

SCHOOL OF ENGINEERING

ME / BE (Hons) Energy Engineering



UCC

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Student Handbook 2022-2023



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Welcome to Energy Engineering 2022-2023

I do hope you can fully enjoy the joys and benefits of the return to an on-campus experience in UCC. In 2022 we are facing new challenges as we emerge from the COVID-19 pandemic, in particular the horrors associated with the Russian invasion into Ukraine. In addition to causing huge human cost and suffering, this war is bringing energy security and affordability issues to the fore. In parallel with this, climate change is ever more visible with the extreme climate related heatwaves, flooding and bushfires.

These are the contextual backdrop to you studying energy engineering, where you explore engineering solutions to the climate emergency, energy security, energy access and energy affordability. Energy engineering focuses on converting energy resources into useful forms to meet our needs for transport, heating and electricity, demand increasing the efficiency of energy end use in our homes, businesses and in transportation and on maximising the penetration of renewable energy supply.

An additional contextual backdrop in Ireland is the recent political leadership in addressing climate change. Over two short years, we have legislation that places Ireland in a leadership role in terms of climate ambition. We have carbon budgets and sectoral emissions ceilings that provide clarity on the short term pathway to a low a carbon future requiring massive changes in the energy system.

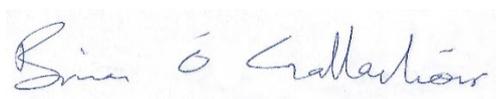
You are studying in UCC, one of Ireland's oldest institutions of higher learning, originally founded in 1845. Ranked in the top 2% of universities worldwide, UCC students instigated a pilot Green Campus programme in 2007, which saw the university become the first in the world to be awarded a Green Flag from the Foundation for Environmental Education. Our programme is student-led, research-informed and practice-focused and our success demonstrates the strong commitment across all levels in the university. In 2018, UCC became the 1st university in Europe to be awarded a Gold Star from the Association for the Advancement of Sustainability in Higher Education, and was ranked in the top ten globally in 2021 on sustainability in the Times Higher Education Impact and the UI Green Metric rankings.

Our graduates are now directly engaged in the energy transition to a sustainable low carbon future in Ireland, across the EU and further afield. Some have taken up leadership roles in wind energy development, intelligent energy efficiency, solar and bioenergy companies. Other graduates are working in the areas of consultancy and in energy and climate policy. In addition, some have also embarked on a research career in sustainable energy.

UCC established Ireland's first accredited degree programme in Energy Engineering in 2008, in recognition of the growing need for sustainable energy systems and the shortage of qualified engineers to address the challenges of climate change. The programme builds on UCC's strong research track record in sustainable energy engineering, in particular in areas where UCC leads internationally i.e. offshore renewable energy renewable gas and energy systems modelling. UCC also has a strong track record intelligent energy efficiency, electric vehicles, wind energy, power electronics, control systems and solar photovoltaic energy.

I hope you find the programme and your time here to be a happy and beneficial experience.

Wishing you every success on our programme,



Brian Ó Gallachóir, Professor of Energy Engineering,
Director, ME (Energy) and BE HONS (Energy) Programmes, UCC



Programme Overview

Do you want to address climate change, which is mainly caused by the burning of fossil fuels? UCC energy engineering graduates are currently working in leadership roles in Ireland and abroad developing renewable energy and energy efficiency solutions.

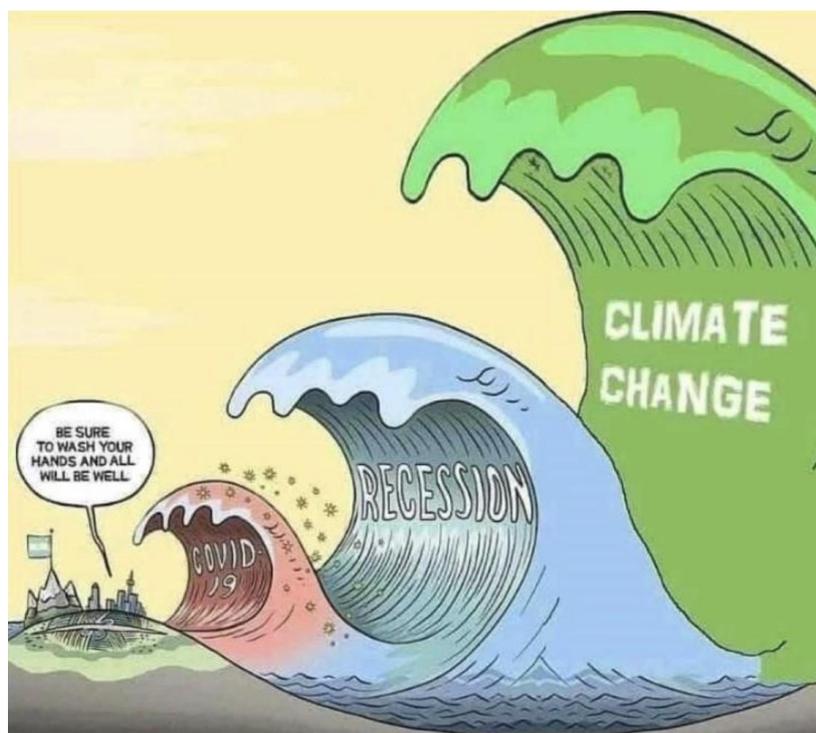
The ME (Energy) and BE (Energy) degrees offer a solid foundation in engineering, covering core topics from across the various disciplines that provide a necessary grounding for energy engineering. The programme moves to a greater focus on areas such as; electricity generation and distribution, building design, transport, automation, and energy policy and modelling. Our goal is to prepare Energy Engineering graduates for a wide range of roles, with the opportunity of making a difference to the world by challenging traditional practices with a new focus on energy and sustainability.

"This degree is challenging, but that is exactly what makes it so worthwhile. This is a modern degree for a modern world that urgently needs higher quality design, more ethical engineering decisions and stronger environmental leadership." - Vera O'Riordan (2019 graduate), PhD student in Energy Policy & Modelling, MaREI

You will develop mathematical and problem-solving abilities and apply these to open-ended and challenging energy systems design problems, both on your own, and as part of a team. This is the longest-established energy engineering degree programme in Ireland and the first accredited by Engineers Ireland.

Further details on the course structure can be found through the below link;
<https://www.ucc.ie/admin/registrar/calendar/engineering/eng008.html>

Detailed descriptions of module content, assessment and other relevant information can be accessed through the [UCC Book of Modules](#).



2nd Year

The 2nd Year energy engineering programme is a multidisciplinary area of study. It involves modules covering the foundations of engineering building on the 1st Year foundations in science subjects. This broad base provides the necessary skills that underpin the engineering to deliver sustainable transport, heating and electricity.

Semester 1:

- [AM2032](#) Numerical Methods and Programming *foundation for computer modelling methods*
- [CE2001](#) Solid and Structural Mechanics *foundation for climate resilient infrastructure*
- [CE2003](#) Fluids I *foundation for wind energy, ocean energy and hydro power*
- [EE 2012](#) Linear Circuit Analysis *foundation for integrating renewable electricity*
- [EE2014](#) Signals and Systems I *foundation for smart energy systems*
- [EE2016](#) Electrical Power Engineering I *foundation for low carbon power systems*

Semester 2:

- [CE2004](#) Fluids II *foundation for pumps and turbines*
- [EE2013](#) Non-Linear Circuit Analysis *foundation for integrating renewable electricity*
- [EE2015](#) Signals and Systems II *foundation for smart energy systems*
- [EE2017](#) Electrical Power Engineering II *foundation for low carbon power systems*
- [NE2001](#) Primary Energy Engineering *focus on energy supply and transformation*
- [ST1051](#) Introduction to Probability and Statistics *foundational techniques for data analytics*



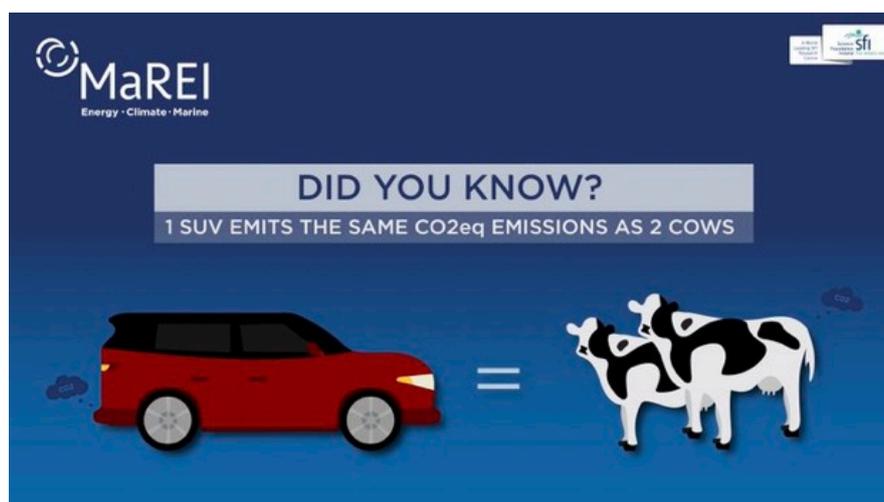
3rd Year

In 3rd Year, you will focus on a number of specialist energy engineering topics, including energy in buildings (which accounts for nearly 40% of energy use), energy and transport (which also accounts for about 40% of energy use), sustainable energy and energy systems modelling.



Semester 1:

- [NE3002](#) Energy in Buildings *there is significant potential in improving building efficiency*
- [NE3003](#) Sustainable Energy *understanding energy trends and policy challenges and failures*
- [CE3007](#) Hydraulics *essential for gas networks, hydro power and pumped storage*
- [ME3003](#) Mechanical Systems *critical to understand boilers, vehicles and power plants*
- [EE3012](#) Electric Vehicle Energy Systems *EVs are a key element of sustainable transport*
- [EE3016](#) Control Engineering *intelligent control of wind turbines and windfarms is essential*



Semester 2:

- [NE3004](#) Transportation and Energy *transportation engineering and energy implications*
- [NE3005](#) Energy Systems Modelling *modelling the future of energy demand and supply*
- [EE3011](#) Power Electronics and AC Machines *key to integrating wind and solar electricity*
- [ME3004](#) Applied Thermodynamics & Work Transfer *engines and turbo-machinery*
- [CE3006](#) Construction Project Management *designing, scheduling and project management*
- [CE3009](#) Environmental Engineering – Wet *interactions between water and energy systems*

3rd Year Abroad (Option)

If you're a Second Year Energy Engineering students and have achieved a 2H1 in your 1st year, you can apply to undertake the Third Year of your studies abroad.

"highlight for me was studying abroad during 3rd year in Los Angeles, California. UCC has great overseas links; there is a good chance to study abroad." Paul Crowley (2013) Grid Control Engineer, Gas Networks Ireland

An application to study abroad must be made to the Head of the School of Engineering by 30th October 2020. Permission to undertake the Third Year of study abroad will be conditional on you achieving at least a 2H1 in 2nd Year in Energy Engineering at the Summer Examination.

If you're doing a year abroad at a university where the language of instruction is not English, up to **20** credits of the programme may be dedicated to formal study of the language of instruction. You will propose a detailed programme of study in consultation with the approved host institution and the Director of the ME / BE (Hons) Energy and requires approval from the Head of School of Engineering.



The examinations for the 3rd Year abroad are provided and marked by the approved host institution. If you achieve a pass standard, as defined by the approved host institution, you will be deemed to have passed the Third University Examination in Energy Engineering.

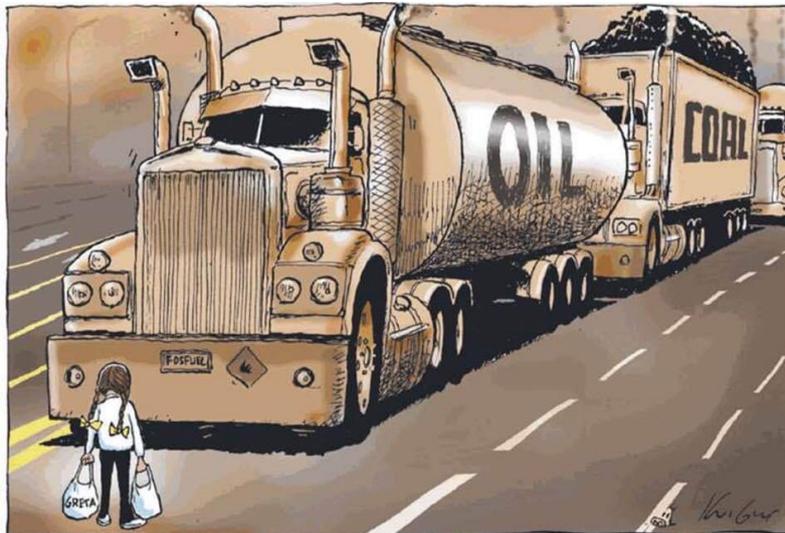
Students can and have undertaken the 3rd Year abroad in many universities including

- University of California San Diego
- University Carlos III of Madrid
- University of California Davis
- University of California Berkeley
- Massachusetts Institute of Technology

4th Year – decision time - ME Energy or BE (Hons) Energy?

At the end of your third year of study, you can choose between the ME Energy with two further years of study or the BE (Hons) Energy Engineering with one further year of study. If you wish to become a professions chartered engineer, the academic requirement is to have a Masters level qualification.

To be eligible to enter the ME (Year 4), you must pass the Third Year of the BE (Hons) (Energy Engineering) and achieve at least 2H2 or 600/1200 marks (50%) at the first attempt. If you pass Third Year BE (Hons) (Energy Engineering) but do not reach the requisite academic standard (2H2 or 50% at the first attempt), you will be deemed ineligible to transfer to the ME. You will instead continue on the BE (Hons) (Energy Engineering) entering Fourth Year. If you are eligible to transfer to the ME but choose not to, you will continue on the BE (Hons) (Energy Engineering) entering Fourth Year.



ME Pathway - 4th Year

If you chose the ME Energy Pathway, you must take modules to the value of **60** credits in 4th Year, comprising 30 credits of lecture modules specified in Part A and a Placement Module in Part B to the value of 30 credits.

Part A;

- [NE4002](#) Wind Energy (5 credits) *currently 33% of Ireland's electricity and growing*
- [NE4008](#) Photovoltaic Systems (5 credits) *significant potential globally for deployment*
- [EE4001](#) Energy Systems, Power Electronics and Drives (5 credits) *focus on EVs and fuel cells*
- [EE4002](#) Control Engineering II (5 credits) *digital and state space control techniques*
- [EE4010](#) Electrical Power Systems (5 credits) *key for integrating wind and solar energy*
- [EE4014](#) Industrial Automation and Control (5 credits) *for grid-connecting renewable power*

Part B;

- [NE6060](#) ME (Energy) Work Placement (30 credits)

The eight month Placement takes place from January to August. It gives you an opportunity to apply your learning and knowledge to the solution of energy engineering problems in the workplace and to further learn about professional engineering ethics, business, societal impact, health and safety, teamwork and organization.

ME Pathway - 5th Year

Students take modules to the value of **60** credits as follows:

Semester 1

- [NE6005](#) Ocean Energy (5 Credits) *Wave & tidal energy, huge resource at research stage*
- [NE6011](#) Advanced Energy Systems Modelling (5 credits) *PLEXOS power systems modelling*
- [NE6014](#) Energy Innovation *Energy technology innovation and energy sector innovation*
- [NE6015](#) Data Analytics for Engineering (5 credits) *programming skills using Python and/or R*
- [NE6017](#) ME Energy Research Project (20 credits) *substantial energy research project*



Semester 2

- [NE4007](#) Computer Aided Design VII (Heating, Ventilation and Air Conditioning) (5 credits)

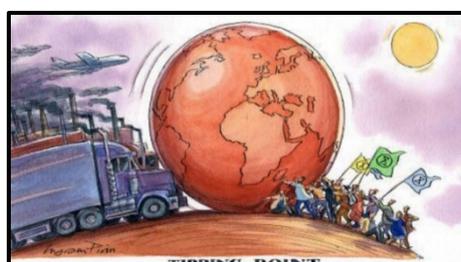
plus a further four of the following modules to the value of 20 credits:

Semester 1

- [CE6043](#) Harbour and Coastal Engineering *Engineering for offshore renewable energy*
- [CS6322](#) Optimisation *Optimisation methods related to network optimisation*

Semester 2

- [CE4024](#) Progressing Toward Sustainable Industry *Applying science based targets in industry*
- [NE6004](#) Sustainability, Bioenergy & Circular Economy Systems (5 credits) *Focus on ren. gas*
- [NE6010](#) Offshore Wind Energy (5 credits) *significant opportunity for Ireland*
- [NE6016](#) Energy Systems in Buildings (5 credits) *Intelligent efficiency in buildings*
- [MG4052](#) Management in Practice (5 credits) *Mgmt styles, activities, entrepreneurship*
- [PE6031](#) Carbon Geocycles and Capture Utilisation & Storage (5 credits) *Negative emissions*
- [EE6048](#) Smart Grids (5 credits) *managing distributed renewable energy and storage*



BE (Hons) Pathway – 4th Year

Students take modules to the value of 60 credits as follows:

Semester 1

- [EE4010](#) Electrical Power Systems (5 credits) *Key for integrating wind and solar energy*
- [NE4020](#) Energy Engineering Project (10 credits) *Energy research project*

Semester 2

- [MG4052](#) Management in Practice (5 credits) *Mgmt styles, activities, entrepreneurship*
- [NE4005](#) Sustainability, Bioenergy & Circular Economy Systems (5 credits) *Focus on ren. gas*
- [NE4006](#) Energy Systems in Buildings (5 credits) *Intelligent efficiency in buildings*
- [NE4007](#) Computer Aided Design VII (Heating, Ventilation and Air Conditioning) (5 credits) S2

Plus a further five of the following modules to the value of 25 credits:

Semester 1

- [EE4001](#) Energy Systems, Power Electronics and Drives (5 credits) *focus on EVs and fuel cells*
- [EE4002](#) Control Engineering II (5 credits) *digital and state space control techniques*
- [EE4014](#) Industrial Automation and Control (5 credits) *for grid-connecting renewable power*
- [NE4002](#) Wind Energy (5 credits) *currently 33% of Ireland's electricity and growing*
- [NE4003](#) Ocean Energy (5 credits) *Wave & tidal energy, huge resource at research stage*
- [NE4008](#) Photovoltaic Systems (5 credits) *significant potential globally for deployment*

Semester 3 (Summer months)

- NE4009 BE Work Placement (5 credits)

*Students wishing to take the elective module, NE4009 BE (Energy) Work Placement, are required to have made final arrangements, as prescribed by the Module Co-ordinator, for the work placement by 31 May of their Third Year of Study.



Useful Additional Information

Sustainable Energy Engineering Research

UCC hosts the SFI [MaREI](#) Research Centre for Energy, Climate and Marine. MaREI undertakes excellent and impactful research, development and innovation working across 12 Irish academic institutions and collaborating with over 50 industry partners. MaREI combines the expertise of a wide range of research groups and industry partners, with the shared mission of solving the main scientific, technical and socio-economic challenges associated with the energy transition, climate action and the blue economy. MaREI is currently undertaking a 6 year €60 million programme of research under MaREI Phase 2 beginning June 1 2019. MaREI is funded by SFI and industry partners and by EU, SEAI, EI, EPA, ERDF, EU, HEA and IRCSET.

MaREI is co-ordinated by UCC's [Environmental Research Institute](#). The ERI is a flagship research Institute at University College Cork, Ireland (UCC) that carries out inter-, multi- and trans-disciplinary research focussing on climate action, circular economy and healthy environment. The mission of the ERI is to generate new research knowledge for the understanding and protection of our natural environment and develop technologies, tools and services to facilitate a transformation to a low carbon and resource efficient society. The Institute brings together over 300 environmental researchers from across science, engineering, business and humanities to address complex environmental challenges in a multi-disciplinary approach. The ERI also incorporates a number environmental research centres including MaREI, Aquaculture and Fisheries Development Centre (AFDC) and the Centre for Research on Atmospheric Chemistry (CRAC).

Useful websites

- Latest COVID related information <https://www.ucc.ie/en/emt/covid19/timetables/>
- Course outline <https://www.ucc.ie/admin/registrar/calendar/engineering/eng008.html>
- Timetables for programmes and modules <http://timetable.ucc.ie/2019-20/default.aspx>
- Maps of UCC <http://app.ucc.ie/maps/>
- UCC Building Codes <https://www.ucc.ie/en/students/campus/buildings/>
- Student IT services webpage <http://www.ucc.ie/en/sit/>
- School of Engineering website on Energy Engineering <https://www.ucc.ie/en/energyeng/>
- UCC Book of Modules <https://www.ucc.ie/admin/registrar/modules/>
- UCC Marks and Standards <https://www.ucc.ie/admin/registrar/marksandstandards/>
- MaREI Research Centre for Energy, Climate and Marine <https://www.marei.ie/>
- Discover Cork and UCC <https://www.ucc.ie/en/discover/>

Lecture venues

The majority of lectures are held on the main campus of UCC in the Civil, Environmental & Energy Engineering Building and the Electrical Engineering Building.

A campus map is available below; the Engineering buildings are labelled 20 & 35.

https://www.ucc.ie/en/media/siteassets/contentassets/maps/UCC_CAMPUS_MAP_23_11.pdf

IT Facilities

All Engineering students may use any of the computer labs in the School of Engineering (in the Civil, Environmental & Energy Building, the Electrical & Electronic Engineering Building and the Process & Chemical Engineering Building).

There are two computer laboratories in the Civil, Environmental & Energy Building which have workstations with useful engineering packages (e.g. AutoCAD, MATLAB) installed. Note that access to the computer labs in this building is controlled by card readers. Hold your student ID card near the black card reader to enter the lab. The computer laboratories are also used for timetabled student activities which have priority over other users.

You may have your own personal laptop, tablet or other device connected to the UCC wireless network, please contact Student IT Services for further information. Their website is listed above and you can visit IT services in the Boole Library Basement in person.

Course Administration

For administrative queries relating to the course, please contact Jennifer Barry

Jennifer_Barry@ucc.ie

For academic queries relating to the course, please contact Professor Brian Ó Gallachóir,

b.ogallachoir@ucc.ie



What some of our graduates say



Rory Geary (2008-2012)
Business Analyst,
State Street International,
Kilkenny

Since graduating from Energy Engineering in 2012, I've been working in the business and technology consulting industry, primarily as a business analyst with the multinational consulting firm Accenture.

Engineering graduates are in very high demand across consulting industries due to the skill set learned during their degrees. It is widely acknowledged that engineering degrees provide a great foundation in problem solving, abstract

thinking and working as part of a project team.

The Energy Engineering degree programme will provide you with invaluable skills that can be applied across all industries, as well as a highly respected engineering qualification and knowledge of real world climate issues and their prospective solutions.

If I was to travel back in time, I have no hesitation in saying I would once again choose Energy Engineering!



Alan Donovan
Assistant Location Manager,
Roadstone, CRH

I am currently working with Roadstone, part of CRH, who are a leading global diversified building materials group and also Ireland's largest company. My day-to-day activities include production planning, maintenance planning and dealing with customers, while at all times upholding safety standards. My role is very diverse and constantly changing.

The BE Energy Engineering degree has equipped me with the broad range of technical expertise required for my role, namely electrical, mechanical and civil engineering knowledge.

The highlights of the four-year degree course included the opportunity to undertake a 20-week industry

placement at the end of third year, where I had the opportunity to put the skills developed in college into practice. The Final Year Project allowed my partner and I to explore potential future energy supply scenarios using energy modelling software.

I am very satisfied with the BE Energy Engineering course as it opened up a diverse range of career paths across many industries as shown by the variety of roles currently undertaken by recent graduates, from financial services to power engineering and research roles. Employers are very aware of the calibre of graduates produced by UCC that opens up many job prospects.



Sarah Ryan (2009-2013)
Manager of Automation, BI & Reporting,
Digital Marketing Program,
Accenture

Hi there, my name is Sarah and I graduated from Energy Engineering in October 2013. A month before I had moved to Dublin having been offered a place on Accenture Ireland's Consulting Graduate Programme.

I'm currently managing the Automation, BI & Reporting team for our Digital Marketing program at a multinational technology company. Every assignment, group project and presentation I completed as part of my Energy Engineering degree has prepared me for a career in Accenture. Not only am I grateful for the reporting and technical skills that I built up, especially Excel and C#, but I also developed a passion for teamwork and problem-solving. The strong work ethic needed for the degree is also needed in the fast-paced worlds of Consulting and Technology.

Highlights from my degree would have to be a site visit to a wind farm in Kerry, the class getting suited and booted for our Construction Project Management end of year presentation, working on my Final Year Project in the Tyndall National Institute, and the lifelong friends I've made from the four years we spent together.

Every Christmas in Cork, we come together from far afield (US, Tokyo, Singapore, France, UK and Ireland) to catch up on the previous months, to marvel at the diversity of our careers and experiences and to reminisce on evenings spent in the Old Bar and the Electrical Engineering CAD Lab. It's hard to believe that our journeys all started with us choosing Energy Engineering.





Diarmaid Nolan (2008-2012)
Project Planning Engineer,
Gas Networks Ireland

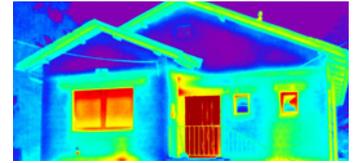
Since graduating, I have been working with Gas Networks Ireland (previously Bord Gais Networks). I started on a two-year graduate programme that consisted of four 6-month rotations across the business. I then moved into what has essentially been a project management role for the last 3 and a bit years, managing large-scale projects and programmes from conception through to construction handover.

This included the securing of project budgets, development and control of budgets, coordination of the planning and design of each project, management of designers, consultants etc., liaison with

third party and statutory bodies, compliance with government and third party regulations amongst other items.

For me and others entering the working world, I think the wide nature of topics covered was of great use, affording me a solid foundation in all main core engineering topics.

In addition, think the policy element of the course was particularly useful for understanding the energy mix as a whole, informing future decisions and direction etc. and I believe it has been of great use to me not only in a working capacity but day to day also.



Daniel Casey (2008-2012)

After completing the Energy Engineering course in 2012, I began working as an Electrical Automation Engineer with NeoDyne out in Little Island, Cork. Primarily working with the control systems for Combined Heat and Power (CHP) plants and other energy systems.

I was performing a job that would normally have been carried out by an Electrical Engineering graduate, with most of my colleagues having studied the Electrical Engineering degree at UCC. However, the management were satisfied that the electrical modules covered (Control, Power etc.) in the Energy Course had given me the background theory necessary for the job, as well as providing me with additional knowledge of fluid dynamics, thermodynamics and energy policy that benefited the design and maintenance of small power plants.

Being part of a small hands on team, the working day was very varied. Tasks included designing electrical schematics on AutoCAD, designing and programming PLC controllers, liaising with contractors on site and (my favourite) troubleshooting of systems on site with a multi-meter and screwdriver in hand to fix issues.

After working with NeoDyne for close to 3 years, I left to go travelling. Over the past two and a bit years, I have travelled around Europe, Asia, America and spent a year living in Canada. I have just started looking for engineering work again back home in Ireland. I was worried that companies would look at my extended break from engineering negatively, but so far, this has not been my experience, with many interesting jobs available in the Energy as well as Automation sectors.

Eric Fitzharris (2013-2017)

Upon completing the course, I joined the Dublin branch of Integrated Environmental Solutions, a software developer responsible for the creation of IESVE that is used to create building energy models and simulate building performance. I joined the company as a project consultant with my tasks typically comprised of developing building energy models for clients, developers and other professionals in the building services and design sectors. As part of the role, we typically advise our clients on the projected performance of their building design and aid them with BER and LEED certification.

My job as a building energy modeller is reliant on my knowledge of building services, particularly with respect to building design, HVAC

systems and building design methodology. I felt the course provides a good introduction to these concepts, particularly in third and fourth year with modules such as Energy in Buildings, Energy Systems in Buildings and HVAC.

Ultimately, I'm happy I chose Energy Engineering as my undergraduate degree. Apart from the aforementioned experiences, it served as the ideal composite of fields that best encapsulate my passions in engineering. I truly believe that it serves as a strong platform to enter the engineering world for graduates with an interest in green energy, power generation, sustainable building design, renewable technology development, energy modelling or energy market analysis. Few other undergraduate engineering courses out there can offer such a comprehensive education in these sorts of areas.

Sean Hayes (2008-2012)

Immediately after graduating, I travelled the world with Spirax Sarco, doing energy consultancy across the food and pharmaceutical industry. I now work with Mainstream Renewable Power, assessing the potential and actual energy production of renewable installations.

Around 60% of my day is programming in Python. The Energy in Buildings modules, Wind Energy and use of C# and Matlab have been most beneficial.

Always knew I wanted to do some sort of engineering, but particularly like the opportunity Energy Engineering offers to have an impact in the world by addressing our energy system's problems. At the end of the day, this is quite rewarding. I would absolutely recommend the Energy Eng degree in UCC, when I was choosing my CAO preferences it was clear Energy would be a hot topic for my generation. This has held true with the security of job opportunities.

Paul Crowley (2009-2013)

After finishing, I spent 4 years with Eirgrid in Dublin, entering through the 2-year graduate programme. Working on the national power grid, scheduling the operation of the various power plants. Then moving into studies on the connection of renewables like wind and solar.

The power electronics modules have been very useful, along with the 4th year module in wind energy. However, the highlight for me was studying

abroad during 3rd year in Los Angeles, California. UCC has great links overseas; there is a good chance to study abroad.

There is plenty of opportunities out there for engineers and I think the Energy Engineering degree provides a good balance across the different disciplines. I'd definitely recommend it.

