Industry insight - Engineering

In a nutshell

- Engineering covers anything that is built or produced. Engineers and other professionals work in manufacturing, transport, construction, medicine, energy, chemicals and more.
- Post-recession forecasts for engineering are good. The engineering and manufacturing sectors are being supported by the government as a way of strengthening the UK economy and helping to manage major challenges such as climate change and world health.
- The Association of Graduate Recruiters (AGR) Graduate Recruitment Survey 2012 (Winter Review) showed that engineering and industrial, IT and telecommunications, construction, energy, utilities and water companies all expected their graduate recruitment to grow in the future due to improved business confidence.
- The Royal Academy of Engineering reported that the current supply of graduate engineers was not projected to make up for the number of engineers who are retiring.

What kind of work can I do?

There is a wide range of work available in this sector including:

- product and process development;
- manufacturing;
- consultancy;
- research and development;
- data management;
- IT support;
- logistics;
- management and administration;
- sales.

The following profiles are examples of key jobs that exist in the engineering sector:

- Aeronautical engineer
- Automotive engineer
- Biomedical engineer
- Chemical engineer
- Communications engineer
- Consulting civil engineer
- Electrical engineer
- Electronics engineer

- Materials engineer
- Mechanical engineer

Many large companies employ more than one kind of engineering graduate. For example, large oil companies recruit chemical, civil, electrical, electronic, mechanical, software and structural engineers.

Non-engineering graduates can find careers in engineering as accountants, HR, IT, sales and marketing professionals and many more.

What's it like working in this sector?

- Working locations vary according to your role, and can include working in an office, laboratory, factory floor, on site or even a combination of these. Office hours, shift work and work away from home are all common.
- The average starting salary for engineering graduates is £24,953, although the figure varies depending on specialisation. General engineers command the highest graduate salaries of around £29,361 (Engineering UK, 2012).
- SEMTA: The Sector Skills Council for Science, Engineering and Manufacturing Technologies provides detailed information for ten engineering-related sectors on their website.
- Less than 9% of professional engineers are female (Engineering UK, 2012). The Women's Engineering Society (WES) and some large companies offer mentoring programmes for women. The UKRC and Women into Science, Engineering and Construction (WISE) provide resources and support for women considering an engineering career.
- In 2010, there were 551,520 engineering enterprises employing 5.6 million people in the UK (Engineering UK, 2012).
- The UK manufacturing industry is the seventh-largest in the world and employs around 2.5 million people (Engineering UK, 2012).
- There are approximately 235,000 registered engineers and technicians in the UK, including incorporated and chartered engineers (Engineering Council, 2011).
- Most opportunities are in major towns and cities.
- Multinationals offer opportunities to spend periods of time working on projects overseas.
- Chemical manufacturing is centred in northwest England.
- The oil industry is centred in Aberdeen.
- High-tech areas of engineering are usually based around Oxford, Cambridge and London.

Entry and progression

How do I find a job?

Engineering vacancies and graduate training schemes are advertised through:

- company websites;
- specialist online recruitment agencies such as Matchtech, Gradcracker and Thomas Telford Recruitment;
- specialist publications such as The Engineer;
- Inside Careers: Engineering & Technology;
- university careers services;
- national and local press;
- graduate websites.

The Institution of Civil Engineers (ICE), Institution of Chemical Engineers (IChemE), Institution of Mechanical Engineers (IMechE), Institution of Engineering and Technology (IET) and the Institution of Structural Engineers (IStructE) are just some of the professional institutions that provide job vacancies, careers advice and accredited training for new graduates. Professional bodies also provide information on smaller companies who do not widely advertise their vacancies. You can apply to these companies speculatively.

Graduate training schemes are common in large companies and generally begin in autumn. Smaller companies tend to recruit when required.

What skills do I need?

A BEng or MEng in a relevant discipline is usually required for entry into graduate training schemes. A minimum 2:1 or 2:2 degree is desirable, depending on the company.

You will also need to demonstrate the following key skills:

- high-level technical knowledge and the ability to apply it to practical problems;
- problem-solving ability;
- good communication skills;
- ability to build relationships with customers;
- teamworking skills;
- organisational skills, such as time and resource planning;
- commercial awareness and entrepreneurial attitude;
- motivation and enthusiasm.

These skills can be gained in many jobs, through sport, volunteering or involvement in university societies.

Where can I find work experience?

- Relevant work experience can help you to land your ideal job. Internships, vacation jobs, work experience and placements are increasingly common ways of securing graduate jobs in engineering.
- Company websites, and your own careers service website, hold relevant information on where and how to apply.

- If no vacancies are advertised, make informal enquiries or send speculative applications.

Is postgraduate study useful?

Entry to most areas of engineering does not require a postgraduate degree. However, some graduate employers are increasingly asking for a Masters qualification as a minimum requirement so you may want to consider this to set you apart from the competition.

For research posts in academia or in industry, a Doctorate (PhD) is usually required.

A Masters may help with entering an area of engineering that did not form part of your MEng/BEng. Discuss your options with potential employers or with a careers adviser.

How can my career develop?

Once employed, gaining a professional qualification, either chartered (CEng) or incorporated engineer (IEng) status, is the next step. This shows that you have achieved a standard level of competence and commitment to continuing professional development (CPD) in engineering.

To become a chartered engineer (CEng) you need either:

- an accredited MEng;
- or an accredited BEng and either further learning to Masters level (accredited) or completion of accredited further learning scheme in the workplace.

To gain CEng status, you will need to submit a written report and satisfy an assessment panel that you have the skills, specialist knowledge and competence to practise as an engineer.

To become an incorporated engineer (IEng) you need either:

- a BEng;
- or an HNC/HND and completion of accredited further learning in the workplace.

It is possible to achieve CEng or IEng status within four to six years after graduation.

You can still become an incorporated or chartered engineer if you do not have academic qualifications. Further information about the assessment process can be found on the Engineering Council website.

Many graduates training schemes offer one or both of these options. Most graduate engineers aim for CEng or IEng status in the early years of their careers. They then progress in specialist technical areas of engineering, as managers of ideas, people and resources, or by diversifying into areas such as marketing, HR or sales.

Many senior-level engineering posts require CEng status.

Typical employers

Big players

The engineering sector has several big players that often recruit from the full spectrum of engineering degrees.

Aerospace is the high-tech end of the sector and requires recruits to have strong academic backgrounds. It is dominated by global companies like Airbus and Boeing who build aircraft, and Rolls-Royce and General Electric who build engines. The Ministry of Defence (MoD) and BAE Systems also recruit large numbers of graduates, as do MBDA and several others. The sector attracts all engineering degrees, except civil.

The **automotive** industry for graduates is small, but dominated by global names such as Honda, Nissan, Toyota, General Motors and BMW. Design and development roles in the UK tend to be with Bentley, McLaren and Williams. A passion for cars, excellent team and communication skills are required to succeed in this fast-paced industry. The sector attracts all engineering degrees, except civil.

The **built environment** sector has been affected by the recession. Employment prospects are expected to improve, particularly in the public sector and for major construction projects such as the new Forth Bridge. Amey, Arup, Atkins and Mott MacDonald are historically big recruiters. Good teamwork and technical skills are important. Civil/structural, control, electrical, electronic, environmental, mechanical, power systems and telecommunications engineering degrees are ideal for this sector.

The **chemical** industry includes petrochemicals, pharmaceuticals, fine chemicals, water organisations, engineering contractors and rapidly growing biotechnology companies. The industry is involved in areas as diverse as water desalination, medicine and paint. It is a global industry, offering travel potential. Major companies include Air Products, AkzoNobel and BASF. There are opportunities for most types of engineer apart from aerospace, automotive power systems and telecommunications.

Defence forms a large part of engineering recruitment. Organisations such as BAE Systems, Dstl and QinetiQ are large and offer a diverse range of opportunities to graduates with solid engineering backgrounds.

The **electronics** industry includes component manufacturers such as Intel, Wolfson Microelectronics and CSR and equipment manufacturers like Sony, Philips and Sharp. The electrical sector covers a wide range of industries including transport, construction, telecommunications and manufacturing.

The **energy** sector has opportunities with large multinationals such as ExxonMobil and BP but also with smaller companies in key areas such as exploration and oil rig construction. Engineers are also needed in power generation companies that use nuclear, wind, hydro, tidal and solar power. Global businesses such as EDF Energy and E.ON coexist with smaller companies which develop niche areas such as solar power. This area is open to most engineering disciplines.

The **railway** network is a major recruiter of graduates from many disciplines. The biggest of these is the infrastructure operator Network Rail. Other recruiters are the train operators, consultants, rolling stock suppliers and London Underground.

In **telecommunications**, key players are household names like Nokia, Ericsson, Siemens and Vodafone. Cutting-edge technological developments define this sector. Business awareness is a must. This area recruits mainly electrical, electronic, software and telecommunications engineers.

The **utilities** sector covers electricity, gas, water and waste management and the large number of major utility companies, such as npower, Scottish Power and Thames Water.

Small to medium-sized enterprises (SMEs)

Most engineering enterprises in the UK are small (10-49 people) or micro (1-9 people), and around 90% of engineering companies have fewer than ten employees (Engineering UK, 2012).

In December 2011 the government announced it would invest £75million of new funding through the Technology Strategy Board (TBS) to help high-tech SMEs develop new products. They have also introduced a range of other measures, including prizes for innovation. The aim of this is to boost economic growth in the UK and encourage research and development.

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Opportunities abroad

Engineering is a global industry and profession. Many graduate recruiters offer opportunities to work overseas, either for a short time or more permanently.

Getting the offer of work abroad depends on:

- the industry you work in - oil, engineering consultancy, energy and defence have more overseas opportunities;
- whether your company trades globally;
- your level of experience.

Some large graduate recruiters that offer overseas opportunities include: BG Group, BP, AECOM, Jacobs, Mott MacDonald, MWH, KBR UK Limited, Procter & Gamble (P&G) and Rolls-Royce.

The Association for Consultancy and Engineering (ACE) produces information on the international work of its members, citing which are active in different countries. Project work could take you anywhere; the Hong Kong metro, airport terminals in Toronto and Tel Aviv, an oil platform in the Philippines and the Channel Tunnel are among their completed projects.

Gaining work abroad becomes easier once you have gained two or more years' industrial experience. It is unusual, but not impossible, for a graduate with a first degree to immediately gain employment in the USA.

Will my qualifications be recognised?

The professional status of chartered engineer (CEng) affords international respect and recognition. The EUR ING qualification from the European Federation of National Engineering Associations (FEANI) is accepted in most European countries.

There is worldwide recognition of registrants and holders of Engineering Council-accredited academic qualifications.

Many countries outside Europe have signed up to the Washington, Sydney and Dublin Accords. This means that academic qualifications accredited by the Engineering Council at chartered, incorporated and engineering technician grade are accepted as meeting those countries' academic requirements.

To become professionally qualified with the Engineering Council as CEng, IEng, EngTech or ICTTech, you must be a member of a licensed professional engineering institution, which will act as the awarding body for your registration. Currently there are 36 of these and they are listed on the Engineering Council website.

For further information, see country profiles.

Future trends

Climate change

Future trends in engineering are dominated by government commitments to combat the effects of climate change and at the same time meet our demand for energy. The Climate Change Act 2008 legally binds the UK to reduce greenhouse gas emissions by 80% by 2050. It is widely accepted that to do this the country will have to develop the full range of low-carbon energy supply technologies already available, including nuclear, renewable energies and carbon capture and storage (CCS). Engineers are central to the development of these and even newer technologies.

New technologies

Some of the latest new technological solutions to reduce carbon emissions come from the field of geo-engineering. These include solar insulation solutions such as sun shades or discs sufficient to reduce the amount of solar radiation reaching the earth. These work in the same way as space mirrors, which are aluminium threads that are inserted into the space between the earth and the sun to reduce the amount of sunlight reaching the earth. Another development is synthetic trees, which attempt to directly remove CO2 from the atmosphere about a thousand times faster than their natural counterparts.

Engineers and scientists are also looking closely at geothermal heat mining technologies to generate electricity with virtually no emissions. One of these is geothermal power plants which use subterranean steam or hot water to turn turbines that produce electricity. The Eden Project in Cornwall will be the site of the first of these power plants and it is estimated that power could be generated from late 2013. Supporters argue that geothermal power could supply up to 20% of the UK's electricity needs.

Renewable energy

Wind energy is projected to offer the largest opportunity for growth in renewable energies and in engineering jobs. The London Array, 12 miles off the coast of Kent and Essex, will be the world's largest offshore wind farm. Wind farms offer similar kinds of work to that in other sectors such as oil and gas: working at sea, at height, safety roles and managing the transmission and distribution of large quantities of power. This means that engineers could transfer their skills and experience between energy sectors.

A type of solar power, photovoltaics (PVs), is a process in which solar cells convert sunlight directly into electricity and is under development in Wales, which is home to the UK's largest solar energy plant.

The government is considering plans for a privately-funded, multibillion-pound hydropower development in the form of a barrage between Cardiff and Weston-Super-Mare. It is estimated that this could provide around 5% of the UK's electricity needs.

Engineering designers may soon work to carbon as well as financial budgets, and all professional engineers have to make sure their designs conform to using the most sustainable kinds of tools, materials and energy. In support of this, the Engineering Council has developed six principles to guide engineers but at the same time enable them to meet their professional obligations. Read more about them at the Engineering Council Guidance on Sustainability.

Shortage of engineers

The engineering and industrial companies surveyed by the Association of Graduate Recruiters (AGR) reported that they were struggling to recruit enough skilled engineering graduates from the UK. There are particular shortages in aerospace and manufacturing, as well as energy, utilities and civil engineering.

'Engineering Graduates for Industry', a 2010 report by the Royal Academy of Engineering stated that the supply of graduate engineers is not projected to make up for the number of engineers who are retiring. It is estimated that an additional 2.2 million employees will be required across the engineering sector over the next five to ten years (Engineering UK, 2012). In the nuclear sector alone, 70% of the workforce is due to retire by 2025 (Gradcracker, 2012).

Jargon buster

- **ARMT** - availability, reliability, maintainability and testability.
- **CAD** - computer-assisted design. Using software such as AutoCAD.
- **CAE** - computer-assisted engineering. Engineering systems controlled in their operation by computer.
- **CAM** - computer-assisted manufacturing. Controlling machine tools by computer so that parts are made automatically.
- **CCS** - carbon capture and storage. Technology designed to prevent large amounts of CO2 from entering the atmosphere.
- **CEng** - chartered engineer status. The highest UK professional qualification requiring a Masters degree or equivalent qualification plus industrial training.
- **CFD** - computational fluid dynamics.
- **CPD** - continuing professional development.
- **DSP** - digital signal processing.
- **EngTech** - technician engineer status. A qualification requiring an HND or equivalent qualification and training.
- **EPSRC** - Engineering and Physical Sciences Research Council, responsible for funding research in engineering and the sciences and for funding some

postgraduate studies. Nearly all the other research councils, including the Natural Environment Research Council (NERC), the Biotechnology and Biological Sciences Research Council (BBSRC) and the Medical Research Council (MRC), employ engineers at their research laboratories.

- **EUR ING** - European engineering qualification, which is equivalent to CEng status and granted to those who have reached that standard of professionalism in their own country.
- **Eurocodes** - a pan-European set of structural design codes for builders, civil and structural engineers.
- **FEANI** - European Federation of National Engineering Associations. European engineering umbrella organisation that grants the EUR ING qualification, recognised in 31 countries in Europe.
- **Finite element analysis** - a mathematical system for analysing stresses and strains in material under certain conditions, e.g. aeroplane wings, building structures, cars and masts.
- **IEng** - incorporated engineer status. A qualification requiring a Bachelors degree plus industrial training.
- **ILS** - integrated logistical support, e.g. for maintenance, repair or supply of equipment.
- **IP** - internet protocol. The protocols required so that a computer user can access a remote internet website.
- **IPD** - initial personal development.
- **ISO** - International Organisation for Standardisation. Coordinates engineering standards in around 100 countries.
- **MPDS** - Monitored Professional Development Scheme of the Institution of Mechanical Engineers (IMechE), leading to IEng or CEng status.
- **N-type/P-type** - semiconductors in which most carriers are electrons and holes respectively.
- **Powertrain** - the system that transfers power from the engine to the wheels in an automobile.
- **RF** - radio frequency.
- **STEM** - science, technology, engineering and mathematics.
- **Stochastic** - statistically random variation.
- **TQM** - total quality management. Many organisations have a commitment to TQM and the continual improvement of their systems, processes, techniques and organisation.

Written by AGCAS editors, April 2012