime source of fuel for transportation;
- resurgence of the manufacturing base of the UK to deliver low carbon process plants and complex pharmaceutical, chemical and bio-technology sectors; and
- the technical and economic viability of emerging industries such as carbon capture, wind and wave power.

The skills of the future workforce are shaped by:

- increased global opportunities that will make UK workers attractive to overseas markets and overseas investors more critical about where and when they build new process plants.
- advances in the technology contained within engineering assets that the ECI will have to build;
- effective management of projects to ensure cost control, risk management and guaranteed dates for process plants to come on stream, with high levels of productivity in operation; and
- recruitment and retention of workers, such as an aging workforce, increasing levels of tertiary education and a rise in the age level of compulsory education, which reduces the availability of young entrants and higher inward migration of potentially low skilled workers.

The critical roles, now and in future, are:

- planners: people responsible for organising new developments. These roles will consider the social, economic and environmental impact of developments, but will also involve close working with Government and the public.
- project and programme design: people who convert an engineering specification into a plan of work and a bill of materials and impacts where and when work will occur.
- project and programme management: people who control the build activity and cost to ensure the plant is brought on stream, within planned time and budget.
- chartered engineers: suitably qualified and experienced staff who can create safe and productive designs for a range of sectors.
- scientists: suitably qualified specialists who can deal, for example, with the science underpinning the design of a nuclear plant or can scale the laboratory approach by making a new drug to a production sized facility.
- site and construction managers: people who can lead teams responsible for a technically difficult job in a challenging and potentially hazardous environment.
- safety specialists: safety case writers who can assess and mitigate risks associated with the industry; safety managers who can create procedures that maintain welfare that do not impede production and safety inspectors who can monitor safety procedures are followed.

1.3. Conclusions

The UK is a World Leader in Engineering Construction

The ECI contributes in it own right to the UK almost 1.5% of UK GDP[2]. Its reputation allows the industry to competitively trade internationally and its knowledge is exported around the globe. The facilities that it builds in the UK generate wealth as well as attracting investment from overseas.

This is skilled work and the industry creates high quality and high value employment. It is a technology based industry that employs engineers, scientists and managers and yet it goes beyond pure knowledge workers as skilled craft workers are employed at all levels. The skills and capabilities developed by the ECI workforce within the areas of project delivery, safety management and engineering are essential for and readily transferable to other sectors.

There are Major Opportunities for the UK from this Industry

This industry is important for the success of the UK as a modern economy. It contributes by creating the infrastructure for other sectors such as power generation, oil exploration, downstream oil and gas, petrochemical processing and pharmaceutical manufacture, steel, metal, cement, glass, paper, food, brewing and distillation, water and sewage treatment and other essential areas.

[2] The ECIA Industry Conference, 2008

The ECI is central to sustaining the country's fundamental industrial infrastructure, where the future landscape will be marked by sufficient and critical demand for people from:

- urgent and simultaneous activity in nuclear new build, decommissioning and dismantling;
- expanding renewable energy sources; and
- extending/maintaining the conventionally powered capacity.

Future technologies for carbon capture and storage will also require advanced engineering construction skills. This is also true of the North Sea Oil and Gas arena as identifying suitable locations and subsequent extraction continues to become increasingly more difficult.

There are Significant Threats by not Sustaining this Industry in the UK

Even taking account the current economic downturn, there are skills shortages that threaten the industry's capacity to deliver. The ECITB estimates that the direct £20m per year investment from employers within the ECI will be insufficient. At the current rates of training, within a decade there will remain a shortfall of 24,500 pre- and post contract trained engineers, managers and skilled craft and technicians. Such a shortfall represents a reduction in capacity of around 30%, which will inevitably drive salary inflation to make the UK an unlikely choice for global investors.

In some sectors where the ECI operate, this additional capacity required may be filled by overseas labour. However, where security is an issue, such as nuclear new build and dismantling sites, or where the skill sets are strategic to the long-term interest of the UK, e.g. power generation, overseas labour presents risk and is not a long-term or viable answer to the problem.

If workforce capacity falls below a critical level, the number of skilled people available will shrink. The situation risks the generation of insufficient training places and employment opportunities to attract the right calibre of people.

Many companies that represent the client sectors are global players who will invest where the opportunities are greatest and development easiest. If the UK-based ECI does not compete on skills and or cost, then it will struggle to attract adequate investment. This will in turn affect those jobs that are responsible for the design, construction and operation of those facilities, including those that make up the contracting community.

This Situation Requires Action

Encouraged by the statutory system, which provides some funding directly from industry, and driven by a necessity to develop appropriate skills, employers have continued to increase their investment in training programmes. The elements required to develop the workforce are in place and over the next five years, the ECITB will invest around £100 million in support of training and this is expected to lever Government support of over £60-70 million. The focus is in three areas:

- **attract:** informing people in school, colleges and universities and other industries about the rewarding career opportunities in engineering construction and the learning pathways to them.
- **develop**: ensuring that pathways of learning continue to deliver relevant skills for the sector, are straight forward to follow and delivered to standard by quality assured providers.
- **qualify:** ensuring that individuals attain industry relevant qualifications to prove competence and enhance productivity.

In parallel with this existing strategy, the conclusions of this Cluster Report suggest that consideration is also given to the following:

- **sustain the flow of science and engineering graduates required, attract the brightest and best students to study these subjects using direct incentives:** significant stakeholders, including Government and employers from client sectors and the contracting industry, should investigate funding approaches that reduce substantially the student debt of successful graduates that join the ECI workforce. In addition, universities that offer degrees that are relevant to the ECI should receive additional grant funding.
- **sustain the flow of apprentices, employers need to guarantee training placements within actual ECI projects:** where this cannot be met, Government needs to create a network of training centres where the right skills are taught and relevant experience can be gained, or alternatively expand opportunities available as work placements.
- **sustain the current workforce, employers need to re-train people from other sectors to work in engineering construction:** Conversion for some could be as short as six months,

whereas for others it may take two years. Government and other stakeholders should intervene to ensure those that lose their jobs in the related sectors, such as civil construction and manufacturing, are actively encouraged to re-train for the engineering construction industry.

- **create improvements in performance:** employers should be incentivised to train their existing workforce.
- **extend the co-operation between sector skills organisations to ensure the maximum impact of programmes** (e.g. National Skills Academies): for example, ensuring compatibility between safety qualifications and card schemes across the industry.

Delivering these recommendations will require additional investment from both the employer and Government. This investment needs careful management to ensure the required return. With its links to employers, Government and training providers and as owner of the relevant occupational standards, the ECITB together with SSCs, employers in the industry and from client sectors, are central to the delivery.

2. The Engineering Construction Industry

In this section of our report, we describe the structure of the engineering construction industry, set out the critical success factors for companies and explain its contribution to the UK economy. We conclude that it is a vital industry, upon significant areas of the economy depend.

2.1. Overview of the Industry

Companies undertake engineering construction activities when they apply engineering and technology expertise to *design* a plant or facility; *manage* the project, *procure* the equipment, *manage* and *execute* construction and often *commission* and start up of the client owned industrial asset. These engineering construction companies are often also contracted by the client to undertake *repair*, *maintenance* and *installation* in the daily operation and upkeep of the plant that they have designed and engineered. The amount of involvement from the ECI pre- and post-contract award varies. Some contracts require the contractor to invest heavily in the design before the contract, whereas another client may pay the contractor to undertake the design of the facility.

Engineering construction companies operate across a range of client sectors:

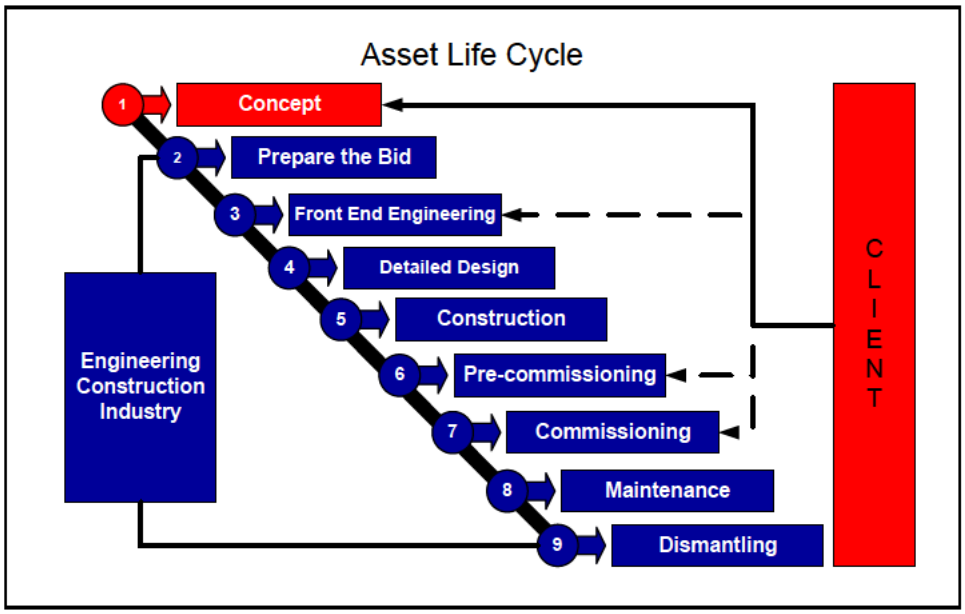
- **oil and gas**: on and offshore including exploration, extraction, terminals, refinery, gas making and treatment facilities.
- **power generation:** dismantling and refurbishing/building new coal-fired and co-generation power supplies, renewable technologies including on and offshore wind, hydro, tidal and wave power.
- **nuclear:** dismantling during decommissioning old and commissioning new nuclear generation and waste processing.
- **processing and manufacturing**: erection, dismantling and fabricating of steel structures and processing and manufacturing plant across a wide range of industries including cosmetics and pharmaceuticals, petrochemicals, and food and drink.
- **water and environmental:** water and sewerage treatment works.
- **transportation infrastructure (rail engineering):** this sector is included for the purposes of this report, although the ECI may have limited involvement.

Additionally, the ECI erects and dismantles the main steel frameworks of buildings and other structures.

There is a tendency to view the ECI population as a small segment of each of these client sectors. However, representing the industry merely as fragments does not give a true representation of the workforce. This entails discarding the previously held notion of considering this population fragmented and separate, as if a part of an often tiny and indistinguishable portion of the oil, gas, chemical, water, electricity, and nuclear industries[3]. Recent independent research has advocated the need for a new approach that considers the contracting workforce as a distinct entity in its own right because it cuts across many sectors of the economy.

For those clients where the engineering construction industry creates and maintains production assets, the diagram below shows the typical stages in the project life cycle and how the ECI contributes to the overall process. This may apply to oil rigs, petrochemical processing plants or power generation facilities, for example.

[3] IFF/IER, Workforce, Skills and Training Issues in the Contracting Community, October 2007



The typical processes in the asset life cycle are described in the table below.

Stage	Description
1. Concept	Usually done by the client, and often with advice from specialist ECI consultancies, the concept stage involves defining the financial, market and technical aims for the project.
2. Prepare the bid	In response to a client request, an ECI company will bid for a contract to provide a specific service or production asset. Bidding is usually a high-intensity activity where in a short time a contract of work is prepared and offered to the client. This contract has to be technically accurate and commercially viable as well as committing the supplier to a high volume of output. Bids submitted by ECI companies require greater accuracy and often carry additional risk due to the larger scope of activity involved. In comparison with other civil construction sectors, for example, this type of bidding entails the higher value of the contract process and longer project times i.e long lead-in and onsite time. A clear definition of the outputs and a sufficiently competitive budget to win the contract from the client is critical at this stage.
3. Front end engineering	At this stage, the concept is tested and a detailed specification generated. The project requires scientists, engineers and project managers to design the asset and establish the detailed programme to construct it. It may be undertaken by a specialist ECI contractor, a client or a partnership of the two.
4. Detailed Design	The specification for the asset is turned into a workable design, again by a highly qualified team. It is critical at this stage to ensure the technical, construction and project plan is precise and correct. Mistakes will mean the asset will not be as productive or cannot be built to the planned budget.
5. Construction	The design is turned into a physical reality using a range of engineering professions and skilled trades. It is critical at this stage to manage the programme since major scale construction projects can rapidly slip behind plan. Overspend is l kely if the project team fail to appropriately control activities, people and expenditure. Without proper risk analysis, sites risk mitigation and safety management could become inherently unsafe.
6. Pre commissioning	This is to ensure the asset can achieve its acceptance criteria agreed at earlier engineering and design stages. It is usually done by the ECI contractor under close supervision of the client.
7. Commissioning	This is where the processing plant is handed over to the owner operator. It is critical at this stage to ensure communication between contractors, the client and their operations team. When well-briefed and well-trained, the operation team will hit productivity targets quickly. Otherwise, the result is a slow start and potential loss of production, which may threaten the commercial viability of the plant.
8. Maintenance	This is the repair and renewal of parts of the asset, either on an ongoing basis or as a refit (often a large project in its own right). It is critical at this stage to understand the performance of the processing plant and know how to respond to increase its productivity.
9. Dismantling	When the facility is dismantled and removed, the process includes ensuring that the land is returned to an uncontaminated state and is ready for re-use. Often, this is a major project, particularly with respect to nuclear sites.

Companies specialising in engineering construction services will focus either on a particular client sector (e.g. nuclear, power, pharmaceutical, offshore oil and gas) for whom they design, build and maintain a production asset such as an oil rig or petrochemical processing plant; or they will focus on a particular activity (design, project management, construct or maintain) where they will offer a world-

class service. The very nature of the industry is reflected by this diverse range of client activities where engineering construction takes place.

It is a workforce that trades both domestically and abroad. Revenue is earned through fixed term or fixed output contracts for which the ECI companies will bid, often competing against global players. Given the contracting nature of most of these overseas projects, it is difficult to undertake a meaningful analysis. However, it is clear that this type of work makes a substantial contribution to the demand for skilled ECI labour. In 2006, for example, the 396 reported overseas employment represents a very small proportion of the overall ECI employment in the Great Britain. However, other estimates suggest that this figure is nearer 10,000.[4]

While the services of the industry are engineering based, the nature of engineering construction is very different from that of, for example, manufacturing. Engineering construction is cyclical and much work is undertaken on a project by project basis. On a global scale the industry tends to win a relatively small number of high value projects at irregular intervals. Whilst contractors employ a core workforce, short-term contracts proliferate. These on a project by project basis do not provide a solid foundation for all companies involved to maintain high levels of investment in the whole workforce. Companies tend to employ people on contract as and when they need them (also known as labour only). In the engineering and design offices, agency staff are used regularly and comprise typically a third of the workforce, but can be as high as 80%.

Critical Issues for the Industry

The following issues are critical to all companies operating in the ECI:

1. **safety, health and environment:** processing plants and sites have the potential to inflict serious and fatal injury, death and environmental damage on a large scale. The industry invests heavily in the safety requirements of its workforce and the protection of the environment and general public.
2. **risk management:** despite the considerable amount of design and planning for each contract, there remains risk associated with the delivery. If mismanaged, these risks can lead to considerable financial losses without appropriate risk analysis and mitigation.
3. **technical and commercial certainty:** a contract offered, for example, to build a nuclear power station in a fixed time and at a fixed cost has significant risks. The industry invests in the technical skills and project planning required to ensure that these are managed, measured and appropriately rewarded.
4. **programme and project management:** delivering complex process plants, involving a large workforce, requires close management and control. The industry invests in the skills and procedures necessary for such effective project management.
5. **productivity:** like most sectors, productivity means profit both for the contractor and the plant operator. The industry invests heavily in the techniques required to ensure new build, repair and maintenance occurs quickly, accurately and cost effectively.
6. **continuity of demand:** the industry is characteristically driven by contracts and relies on clients for discrete packages of work. The result is uncertainty in anticipating future work, which makes forward planning, especially for skills and workforce development, particularly difficult. Currently, the industry recognises the potential of high demand in future client contracts, but until this is converted to orders it becomes increasing difficult to identify the investment in the skills required[5].

2.2. Overview of Client Sectors as the Driver of ECI Skills Demand

The SSCs members of the Cluster that contributed to this Report represent the clients of the ECI. It is from these client sectors that the anticipated and increasing demand will be identified as significant ECI drivers to design, install, repair and maintain.

[4] IES, Stage 1: Skills Demand Assessment, 2008
[5] ECITB, Securing Engineering Construction Skills for the Future, 2008

2.2.i Power Generation, Energy and Carbon Capture

Irrespective of the source of new power generation, whether this will be from renewables or nuclear or conventional sources, the ECI will be called upon to maintain the existing and replace the ageing power generation plant in the UK, as well as create carbon capture solutions. This will place a significant demand for ECI skills and capabilities.

It is likely that new power generation facilities will be built over the next ten years within the UK. From the client sectors that impact the ECI, the infrastructure necessary to support energy requirements probably has the greatest stability and certainty of demand. Much of the immediate new power plant will be combined cycle gas turbine (CCGT) gas-fired stations, which are needed to bridge the supply gap as old stations close in the 2010s and before the new nuclear and renewable power generation come on line. Some coal-fired generating plants, which use integrated gasification combined-cycle process (IGCC), are likely to be built. Overall, this is a more complex process than a conventional boiler and turbine system, but it can co-fire with a range of fuels, including biomass.

The energy sector will also seek to build some new, super-critical, coal-fired capacity, both to hedge against over-dependence on gas and to provide a flexible output to meet rapid changes in load. Nuclear new build has a longer lead time, with construction of the first station unlikely to start before 2012 and first nuclear power generation facilities to arrive in 2018 at the earliest.

New power stations and renewable energy projects may place a demand on companies involved in the research, testing and development of equipment, new technologies and materials for wind turbines such as composites and mechanical equipment for hydro, wave and tidal power. Although it is not possible to identify companies specifically involved in this area of activity easily, the ECI is likely to have some involvement such as the installation, repair and maintenance of such facilities.

2.2.ii Renewable Energy

The contribution to the 2020 target for renewable energy from wind power, both onshore and offshore, will require about 10,000 turbines to be installed. Each structure, particularly offshore facilities, are themselves complex pieces of engineering combining a range of scientific disciplines (aeronautical, structural and electronic engineering). The construction skills required to build large and complex engineering structures often takes place in a hostile and remote environment. Given the high level of global demand for wind power "it is arguable that a UK manufacturing capability will be required"[6]. This requires policy certainty in areas such as planning policy, grid connection and labour supply.

There are no reliable estimates of current UK employment in renewables or its growth potential, although given the growing certainty of a policy framework centred on 15% of UK energy from renewables by 2020, such forecasting should now be more reliable. However, the increase in carbon price will drive progressive, incremental demand pressure on the ECI workforce and competition for talent is likely to be at the same time as demand growth in other energy areas. On and offshore wind will be a growth area in the renewables sector that will also place further demand on ECI skills.

2.2.iii Carbon Capture and Storage

In common with other priority areas, carbon capture and storage will draw on the ECI skills base to design and build the facilities. However, this as yet is an immature sector and so estimates of the numbers of people need and when are at best approximates.

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

Clean coal with CCS is likely to become part of the UK's generation mix to give a balance of renewables, baseload nuclear energy, clean coal and limit dependence on gas, whilst at the same time providing a flexible capacity to handle rapid load change. Coal accounts for 41% of electricity supply worldwide and this is expected to rise to 45% by 2030[7]. Replacing all these facilities with a low-carbon alternative in the timeframe for carbon reduction is not feasible. Retro-fitting of CCS facilities will be necessary for recognition of the global importance of CCS, both coal and gas (for

[6] BWEA: 2020 vision, 2008.
[7] see http://www.eia.doe.gov/oiaf/ieo/electricity.html

example, see the Stern Review[8]). This has already led to UK Government action on R&D, demonstration, regulation and specification that a newly-consented power plant should be "capture-ready".

The EU aims to have 10-12 CCS demonstration projects in Europe by 2015. There will be a similar number in the rest of the world if CCS is to be commercialised and rolled out on the scale necessary from 2020. Since the location of the UK and its offshore geology is well-understood, several of these projects are likely to involve CO_2 storage in depleted gas fields or aquifers on the UK Continental Shelf.

The successful development of technologies to capture, transport and safely store CO_2 emissions will create major industrial and employment opportunities for the UK. Capture technologies are required not just for coal and gas-fired power generation, but for other heavy emitters (steel, aluminium, cement), while transport networks and safe long-term storage facilities are essential to achieve economies of scale and to secure high volume CO_2 capture. CCS involves chemical processes, while the storage involves pipeline, offshore and oilfield technologies. The complexity arises from uncertainties around overall system operability, cost, the amount of energy consumed and the trade-offs, such as whether to dry the carbon dioxide, or install corrosion-resistant metallurgy. The skills to design and build CCS systems will depend upon the skills base that already exist to design and build chemical plants, pipelines and offshore installations. However, capacity is limited and competing demand for these resources, especially if there is continuing rise in global demand for chemical process design, is likely to be high.

The experience gained by the contracting workforce in the oil and gas sectors is critical because storage of CO_2 will demand many of the same engineering skills[9]. The potential scale of CCS technology is largely akin to retrofit of FGD on coal stations and allied to major transportation issues. The limiting factor is proof of large scale and UK engineering knowledge base for scaleability. The flow of people into the industry is insufficient to meet anticipated volume, especially along side competing client sectors pursuing the same skills base. The result is a lag effect, where there is a lack confidence until orders are placed. At present the scale is inefficient and the mix of low carbon (nuclear, coal, renewables etc.) lacks the necessary certainty.

2.2.iv The Nuclear Sector

The development of new nuclear energy capacity will begin to have a significant manpower impact on the contracting community from 2015/2016 onwards. The ECI forms a critical element of the supply chain and will fall short in both numbers and quality unless skills investment rises.

The existing nuclear fleet contributes around 18% of the peak demand level for electricity and, as a stable base load supply, the nuclear contribution to energy use increases during periods of reduced demand when (mainly) coal-fired stations are taken off-line. Currently, nuclear power is the largest component of low-carbon electricity programme – zero at point of generation – and is recognised by Government as an important contribution to the UK energy mix, along with renewable sources and energy conservation. It is a significant low-carbon alternative that has demonstrable generating capacity to match, if not exceed, that of traditional fossil fuels on a station-for-station basis.

However, the fleet is ageing and only one nuclear-powered electricity station (Sizewell B) has an operating plan beyond 2025. There is currently a high expectation that nuclear new build will begin within the next two to three years, with the formal assessment and licensing process already underway. Government has identified 10 sites as potentially suitable in England and Wales for new nuclear power stations to be built over the next 15 years. Final approval, following public consultation and parliamentary scrutiny, is expected in 2010. All sites under consideration are on or near existing nuclear sites. The intention is that the first of these will be on line by 2018.

These are significant engineering projects and, even assuming that the reactor designs will be imported, the infrastructure to house the reactor and "take off" the power to the grid pose a substantial impact on the engineering construction workforce.

New nuclear power station projects may place a demand on the research, development and manufacture of turbines and electricity distribution and supply equipment. The ECI is involved in the

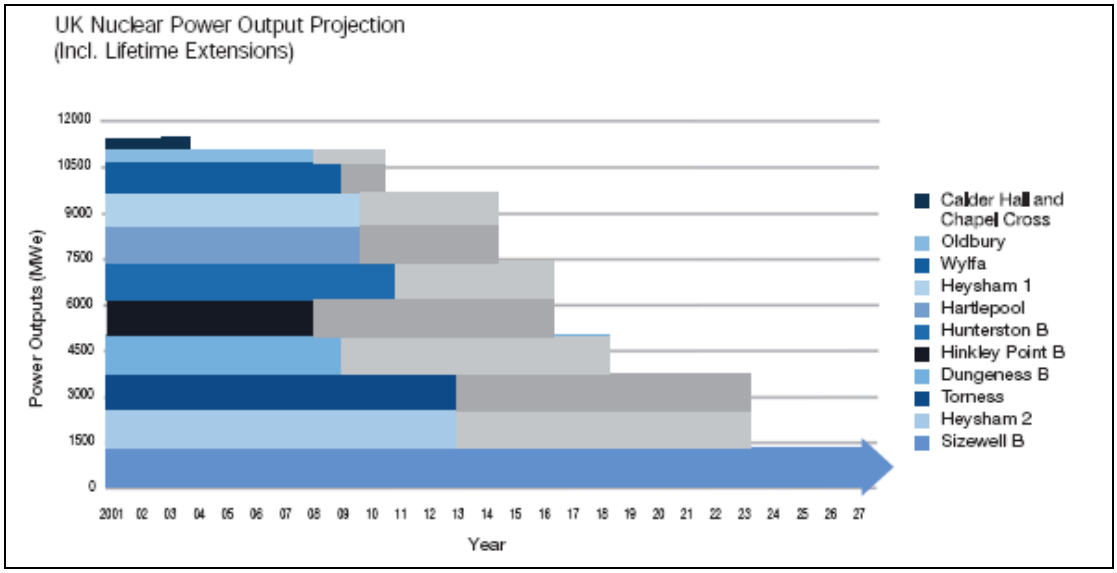
[8] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_Report.cfm
[9] September 2009, The Herald

design stage of the new build programme and forms part of the supply chain to install, repair and maintain these facilities in the nuclear sector.

Nuclear Decommissioning and Dismantling

In parallel with building new, the UK needs to decommission and dismantle the existing fleet of AGR reactors.

The chart below is taken from 2009-2025 Power People: The Civil Nuclear Workforce[10] and shows the planned timing of future decommissioning.



2.2.v Oil and Gas

The ECI enables both the upstream (exploration and extraction) and downstream (processing and distribution) activities of the oil and gas industry.

Upstream Activities

Oil and gas is a global industry and the UK is a major player. There are approximately 30,000 people employed directly in the oil and gas companies and their major contractors in the UK. A further 260,000 are employed in the supply chain and another 190,000 in induced employment.

Oil and gas extracted from the UK Continental Shelf (UKCS) satisfies about two thirds of the UK's primary energy demand and it meets 97% of oil demand and 73% of gas demand. This is unlikely to change significantly in the next 10 years[11].

At peak, the UK was ranked as the twelfth largest overall producer (oil and gas combined), which is larger than Kuwait, Nigeria and Indonesia. It is estimated that the more-difficult-to-extract reserves in the UK oil and gas basin could contain as much as 25bn barrels of ultimately recoverable raw material. This is worth well over £1 trillion to the UK economy at recent market values.

Some of the world's largest oil and gas engineering companies are based in the UK and have a global outreach to draw from a pool of indigenous skills that has been built around a generation or more of extraction from the UKCS. Competition between companies to address their skill gaps and shortages shortfall in the UK often means that employers from this sector and others are all vying to employ the same ever-decreasing groups of trained people.

[10] published by Cogent in 2009
[11] UK Oil and Gas, Oil and Gas Economic Report, 2009

Downstream Activities

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

Capacity in the UK is the fourth largest in the EU. From a high of 18 refineries in 1974, there are now nine refineries remaining in the UK. To achieve current capacity, these remaining refineries have become larger and more complex over time.

UK refineries process domestic crude oils from the North Sea (approx 70% of capacity) as well as imported oils. Outputs are dependent upon the type of oil being processed and is also constrained by the processing equipment at the refinery. Typically the UK produces an excess of gasoline, which is exported, and a deficit of diesel oil and jet fuel. Overall, the UK refining production is moving further out of line with product demand, resulting in an increase for imported diesel and jet fuel. This is being driven by the increase in use of diesel fuel for transport in the UK, the changing qualities of crude oil, feedstock and the need to meet environmental targets. Re-addressing this trend will require significant investment in new process facilities. In addition, low-sulphur oil from the North Sea is becoming more expensive, in line with prices for light, sweet crude globally.

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

2.2.vi The Chemical and Pharmaceutical Sectors

The ECI designs and constructs the plants that facilitate the production of chemicals and medicines to meet the UK pharmaceutical and chemical industrial needs.

All chemicals end up being used in products and services purchased by the consumer. There may be many stages between the processing of a chemical and the final consumer, but it is estimated that each UK household either directly or indirectly spends around £30/week on chemicals.

With a turnover of £55 billion, the chemicals sector is one of the largest manufacturing industries in the UK and has one of the highest growth rates at 5 per cent per annum over recent years.

The UK's chemical industry has an 8.2 per cent share of the world market, spends in excess of £2 billion per year on new capital investment.

Approximately 214,000 people are employed in the manufacture of chemical ingredients used in the production of a wide range of products such as pharmaceuticals, paints, plastics and textiles.

Bulk chemical production for the pharmaceutical sector is leaving the UK and manufactured cheaply instead overseas. The production of the active ingredient remains in the UK, but this is required in tiny amounts. Therefore the scale of pharmaceutical companies is likely to diminish, although somewhere these two sets of products will need to be combined. However, because pharmaceuticals are heavily regulated this reduction in scale in the UK will take time to have an effect.

The pharmaceutical industry is one of Britain's leading manufacturing sectors, bringing in a trade surplus of £3.4 billion in 2004. Nearly 20 per cent of the world's top medicines were discovered and developed in Britain. Twelve out of the top 25 medicines prescribed by GPs on the NHS are British. The value of UK pharmaceutical exports in 2005 was £12.2 billion, more than £166,000 per employee. Indeed, modern medicines make the third-highest contribution to Britain's trade balance and amounts to some £2 billion a year. The UK-based pharmaceutical industry employs around 65,000 people. A quarter of them are graduates, with about another 250,000 people employed in related industries. The industry requires managers and leaders, science and technology professionals, process operatives and engineers to remain at the forefront of developments.

Industrial Biotechnology

Industrial biotechnology (IB) does not at the moment have sufficient labour market information to go further than identifying this as potential large scale developments. Moreover, this requires political commitment and local planning consent, neither of which can be guaranteed. However, the drivers of energy security and reducing greenhouse gas emissions mean that, at some level, developments like these are very likely. Indeed, the Department for Business Innovation and Skills (BIS) is encouraging

and funding further pilot and demonstration plants with others to collaborate to "ensure the pipeline of talent is captured". It is only right then to plan, as far as possible, for the emergence of the demand in the comparatively near future, despite the lack of detail currently available.

The outcome to these initiatives will continue to develop industrial biotechnology an emerging industry that in turn will place demands on the ECI. Industrial biotechnology involves the use of biological substances, systems and processes to produce materials, chemicals and energy. This could play an essential part in the creation of a low-carbon knowledge-based economy in the UK.

Already the UK is one of the world's leaders in terms of quality of research in this area, but the conversion of this strength into a real return will depend on several factors, including (but not restricted to) the prices and availability of petrochemical feedstocks. However, robust estimates of the global IB market by 2025 range from £150 billion to £360 billion and similar estimates for the UK IB market range from £4 billion to £12 billion. ConstructionSkills' data indicates that there is around £1.3bn worth of work on current, planned and proposed construction of Laboratories/Research and facilities.

2.2.vii Transportation infrastructure (rail engineering)

In terms of transportation and infrastructure, an increase in commissioning or developing of the public transport infrastructure such as additional railway lines and light rail infrastructure is likely to lead to an increased demand for the fabrication and erection of steel structures for catenary, bridges, stations, stops and related permanent way structures, as well as for the manufacture of rail vehicles, rails and associated mechanical, electrical and electronic engineering infrastructure.

In addition to the ongoing railway maintenance, repair and replacement work being undertaken by or on behalf of Network Rail and a plethora of local infrastructure owners and their contractors, there are a number of key projects being undertaken to improve the rail infrastructure. Some of the new, planned and proposed projects require a new approach and project planning techniques – such as the £500 million plus Edinburgh TIE tram system currently under construction – whilst others – such as the £300m reintroduction of the 'Waverley Route' between Edinburgh and the Scottish Borders – might require less work as some of the physical structures and line may be reusable along its former alignment.

For all new rail projects, such as Crossrail or High Speed Two (the proposed high-speed rail line north from London), the initial construction phase would focus on securing the route including the construction of cuttings, embankments, viaducts, bridges and tunnels; this would require a wide range of skilled staff including civil engineers, engineering technicians and related operatives, as well as other associated skilled construction workers.

For the construction phase, the plans drawn up at the earlier design stage will be critical, which will have involved a wide range of skilled employees including transport planners, civil and electrical engineers, architects and surveyors. Based on these plans building techniques and the materials needed, such as steelwork, will be sourced and produced to specification.

The main areas involving the skills of engineering construction will be around the dismantling of obstructions or those elements of existing infrastructure that will require removal, adjustment or re-establishment, the erection and fabricating of new or replacement steel structures, and the establishment of post-award (or pre-award) and processing and manufacturing plant needed to enable the infrastructure project to be completed. The ECI is likely to supply mechanical fitters, steel erectors, pipefitters, electrical installers and additional personnel such as associate professional, supervisory, semi-skilled and operative level for a variety of tasks. This is particularly for the construction of stations, depots and related permanent way facilities.

Engineering professional and engineering technicians will be involved in the subsequent fitting-out of depot maintenance and repair facilities, as well as stations (escalators, lifts, automatic doors, etc) and installation of electrical and electronic equipment. This is also true for existing rail infrastructure refurbishment and enhancement projects – such as the forthcoming £1.1bn electrification of nearly 300 miles of track including the Great Western Mainline between London Paddington and Swansea and the Liverpool to Manchester route, confirmed in July 2009.

2.2.viii Science, Engineering, Process and Manufacturing Technologies

Some specific manufacturing areas covered within this sector have a particular link in the supply chain in relation to engineering construction. For example, oil and gas exploration projects involve building and repairing of ships, including construction of drilling platforms, floating or submersible/construction of floating structures. This may entail the manufacture of modules, jackets and topsides. ECI projects would undertake the modular construction aspects, where modules are manufactured off-site before being transported onsite for hook-up or installation and commissioning.

The field of bio-sciences is another instance where there is around £1.3bn worth of work on current, planned and proposed construction of laboratories/research facilities. Further new engineering construction projects using metal structures will require the supply and manufacture of the necessary metal structures, fixings and electrical monitoring equipment. All these illustrate how the ECI are involved to install, repair and maintain this type of equipment at these sorts of processing plants.

The level of public investment and support given to engineering construction will have a notable effect on many of the industries in the construction supply chain, specifically manufacturers of building products, refractories, concrete, extractives, coatings, glass and furnishings. The effects on employment and skill demands in these industries are currently hard to define without clearer estimations of the investment and demand from the market, and further work will have to be done to establish needs across all these sectors in the future.

2.3. Industry Footprint

The engineering construction industry has a cross-sectoral footprint that is determined by a Statutory Instrument. It is characterised by its activities, rather than the kind of machinery that is involved or the end customers. This means that companies undertaking engineering construction activities are involved in:

1. Assembly, construction, dismantling, erection, fabrication, fitting, inspection, installation, maintenance, repair, replacement, testing of any chemical, electrical or mechanical apparatus, machinery or plant that is located on any site where a product is processed, including (but not limited to):
    - chemical works;
    - gas making or gas treatment works;
    - nuclear or thermal power station;
    - nuclear waste reprocessing site;
    - hydro-electric station;
    - oil refinery or oil terminal;
    - plant concerned with the exploration for or exploitation of oil or gas;
    - metal smelter;
    - steel or paper mill;
    - brewery or distillery;
    - human and/or animal food production;
    - pharmaceutical, cosmetic and petrochemical production;
    - cement and concrete bricks;
    - glass and paper production;
    - sewerage treatment works; and
    - any other installation involving the processing of any product.
2. The erection and/or dismantling of the main framework of a building or other structure that is made of steel or other metal when erected or dismantled on any site (not necessarily on a site where a product is processed). Types of structures erected or dismantled could include, for example, supermarkets, warehouses, stadiums, agricultural buildings, office blocks, etc.
3. Supervision of the activities listed above.
4. Research, development, design or engineering construction drawing (either created by hand or by computer related software) or dynamic simulation.
5. Buying, selling, hiring out, testing (including NDT), advertising, packing, distribution, transport or any similar operations.
6. Operations of a kind performed at office premises or laboratories, or at stores, warehouses or similar places.

7. Cleaning, washing or garaging vehicles or carrying out running repairs or minor adjustments thereto.
8. Training of employees or apprentices.

Nearest SIC Code Description of the Industry

Recent research found when the Standard Industrial Classifications (SIC) system is applied to the ECI, it too often proved cumbersome[12]. The SIC 2003, for instance, is limited to client sectors where often engineering construction takes place within the description given, but the activity of engineering construction itself is not distinctly identified from that of client operations. This inadequacy of SIC 2003 is anticipated to be partially addressed in the 2007 version of SIC. It is perhaps the closest classification system from the two, which importantly has codes dedicated to the engineering design, installation, maintenance and repair at processing plants for the first time. The difficulties remain as manufacturing categories could include activities where the ECI operates in, while the repair categories could equally cover other non-ECI activities.

The client priority areas in terms of applicable SIC 2003 and where engineering construction is likely to occur include:

Client Sector	Representative SSC	SIC 2003
Property, housing, cleaning and facilities management	Asset Skills	• 70.32 Management of real estate on a fee or contract basis (used as a proxy for facilities management).
Civil construction	ConstructionSkills	• 45.1 Site Preparation • 45.2 Building of complete construction or parts; civil engineering • 45.32 Insulation work activities • 45.34 Other building installation • 45.4 Building Completion • 45.5 Renting of construction or demolition equipment with operator • 74.20/4 Engineering consultative and design activities • 74.20/5 Engineering design activities for industrial process and production • 74.20/6 Engineering related scientific and technical consulting activities • 74.20/9 Other engineering activities
Nuclear power generation (including decommissioning)	Cogent	• 23.30 Nuclear fuel processing (note this is only the nuclear generation related SIC and most of the industry is not covered)
Industrial Biotechnology and bio fuel	Cogent	• 24.14 Manufacture of other organic basic chemicals • 24.15 Manufacture of fertilisers and nitrogen compounds • 24.41 Manufacture of basic pharmaceutical products • 24.12 Manufacture of dyes and pigments • 24.42 Manufacture of pharmaceutical preparations • 24.51 Manufacture of soap and detergents, cleaning and polishing preparations • 24.52 Manufacture of perfumes and toilet preparations • 24.62 Manufacture of glues and gelatine • 24.63 Manufacture of essential oils
Oil and Gas	Cogent	• 11.10 Extraction of crude petroleum and natural gas • 11.20 Service activities incidental to oil and gas extraction excluding surveying
Large scale power generation	Energy and Utility Skills	• 40.11 Production of electricity
Energy from waste	Energy and Utility Skills	• 40.11 Production of electricity
Carbon capture and storage	Energy and Utility Skills	• 40.11 Production of electricity
Transportation infrastructure (rail engineering)[13]	GoSkills	• 60.10 Transport via railway transport
Process manufacturing, coatings, extractives, glass, building products and furniture industries	Proskills	• 14.21 Operation of gravel and sand pits • 14.5 Other mining and quarrying not elsewhere classified • 26.11 Manufacture of flat glass

[12] IES, Stage 1: Skills Demand Assessment, 2008
[13] This sector is included for the purposes of this report, although the ECI may have limited involvement

		• 26.12 Shaping and processing of flat glass • 26.14 Manufacture of glass f bres • 26.15 Manufacture and processing of other glass including technical glassware • 26.23 Manufacture of ceramic insulators and insulating fittings • 26.24 Manufacture of other technical ceramic products • 26.25 Manufacture of other ceramic products • 26.26 Manufacture of refractory ceramic products • 26.3 Manufacture of ceramic tiles and flags • 26.4 Manufacture of bricks, tiles and construction products in baked clay • 26.51 Manufacture of cement • 26.61 Manufacture of concrete products for construction purposes • 26.63 Manufacture of ready-mixed concrete • 26.65 Manufacture of f bre cement • 26.66 Manufacture of other articles of concrete, plaster and cement • 26.82/9 Manufacture of other non-metallic mineral products not elsewhere covered • 36.14 Manufacture of other furniture
Transportation infrastructure (rail engineering)[14] *(60.1 Transport via railways)*	Semta	• 35.20 Manufacture of railway and tramway locomotives and rolling stock • 31 Electrical equipment manufacture
Nuclear[14] *(23.3 Processing of nuclear fuel* *40.1 Production and distribution of electricity)*	Semta	• 73.10 Research and development • 29.11 Manufacture of engines and turbines • 29.23 Manufacture of non-domestic cooling and ventilation equipment • 33.30 Manufacture of industrial process control equipment
Power generation[14] *(40.1 Production and distribution of electricity*)	Semta	• 73.10 Research and development • 29.11 Manufacture of engines and turbines • 28.11 Manufacture of metal structures and parts of structures • 33.30 Manufacture of industrial process control equipment • 40.1 Production & distribution of electricity
Processing and manufacturing[14] *(40.1 Production and distribution of electricity* *23 Manufacture of coke oven products* *24 Manufacture of chemicals and chemical products)*	Semta	• 28.11 Manufacture of metal structures and parts of structures • 28.74 Manufacture of fasteners, screw machine products, chains and springs • 33.30 Manufacture of industrial process control equipment
Oil and gas exploration projects[14] *(11 Extraction of crude petroleum and natural gas, etc.* *40.1 Production and distribution of electricity* *23 Manufacture of coke, refined petroleum products and nuclear fuel* *24 Manufacture of chemicals and chemical products)*	Semta	• Building and repairing of ships, including construction of drilling platforms, floating or submersible/construction of floating structures (see detail given above).
Water and environmental[14] *(41 Collection, purification and distribution of water)*	Semta	• 33.30 Manufacture of industrial process control equipment
Building services and engineering	SummitSkills	• 45.31 Installation of electrical wiring and fittings • 45.33 Plumbing • 52.72 Repair of electrical household goods

The client priority areas in terms of applicable 2007 SIC and where engineering construction is likely to occur include:

Client Sector	Representative SSC	SIC 2007

[14] Areas of manufacture in support of the 'client', based on the supply chain from Semta's footprint

Property, housing, cleaning and facilities management	Asset Skills	• 81.1 Combined facilities support activities
Civil construction	ConstructionSkills	• 41 Construction of Buildings • 42 Civil Engineering • 43.1 Demolition and site preparation • 43.29 Other construction installation • 43.99 Other specialised construction activities n.e.c. • 71.12 Engineering activities and related technical consultancy • 71.12/1 Engineering design activities for industrial process and production • 71.12/2 Engineering related scientific and technical consulting activities • 71.12/9 Other engineering activities (not including engineering design for industrial process and production or engineering related scientific and technical consulting activities)
Nuclear power generation (including decommissioning)	Cogent	• 24.46 Processing of nuclear fuel
Chemical and pharmaceutical (affected by the emerging biotechnology industry)	Cogent	• 20.14 Manufacture of other organic basic chemicals • 20.15 Manufacture of fertilisers and nitrogen compounds • 21.10 Manufacture of basic pharmaceutical products • 20.12 Manufacture of dyes and pigments • 21.20 Manufacture of pharmaceutical preparations • 20.41 Manufacture of soap and detergents, cleaning and polishing preparations • 20.42 Manufacture of perfumes and toilet preparations • 20.52 Manufacture of glues and gelatine • 20.53 Manufacture of essential oils
Gas, power, waste management and water sectors	Energy and Utility Skills	• 35.11 Production of electricity
Transportation infrastructure (rail engineering)[13]	GoSkills	• 49.10 Passenger rail transport, interurban passenger facilities at railway stations • 52.21/2:Operation of rail
Process manufacturing, coatings, extractives, glass, building products and furniture industries	Proskills	• 23.2 Manufacture of refractory products • 23.32 Manufacture of bricks, tiles and construction products, in baked clay • 23.43 Manufacture of ceramic insulators and insulating fittings • 23.44 Manufacture of other technical ceramic products • 23.51 Manufacture of cement • 23.61 Manufacture of concrete products for construction purposes • 23.65 Manufacture of f bre cement • 23.69 Manufacture of other articles of concrete, plaster and cement • 23.99 Manufacture of other non-metallic mineral products n.e.c. • 23.31 Manufacture of ceramic tiles and flags • 23.49 Manufacture of other ceramic products • 8.12 Operation of gravel and sand pits; mining of clays and kaolin • 8.99 Other mining and quarrying n.e.c. • 9.9 Support activities for other mining and quarrying • 23.63 Manufacture of ready-mixed concrete • 31.09 Manufacture of other furniture • 23.11 Manufacture of flat glass • 23.12 Shaping and processing of flat glass • 23.14 Manufacture of glass f bres • 23.19 Manufacture and processing of other glass, including technical glassware • 43.34/2 Glazing
Science, engineering and manufacturing technologies	Semta	• 20.51 Manufacture of explosives • 20.51 Manufacture of explosives • 22.11 Manufacture of rubber tyres and tubes and retreading and rebuilding of rubber tyres • 24 Basic metals (excluding processing of nuclear fuel) • 25 Fabricated metal products (includes manufacture of

		weapons and ammunition) • 26 Manufacture of instruments and appliances for measuring, testing and navigation (includes electronics and medical devices) • 27 Electrical equipment • 28 Manufacture of machinery and equipment, i.e. Mechanical equipment • 29 Motor vehicles (automotive) • 30 Other Transport equipment (includes marine and aerospace) • 33.15 Repair and maintenance (R&M) of ships and boats (marine R&M) • 33.16 Repair and maintenance of aircraft and spacecraft (aerospace R&M including MROs) • 33.17 Repair and maintenance of other transport equipment (includes railway rolling stock). • 33.10 Repair of fabricated metal products, machinery and equipment • 33.11 Repair of fabricated metal products • 33.12 Repair of machinery • 33.13 Repair of electronic and optical equipment • 33.14 Repair of electrical equipment • 33.19 Repair of other equipment • 33.20 Installation of industrial machinery and equipment • 43.29 Other construction installation (includes lift and escalator installation) • 46.72 Wholesale of metals and metal ores • 71.12/1 Engineering design activities for industrial process and production • 71.20 Technical testing and analysis • 72.10 Research and experimental development on natural sciences and engineering • 72.11 Research and experimental development on biotechnology • 72.19 Research and experimental development on natural sciences and engineering
Building services engineering	SummitSkills	• 43.21 Electrical installation • 43.22 Plumbing, heat and air-conditioning installation

In the case of new build, for example, the ECI would typically undertake the engineering design, project management, procurement and installation of the mechanical and electrical plant and equipment. Similarly, the construction industry, represented by ConstructionSkills, would typically be engaged under sub-contract to build the foundations and fabric of the power station. Once construction is completed, operation, maintenance and safety regulation of the power station itself will be undertaken by the owner (client) who is represented by Cogent. However, ECI is often engaged to carry out repair and maintenance activity. When a nuclear power station reaches the end of its operating life, the operator (client) is responsible for taking it out of service (decommissioning) and it is then typically dismantled by contractors within the engineering construction industry.

This illustrates how when SIC are applied to the engineering construction industry, they fall across numerous categories. It means that often the ECI operates in the activities listed in the 2003 and 2007 SIC above. However, whilst 2007 SIC codes do not readily map to the ECI, the following table is indicative of certain SIC 2007 that directly reference ECI type activities and highlights what contractors actually "do" at asset-owning client sites. These 2007 SIC codes are:

Contracting Sector	Representative SSB	2007 SIC
Engineering construction	ECITB	• 25.11 Manufacture of metal structures and parts of structures • 25.29 Manufacture of other tanks, reservoirs and containers of metal • 25.3 Manufacture of steam generators, except central heating hot water boilers • 33.11 Repair of fabricated metal products • 33.12 Repair of machinery • 33.14 Repair of electrical equipment • 33.20 Installation of industrial machinery and equipment • 42.99 Construction of other civil engineering projects n.e.c. • 43.11 Demolition • 43.99 Other specialised construction activities n.e.c. • 71.11/1 Architectural activities • 71.12 Engineering activities and related technical consultancy • 71.20 Technical testing and analysis • 72.19 Other research and experimental development on natural sciences and engineering • 78.10/9 Activities of employment placement agencies n.e.c. • 78.20 Temporary employment agency activities • 81.22/2 Specialised cleaning services

These SIC 2007 cannot be back-cast on to SIC 2003 that currently underlies the available official data. For these reasons, sources such as the Labour Force Survey (LFS) and the Annual Business Inquiry (ABI) are not included in this Cluster Report. The remainder of this report relies primarily upon the labour market information collected annually by the ECITB.

3. The Current Demand for Skills

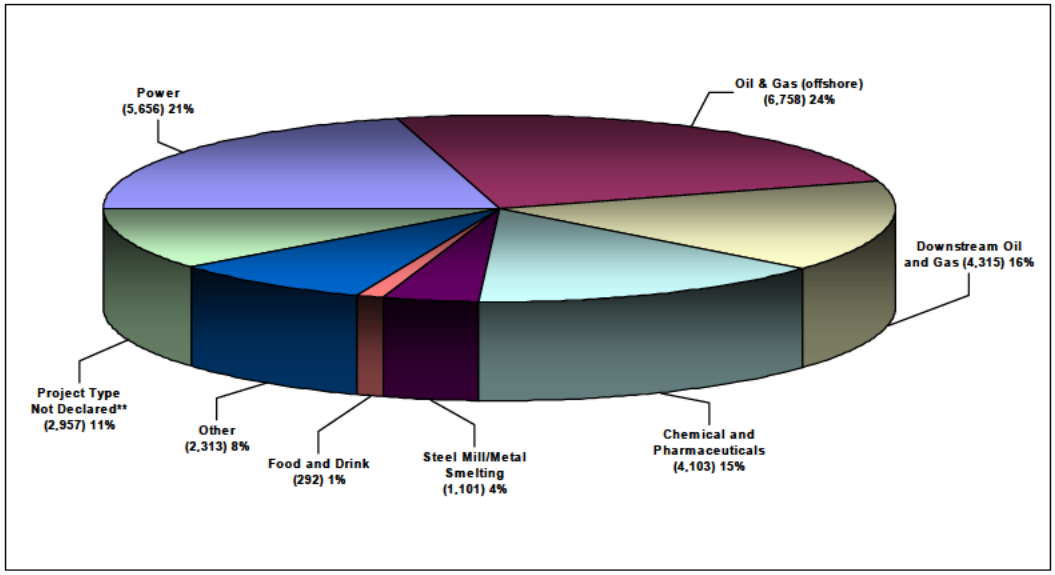
In this section of our report we answer the question "What is the current demand for skills", we describe the ECI by setting out the nature of the workforce and the factors affecting the skills they require. We conclude that this is a:

1. *highly skilled industry in which education, training and qualifications are critical.*
2. *global industry where there is continued demand for the skilled workers*

3.1. The Current Demand from Client Sectors

Demand in the ECI is driven in the main by the need to maintain, upgrade and expand the UK power generation, oil and gas, chemical, pharmaceutical and manufacturing industries. Whilst all of these sectors are forecast to grow, it is perhaps the UK power generation that will place the greatest demand on the contracting industry.

The evidence suggests the following current demand profile[15]:



However the volume of activity in the industry is strongly cyclic. There is also significant in-year variation with seasonal peaks and troughs corresponding to when operators schedule major maintenance work. For example, the craft labour on sites between January 2008 and October 2009 has fluctuated between 12,367 and 7,171[16]. This cyclicality has led to a situation where the workforce contains a high proportion of people who have permanent employment status, but are effectively employed for a fixed period, or sometimes of short duration. On major projects, a substantial proportion of craft workers live away from home for the duration of a particular project.[17]

In 2008, approximately 50% of the workforce was deployed on a peripatetic basis on client-owned asset sites in various locations around the UK. The degree of mobility required from skilled people to follow where this work is may even involve moving from employer to employer in accordance with successful bids. Approximately 24% of the total workforce was recruited on a labour-only basis as and when required to meet client demand. For the engineering and design, agency staff is used regularly and comprise typically a third of the workforce, but it can be as high as 80%.

[15] ECITB, Industry Report, 2008 (S1M07 post-award workforce)
[16] National Joint Council data
[17] Department for Business, Innovation and Skills, Productivity Review, 2009

3.2. Location of Activity

Although engineering construction activity is undertaken throughout the UK, there are clusters of companies with a specific focus in particular locations based upon the type of processing plant e.g the North East has a strong chemicals sector. With the exception of offshore activities in Scotland and the dominance of engineering design and project management activity in the South East, the skill requirements of individuals within the industry are similar across the UK.

The ECI is a contracting workforce that is by default highly mobile. It is a feature that allows the industry to respond effectively to client projects, regardless of where the sites are located nationally. The mobility of personnel from employer to employer and from client sector to client sector requires a breadth of skills and knowledge that can be effectively deployed in each of the four nations. It is not unusual to find employees domiciled in one nation and working in another.

This flexibility means that competition between companies to address their skill gaps and shortages in the UK can often lead to a situation where all are vying to employ the same ever-decreasing groups of trained people. The current economic downturn will release groups of 'almost-appropriately' trained individuals from specific sectors, such as civil construction and civil engineering. To address the skill shortage issues, and enable successful re-employment within the growing engineering construction industry. This population may require re-skilling or, if the migration is from the civil construction or manufacturing sectors, up-skilling. The latter is particularly true of craft operatives working to higher tolerance or more stringent specification.

There may be instances where it is appropriate to utilise migrant/mobile labour (including UK citizens), rather than to provide training. However, as discussed elsewhere in this report, this is not a viable solution long-term.

Regional Distribution of the Workforce

- **England (excluding SW England):** 66% of the ECI workforce is employed in England. Engineering construction activities are dispersed across the regions with power generation, downstream oil and gas and chemical and pharmaceuticals making up 30% of those employed at a site where the client-owned asset is located.
- **Scotland (including offshore sector):** 30% of the ECI workforce are employed in Scotland, where activity is dominated by the offshore sector based mainly in Aberdeen. Approximately, 30% of the ECI population that are working at a site where the client-owned asset is located are involved with the offshore oil and gas industry, whereas the remaining population is divided between other sectors.
- **Wales (including SW England):** 5% of the workforce is employed in Wales, where 10% of the workforce found at a site where the client-owned asset is located are mainly involved in power generation, downstream oil and gas and steel mill/metal smelting.
- **Northern Ireland:** The majority of engineering construction activity in Northern Ireland is undertaken by companies based in Great Britain. Approximately 0.1% of the workforce is domiciled in Northern Ireland.

3.3. Workforce Demographics

The data on demographics demonstrates and supports findings from recent labour market research that the ECI overall workforce has a specific set of characteristics:

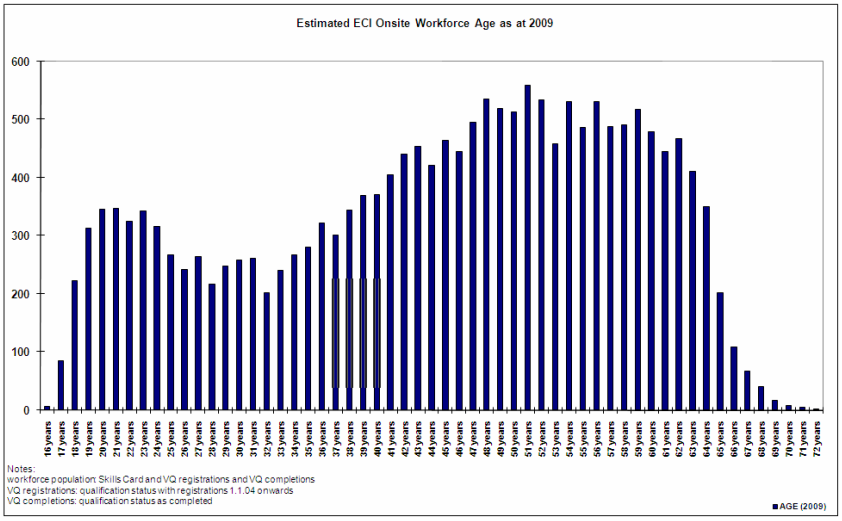
a) 90% are males and the remaining 10% are women (or 9:1), which is lower than the 18% of women found in Science, Engineering, Construction and Technology (SECT) sectors[18]
b) 97% are white, which is higher than the 90% nationally across Great Britain, and 3% are from under-represented backgrounds, compared with 10% of the British population[19]
c) an ageing population, e.g. the average age of manual workers holding an ECITB ACE card is 49 years, and points to a similar trend in the UK as a whole when in 2008, for the first time, the population consisted of more people at pensionable age than children under the age of 16.[20]

[18] JIVE (Bradford College) the UK national partnership
[19] BBC News, 8 April 2008
[20] The Guardian, 22 August 2008

The workforce appears to be representative of the 1970s demographic, when many were recruited, and the geographically remote centres of some ECI activity also mirror the narrow diversity in the local population. The under-representation of women and minority workers reflects a wider pattern of occupational segregation in science, engineering and technology industries generally[21].

Age of Workforce

The industry has an ageing workforce. The evidence presented here particularly explores the demographics in relation to the proportion of the ECI workforce found at a site where the client-owned asset is located. Over the next ten years, if action is not taken, approximately two people are anticipated to retire for every one person that joins the industry. The chart below shows how the overall age profile of this population will impact on engineering construction:



Although we cannot confirm whether these persons remain active in the industry, it does illustrate the flow of people going into engineering construction. For example, the decline in the numbers of individuals reported in each age from 50 years and younger is noticeable. The graph indicates that as older members of the workforce approach their retirement, there will be insufficient qualified people to follow as replacement. On average, we can expect the retirement age to be 65 years, although this will vary. It is of increasing concern that the flow of people aged over 40 into the industry is almost twice as great as those under the age of 40. These figures represent slightly less than 50% of the total ECI population: the remaining ECI workforce involved in pre-award activities is affected in the same way. This especially corroborates with data on the predicted ECI demand discussed in "Securing Engineering Construction Skills for the Future"[22].

The mobility feature of those employed in the ECI enables a fluidity that allows their work pattern to shift from the contracting workforce into the client sector depending upon the projects initiated. This message re-enforces those from the recently conducted review into the productivity of the ECI[23]. The findings concluded that clients will need to engage significantly in partnership with the ECI community to communicate strategic demand signals and take responsibility for the future and planned projects.

3.4. Factors that Drive Demand and Shape the Current Workforce

The skills mix in the ECI workforce is shaped by the structure of the industry, the impact of globalisation and the need for productivity improvements. Below, we describe and explore each of these.

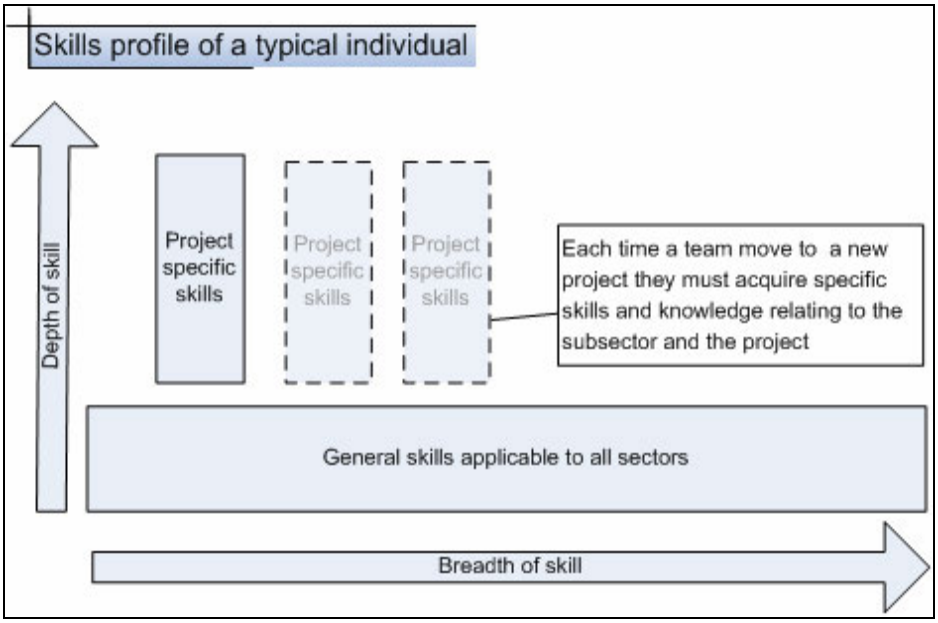
The Impact of the Structure of the Industry on the Current ECI Workforce

The structure and type of work is a major factor that shapes the skills mix of the workforce. Typical features are:

[21] BERR, The Energy White Paper, 2008
[22] http://www.ecitb.org.uk/AboutECITB/SecuringEngineeringConstructionSkillsForTheFuture/
[23] Mark Gibson, BIS Review of Engineering Construction, 2009

- **The safety critical nature of the work**: all workers need to understand or be competent to operate safely in hazardous environments. The cost of getting safety wrong ranges from the tragic disaster of Piper Alpha and the explosion at the Buncefield Oil Storage Depot through to individual reportable incidents that occur each week.
- **working patterns and the contracting nature of employment**: research conducted in 2005 showed how those employed in engineering construction were less likely to come from the regions where they were working (62% as opposed to 67% of workers on other construction sites), which leads to high degrees of labour mobility[24]. Most ECI employers have core full-time staff supplemented by an ad-hoc workforce hired as labour only on short-term contracts to deliver a specific client assignment. This group are a significant characteristic of the industry as they move into and out of engineering construction for periods of time to meet the peaks and troughs in client demand. The workforce is highly mobile as post-award, and often pre-award, employees are asked to work on contracts and projects that are located some distances from their home or office base.
- **the diverse markets serviced by ECI employers**: the industry is specialised as engineering construction, but the activity takes place across a wide range of different client sectors, including oil and gas, water, environmental, steel and metal, cement, glass, paper, brewing and distillation, food, power generation, nuclear waste reprocessing, pharmaceuticals production, petrochemical and chemical sectors.
- **the cyclical nature of demand**: the broad range of client sectors means that the mix of work varies. As one sector expands, demand from another may be reduced. For example, the chemical industry in the North East is affected by the current economic climate, whereas plans for Britain's first coal-fired power station equipped with carbon capture technology have been backed by the European Commission in Hatfield, near Doncaster. At the same time, the pressure on skills is increased. In the last ten years, overall demand has grown by around 50% in real terms, subsectors that make up that demand have (in the same ten year period) fallen by 50% and then risen to 100% of their 1996 level.
- **working patterns and training**: the majority of firms within the ECI provide services to major clients as discrete and finite contracts. Whilst some companies have framework type agreements lasting several years, the majority relate to a particular task, which once completed is the end of the relationship. There is little continuity of work beyond the project in terms of geographic location and employment. This leads to a large pool of ad-hoc labour which moves from contract to contract.
- **difficulty in attracting sufficient high-quality new entrants into the industry**: power is seen as old-fashioned (although renewables offers comfort). Most engineers from engineering disciplines do not consider working in the power industry once they've graduated. There are larger perceived rewards to be had in other sectors of the economy, particularly by those from the under-represented groups e.g. ethnic minorities and women[25]. Research by ConstructionSkills has previously indicated that the financial services industry was a destination for civil engineering and quality surveying graduates, areas the recession has limited the opportunities available, to create a surplus of more appropriately experienced individuals.
- **the skills profile of a typical employee**: frequent moves between different contracts requires regular upskilling and knowledge transfer as people move from job to job and subsector to subsector. Whilst all employees have a common core of skills, they need additional skills to transfer from one sub sector to another and yet further skills to transfer from one project to another. The typical skills profile of an employee is shown by the diagram below.

[24] ECITB, Assessing Workforce Mobility and Skills in UK Engineering Construction: the Key Findings, 2005
[25] ECITB, Applications from Ethnic Minority Pupils for Training Places, 1998



Employers operating in the ECI seek people with a broad range of skills where they can develop industry and project specific skills. They generally see the provision of general skills as an industry-wide issue – hence their support of the Statutory Act and grant system to develop training provision. Employers understand the addition of increased depth on sub-sector skills and project skills they see as their responsibility.

The Impact of Globalisation on the Current ECI Workforce

The UK ECI is the second largest in the world (after the US only) and the largest in Europe. Globalisation is therefore a major opportunity for the UK. Within the context of ECI, globalisation means:

- the UK industry can exploit international opportunities;
- the UK can compete for inward investment from major international clients; and
- an international workforce

The UK Industry is able to Exploit International Opportunities

Evidence from recent press releases of major UK engineering construction companies demonstrates the global reach of the industry.

- Atlanta, Georgia, United States (16 November 2009) – AMEC Group Ltd was awarded a US$93 million contract by Packaging Corporation of America (PCA).
- Kuala Lumpur, Malaysia (28 October 2009) – AMEC Group Ltd was selected to provide basic engineering studies for Sabah Shell Petroleum Company.
- London, United Kingdom (30 September 2009) – AMEC Group Ltd signed a Memorandum of Understanding with Hindustan Construction Co. Limited (HCC), the leading engineering construction company in India.
- Mexico (12 November 2009): The Costain Group, in a joint venture project, won a British Expertise* International Award for involvement with Energia Costa Azul LNG Terminal in Mexico.
- Scotland (October 2009): Wood Group Ltd was awarded a three-year engineering and construction contract by International Oil company Chevron.
- HOUSTON, Texas (September 22, 2009): Wood Group Ltd was selected by StatoilHydro to provide operations, maintenance and modification services for the two Peregrino wellhead platforms in Brazil.
- Aberdeen, Scotland (09 September 2009) – Petrofac Ltd was awarded a US$2 million contract from Sasol for drilling and testing two exploration gas wells onshore in Papua New Guinea.
- Zug, Switzerland (October 13, 2009), Foster Wheeler Energy Ltd announced was awarded a process design contract by SETE Energy Saudia for Industrial Projects Ltd in Saudi Arabia.

- London (15 Oct 2009): Alstom Power Ltd, in a joint venture project, won the contract to construct a large-scale carbon dioxide (CO_2) capture and storage (CCS) demonstration facility in Canada.
- Renfrew, Scotland (24th July 2009): Doosan Babcock Energy Ltd announced their involvement with a full-scale carbon dioxide capture and storage at Renfrew.

The examples above support our conclusion that the work of the Engineering Construction Industry is increasingly delivered around the world using globalised supply chains and an international workforce. Often international contracts managed by UK companies will stipulate the proportion of local labour to be employed in the build and operate phases. This requires the UK company operating abroad to establish local recruitment and training centres to create a new local workforce.

The UK as a Location for Inward Investment

Clients will seek the most economically advantageous location for their processing plant. All of the client sectors described above are global industries and many can locate their production assets where it is most economically beneficial or where raw materials are abundant. For example, in recent years we have seen a migration to the East of major chemical plants that produce the raw materials for plastics manufacture. New oil and gas fields within Russia have called for new exploration and processing plant. The market for refurbishment is entirely global with process plant in many parts of the world.

A sustained and sustainable ECI workforce is part of the unique attraction of the UK for inward investment.

The International Nature of the Workforce

The mobility of the ECI workforce is not limited by international borders, which presents both challenges and opportunities: skilled UK workers will be attracted to jobs overseas, while foreign workers will seek to work in the UK. It is probable that specialised activities, such as installation and commissioning services, and some specific skills, will be delivered on a worldwide basis. When these services are needed in the UK, Government will need to ensure that the work permit and immigration process is supportive and the sector skills networks, together with the safety regulators, will need to ensure that competence and quality are maintained.

The Impact on Skills of these Factors

Factor	Impact on Skills
The UK industry can exploit international opportunities	To exploit overseas opportunities means that the skills and experience of the UK has to outperform that of the indigenous population, otherwise it is not economically advantageous e.g Brazil to import engineers from the UK. *The UK needs to maintain its lead in science and engineering to maintain this profitable position. The UK ECI needs a flow of suitably educated graduates that it can train for international engineering construction work.*
The UK competes for inward investment from major international clients	The potential investment of global companies seeking to place major process plants in the UK is an opportunity to be exploited. The UK needs a highly capable engineering construction industry that can make this country the lowest cost option for investors seeking to build high technology process plant. *The UK needs to maintain and grow its engineering construction workforce.*
An international ECI workforce.	A highly mobile international workforce is a short-term solution to meet the peaks in engineering construction demand forecasted. However, it is not sustainable. For instance, on UK based nuclear sites the ability to import personnel from overseas increases the risk to security and may not be an option that is acceptable to client companies and regulators. *The UK needs an indigenous workforce to deliver its commitments.*

The Impact of the Need to Increase Productivity on the ECI Workforce

Productivity in engineering construction is, as for other sectors, the level of output for a given input. In engineering construction, the term is applied in a variety of ways using measures of inputs (such as numbers of hours worked), outputs (such as inches of weld completed) and scope of activity (such as time taken for a particular milestone to be achieved) depending on what is of interest.

Relative differences in productivity are the result of different proportions and performance of capital and people used in a particular activity or, at the level of a whole sector, reflect variation in how much is made by the sector versus being bought in from elsewhere.

The debate over whether and how the industry can be more productive is therefore complex and goes beyond the skills of one particular group of employees or part of the supply chain.

Whilst it is accepted that the quality of constructed plant in the UK is generally good, productivity is believed to be variable between projects. Reasons for this variation are a complex mixture of unexpected restrictions caused by the condition of the site which only came to light after construction had started, inadequacy of the design, delays in delivery of equipment to be installed, poor project scheduling or the organisation of the site, low work rates, inadequate supervision and industrial disputes. Low work rates are of particular concern for clients and contractors and these are partly due to high rates of lost or unproductive time on some projects.

The most recent published study of productivity in the ECI industry is from 2005 and was published to stimulate a debate on the subject. It concluded that client companies believe:

- productivity has not become any worse, but that "stagnation" is inadequate and unacceptable.
- value for money is not apparent e.g. clients are concerned that whilst the NAECI base rate (the agreed pay rate for construction workers) has increased significantly over the last decade, productivity has not noticeably improved.
- costs are higher in the UK and that this is not sustainable, in particular the chemical sector where facilities can be located anywhere in the world.

The collective impact of this perception is that clients are setting stringent cost reduction targets over relatively short time periods. To help to achieve these targets, clients are:

- **'designing out' site work**: using modularisation and outsourcing globally on an even greater scale, which is not without challenges. Although modular construction can de-skill some roles, it does require an adequate group of suppliers capable of producing the modules and the transportation of these modules places continuing demands on the environment.
- **phasing repair and maintenance work more evenly throughout the year:** rather than to schedule these through major annual shutdowns, which will facilitate long-term partnering with favoured contractors.
- **looking for alternative methods of utilising labour:** in particular two tier workforces and the greater use of semi-skilled personnel.
- **awarding contracts to foreign companies:** when clients believe that these are more productive with their workforce compared with domestic companies.

The international consultancy Independent Project Analysis Incorporated (IPA) published in 2009 a confidential report, which suggests that the answers to productivity lie in:

- the use of integrated client teams involving construction and operations managers from the beginning of the project;
- investing sufficient time in planning and scheduling before construction;
- the criteria for contractor selection; accepting the lowest price does not always guarantee the most productive outcome;
- the schedule strategy, particularly the amount of design completed when construction begins;
- using robust project controls owned by the client;
- having sufficient numbers of supervisors;
- using local labour (as opposed to men travelling within the UK); and
- involving craft labour in construction task planning.

Generally, the whole industry accepts that productivity is not a partisan issue: clients, contractors and suppliers recognise its importance for the competitiveness of the industry. It is also recognised that to significantly achieve improved productivity and performance requires the commitment and the co-operation clients, contractors, unions and workers.

The Implications for Skills

The actions then to improve productivity are listed in the table below:

Action to Improve Productivity	Skills Issues
Closer and more open partnerships between client and contractor – risk is understood, appropriately shared and rewarded. Much time is lost dealing with disputes over unspecified work or holding up a project programme whilst unplanned and unexpected work takes place.	The skills gap is at the client/contractor interface and is about communication, negotiation and commercial skills. It is important that programme directors on both sides are able to understand the implications of their decisions, explain these and negotiate viable solutions.
Better quality construction programmes and plans – an outcome of more open partnerships. With a clear and better defined picture of what has to be done the right resources can be deployed at the right time. Having labour "idle" whilst waiting for over running work is a major drain on productivity.	The skills gap is project planning and implementation. It is important that project leaders have the skills to plan realistically and accurately. This means understanding the engineering requirement and translating that into accurate materials flows and resource plans.
Better project management – ensuring that work programmes are able to start and end when expected and that the right resource is deployed at the right time.	The skills gap is in project delivery and logistics. It is important the project leaders "procure" the resources correctly so that people and plant are available when they are required.
Better site supervision – ensuring that the workforce understands what is expected of them and is correctly equipped to do the job.	The skills gap is in supervision. It is important that the project team are correctly deployed on tasks for which they are qualified and well motivated. Supervision is about engaging disparate teams.

Generally, skills for productivity are present in many of the leaders and managers in the sector but need improving. For those entering the sector it is critical that they quickly gain relevant experience in project planning and people management.

The ECI keenly awaits the review of productivity and skills in the engineering construction sector that is being led by Mark Gibson, Chief Executive of the Whitehall and Industry Group. The outcomes will facilitate identifying clearly specific factors that influence success for UK-based companies when bidding for UK and foreign engineering construction contracts.

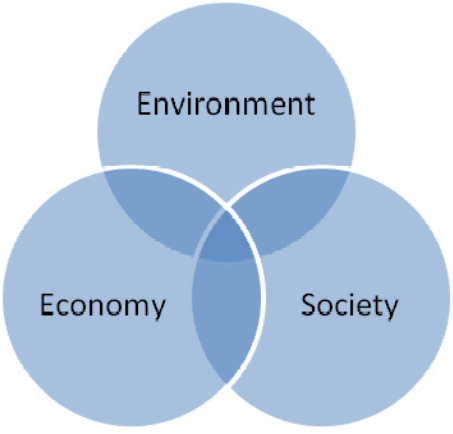
3.5. Other Factors Driving the Skills Mix

As well as the primary factors a number of secondary factors act on the skills mix of the workforce.

Technology Change

Technology in parts of the engineering construction industry is rapidly changing, particularly in the areas of:

- **process design:** the complexity of processes used within the industry continues to increase. In UK Oil and Gas, reserves are increasingly more difficult to extract profitably, but new technology – designed, built and supplied by the engineering construction industry - is making previously unprofitable fields profitable.
- **telemetry and control:** the complexity of major UK assets is increasing and the associated systems to monitor performance and control output are also becoming more greatly sophisticated. The ECI needs to understand the application of these systems and have the technology to install and maintain them.
- **fabrication techniques:** new fabrication techniques, particularly around access and working at height, are ensuring the workforce improves productivity and safety techniques.



Sustainability

The ECI impacts on all three facets of sustainability:

- **environment:** the client projects undertaken by engineering construction contractors can have a major detrimental effect on the environment and (without correct engineering and science) carries high risks of pollution and permanent damage. In relation to nuclear decommissioning and dismantling activities, the skills of the workforce will remediate and return substantial parts of land to conventional use. With the correct skills, these risks can be

mitigated and, with the correct design, the negative impact of the resulting process plant can be minimised.

- **economy:** the industry sustains directly and indirectly many thousands of jobs. The skills to maintain productive outcomes from UK designed and built plant is central to this.
- **society:** in whole regions of the UK the ECI is critical to job and wealth creation. The Nuclear community in the North West and the Chemical Industry in the North East are two examples. When UK companies operate abroad they often recruit, train and employ local labour to leave a legacy way beyond their finite contract.

An example of one ECI company's achievements in sustainability is AMEC Group Ltd when it was ranked the sector leader for sustainability in the oil equipment and services sector of the worldwide Dow Jones Sustainability Index (DJSI) 2009/10.

4. The Current Supply of Skills

In this section of our report we answer the question "What is the current supply of skills?". We set out the main education and training routes for people entering the sector and the main approaches to re-skilling the existing workforce. This shows the major commitment by employers who invest £20m per year in training their existing workforce and the diversity of training options created by ECITB.

4.1. Summary

In 2008, the ECITB maintained and in a number of instances increased the levels of training delivered[26]:

Data on people entering and/or having obtained industry training:

Programme	Planned	Achieved
Apprenticeships	600	750
TECSkills (re-skilling and up-skilling)	650	967
Technical, Supervisory and Management	2,600	3,788
ACE Registrations	2,000	1,100
Regional Discretionary Grants (number of learners supported)	800	6,262
Total	**6,650**	**12,867**

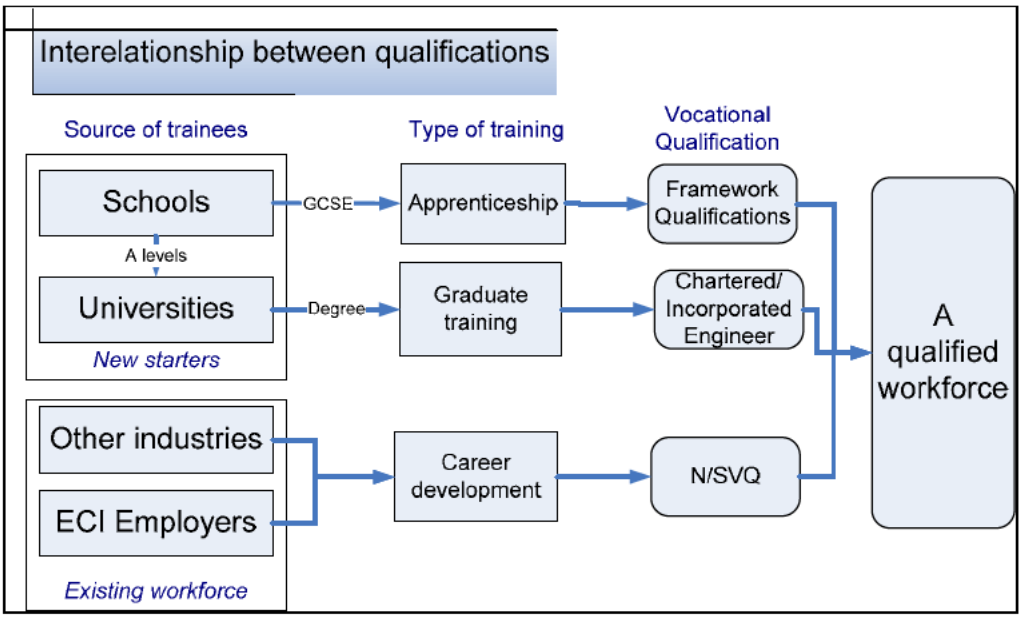
Data on people having left or withdrawn from their industry training programme:

Programme	leavers or withdrawn
Apprenticeships	47
TECSkills (re-skilling and up-skilling)	96
ACE Registrations	104

4.2. Main Supply Routes for Skilled Workers

Through the ECITB, the ECI recruits directly from schools and universities to create a pool of new starters and from other industries to fill vacancies for experienced workers. This latter approach can exacerbate skills shortages within other sectors, particularly within client sectors where skills may already be in short supply e.g. civil construction areas.

[26] ECITB, Annual Report and Accounts, 2008



4.3. The Main Training Routes

Apprenticeships	The preferred route to a trade qualification is an apprenticeship funded by employers, through the statutory employer funding and grant systems operated by ECITB. The current ECITB apprenticeships are mainly Advanced Apprenticeships[27] (these are Level 3 awards). There are a minority of the ECITB apprenticeships at Level 2, now known simply as apprenticeships (formerly Foundation Modern Apprenticeships). The ECITB is currently expanding the apprentice scheme in response to the predicted growth in demand for skilled labour. For example, 612 apprentices commenced their apprenticeship in 2007 (compared to 325 the previous year) and in total the ECITB is supporting the development of 1,338 apprentices on behalf of approximately 160 ECI employers.
Vocational scheme: skills and technical	The TECSkills programme is an ECITB-supported skills development scheme and a training route to an N/SVQ. It provides development opportunities for new entrants and current ECI personnel who need to learn new or develop existing skills, prior to assessment of competence, and may be ineligible (for various reasons) to register on to the apprenticeship scheme. The bulk of these qualifications are Level 3 qualifications.
Technical, supervisory and management programme	This area of training covers a wide range of courses, some of which lead to qualifications. These schemes are developed or supported by ECITB in response to employer demand. These do not always lead to a qualification that is within the National Qualifications Framework and instead are often highly tailored to the participants and the requirements of the ECI. Examples of training delivery in this category are: • **Supervisory management training and development programme (SMTD)**: a modular programme for engineering construction supervisors available either through conventional or on-line training. • **Project management short courses:** there is a range of bespoke project management short courses offered through the ECITB and these include: Operational, Tactical and Strategic Project

[27] Previously known as Advanced Modern Apprenticeships (AMA)

	Management and Project Management Master Classes. • **Technical courses:** there is a growing range of technical courses covering specific subjects and in particular design and IT related. Much focus is upon learning software applications of particular relevance to the industry. • **Management courses:** there is a range of other management courses on offer including a MSc in Project Management and a Post Graduate Certificate in Engineering Management.

4.3.i Current Volumes in the Supply of ECI Skills

A proxy for training volumes is the investment in training itself by the industry through the ECITB statutory funding and grant systems. The table below shows the most recent available figures for this.

Funding and costs for the ECITB in 2008[28]	**Total 2008** (£'000)
Recruiting and developing new entrants	7,413
Re-skilling and skill enhancement of existing workers	3,087
Supervisory, leadership, management and Project management training	2,857
Competence assurance	1,197
Levy collection costs	1,889
Total	**16,443**

Graduates

In the short-term, the potential recruitment pool for graduate entrants is already fixed for at least the next three years. The ECI must capture around 7,000 of the 260,000 people enrolled in potentially suitable degree qualifications. Up-skilling programmes will be needed for these people very quickly to get them up to standard. In the future, more undergraduate places in programmes that are relevant to the industry will become available and followed by rapid up-skilling will help to ensure sufficient quality people.

Apprentices

Apprentice starts	**2006**	**2007**	**2008**
Design and drafting	38	84	78
Electrical sector	-	19	18
Electrical installation	-	8	10
Electrical maintenance	12	13	24
Electricians	44	70	41
Instrument and Control	30	28	34
Instrument pipefitting	-	-	4
Mechanical fitting	62	64	89
Mechanical maintenance	15	21	32
Moving Loads	7	1	11
Non Destructive Testing (NDT)	-	16	13
Pipefitting	60	88	120
Plating	17	38	26
Project control	-	14	26
Steel erecting	4	34	23
Supervisory management	-	40	11
Welding (pipework & plate)	33	74	87
Grand Total	**322**	**612**	**647**

The pattern by trade shows that some trades have increased well above the overall trend. There has been more than 50% growth in the numbers of welding apprenticeships: an increase from 30 in 2005 to 74 in 2007. This is consistent with the indications that the forecast growth in new build will see an increase in the demand for welders. Similarly, there has been a rapid increase in the numbers of pipefitting apprenticeships: up from 52 to 88. Design and draughting is another trade showing similar growth, up from 15 to 84, a 460 per cent increase. Unsurprisingly, there is an increase in the number of Non-Destructive Testing (NDT) apprenticeships, from 0 reported in 2005 to 16 in 2007. Although

[28] ECITB, Annual Report, 2008

only a small number of NDT personnel are required, this group are essential to safety-critical new builds and the demand is expected to increase. Importantly, all of these apprenticeship starts will take at least two years to produce fully qualified staff. It is a shortage experienced elsewhere as NDT technicians are required in a number of manufacturing sectors.

N/SVQ completions

The table below shows the number of completions during 2006, 2007 and 2008. It includes all categories of entrant: apprentices, those assessed through the ACE scheme, and those trained and assessed via TECSkills.

ECITB Vocational Awards	2006	2007	2008
Fabricating Steel Structures (Plating)	384	361	260
Installing Plant and Systems - Instrument Pipefitting	492	329	8
Constructing Capital Plant Steel Structures (Erecting)	304	290	248
Supporting Engineering Activities	132	253	271
Maintaining Plant and Systems - Mechanical	182	212	200
Welding - Plate	120	204	201
Welding - Pipework	190	195	142
Installing Plant and Systems - Mechanical	51	179	127
Maintaining Plant and Systems - Electrical	12	56	76
Management	46	45	84
Installing and Commissioning Electrotechnical Systems and Equipment (Plant)	3	35	55
Maintaining Plant and Systems - Instrument and Control	6	34	54
Moving Loads	20	31	242
Project Control – Level 3	1	9	34
Design and Draughting	0	7	18
Project Control – Level 4	8	7	15
Installing Plant and Systems - Pipefitting	1	4	283
Non Destructive Testing	2	0	1
Project Control Support	-	-	0

Skills and Technical

The TECSkills programme is an ECITB-supported skills development scheme and is the training route to an N/SVQ. It provides opportunities for existing or new staff that require development prior to assessment of competence, but are ineligible (for various reasons) to register for an apprenticeship. The bulk of these qualifications are Level 3 qualifications.

The table below shows the types of activity undertaken by people registered through the TECSkills scheme during 2008. Unlike apprenticeships, in which only a minority of individuals take a Level 2 award, a significant proportion completions under the TECSkills are at Level 2.

Level	TECSkills (UK)	England	Scotland	Wales	Offshore
Level 2	110	73	31	4	2
Level 2 and 3	24	24	0	0	0
Level 3 only	211	172	22	13	4
Up skilling	121	0	24	18	79
Grand Total	**466**	**269**	**77**	**35**	**85**

Assuring Competence in Engineering Construction (ACE)

The Assuring Competence in Engineering Construction (ACE) scheme is an initiative that assesses the competence of skilled ECI onshore workforce against National Occupational Standards (NOS).

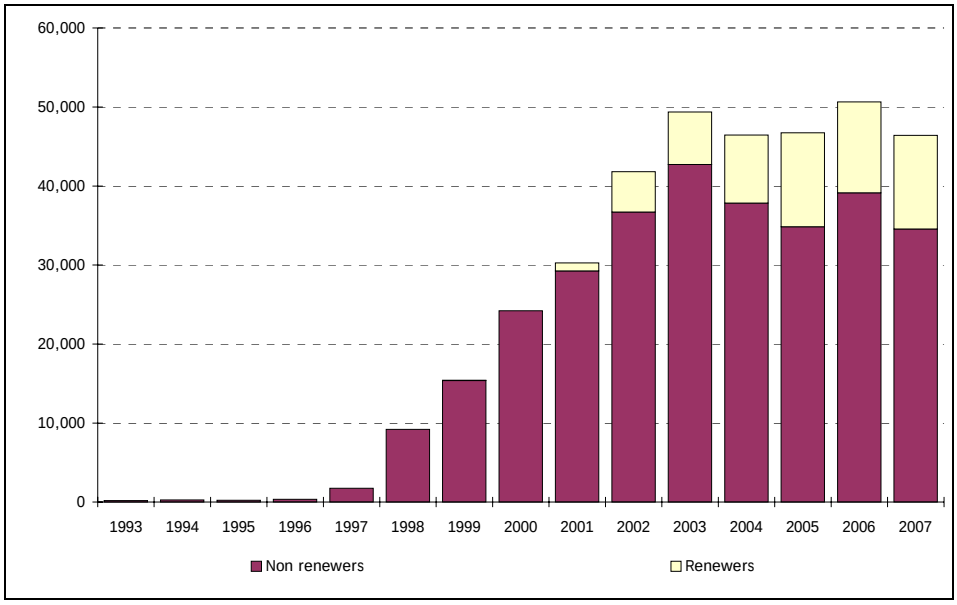
The table below provides data on the ACE completions in 2007 by the qualification title. This shows that the most popular awards are Fabricating Steel Structures (Plating) followed by Installing Plant and Systems - Pipefitting and Constructing Capital Plant Steel Structures (Erecting).

ACE registrations and completions	2007 Registrations	2007 Completions
Fabricating Steel Structures (Plating)	335	421
Installing Plant and Systems - Pipefitting	365	324
Constructing Capital Plant Steel Structures (Erecting)	254	291
Welding – Plate	180	272
Maintaining Plant and Systems - Mechanical	202	234
Welding – Pipework	149	196
Installing Plant and Systems - Mechanical	167	193
Maintaining Plant and Systems - Electrical	56	77
Moving Loads	85	66
Installing and Commissioning Electrotechnical Systems and Equipment (Plant)	97	56
Maintaining Plant and Systems - Instrument and Controls	15	13
Installing Plant and Systems - Instrument Pipefitting	3	4
Grand Total	**1,908**	**2,146**

Safety Passports

The ECITB/CCNSG Safety Passport provides supervisors and employees with a general knowledge of many aspects of health and safety on hazardous sites. There is increasing feedback from employers that individual contractors hold this Safety Passport before they are allowed to start work on a client-owned asset site.

Currently, there are about 150,000 valid safety passports, both non-renewal and renewal.



It will be important that the strategic skills bodies and regulators work together to ensure skills and safety passports are aligned and work effectively and efficiently.

Technical and Supervisory Management

One aspect involves Supervisory Management Training and Development (SMTD). In 2008, a total of 1,245 people were registered for this programme and completed a total of 5,394 training days, having undertaken 474 courses during the course of the year.

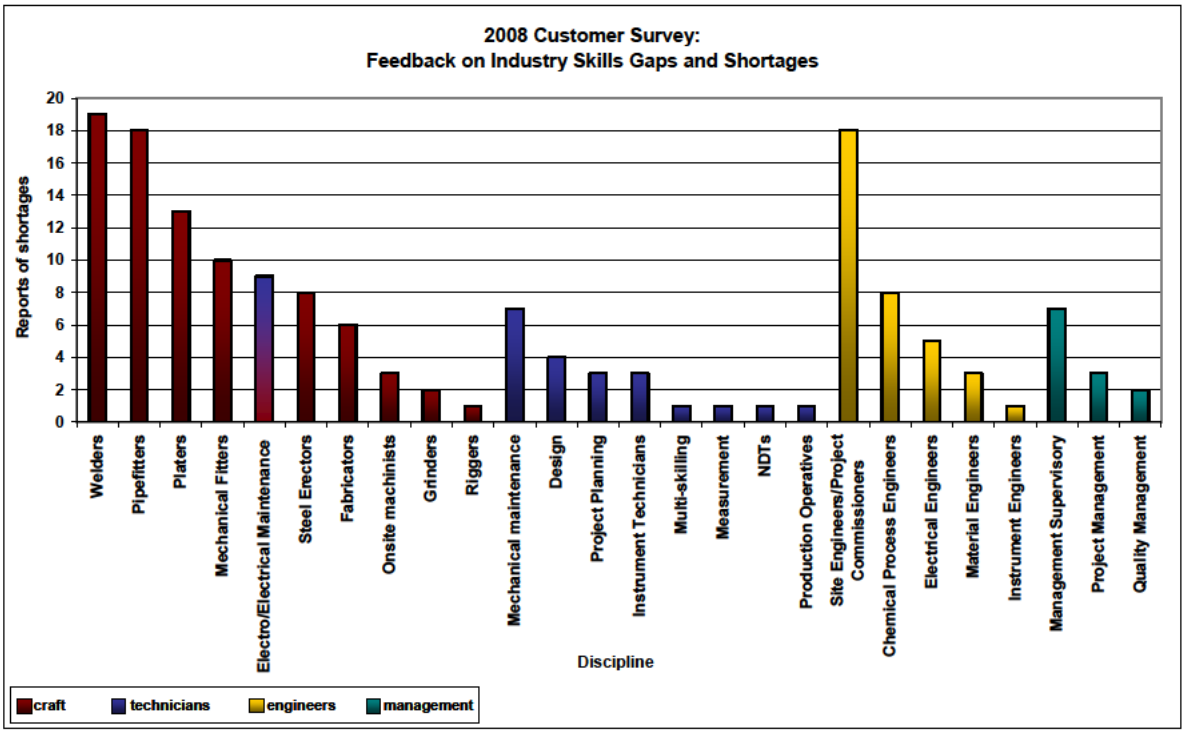
4.4. The Mismatch between Current Demand and Supply

Skills Shortages in the Supply of People to the Industry

The available engineering construction skills pool is not meeting the UK's current need, even when we do not take into account future requirements. This is acute shortage of suitably qualified people in

the UK workforce is exasperated further by the rate of people retiring or otherwise leaving the industry for employment in other sectors.

Recent research highlighted where ECI employers felt the skills shortages were most acute. The chart below shows that welders, pipe fitters, site engineers and commissioning engineers were identified as significant priorities by the industry.



In addition to employer concern, ECITB has found that there are approximately 3,000 unfilled vacancies reported in typical engineering, technical and project management roles in the UK.

The roles that are of particular concern:

Project managers	Crucial to the significant planned new build and refurbishment projects, especially in the power sector.
Civil engineers	Civil engineers are already on the Shortage Occupation List – and overall demand for this occupation is certain to increase with the proposed infrastructure projects in the UK.
Engineers of all disciplines	Critical to the design and implementation of the majority of projects.
High quality supervisors	Where experience counts – affected by retirement rate.

These issues are echoed within the energy sector from clients and their perception of the ECI:

Project managers	With significant new build and refurbishment projects being implemented over the next few years in terms of building new generating capacity and refurbishing current power stations to bring them in line with environmental legislation, this role will be crucial to their successful implementation.
Civil engineer	Civil Engineers are already on the shortage occupation list; this role will be crucial in the development of both the current generating capacity and the commissioning of new capacity. Overall demand for this occupation will increase.
Mechanical engineer	These engineers are critical to the design and implementation of the majority of the new build and refurbishment activities that are set to take place. Overall demand for this occupation will increase.
Electrical engineer	These engineers are critical to the design and implementation of the majority of the new build and refurbishment activities that are set to take place. Overall demand for this occupation will increase.

Whilst the importation of skilled people from mainland Europe and further afield is meeting some of the skills shortages at the moment, the consensus is that these people will not be available in the same numbers in the medium-term.

Competition for engineering construction skills is growing as a result of clients increasing their in-house capabilities (after a period of outsourcing) and the Government's ship-building programme. Together, this is likely to take around 20% of the current post-contract award population employed by engineering construction contractors[29].

The reason for the mismatch of supply and demand is because often there are insufficient resources provided for training and development. The benefits to the employer from their investment are lost should the employee concerned leaves. This is particularly true in engineering construction, with its high levels of short-term employment. Is one of the main reasons for the statutory funding from employers operating within the industry. The costs of training are high relative to general construction. Level 3 apprentices, for example, cost £17,000 to train in engineering construction (£12,500 from Government and £4,500 from employers). However, retention and completion rates are high, indicating good value on return from the investment made by ECI employers.

The number of applicants for training outstrips the available training funds and work placements, suggesting that a final point of mismatch is the capacity to accommodate training placements.

Awareness of and skills in safe working are high in the UK and the industry has a good record of health and safety compared, for example, to general construction[30].

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

Skills Gaps in the Current Workforce

A shortage of competence in the current workforce identifies skills priorities into the following categories:

- engineering, design and construction project management;
- design management, including multi-discipline team leadership and technical leadership;
- contract and relationship management to ensure effective relationships between the engineering project sponsor and the executing contractor; and
- leadership and supervision onsite, including operating plant, construction and maintenance.

Leadership and management are high on the list of skills required. Project management and the associated activities such as planning, scheduling, cost control, procurement and supervision are typical areas where, as project activity grows, more skilled practitioners will be required.

Improving leadership, management and supervisory skills is recognised by the sector skills organisations, embracing both the client sectors and the contracting industry. There is a great deal of common interest in ensuring we have the effective leadership and management of capital projects.

[29] ECITB, Securing Engineering Construction Skills for the Future, 2008
[30] ECIA (2008) Engineering Construction Industry Association Year Book: "the rate of serious reportable injuries to engineering construction workers in 2008 was a quarter of that in general construction".

5. The Future

In this section of our report, we outline the future demand for skills in the context of continued expansion of global demand for engineering construction. We use projections of demand developed by ECITB and incorporate client projects from SSCs to demonstrate the nature of the skills challenge. From this, we conclude that the industry faces a major increase in workload at a time when the availability of skilled workers is falling. The mismatch in terms of the deficit in skills is substantial and on-going.

5.1. The Market Context underpinning Anticipated Demand

The UK is poised on the brink of an "infrastructure boom" (New Civil Engineer) and the Government has recognised the need to co-ordinate this work. On 9 November 2009, the Government announced that a new Infrastructure Planning Commission (IPC) will take over planning decisions for large infrastructure. The first six of a series National Policy Statements (NPSs), or frameworks, for building major infrastructure were released for consultation within: nuclear power; fossil fuels; electricity networks; renewable power; gas networks and ports. Between 2010-2012, further NPSs will be released on airports, national networks, wastewater, hazardous waste and water supply.

Variability of workload is a feature of the engineering construction industry and makes it difficult to forecast future skill needs with precision. It is also hard for employers to offer continuity of work to their employees, although stakeholders agree it would help build better relationships and improve productivity, and some employers make real efforts in this respect.[31] However, with input from the Cluster of client representing SSCs, and the ongoing and existing relationships between client sectors and ECITB, it has been possible to compile the following data on overall trends and specific demands.

[31] Department for Business, Innovation and Skills, Productivity Review, 2009

Trends in Demand

Client Sector	Projected Demand Trend	Explanation
Power	Increasing rapidly	Successive energy white papers have identified shortfall in UK generating capacity. If this remains unaddressed then the UK will suffer power cuts within the next seven years.
Nuclear	Increasing	This is subject to relevant approvals and the go ahead of dismantling. Nuclear is recognised as a sustainable source of zero carbon electricity. The existing fleet of reactors is coming to the end of its useful life. This creates a double demand on the ECI workforce; people are required to dismantle the existing fleet and build the next generation of nuclear power.
Chemicals and pharmaceuticals	Static and falling	Whilst the UK chemical industry has seen a marked downturn in demand during the current recession, there is expected to be an increase in pharmaceutical activity. The largest UK site in Teesside has experienced closures by clients such as Dow, Invista, Sabic and Le Seda in recent months. As the chemical industry re-sizes to meet lower demand production will go to lower waged economies where plant is less expensive to operate and maintain. Some new capacity is expected to deliver biofuels for renewable energy sources.
Manufacturing and metal smelting	Increase (after recession)	This is forecasted rise after recession is over. Manufacturing in the UK has been in decline, but demand for new facilities is likely to increase with the resurgence of major capital expenditure, with demand for steel/metals rising post recession.
Downstream oil and oil production	Increasing	Demand for oil is increasing and the UK will continue to rely on oil as its primary energy source for at least the next 20 years. Work in the North Sea continues and international opportunities are increasing.
Transportation infrastructure (rail engineering)	Increasing	An increase in commissioning or developing of the public transport infrastructure, in addition to the ongoing railway maintenance, repair and replacement work. New rail projects include Crossrail and High Speed Two.
Other Infrastructure	Increasing	The UK requires considerable infrastructure to maintain the economy and fabric of business. This includes both infrastructure and utilities examples such as: airports/air terminals, local roads, motorways and trunk roads, multi storey car parks, railway stations, river works and waterways, sea defence/flood protection, sewage treatment works, sewer systems, storage tanks, waste transfer stations. Although engineering construction may have limited involvement in some of these areas, it does highlight how some ECI companies will bid for (non-ECI) projects, but equally compete for the same skills set.

Specific Demand: examples of future major planned projects

The list of major infrastructure projects that will require either *direct* or *indirect* involvement from the ECI is significant. Those projects in italics will compete for resource from civil engineering and related client sectors.

- the next generation of nuclear power stations: in November 2009, new planning procedures to streamline the review of sites and reactor designs for potential new nuclear power stations were announced and ten sites have been identified as 'potentially suitable'.
- offshore wind programme: annual deployment rate of circa 5 GW across Europe envisaged
- the possible Severn tidal power scheme: this continues to full public consultation in 2010
- carbon capture and storage: the EU aims to have 10-12 CCS demonstrations by 2015 and several likely to involve the UK Continental Shelf
- UK Oil and Gas state that the industry will need to spend some £19bn decommissioning facilities in the North Sea between now and 2030.

- MoD programmes: includes building two new aircraft carriers due to enter service in 2014 and 2016 (whilst not in-scope to engineering construction, these two projects are likely to compete in the same labour pool for a specific skills set).
- rail projects: including ongoing East Coast mainline and Thameslink upgrades, Waverley Line (2011) and Crossrail when construction starts 2011-2017 (whilst not in-scope to engineering construction, these projects are likely to compete in the same labour pool for a specific skills set)
- London 2012 Olympics (whilst not in-scope to engineering construction, these projects are likely to compete in the same labour pool for a specific skills set)
- Thames Gateway: its spending programme to accelerate regeneration 2008-2011.
- London Tideway Tunnels to improve sewerage in London, due for completion in 2014.

Specific Demand: known major power projects

Research by regulator Ofgem has suggested that UK energy infrastructure will require investment of £200bn in the coming years. To maintain the present proportion of coal in the UK, the power generation mix will require 2GW of projects (at least one new or replacement power station) to start each year (2008 to 2012) to be ready for 2016.

The table below shows some of forward workload in the power sector:[32]

NATIONAL JOINT COUNCIL for the ENGINEERING CONSTRUCTION INDUSTRY

CATEGORY 1 PROJECTS TIMELINE 6th OCTOBER 2009

► *PLEASE NOTE THAT START AND FINISH DATES ARE ESTIMATIONS ONLY AND ARE THEREFORE SUBJECT TO CHANGE*

Client	Location	Project	Managing / Main Contractor	Peak Workforce	Start	Finish	Q4/09	Q1/10	Q2/10	Q3/10	Q4/10	Q1/11	Q2/11	Q3/11
Centrica	Langage	CCGT	ALSTOM Power	825	Q3/07	Q4/09								
DONG Energy	Uskmouth	CCGT	Siemens	900 - 1,000	Q1/09	Q4/10								
EDF	West Burton	CCGT	CIT	1000	Q2/09	Q3/11								
Ensus Group	Wilton	Bioethanol	Simon Carves	500 – 600	Q4/08	Q4/09								
E.ON UK	Isle of Grain	CHP	ALSTOM Power	647	Q4/08	Q2/10								
E.ON UK	Drakelow 'D'	CCGT	TBA	TBA	Q1/10	Q2/12								
E.ON	Holford	Gas Storage	Costain	200	Q1/10	Q3/10								
E.ON UK	Sheffield	Biomass PS	TBA	TBA	Q3/10	Q4/12								
ESBI	Carrington	CCGT	TBA	700	Q3/10	Q2/13								
INEOS Chlor	Runcorn	Waste CHP	Keppel Seghers	600 - 700	Q1/11	Q4/12								
MGT Power	Teesport	Biomass PS	TBA	600	Q3/10	Q3/13								
Peel Environmental Ince Ltd	Ince Marshes, Helsby	95MW Incinerator	TBA	TBA	Q1/11	2012								
Prenergy	Port Talbot	350MW Biomass	TBA	850	Q3/10	2012								
RWE Npower	Pembroke	CCGT	Alstom	2000	Q2/10	Q3/11								
RWE Npower	Staythorpe	CCGT	ALSTOM Power	1053	Q4/08	Q2/10								
Scottish Power	Longannet	FGD	Amec	454	Q3/07	Q4/09								
Sellafield Ltd	Sellafield	Evaporator D	Costain	TBA	Q2/10	Q2/12								
South Hook LNG	Milford Haven	LNG	CB&I UK	1642	Q2/05	Q4/09								
Tilbury Green Power Ltd	Tilbury Docks	Biomass	TBA	350	Q3/10	2012								
TOTAL	Immingham	HDS3	Jacobs	1011	Q1/08	Q4/09								
Transco	Isle of Grain	LNG 3	CB&I UK		Q1/09	Q3/10								
Tullis Russell	Markinch	CHP	Aker Solutions	400	Q1/11	2012								
Vivergo	Saltend	Bioethanol	Aker Solutions	42	Q4/08	Q2/10								
Total Projects per Quarter							11	8	11	12	10	12	12	12

Known Demand: civil engineering and infrastructure

ConstructionSkills monitor future infrastructure projects for their econometric forcasting. The table below shows the future workload in the sector and demonstrates the competition for the same skills set for projects initiating around the same time.

[32] National Joint Council, October 2009

Major Infrastructure Projects e.g. airports/air terminals, aqueducts/viaducts, bridges, estate roads, infrastructure, local roads, motorways and trunk roads, multi storey car parks, railway stations, railway track/works, runways, taxiways, aprons, subways/underpasses, surface car parks, traffic management/calming, tunnels					
Current Projects		Planned projects with start date		Proposed projects without start date	
No. of Projects	Value (£million)	No. of Projects	Value (£million)	No. of Projects	Value (£million)
491	£16,069	821	£103,221	185	£3,919
Major Utilities Projects e.g. culverts, dams/barrages, gas/oil platforms, hydro electric projects, pipelines, power stations, power supply lines. pumping stations, renewable energy, reservoirs and lakes, river works & waterways, sea defence/flood protection, sewage treatment works, sewer systems, storage tanks, waste transfer stations, water distribution, water treatment works					
282	£14,517	784	£84,019	197	£5,591
Totals of Infrastructure and Utilities					
773	£30,586	1605	£187,240	382	£9,510

The illustrations that show where these are distributed across the UK are attached in the Annex.

The Impact of Recession

These major projects are not immune from the current recession or from the requirements of an often elongated planning procedure.

The shortage of credit for investment is causing clients to delay investment in new plant and postpone refurbishment programmes. Similarly delays to granting planning (an issue recognised by Government with its establishment of the Infrastructure Planning Committee) could change the timescales.

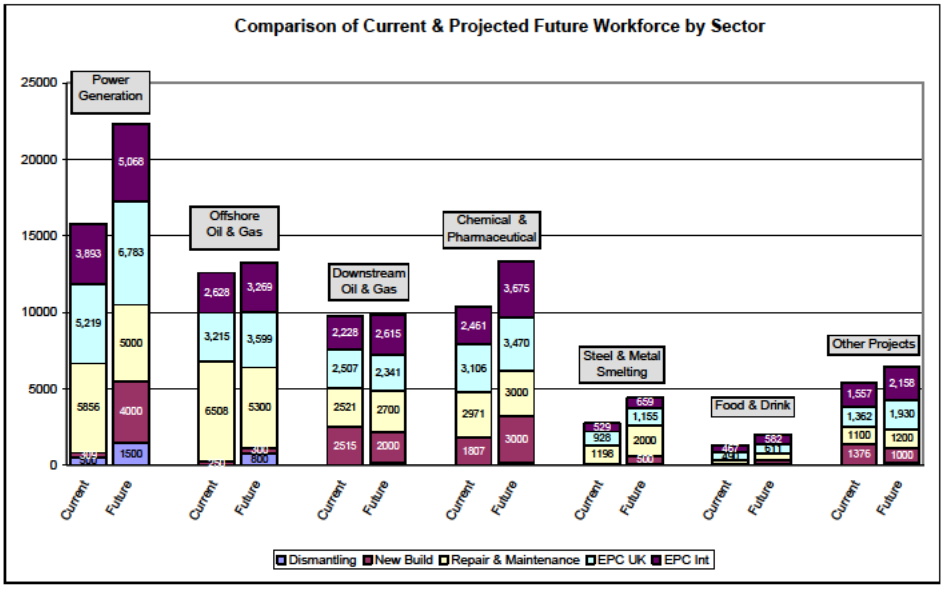
This delaying of programmes exacerbates the skills issue as it compresses the time in which this work needs doing. It presents the engineering construction industry with a conundrum: although the recession has eased the pressure, it has not created an excess pool of available labour. The work does not go away, the time to do it just becomes shorter.

International Demand

The international engineering construction market is also buoyant and expected to remain so, competing with the UK based engineering, design and procurement contractors (pre-award). Large European projects include the European Pressurised Reactor (EPR) plants at Flamanville in northern France and Olkiluoto in Finland.

5.2. The Magnitude of Future Demand

To meet the demand from client sectors described in the earlier sections of this report will require that the workforce expands. The graph below shows how many more people are needed by the industry to meet the anticipated demand.



When we making the assumption that this demand is to increase in a consistent and managed way, the following table shows the requirement over the next seven years. Recent consultation with employers suggests the increase in demand will neither be consistent or predictable.

Skill Category	2007 Population	Average Annual Need	Total Need to Meet Demand
Senior Management & Project Management	4,278	471	3,294
Engineering Design & Project Engineering	14,667	1,613	11,293
Administration & non technical support	8,556	941	6,588
Professional Engineering and Technical	4,800	528	3,864
Management & Supervisory	2,400	264	1,846
Skilled Craft & Technician	18,000	1,980	13,843
Semi-skilled & technical support	4,800	528	3,691
Total pre-award workforce	**57,500**	**6,325**	**44,419**

5.3. Creating the Future Workforce

This future supply of skills and anticipated increase in demand comes at a time when the number of suitably qualified and experienced people available in the engineering construction industry appears to be in decline. This situation is made more critical by the demographic trends. From 2010 onwards, the number of young people reaching working age will begin to fall by 60,000 every year. Between 2010 and 2020, the UK will need 2.1 million new entrants to the adult workforce, a demand which can only be met through a combination of most adults working longer and a significant increase in the number of adults re-entering the labour market. Furthermore, by 2011 the mean age of the UK population will exceed 40 for the first time.[33]

These issues are further exacerbated in the engineering construction industry, which will additionally feel the combined effects of:

- skills deficiencies, gaps and shortages in the highly-sought-after occupations, such as pipefitters, welders and steel erectors;
- to sustain the flow of apprentices, employers need to guarantee training placements within actual ECI projects;

[33] The Employers Forum on Age

- the ability of the industry to transfer knowledge from experienced workers is becoming constrained as the knowledge leaves the industry in the form of higher retirement rates and magnified further by the piecemeal nature of work;
- low margins within the industry constraining the funding available for training, with many employers having little interest or lacking the infrastructure to train;
- the cyclical nature of engineering construction, which means that employers have found it difficult to identify skills shortages and train to alleviate them in the long-term without having the certainty of anticipated demand from clients;
- increasing demand for labour, including Government policy and investment, global energy demands, environmental mandatory considerations (e.g renewables, co-generation) as set out above;
- the loss of transferable skills to other sectors of the economy; and
- increased globalisation of the workforce as domestic employers struggle to compete with lucrative overseas recruitment.

The Strategy for Expanding the Workforce

Even against this back drop, the industry, through the ECITB, are working towards a considerable increase in the number of skilled people available. There is a well-developed two-part strategy for developing skills within the industry by targeting the two different skills set that make up the ECI.

The first part of the strategy is aimed at increasing the inflow and increasing the capability of craft, technician, supervisory and construction management roles, with support from engineering and project management personnel. The strategy involves:

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

The second part of the strategy is aimed at increasing the inflow and increasing the capability of knowledge workers that design, plan and manage the engineering construction projects. These are mainly, technical, engineering and professional engineering, project and project management roles, with support from contract, procurement management and project control personnel. The strategy involves:

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

The table below shows the planned output from this work.

Skill Category	**ECITB Plan**
Senior Management & Project Management	1,600
Engineering Design & Project Engineering	5,500
Administration & non technical support	1,000
Professional Engineering and Technical	1,600
Management & Supervisory	1,540
Skilled Craft & Technician	6,900
Semi-skilled & technical support	1,750
Total	**19,890**

The overwhelming consensus of employers within the industry is that the engineering construction has passed a critical point. The supply of suitably qualified personnel in the UK workforce has tipped

into shortage. Demand for skilled employees is forecast to escalate further, increasing pressure on the labour market, with employment costs rising rapidly in some disciplines. There is increasing evidence of poaching and European sources are becoming more difficult to access. There is also an impact from the introduction of MAC Points Based System, which may restrict employment of non-EEA nationals. Business expansion is being compromised by lack of suitable people[34].

5.4. The Mismatch between Skills Supply and Demand

The engineering construction industry, is projected to need a further 44,400 employees to replace retirees and meet expected demand within the next decade. All but 6,588 of these are highly technical roles and range from senior managers through to skills craft workers.

The table below has been developed having incorporated employer consultation, modelling the retirement rates and other reasons for leaving the industry, coupled with the forecast demand for people. It is based on reasonable estimates of the workforce requirements to both maintain existing facilities and the new build of processing plants.

Cumulative Workforce Requirements

Skill Category	2007 Population	Projected Future Workforce	Total Need to Meet Demand and Natural Wastage
Senior Management & Project Management	4,278	5,177	3,294
Engineering Design & Project Engineering	14,667	21,181	11,293
Administration & non technical support	8,556	11,747	6,588
Professional Engineering and Technical	4,800	6,592	3,864
Management & Supervisory	2,400	3,296	1,846
Skilled Craft & Technician	18,000	24,720	13,843
Semi-skilled & technical support	4,800	6,592	3,691
Total	**57,500**	**79,305**	**44,419**

5.5. Future Supply

Engineering construction companies (including Alstom Power Ltd, Doosan Babcock Energy Ltd, Siemens Plc, AMEC Group Ltd) collectively invest £18 to 20 million per annum in skills. This is administered by ECITB to fund industry programmes through appropriate training provision.

These programmes will generate almost 20,000 people for the industry. However, as the table below shows, this still leaves a shortfall of over 24,000 skilled people required:

Skill Category	Total Need to Meet Demand and Natural Wastage	ECITB Plan	Net Shortfall
Senior Management & Project Management	3,294	1,600	1,694
Engineering Design & Project Engineering	11,293	5,500	5,793
Administration & non technical support	6,588	1,000	5,588
Professional Engineering and Technical	3,864	1,600	2,264
Management & Supervisory	1,846	1,540	306
Skilled Craft & Technician	13,843	6,900	6,943
Semi-skilled & technical support	3,691	1,750	1,941
Total	**44,419**	**19,890**	**24,529**

[34] ECITB, Securing Engineering Construction Skills for the Future, 2008

6. Actions

In this final section of our report, we set out the strategy and actions required to sustain the contribution of the ECI to meet the demands of anticipated client activities.

6.1. The Strategy so that Supply can Meet Demand

The core objectives are to increase the flow of new entrants with suitable qualifications and experience, upskill existing people and ensure wide portability and employability across the client sectors and within the supply chain.

Collaboration on skills and aggregation of learners onto common training programmes will be helpful, increasing efficiency of delivery. Whilst there is ongoing research on cross cutting skills issues, there is increasing consensus that action needs to be taken reasonably quickly if demand is to be met.

Cross-Sector Collaboration Initiatives

Cogent, E&U Skills and ECITB are collaborating on an Energy Alliance with the aim to:

- optimum transferability of skills and competence across energy [systemic recognition]
- world leading project delivery and productivity that is world leading
- attractive career pathways and recognition across the industry
- responsive skills and training system [independent of energy mix]

Also, there is a wider collaboration that also involves Asset Skills, ConstructionSkills, Semta and SummitSkills to establish a cross-sector party reviewing the skills strategy applicable to renewable energy.

Engineering Construction Initiatives

In order to meet the objectives described above, the ECITB has a three strand strategy:

- **attract:** informing people in school, colleges and universities and other industries about the rewarding career opportunities in engineering construction and the learning pathways to them;
- **develop**: ensuring that pathways of learning continue to deliver relevant skills for the sector, are straight forward to follow and delivered to standard by quality assured providers; and
- **qualify:** ensuring that individuals attain industry relevant qualifications to prove competence and enhance productivity.

Delivering the Strategy

The following table is an extract from the ECITB strategic plan[35]:

[35] Approved by the ECITB Board in November 2009.

Activity area	2010	2011	2012	2013	2014
Attract people. The key aims are to Increase the flow rate of people applying for ECI careers and to increase learning opportunities relevant to ECI at school, in colleges and universities.	Extend careers Roadshow to colleges and universities. Careers web-site enhanced and available for recruitment service. Curriculum material based on ECI content.	Web channel and self-funded web site for careers advice, learning support and competence tracking. Project Management skills campaign "Low carbon future – it starts here	Campaign about – how we built the Olympics and delivered a legacy of skills. RAE partnership on "where biology and engineering meet" "Renewable energy – we do it" campaign	Campaign "getting ready for nuclear" Pilot "industry excellence" campaign.	Industry excellence campaign – case studies, career opportunities update Curriculum support tools
Develop People: The key aim is to increase the number and utilisation of approved pathways to engineering construction skills that are easy for employers and individuals to access.	Continue expansion of provider network to around 95 in the UK. Pilot programmes developed for use in universities to train U/grads in ECI skills. Up-skilling focus.	Continue expansion of provider network to around 120 in the UK. New entrant focus.	Continue expansion of provider network to around 95 in the UK. Higher level skills focus.	Network of centres in place – and position for nuclear build programme Commercial income maintained	Network of centres in place – and beginning training for nuclear build programme Commercial income maintained
Qualify People: The key aim is to establish a robust framework of qualifications and products that allow training to and effective measurement of competence to these standards.	Complete qualification review. Renew use of paperless portfolio and skills analysis tools. Product development as required by needs	Product development as required by needs Establish industry qualifications and competence framework linked to the QCF.	Review and implement revised accreditation standards. Product development as required by needs	Review and implement revised accreditation standards. Product development as required by needs	Product development as required by needs

Extending the Strategy to Develop New Capacity

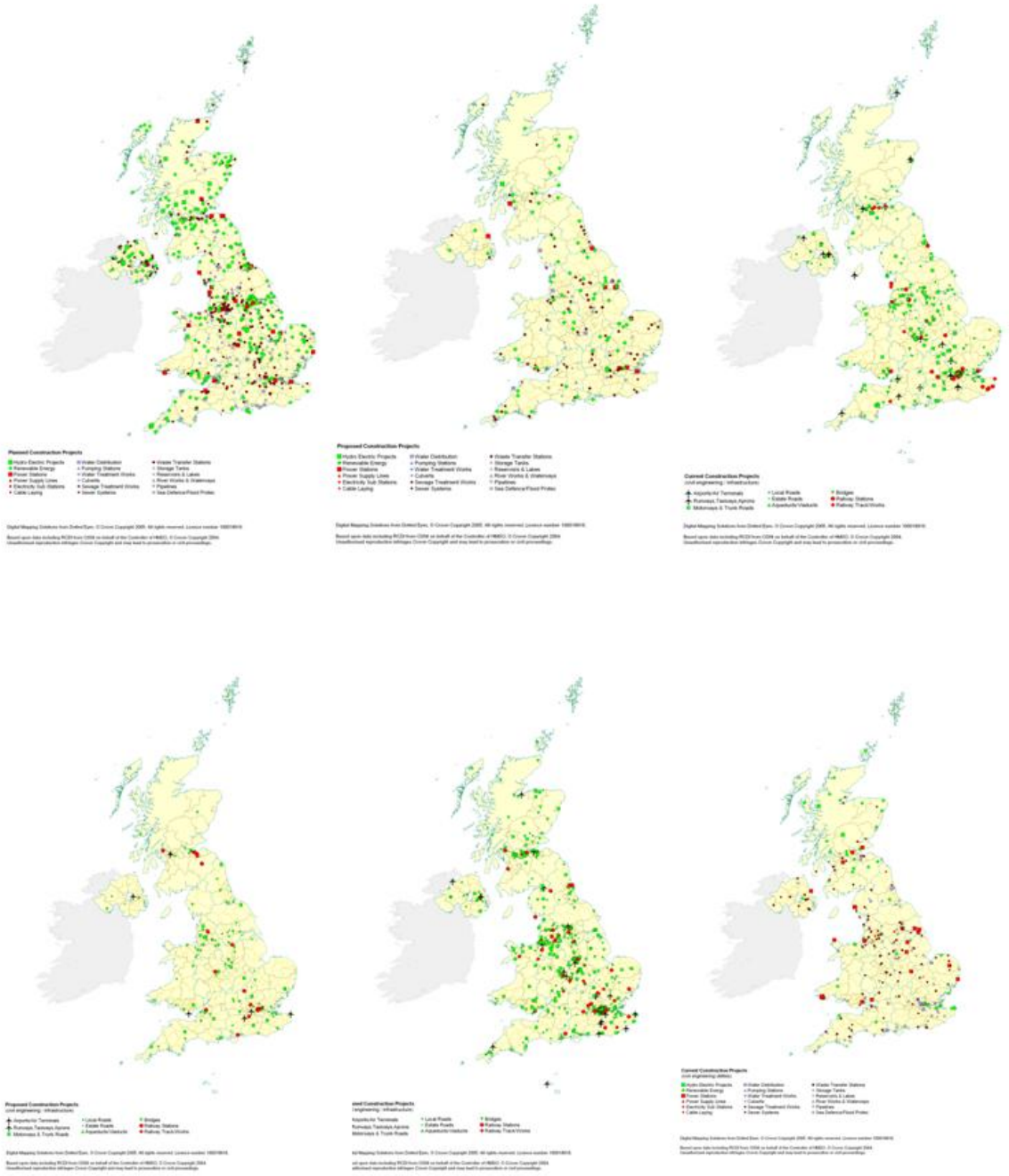
Although the situation is serious, it is not too late. The conclusions of this Cluster Report suggest urgent consideration should be given to actions that will:

- **sustain the flow of science and engineering graduates required, attract the brightest and best students to study these subjects using direct incentives:** significant stakeholders, including Government and employers from client sectors and the contracting industry, should investigate funding approaches that reduce substantially the student debt of successful graduates that join the ECI workforce. In addition, universities that offer degrees that are relevant to the ECI should receive additional grant funding.
- **sustain the flow of apprentices, employers need to guarantee training placements within actual ECI projects:** where this cannot be met, Government needs to create a network of training centres where the right skills are taught and relevant experience can be gained, or alternatively expand opportunities available as work placements.
- **sustain the current workforce, employers need to re-train people from other sectors to work in engineering construction:** Conversion for some could be as short as six months, whereas for others it may take two years. Government and other stakeholders should intervene to ensure those that lose their jobs in the related sectors, such as civil construction and manufacturing, are actively encouraged to re-train for the engineering construction industry.
- **create improvements in performance:** employers should be incentivised to train their existing workforce.
- **extend the co-operation between sector skills organisations to ensure the maximum impact of programmes** (e.g. National Skills Academies): for example, ensuring compatibility between safety qualifications and card schemes across the industry.

This investment needs careful management to ensure the required return. With its links to employers, Government and training providers and as owner of the relevant occupational standards, the ECITB together with SSCs, employers in the industry and from client sectors, are central to the delivery.

7. Annex

The illustrations below show where major infrastructure and utilities projects are distributed across the UK[36].



[36] ConstructionSkills, 2009

8. Reference Documents Used

Year of Publication	Author/Organisation	Title
2009	ConstructionSkills	Construction Activity Mapping
2009	Asset Skills	Facilities Management Action Plan
2009	BIS	New Industry, New Jobs
2009	Cogent	2009 – 2025 Power People: The Civil Nuclear Workforce
2009	ECITB	2008 Results & 2009 Skills Action Plan
2009	Semta	England Engineering Skills Balance Sheet
2009 (September)	Rolls Royce press release	Rolls-Royce and EDF Energy to collaborate on UK new nuclear build
2009	UKCES	Ambition 2020
2008	BERR Cogent EU Skills ECITB NSA Nuclear	Energy Skills – Opportunity and Challenge: A Response to the Energy White Paper 2007
2008	ECITB	Customer Survey Results Report
2008	ECITB	Industry Report
2008	ECITB	Securing Engineering Construction Skills For The Future
2008	ECITB	Annual Report and Accounts
2008	IES	S1-3 Skills Demand, Supply and Gaps: Executive Summary
2008	IES	Stage 1: Skills Demand Assessment
2008	IES	Stage 2: Skills Supply Assessment
2008	IES	Stage 3: Skills Gaps Analysis
2007	IFF/IER	Workforce, Skills and Training Issues in the Contracting Community
2006	Semta	Marine Sector Skills Agreement http://www.semta.org.uk/PDF/SSA%20marine.pdf
2005	ECITB	Assessing Workforce Mobility and Skills in UK Engineering Construction: the Key Findings
2005	Ivor Williams	Productivity in UK Engineering Construction: a view from the Industry
2004	MRM	The Skills Profile of the Engineering Construction Industry
2003	ECITB	Sector Workforce Development Plan
2001	ECITB	ECI Sector Workforce Development Plan

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December 2009