Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

energy institute
Learning Affiliate

MSc in Energy Science

Learning Affiliate of the Energy Institute

90 ECTS
Full time over 12 months
Part time over 24 months

Energy Science is a broad, modern, inter-discipline essential to the global way of life in the 21st century and beyond. Energy Science encompasses the essential aspects of Physics, Chemistry, Geology, Engineering and Business that pertain to the generation and utilisation of Energy.

About the Degree

The connection between physics, chemistry, earth science and economics determines how energy is utilised, the environmental consequences of its use, and in turn determines many government policies across the globe.

A working understanding of each of these areas is necessary for students inspired to pursue a career in the energy sector, or for those interested in communicating or managing the environmental impact of the world's energy use, such as climate change.

The syllabus covers Energy Economics and Policy, Natural Resource Management, Fossil & Nuclear Energy, Conventional Energy Conversion Devices, Sustainable Energy Technologies, Electricity & Power Electronics, and Mitigation of the Environmental Impact of Energy Utilisation. Each topic starts from the fundamental scientific principles and develops to the actual engineering implementations.

Course Structure

The curriculum is designed to allow students from science, engineering, or other backgrounds with relevant experience, to gain the scientific knowledge needed to contribute to the energy sector. This can be through industry, business, academia, government policy or media communication.

Students will examine the fundamental and applied science of how energy resources could be diversified from conventional polluting sources (e.g. CO_2, NO_X, SMOG) to renewable sources, where the sustainability of both the energy source and the conversion technology is presently unknown.

Introduction to Energy Science	Lecture Hours
Context and Philosophy of Energy Science	2
Environmental Impact of Energy Utilisation	12
Economics of Energy & Energy Regulation & Policy	15
Thermodynamics, Reaction Kinetics and Heat Transfer	12
Energy Storage Electromagnetism	12
Materials for Energy Applications	7
Total	60

Core 1: Conventional Energy Sources & Technologies	Lecture Hours
Fossil fuels, Combustion, Engines and Emissions	25
Nuclear Reactions, Materials and Reactor Technology	15
Total	40

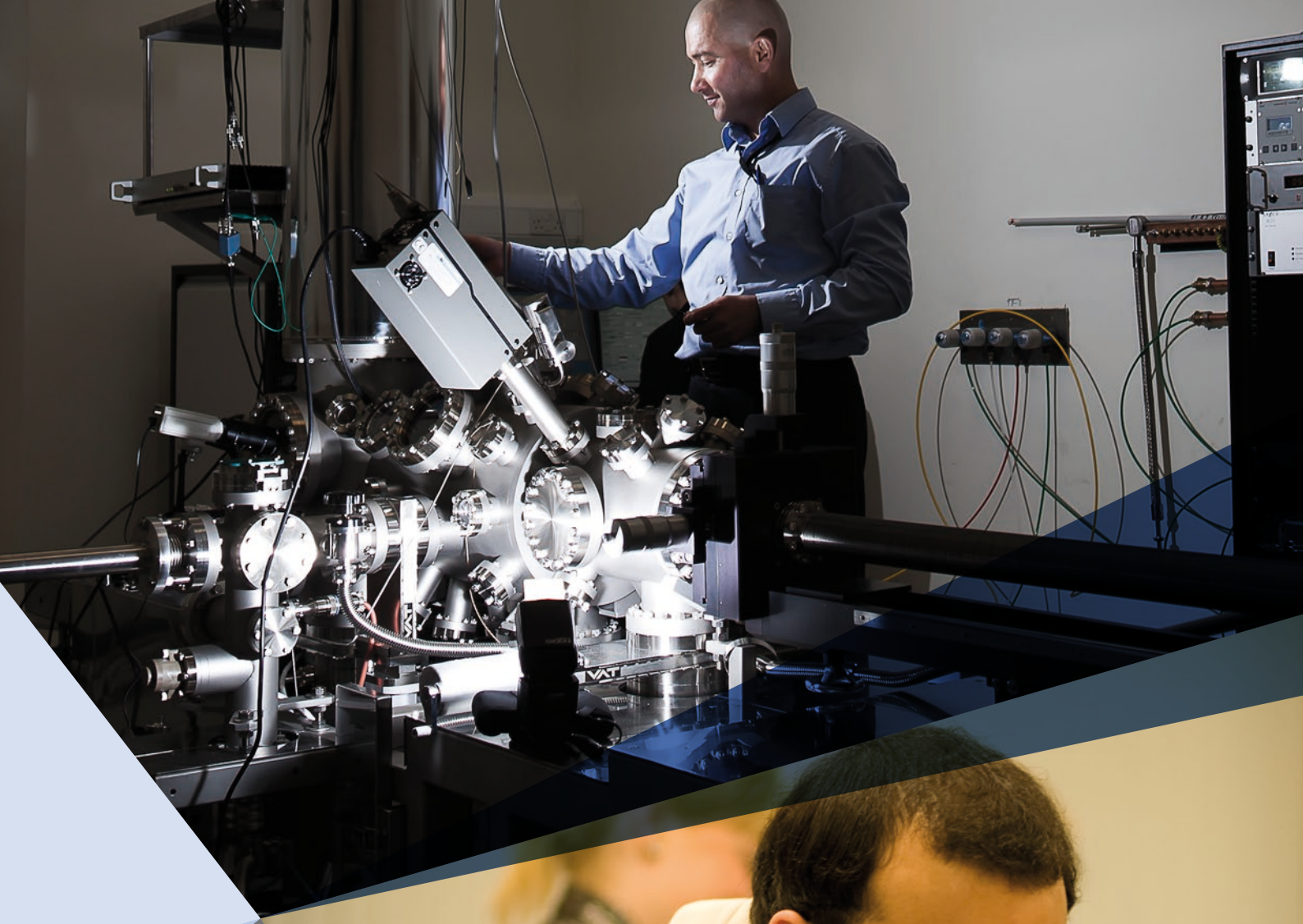
Core 2: Electric Power Generation and Distribution	Lecture Hours
Electric machines and Power electronics	20
Power systems analysis and Smart grids.	20
Total	40

Core 3: Sustainable Energy Sources & Technologies I	Lecture Hours
Electrochemical cell technology	12
Wind Energy Generation and Storage	28
Total	40

Core 4: Sustainable Energy Sources & Technologies II	Lecture Hours
Photovoltaics	13
Carbon Dioxide and Capture & Storage	14
Biomass, Biofuels and Hydrogen	13
Total	40

Core 5: Managing the Impact of Energy Utilisation	Lecture Hours
Raw Materials and Natural Resource Management	15
Techniques for Quantitative Analysis and Characterisation of Energy Critical Raw Materials	15
Nuclear Safety and Environmental Impact	10
Total	40

Core 6: Research Project and Dissertation in Academia or Industry
15 weeks Full-Time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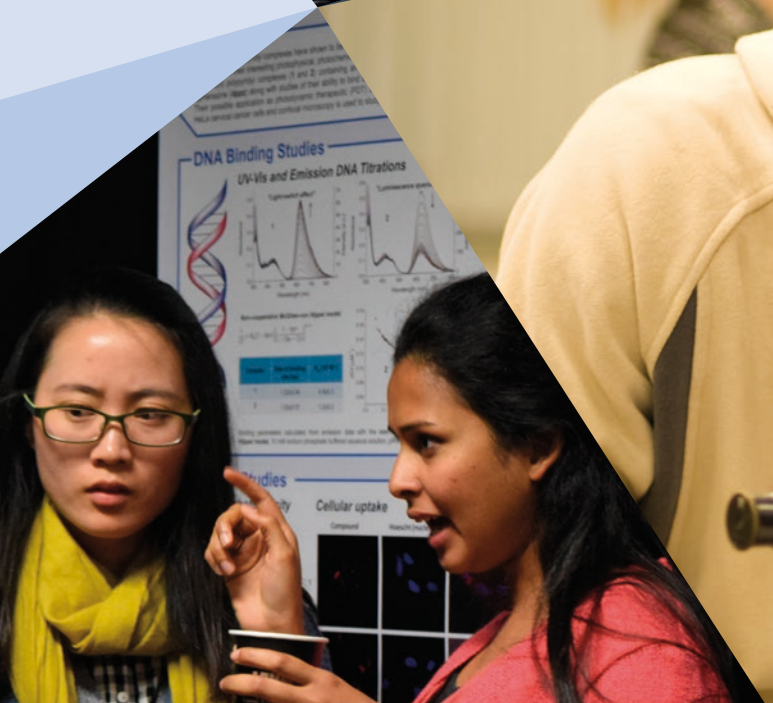
DNA Binding Studies
UV-Vis and Emission DNA Titrations
Cellular uptake

RECHARCHABLE
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Syllabus Summary

Introduction to Energy Science: Essential Science and Economics for Energy

A cross cutting introductory module is designed to furnish students with all of the basic physics, chemistry and engineering concepts that are required to become an "Energy Scientist". These basics complement an introduction to the essential **"Economics of Energy"** and **"Principals of Energy Policy"** which will help students understand the compatibility of energy technologies with market uptake arguments.

Syllabus: Economics of energy, Energy policy & regulation, Essential Thermodynamics, Reaction kinetics and Heat transfer, Essential Electromagnetism, Materials for energy applications, Greenhouse gases and the carbon cycle.

Armed with all of the essential science, engineering and economics pertinent to the energy discipline, the students proceed to **five specialised modules**;

1. **Conventional Energy Sources & Technologies:** Fossil fuels, combustion, engines and emissions, Nuclear energy reactions, Nuclear materials and reactor technologies, Nuclear safety and environmental impact.
2. **Electricity Generation and Distribution:** Power electronics and Electricity generating machines, Photovoltaics, Power systems and analysis, Smart grids.
3. **Sustainable Energy Sources & Technologies I:** Electrochemical cell technology, Wind Energy Generation and Storage.
4. **Sustainable Energy Sources & Technologies I:** Photovoltaics,Carbon Dioxide and Capture &Storage, Biomass, Biofuels and Hydrogen.
5. **Managing the Impact of Energy:** Raw material availability, Carbon dioxide capture & storage, Managing environmental impact of energy use.
6. **15-week research project** in industry or academia or on energy-relevant topic.

Career Opportunities

The cost of energy is a dominant factor in determining the profitability of any manufacturing business. Large multi-national companies are therefore very concerned by the efficiency and sustainability of their energy usage, as are government organisations.

Ireland and the other European Union member states are the international leaders in energy efficiency and energy sustainability. Our leadership is driven by the European target to produce a 30% reduction in energy usage and CO_2 production by 2030. The energy innovations that will deliver this target will be underpinned by graduates strong in the discipline of energy science.

Because of this, graduates who understand the scientific factors that determine these "Energy Bottom Lines" are in high demand. In addition to environmental and energy regulating authorities, graduates of the MSc in Energy Science have knowledge and skills directly applicable to a host of energy orientated industries, including; power generation and distribution; electronics, automotive, aviation, construction and oil & gas. For graduates interested in academic research, the societal pursuit of clean and secure Energy is at the heart of the research agenda of every major country.

Irish Visa – Third Level Graduate Programme

Under the Third Level Graduate Scheme the Irish Government allows both EU and non-EU/EEA students obtaining a MSc in Energy Science 24 months to seek employment in Ireland.

Top-ten reasons to study for an MSc in Energy Science at Trinity College Dublin…

1. Dating back to 1592, Trinity College Dublin (TCD) **is one of the world's leading universities**, ranked in the top 100, and is recognised internationally as Ireland's premier university. (QS University Rankings 2016/2017).
2. Trinity is also recognised as one of the world's leading research – intensive universities, many of the MSc Energy Science teaching staff are world leaders in their fields.
3. Dublin has a strong energy relevant industry with many energy intensive multinational companies located close by including; 24 of the world top 25 world pharmaceutical and biotechnology companies and 9 of the world top 10 ICT companies. All of these businesses are energy intensive and have an economic necessity to manage their energy utilisation effectively.
4. The MSc is hosted across the Schools of Physics, Chemistry, Geology and Engineering. This gives the student an unmatched **interdisciplinary ability** to understand all of the science and technology issues related to energy science.
5. Dissertations from all postgraduate courses are showcased every year and students discuss their research results with guests from the public sector, business, and industry offering opportunities for recruitment, networking and further collaborations.
6. Graduates of Trinity are highly sought after. Our direct links with industry and research sponsors facilitate the employment and career development of our graduates.
7. Trinity college Dublin is one of the most successful colleges in Europe for **fostering entrepreneurship**. For the second year running Trinity is the top University in Europe for entrepreneurial graduates who have raised venture capital.
8. Trinity contains large international scale research centres co-funded by Irish and European Government in addition to Industry.
9. Dublin is a **global capital of culture**, Trinity is located in the very centre of this vibrant, multi-cultural city and is a very attractive location for student life, scholarship and for learning and practicing the English Language.
10. Dublin is a **gateway to all interesting European cities** and is the hub location for Ryanair the world's leading low cost airline, allowing affordable access to all of the culture of Europe.

Comments from Trinity Student's across the world:

"Studying with students from all the different corners of earth has been one of the best opportunities for me at Trinity. I think that the high diversity of international students on this campus allows students to be more culturally aware and to learn from each other. As an engineering student if I am to contribute to solving challenges in the world today, even with all of the academic skills that I have gained, embracing these values are just as important. The environment at Trinity is perfect for that!"

Herbert Innocent
Engineering

"Returning to academic studies after ten years in the mining industry, was quite a daunting prospect at first! However, my decision to study at Trinity College Dublin has proven to be one of the most rewarding I've made in my career. As a postgraduate student in science at Trinity you immediately become part of a vibrant, international and outward-looking research community; you have access to some of the greatest minds in your field along with world-class equipment. It's a great place to be and I'd highly recommend going for it."

James Stratford
Geology

"Trinity is one of the best universities in the world with many state-of-the-art facilities. I have been interested in studying in Europe for a long time, so Trinity is the perfect choice for me!. My research project is very compatible with my background and research interest. I can get started as soon as possible on my career path while I am working on my postgraduate degree!"

Xin Chen
Chemistry

"I'm starting the final year of my PhD in gas storage in Metal-Organic Frameworks. I found it very easy to study here because of how helpful my peers and the staff were. Since then, I've been very grateful for how much I've learned from the faculty and other researchers, resources that were made available for my research, and exposure both for my own work, and to current world-class research. Dublin is also a very lively place to live, and I'd recommend it to everyone!"

Debobroto Sensharma
Chemistry

"The atmosphere at Trinity is friendly and comfortable. Whatever stress the course brings, the working environment makes up for it. A lot of the professors are super approachable and if you have a question, they will try their best to answer it. And then there's sitting in the Schrödinger lecture theatre and learning the theories that the great scientist formulated. Knowing that he had once stood there is a surreal feeling!"

Yashaswi Nalawade
Physics

Entry requirements

This MSc is suitable for graduates who have achieved an upper second class honours degree or the international equivalent in either physical sciences or engineering. However, applications from similarly qualified candidates from other disciplines are welcome if they can demonstrate a sufficient level of knowledge or interest in the Energy sector.

Application Procedure

Applications will be accepted until June 30th. Final decisions on all applications will be made by the July 31st. However as entry to the MSc in Energy Science is highly competitive, early application is advised and opens on November 1st.

Your application should consist of the following documents

- Cover letter outlining your interest in the degree.
- Curriculum Vitae.
- Transcript of academic results.
- Copies of degree certificates.
- Contact details of two academic references.

If English is not your first language, you should also include documentation showing reasonable competency in the English language. Applicants whose first language is not English or who have not completed their undergraduate degree through the medium of English are welcome but may be required to demonstrate their English through an assessment or interview with the Course Director prior to a final decision on admission Trinity's English language requirements are available at **https://www.tcd.ie/study/eu/undergraduate/admission-requirements/english-language/**

The University may request additional documents. Guidelines on how to complete the application form as well as the additional documents that must accompany an application are available from the **https://www.tcd.ie/Graduate_Studies/students/prospective/apply**. Please note that in some cases where there are pending documents, excellent candidates may be made a Conditional Offer.

Most candidates are typically informed of the decision on their application within three weeks following the receipt of the complete application.

Prospective students should contact
the course director at the details below.

Contact us:
Email: energyscience@tcd.ie
Website: **www.tcd.ie/energyscience**
Telephone: +353 1 896 4141

Course Fees
The fee levels for the current academic year are available at
https://www.tcd.ie/academicregistry/fees-payments/course-fees/

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International Accreditation

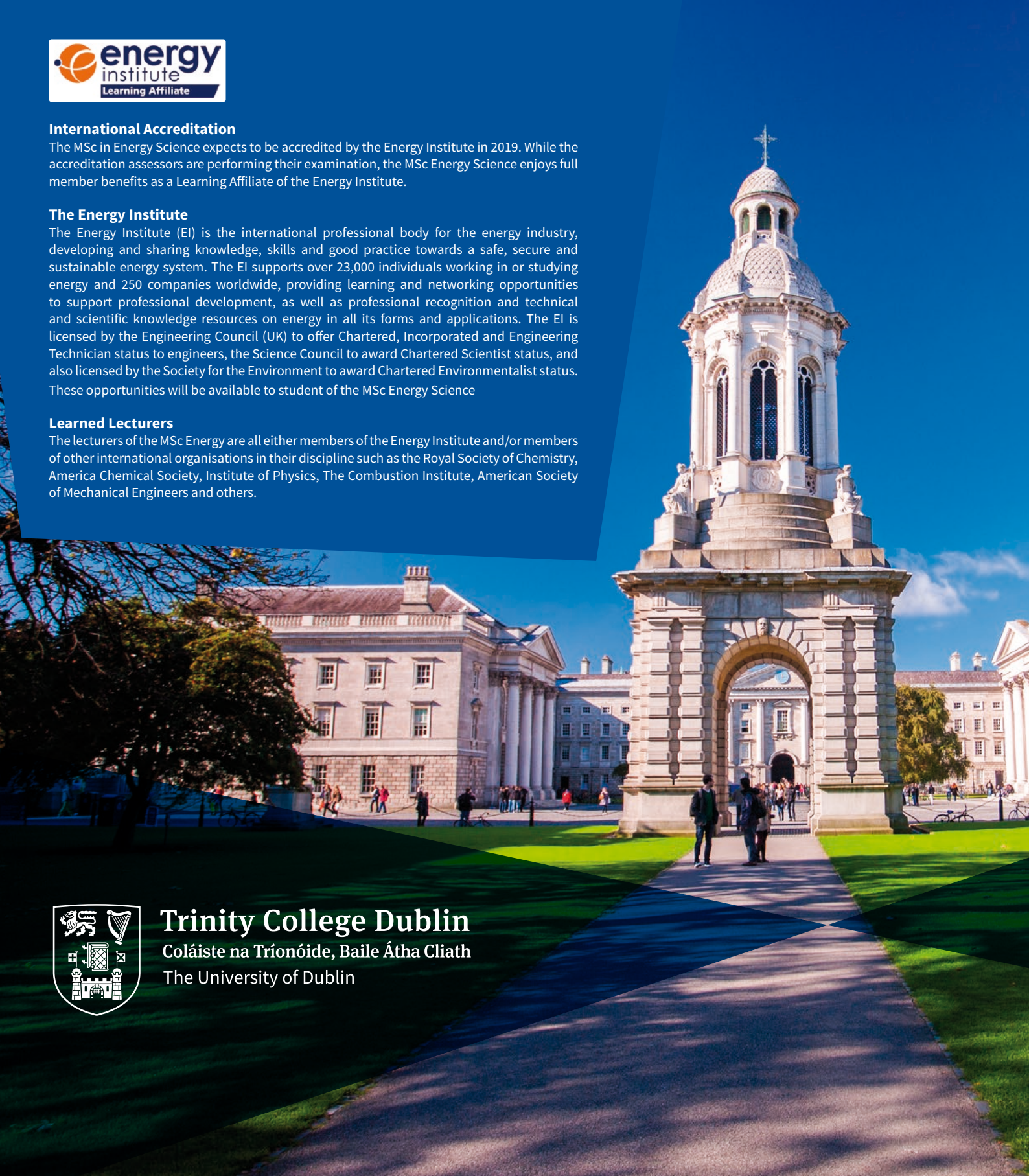
The MSc in Energy Science expects to be accredited by the Energy Institute in 2019. While the accreditation assessors are performing their examination, the MSc Energy Science enjoys full member benefits as a Learning Affiliate of the Energy Institute.

The Energy Institute

The Energy Institute (EI) is the international professional body for the energy industry, developing and sharing knowledge, skills and good practice towards a safe, secure and sustainable energy system. The EI supports over 23,000 individuals working in or studying energy and 250 companies worldwide, providing learning and networking opportunities to support professional development, as well as professional recognition and technical and scientific knowledge resources on energy in all its forms and applications. The EI is licensed by the Engineering Council (UK) to offer Chartered, Incorporated and Engineering Technician status to engineers, the Science Council to award Chartered Scientist status, and also licensed by the Society for the Environment to award Chartered Environmentalist status. These opportunities will be available to student of the MSc Energy Science

Learned Lecturers

The lecturers of the MSc Energy are all either members of the Energy Institute and/or members of other international organisations in their discipline such as the Royal Society of Chemistry, America Chemical Society, Institute of Physics, The Combustion Institute, American Society of Mechanical Engineers and others.



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