# **engineering science** undergraduate course

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**The Department of Engineering Science at Oxford is one of the largest unified engineering departments in the UK.**

The Department of Engineering Science would like to thank Jaguar Land Rover and Rolls-Royce for their sponsorship of the Oxford Engineering Undergraduate Prospectus.

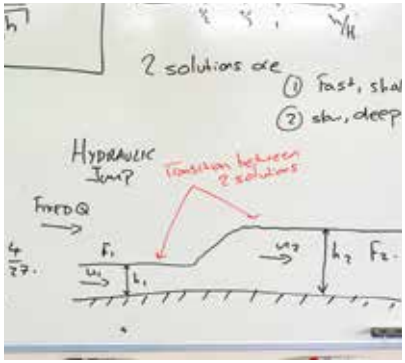
# about **engineering**

Engineering is the application of science and mathematics to benefit society. It encompasses a vast range of subjects on which the modern world depends for its capacity to maintain and improve the quality of life. It is also is concerned with tackling problems of pollution and sustainability that can result from technological development. Professional graduate engineers are the people who make good engineering happen; their qualities include technical competence, imagination, strength of purpose, common sense - and a social conscience.

**Engineering at University**

Engineering is an established subject at UK universities, generating valued graduates and essential research. Most UK undergraduate courses, some more highly specialised than others, are accredited by the major professional engineering institutions. To read such a course is the most straightforward route to becoming a chartered professional engineer.

The combination of rigour and practicality in their training makes good engineering graduates attractive to a wide range of employers. This element of later choice is a further advantage of an engineering degree.




**Engineering at Oxford**

The Department of Engineering Science at Oxford is a unified department, covering all the important engineering disciplines. It has a top-level rating for teaching and an international reputation for research. In keeping with other top-ranking engineering departments, it aims to provide a professional training with a sound theoretical foundation.

About 165 undergraduates per year are admitted onto the four-year programme in Engineering Science, leading to the degree of Master of Engineering. All undergraduates are members of an Oxford college, as well as the wider university.

# admission

**Requirements**
Enthusiasm for Engineering combined with high ability in mathematics and physics is essential for our engineering course. Good performance in Maths, Physics and a third A-level (or its equivalent) is normally required.

Inclusion of Maths Mechanics modules and study of Further Mathematics at AS or A-level is strongly encouraged, but is not required. Whilst many of the students applying for Engineering at Oxford are taking A-levels, any candidate who has already taken, or who is currently studying, any equivalent qualifications is also welcome to apply.

In addition to making a UCAS application, all candidates must take the Physics Aptitude Test (PAT), normally at their own school or college. Separate registration for this test is required and it is the responsibility of the candidate to ensure that they are registered at the appropriate time.

**The Admissions Process**
Admission of undergraduates to Oxford is the responsibility of colleges. Decisions on who will be offered a place are normally made on the basis of the UCAS application, interview performance and the PAT score. Every candidate called for interview will be interviewed by two colleges, one of which will be the candidate's college of preference.

The Engineering tutors act together in the admissions process so as to avoid the possibility of differences in procedures between colleges and to ensure that all candidates are treated fairly and consistently. Any query about Engineering admissions should therefore be sent to **deputy.administrator@eng.ox.ac.uk**

**Further Information**
More information about undergraduate study at Oxford – including how to apply, student funding and international applications – is available on the University's Undergraduate Courses website at **http://www.ox.ac.uk/admissions/undergraduate_courses/index.html**. A copy of the Undergraduate Prospectus can also be downloaded from this location.

Information specific to Engineering Science can be found at **http://www.eng.ox.ac.uk/admissions/undergraduate**

# learning

At school you are taught, but at University it is up to you to learn. Information is made available to you by several modes:

- **University lectures** introduce the material to be studied. In presenting topics that make up the syllabus, lecturers aim to explain what has to be thought about, why it is of interest, and how to approach the subject. Oxford's terms are short, and the number of lectures for each topic is smaller than elsewhere. It remains for undergraduates themselves to do the thinking and learning, guided by exercises that provide the basis for their tutorial work.
- **College tutorials** are Oxford's mechanism for helping undergraduates to learn. Tutorials in Engineering are organised to complement the University lectures. Undergraduates, normally in pairs, usually have two one-hour sessions with one of their college tutors each week. These tutorials provide a personal focus for each undergraduate's work and an opportunity to discuss any aspect of the course. For specialist topics in third and fourth years, tutorials are replaced by classes.
- **Practicals** are an essential part of the training of an engineer. Practical work is compulsory and supplements lectures. Practicals can range from computer programming to testing reinforced concrete columns or to exercises in multivariable control.
- **Coursework modules**. During the summer term of the second year, students take four-day intensive modules which integrate predominantly practical work with relevant theory and may include site visits.
- **Projects** provide an opportunity to gain experience of the process of design, from drawing up a specification through to analysis, assembly and evaluation. A project may be undertaken individually or by undergraduates working in groups.
- **Industrial experience** is an extremely important adjunct to an academic engineering education, and undergraduate are strongly encouraged to obtain it, possibly by spending some time in an industrial environment during their vacations.

# the **course**

The first two years are devoted to topics which we believe all Engineering undergraduates should study. In the third and fourth years there is scope for specialisation into one of six branches of engineering: Biomedical, Chemical, Civil, Electrical, Information and Mechanical. Decisions about which of these will be your specialisation can be deferred until the third year.

University examinations are held at the end of each year - see below for details.

**A typical week**
As a guide, you will have up to about ten lectures, two college tutorials or classes, and up to five hours of practical work each week of term for the first three years. In the fourth year, the research project will take up roughly half your time.

## Course Summary

| | |
|---|---|
| **The First Year** | 4 Core Engineering Papers |
| | Engineering Practical Work |
| | Preliminary Examination at end of 1st year |
| **The Second Year** | 4 Core Engineering Papers |
| | Engineering Practical Work |
| | Finals Part A taken at end of 2nd year |
| **The Third Year** | Engineering Computation |
| | Engineering in Society |
| | Engineering Intermediate Options |
| | Engineering Design Project |
| | Finals Part B taken at end of 3rd Year |
| **The Fourth Year** | Engineering Specialist Options |
| | Major Project |
| | Finals Part C taken at end of 4th Year |

# the **first** year

**Lecture Courses**

- Structures
- Electricity
- Materials
- Mathematics
- Mechanics
- Digital Systems
- Thermodynamics
- Energy Systems

**Outline**
Part of the first year revises, and presents in a new way, aspects of the mathematical and physical foundations of engineering which will be familiar to you from school. Topics more specific to engineering are introduced, such as structures, fluid mechanics, material properties and digital systems.

You are also introduced to practical work, and the important idea of engineering design, build and test. Undergraduates have access to computer facilities and extensive library services to support their work.

**Practical Work**
Structural laboratory work complements lectures, introducing students to sound engineering practice. In addition to sessions on drawing and design, workshop practice and thermofluids, there are three projects to design, build and test in the following areas:

- Structural and mechanical engineering
- Electrical engineering
- Computing

In these, students have a single product goal but must make their own design decisions.

# years **two-three**

**Core Course**
In the second year, students continue to study core subjects which the Department believes form the essential foundations of general engineering. Practical work supplements each of these subjects and includes intensive coursework modules on various practical topics during the summer term of the second year.

**Engineering in Society**
Students also take courses that relate technical issues to engineering practice in society, including the professional obligations of engineers, safety and risk, sustainability and the environment, engineering project management and technology strategy.

**Third Year Options and Design Project**
In the third year, students start to specialise in those subjects of most interest. Currently fourteen options are available, across the range of engineering disciplines. Each student must select five options.

Students also undertake a design project to gain experience of, and insight into, the engineering design process. Students work in a small design team to produce a report in the form of a detailed design proposal which could then be used either by a manufacturer as the basis for a marketable product, or as a design for a proposed engineering project. Visiting Professors of Engineering Design participate and provide guidance and technical advice drawn from their industrial experience.

**Recent projects have included the design of:**

- Electric and hybrid Formula Student race cars
- An optical fabrication system for nanotechnology
- Medicines for the next generation: pharmaceutical production
- Marine renewable energy devices
- A planetary explorer
- Low-energy buildings
- The Oxford Roller Coaster

**Core Subjects**
- Mathematics
- Electronic and Information Engineering
- Structures and Dynamics
- Energy Systems
- Engineering Computation

**Typical Option Topics**
- Solid Mechanics
- Equilibrium Thermodynamics
- Structures and Hydraulics
- Circuits and Communications
- Control Systems
- Software Engineering
- Biomedical Modelling and Monitoring

# year **four**

**Specialist Options**
Specialist options are taken in the fourth year and the detailed lists from which students choose are reviewed each year.

**Typical Option Topics**

- Automotive Engineering
- Materials and Solid Mechanics
- Geotechnics
- Soil Mechanics
- Hydraulics
- Environmental Engineering
- Sustainable Energy
- Process Systems
- Chemical Engineering
- Production Engineering
- Optoelectronics
- Communications
- Robotics
- Biomedical Imaging
- Optimization and Mathematical Methods

**Project**
Each student works on a major project chosen from well over a hundred topics offered by supervisors in the Department. It is sometimes possible to work on an idea of your own, or one suggested by a sponsoring firm, provided that you can find a member of the academic staff to supervise it. A strong element of engineering design is required.

**Recent projects include:**

- Storm flow through built-up areas
- Foldable structures for medical applications
- Electric Carpet - wireless power for the home
- Laptops in the sun
- 3D city reconstruction

**Overseas Study**
Some opportunities exist for overseas study in the final year, either as part of an exchange scheme (e.g. with Princeton University, USA) or in the form of a six-month placement.

# accreditation & sponsorship

University courses are considered for accreditation by each major institution separately and this approval is reviewed regularly. The following institutions accredit our course:

**Institution of Civil Engineers (www.ice.org.uk/)**
**Institution of Structural Engineers (www.istructe.org.uk/)**
**The Institution of Engineering and Technology (www.theiet.org/)**
**Institution of Mechanical Engineers (www.imeche.org/)**
**Institute of Measurement and Control (www.instmc.org.uk/)**
**Institution of Chemical Engineers (www.icheme.org/)**

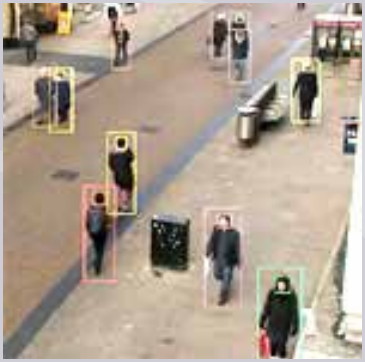
In some cases appropriate options and project topics are required for accreditation.

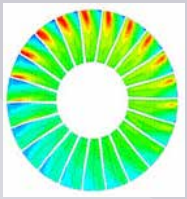
Industrial sponsorship can be valuable but is not required as far as the course is concerned. Further information is generally available through your school careers teacher, or from the engineering institutions. If your sponsoring company want you to spend a year with them before university, you will be asked to declare this at your admissions interview, so your college does not allocate a place to you that could otherwise be given to another candidate.

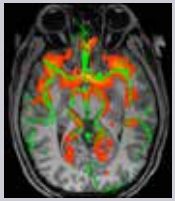
For those considering a year out between school and university there is also the Year in Industry scheme. Visit the scheme's website at **www.etrust.org.uk/year_in_industry.cfm** for further information.

"I not only really enjoyed my year working at DSTL (Defence Science and Technology Laboratory) but got a lot from it; I was able to take a large role in the development of a new technology and was involved in all aspects of its testing and improvement. With Year in Industry you also get experience of working on your own and using your own initiative which makes the jump from school to the university style of learning far easier - knowing what being an engineer is actually like before studying is invaluable. Besides going back to work at DSTL every summer for a couple of months, they are also sponsoring me which definitely helps reduce my overdraft at the end of every term!'

*Helena, who completed a Year in Industry at the Defence Science Technology Laboratory*







# **engineering** at Oxford

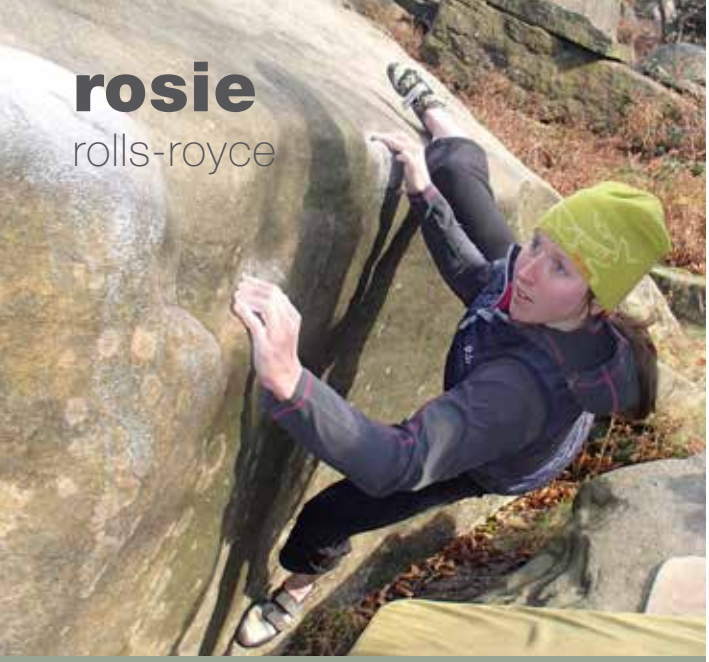
Outside the academic programme of study, there are opportunities for undergraduates to meet with senior staff in the Department as well as former graduates of the Engineering courses at Oxford.

**Joint Consultative Committee**
The Joint Consultative Committee is a body of undergraduate and postgraduate students and senior staff which meets on a regular basis to discuss matters relating to the Department of Engineering Science and students' needs.

**Oxford University Engineering Society (OUEngSoc)**
The Engineering Society exists to promote a wider interest in Engineering than is possible through the academic course. A regular programme of meetings and visits is run by an undergraduate committee with the support of a senior member from the staff of the Department.

Further information about OUEngSoc and other Engineering Societies is available on the Department's web pages at **http://www.eng.ox.ac.uk/about-us/engineering-societies**

**Careers**
The analytical skills, numeracy and practicality developed by Engineering Science graduates are sought after in both industry and commerce. Many continue into a career as a professional engineer, while others enter business areas such as management consultancy. Around 30% go on to further study following their degree. Profiles of four of our graduates are included on pages 10-11 of this prospectus - further profiles can be viewed online at **http://www.eng.ox.ac.uk/admissions/student-profiles**.



# rosie
rolls-royce

## student profile

**Rosie Wilson MEng Oxon AMIMechE**
**Graduate Engineer, Rolls-Royce**
**Engineering Science, Magdalen College 2008-2012**

"The Engineering Science course at Oxford has provided me with an excellent technical base for tackling real world problems in the workplace. Having knowledge of all the engineering disciplines has been extremely beneficial to me during my time at Rolls-Royce. So far on the graduate scheme I have completed a variety of roles all requiring a broad knowledge of engineering. For example, I have supported early phase Research & Technology testing of composite technology, produced a business case highlighting a cost reduction opportunity through the use of a cutting edge manufacturing process and developed a new automation technique for turbine blade and vane thermal modelling.

Engineering Science has provided me with the theory and breadth required to face the fast paced challenges of the aerospace industry."

## student profile

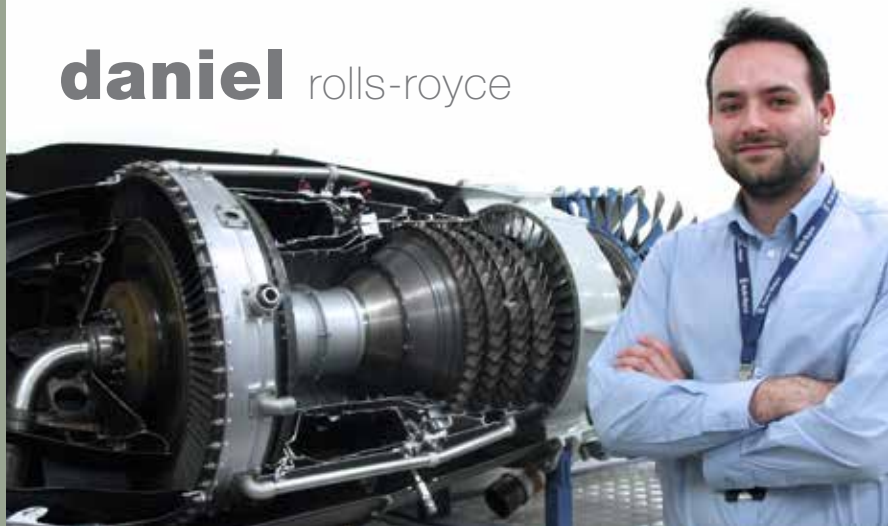
**Daniel Williams MEng (Oxon) MIET**
**Control Systems Engineer, Rolls-Royce**
**Engineering Science, University College 2005 – 2009**

"I chose to study at Oxford due to the broad nature of the Engineering Science course - having interests in several different fields of Engineering I couldn't decide on a particular area to specialise in. The analytical and theoretical nature of the course provided a great knowledge base, which allows me to apply my Engineering knowledge to a wide range of problems.

I applied for a summer internship at Rolls-Royce during my 3rd year at Oxford; the experience was hugely rewarding and helped me to gain a better understanding of how my studies might be applied in the real world. I returned to Oxford to complete my final year with a renewed enthusiasm for Engineering and a goal to further my knowledge in the fields of manufacturing and control systems. Following my internship I was offered a job at Rolls-Royce and upon the completion of my 4th year I returned to Rolls-Royce as a Controls Engineering Graduate.

I have now been working for Rolls-Royce for as long as I studied at Oxford. Both experiences have provided me with amazing opportunities to develop myself both as a person and as an Engineer. For example, during my time as a Rolls-Royce Graduate I was lucky enough to be seconded to support the business in Montreal, Canada. I currently work on the LiftSystem for the Joint Strike Fighter, which requires me to work closely with both suppliers and with the customer. Managing these relationships whilst also delivering complex technical solutions is a very interesting challenge which I have found to be very satisfying. I am currently working towards Chartered Engineer status with the Institution of Engineering Technology, the accredited course at Oxford, and the structured Graduate scheme at Rolls-Royce has been instrumental in gaining the experience required."

# daniel
rolls-royce

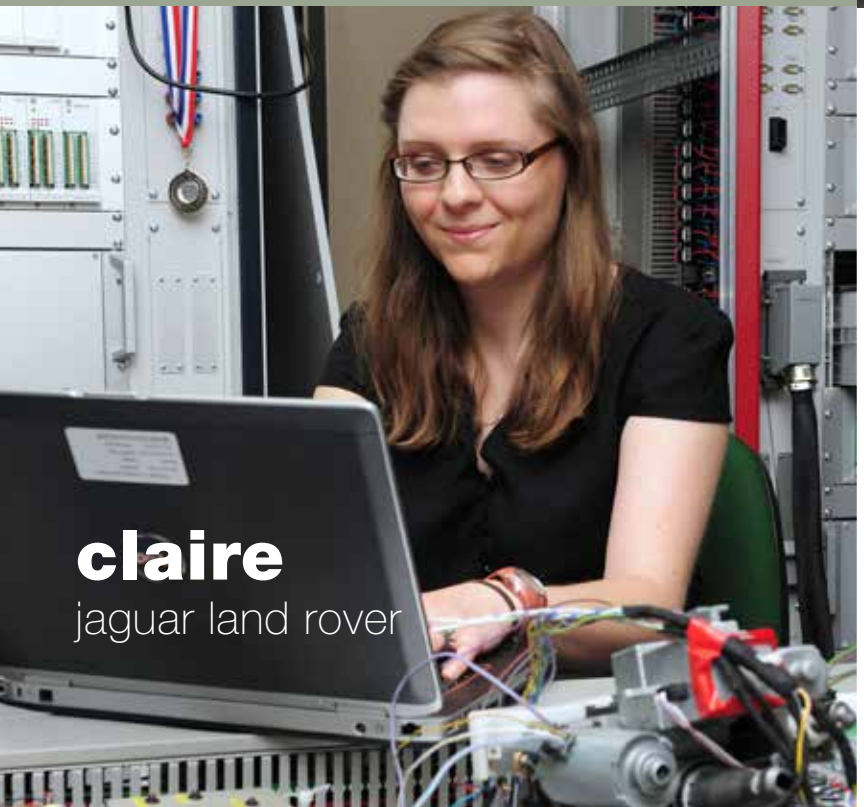


## **student** profile

**Dr Claire Lucas**
**Mathematical Modeller, Electrical, Electronic and Software Engineering, Jaguar Land Rover**
**Engineering Science, Worcester College 2004-08 and St Cross College 2008-12**

"My role at Jaguar Land Rover involves deriving the equations to describe complicated, multi-body systems and then coding a model for use in virtual development and testing of components and software. The benefit of a general introduction to engineering disciplines is therefore a common 'first principles' approach to any problem, which is advantageous when compared to a specific degree. This, combined with experience in coding and simulation gained during my DPhil (PhD), has enabled me to carve a specific niche within Jaguar Land Rover and I have modelled everything from the use of flexible desks in the company to a thermodynamic air spring.

The skills of an engineering scientist is therefore in high demand as more complicated systems are developed virtually (without prototype testing) – for example, all wheel drive which electronically adjusts the mechanical power delivered to the individual wheels in order to maximise the available grip."





## **student** profile

**Omar Islam MEng Oxon AMIMechE**
**Chassis Graduate Engineer, Jaguar Land Rover**
**Engineering Science, Pembroke College 2007-2011**

"My Oxford degree has offered me the perfect knowledge platform for initiating my career with Jaguar Land Rover. Specialising in mechanical engineering, I have found that real life problems require an understanding of all engineering disciplines; one day I may be analysing component stresses and load paths, and the next day I may be wiring up instrumentation on a prototype vehicle. Everyday can offer a new challenge.

Engineering Science taught me the latest technologies and industry techniques. It is this theory and skill which I put in to practice everyday as a product development engineer. The breadth of the Engineering Science course allowed me to keep up with the fast pace of a thriving automotive industry from day one!"

# visits & open days

University departments and colleges co-operate to organise Open Days at the end of the summer term and in some cases also in September. Many schools are on the mailing list for these Open Days and others will be added on application to the Admissions Information Centre.

Open Days at the Department of Engineering Science enable visitors to learn more about the Engineering courses at Oxford and provide the opportunity to see laboratories and research displays. In addition college tutors can be consulted. Prospective students who are unable to attend the Open Days should contact the Deputy Administrator to discuss alternative arrangements.

**For further information contact:**

Deputy Administrator (Academic)
Department of Engineering Science
University of Oxford
Parks Road
Oxford OX1 3PJ
+44 (0) 1865 273012
deputy.administrator@eng.ox.ac.uk
**http://www.eng.ox.ac.uk**

Admissions Information Centre
55 Little Clarendon Street
Oxford OX1 2HS
+44 (0) 1865 288000
undergraduate.admissions@admin.ox.ac.uk
**http://www.admissions.ox.ac.uk**


**Travel to the Department**
Directions on how to find the Department of Engineering Science are available at **http://www.eng.ox.ac.uk/contact-us/travel-to-the-department**.

*Innovation, quality, performance and premium... since conception, Jaguar Land Rover has been redefining the boundaries of luxury motoring. Each of these brands is a clear market leader in its field, known and desired the world over. Less well-known perhaps, is the quality of Jaguar Land Rover's 2 year graduate programme. Yet this, too, displays the same hallmarks of excellence as their exceptional vehicles.*

Jaguar Land Rover is the UK's largest automotive manufacturing business built around two iconic British car brands with a wonderfully rich heritage and incredibly powerful consumer appeal and loyalty.

As the UK's largest investor in automotive R&D and engineering, committing over £2.75 billion in 2013/14 to product creation, Jaguar Land Rover is at the centre of the UK automotive industry's drive to deliver technical innovation in all areas of vehicle development.

As the UK's largest automotive employer, Jaguar Land Rover has a world class team of 24,000 people in the UK, plus 1,000 globally. In addition, it supports 170,000 people through the supply chain, dealer network and wider economy.

# Rolls-Royce

*Rolls-Royce is a global company, providing integrated power solutions for customers in civil and defence aerospace, marine and energy markets.*

We currently employ over 45,000 people in more than 50 countries around the world. With an order book of over £60 billion, those numbers are set to increase as well. Our people are our power. Their pride in what Rolls-Royce has achieved, their commitment to delivering excellence to our customers, and their vision of what we can achieve in the future are all fundamental to our continued success.

To date, we've enabled land-speed records, designed the world's most eco-friendly ships, and powered nuclear submarines. In pursuit of better power for a changing world, we apply our knowledge and technology to developing the best solutions for our customers and the environment.

Each year we invest millions in research and development so we can keep on powering the future. In 2012 for instance, we invested £919 million – and over the last decade we've poured over £7.9 billion into R&D. Two thirds of that investment goes into improving the environmental performance of our products; at the moment we're investing in renewable and low-carbon technologies, as well as in nuclear energy.

We're busy exploring the next generation of technology, for products the market will be demanding 10 or 20 years from now. As a graduate or undergraduate, your drive and fresh approach are vital to our business. So think about the next step in your future career. Then like we always do, think higher, bigger, faster, better.

www.eng.ox.ac.uk

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