



UCD Engineering Programmes

BSc Eng, BE, ME

**Mechanical Engineering
Students**

March 2016



**UCD School of
Mechanical and Materials Engineering**

UCD Engineering Degree Programme Pathways Agenda

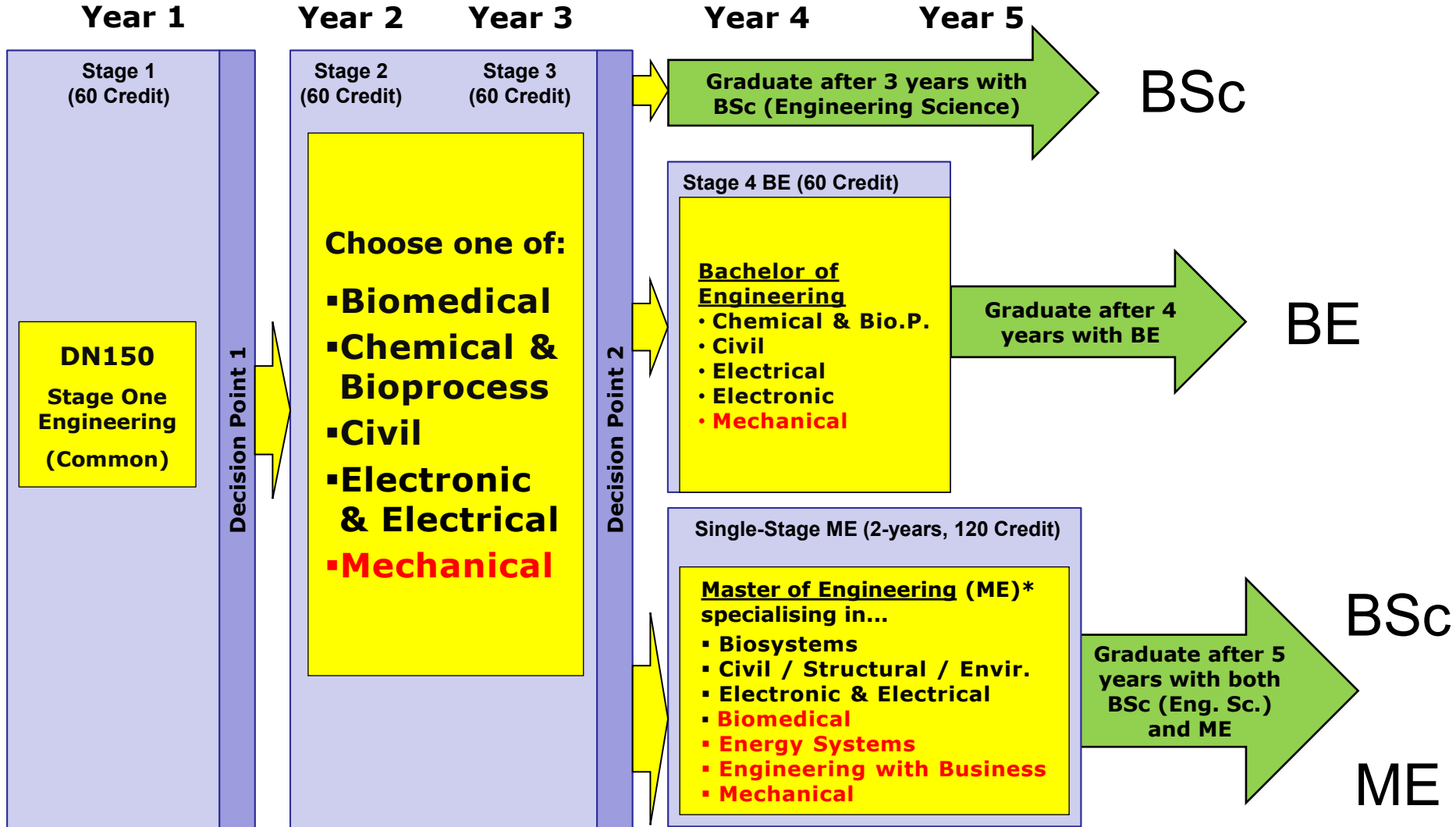
1300 - 1320 Overview BSc, BE & ME	Dr. Donal Finn
1320 - 1325 ME Mechanical Engr.	Dr. Malachy O'Rourke
1325 - 1330 ME Materials Sc. & Engr.	Dr. Ken Stanton
1330 - 1335 Energy Systems Engr.	Dr. David Timoney
1335 - 1340 Engineering with Business	Dr. Nikolaos Papakostas
1340 - 1350 Q&A	



**UCD School of
Mechanical and Materials Engineering**



UCD Engineering Degree Programme Pathways DN150

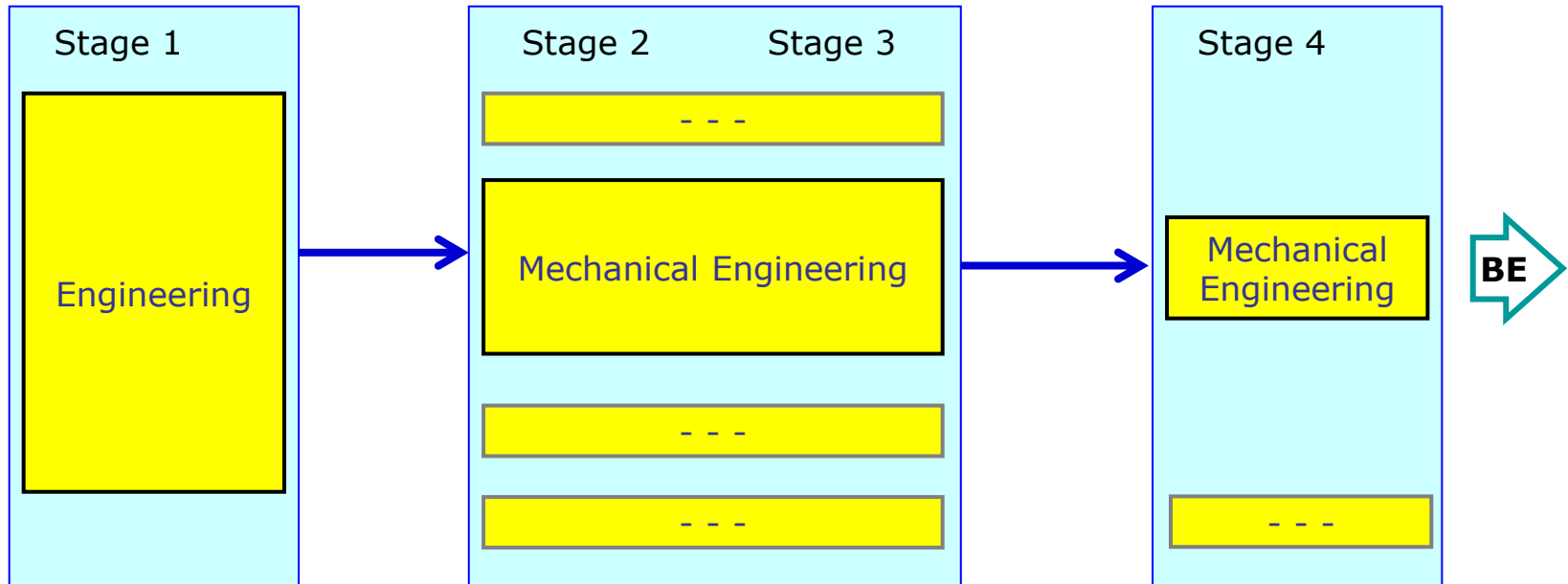




BSc (Engineering Science) Degree

- Bachelor of Science degree Level 8
 - 3 years, 180 credits
 - not a professional engineering qualification
 - 30% based on Stage 2, 70% on Stage 3
- To be compatible with European system:
 - *first cycle* = Bachelor degree (often 3 years)
 - *second cycle* = Master degree (typically 2 years)
 - *third cycle* = PhD (minimum 3 years)
 - could choose now if want ME programme in Europe...
- To provide exit from Engineering
 - provides strong technical foundation
 - to pursue career in another field
 - to continue studies in another area

The BE Degree Programme



- You entered the BE degree programme
 - you can continue with Mechanical
 - you graduate with BE degree: 240 credits





Bachelor of Engineering (BE) Degree

- Traditional qualification in Engineering
 - still respected in the workplace
 - accredited for MIEI
 - membership of Engineers Ireland, professional bod
 - no longer sufficient for Chartered Engineer
 - further study would be needed (later in career?)
- Four years study in total
 - stage 4 mostly core modules, two options
 - project module – 15 credits
 - no formal work placement
- No additional barriers to progression
 - normal progression rules apply
 - you need 50 credits in stage 3 to progress & register for project module in stage 4

BE - Mechanical Engineering (Stage 4)

• Core Modules

- BE Project
- Process Instrumentation and Control or Control Theory
- Mechanics of Fluids 2
- Manufacturing Engineering 2
- Computational Continuum Mechanics 1
- Thermodynamics 3
- Materials Science and Engineering 3
- Professional Engineering (Management)

• Option Modules (Choose 2)

- Energy Systems and Climate Change
- Technical Ceramics
- Materials Thermodynamics and Kinetics
- Medical Device Design
- Advanced Metals/Materials Processing
- Composites and Polymer Engineering
- Nanomaterials



- Total 9 taught modules: 45 credits
- Project (through both semesters): 15 credits



BE Project Module

- Project choice and allocation
 - we propose a list of projects (Week 1, Semester 1)
 - you choose your preferences
 - allocation according to Stage 3 GPA
 - option to propose your own project – act early!
- Independent work through both semesters
 - research and/or design, putting theory into practice
 - guided by supervisor – meet typically weekly
 - work in parallel with 4 or 5 taught modules
 - time management is critical...
- Assessment through the year
 - interim report, final report
 - oral presentations (Semester 1 and Semester 2)
 - interview – supervisor and another examiner



After the BE...

- Work
 - often with further training, specific to employer
 - maybe a higher degree later in career?
- Taught Master's degree
 - in engineering or another area
 - minimum 90 credits (three semesters or full year)
 - fees payable
- Research Master's degree
 - 18 months to 2 years...
- PhD
 - typically 4 years research, can be more...
 - substantial thesis, original work
 - fees payable, but often scholarship available...



Chartered Engineer – CEng

- Used in Ireland, UK, India, ...
 - US, Canada: PE = professional engineer
 - Australia, NZ: CPEng = chartered prof. engineer
- Registered title, protected by law
 - required by law for certain engineering activities
- Awarded by professional body
 - Engineers Ireland, must also be member!
- Requirements:
 - education to suitable standard - accredited degree
 - from 2013, Master's level or equivalent
 - development of competence in practice
 - minimum 4 years responsible experience
 - continuing professional development - CPD



Master of Engineering (ME) Degree

- Professional qualification for the future
 - level required to become Chartered Engineer
 - level expected in most of Europe
- Two years of specialised study in chosen field
 - making five years in total
 - includes work placement (6-8 months)
 - includes major project at Masters level (25 credits)
- Entry requirement
 - based on stages 2 and 3, weighted 3 and 7
 - currently, minimum GPA 2.8 (equivalent to C grade)
 - GPA of 2.8 or higher recommended!
 - no easy way back to BE if finding ME too hard...



Master of Engineering (ME) Degree

- Work Placement

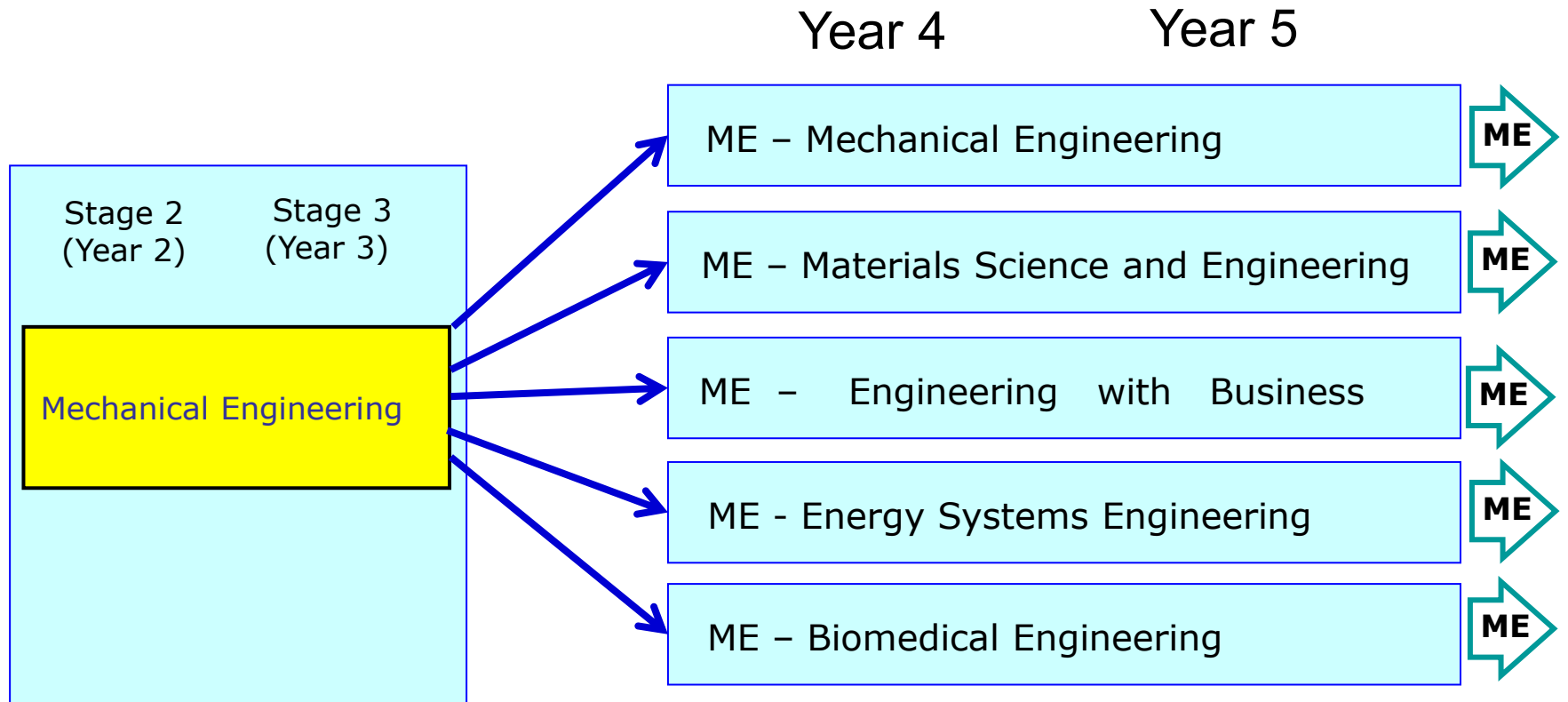
- 30 credit, 6-8 months, start Jan 2017
 - replaces entire spring semester
 - May to Dec 2017 Semester 1 for ME Eng. with Business
- UCD helps to arrange placements
 - each student picks four companies from list of employers
 - selected CVs sent, meetings/ interviews in Oct. and Nov.
 - you may propose your own placement, through UCD
- Alternative: 10 credit 2-3 months (Jun-Aug 2017)
 - take additional 4 modules in Year 2 of ME

- ME (Mech) Project

- runs through last two semesters
- 25 credits, (15 for ME with Business)
- but expect Master's level work ...



Available ME Routes





Summary - Your Options

- Graduate with BSc (Eng. Sci.) in 2016
 - for work or further study
 - e.g. ME in Europe or qualification in a different field
 - not professional Engineer
- Continue in BE programme
 - graduate in 2017
 - work as engineer
 - further postgraduate study
 - but further master qualification needed for C. Eng
- Continue towards ME in UCD (if eligible)
 - graduate in 2018 with fully accredited degree
- Decision required by Friday 15th April
 - Online survey by Programme Office



Programme Coordinators

- Dr. Donal Finn donal.finn@ucd.ie
 - BSc Eng, BE Mechanical Engineering
- Dr. Malachy O'Rourke malachy.orourke@ucd.ie
 - ME Mechanical Engineering
- Dr. David Timoney david.timoney@ucd.ie
 - ME Energy Systems Engineering
- Dr. Ken Stanton kenneth.stanton@ucd.ie
 - ME Materials Science and Engineering
- Prof. Madeleine Lowery madeleine.lowery@ucd.ie
 - ME Biomedical Engineering **Rm. 216, 12.00 Tues, 5 Apr**
- Dr. Nikolaos Papakostas nikolaos.papakostas@ucd.ie
 - ME Engineering with Business **Rm. 135, 12.00 Thurs, 7 Apr**



UCD Taught Masters Programmes

ME in Mechanical Engineering

Prof. Alojz Ivankovic

Programme Director

Dr Malachy O'Rourke

Programme Coordinator

Malachy.ORourke@ucd.ie



Programme Overview

Aims to provide students with the opportunity to gain advanced theoretical, conceptual and practical knowledge in the application of Mechanical Engineering

Emphasis is placed on

- core subject areas such as continuum mechanics, solid mechanics and fluid dynamics
- acquiring the skills required to generate new knowledge through research
- independent and project based learning while working with UCD academics and researchers on contemporary research projects
- professional engineering practice during work placement



Programme Structure

2-Year Full Time Programme (120 ECTS Credits)

Year 1

- 30 credits (6 taught modules) in semester one
- 30 credit work placement in semester two

or

4 taught modules in semester two + 10 credit work placement either during semester 2 or summer semester

Year 2

- Year long 30 credit research project + research skills and techniques
- 30 credits (6 taught modules) distributed across semesters 1 & 2



UCD School of Mechanical and Materials Engineering

YEAR 1

Semester 1

- Engineering Thermodynamics III
- Mechanics of Fluids II
- Manufacturing Engineering II
- Computational Continuum Mechanics I
- Fracture Mechanics
- Mechanics of Solids III

Semester 2

- Professional Work Experience (30 credits)

YEAR 2

Semester 1

- Computational Continuum Mechanics II
- Research Skills and Techniques

Semester 2

- Mechanics of Fluids III
- Professional Engineering (Management)

Semester 1 and 2

- ME Mechanical Thesis (25 credits)

Semester 1 or 2

- Control Theory
- Option modules 1 & 2

All semesters are 30 credits.
All modules are 5 credits unless otherwise stated.



Module Choice

Core Modules

- Computational Continuum Mechanics 1
- Computational Continuum Mechanics 2
- Mechanics of Solids 3
- Mechanics of Fluids 2
- Mechanics of Fluids 3
- Materials Science and Engineering 2
- Fracture Mechanics
- Professional Engineering Management
- Manufacturing Engineering 2
- Engineering Thermodynamics 3
- Control Theory

Option Modules

- Energy Systems and Climate Change
- Applied and Computational Mathematics
- Technical Ceramics
- Kinetics and Thermodynamics of Materials
- Technical Communications
- Advanced Metals/Materials Processing
- Advanced Composites and Polymer Engineering
- Nanomaterials



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Work Placement



- Takes place during semester 2 of year 1
- Students apply for positions during semester 1 of year 1

Companies involved in work placement to date include:



- Accenture (Dublin & UK)
- BD Medical
- BMR
- Boston Scientific
- Caterpillar (UK)
- CCM (Delaware, USA)
- CTS (USA)
- De Puy
- Dublin Port
- Eirecomposites

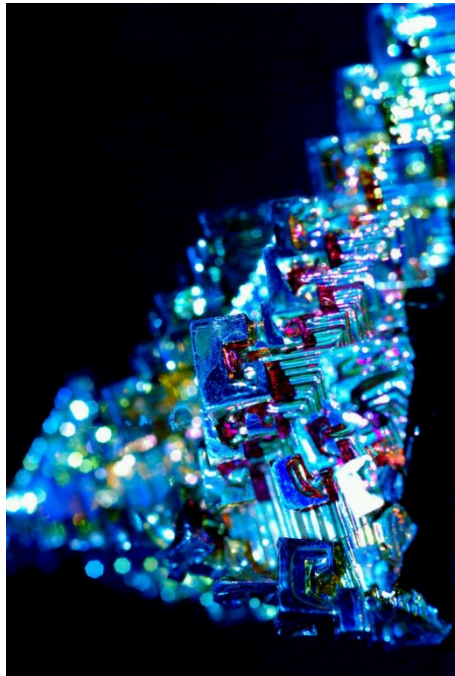


- Element 6
- Henkel
- Irish Rail
- Jaguar Landrover (UK)
- MSD
- Nypro Healthcare
- PCH (China)
- ProCut
- Tech Eng Tools
- Technology from Ideas





ME: MATERIALS SCIENCE AND ENGINEERING

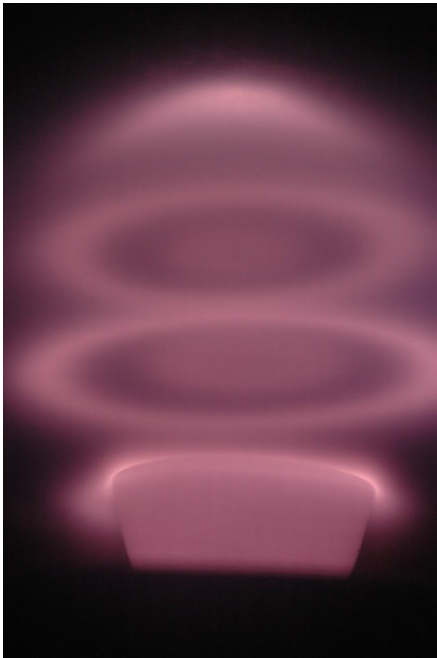


- ◆ Master of Engineering in Materials Science and Engineering
 - ◆ A materials science degree course with a focus on engineering applications of advanced materials
 - ◆ The only such course in the country
- ◆ 2-year full-time 120 credit (ECTS) programme
- ◆ Professionally dual accredited
 - ◆ Institute of Materials, Minerals and Mining (IOM3)
 - ◆ Engineers Ireland
 - ◆ A member of the Washington Accord signatory institutions



ME: MATERIALS SCIENCE AND ENGINEERING

- ◆ Fundamentals and applications of metals, ceramics, polymers, composites, semi-conductors and materials processing
- ◆ Options for programme focus on materials for:
 - ◆ Biomedical devices
 - ◆ Nanotechnology
 - ◆ Energy
 - ◆ Manufacturing
- ◆ Includes 6-month industrial work placement





ME MSE: INDICATIVE MODULES

◆ Core:

- ◆ Manufacturing Engineering I
- ◆ Material Science and Engineering II
- ◆ Technical Ceramics
- ◆ Professional Engineering (Finance)
- ◆ Solid-State Electronics I
- ◆ Fracture Mechanics
- ◆ Kinetics & Thermodynamics of Materials
- ◆ Material Science & Engineering III
- ◆ Advanced Composites and Polymer Engineering
- ◆ Research Project
- ◆ Research Skills and Techniques;
- ◆ Professional Work Placement

◆ Options:

- ◆ Computational Continuum Mechanics I
- ◆ Energy Systems and Climate Change
- ◆ Manufacturing Engineering I
- ◆ Design and Innovation
- ◆ Medical Device Design
- ◆ Chemistry of Materials
- ◆ Physics of nanomaterials
- ◆ Advanced Metals/Materials Processing
- ◆ Nanomaterials
- ◆ Mechanics of Solids II
- ◆ Solid State Electronics II
- ◆ Professional Engineering (Management)



UCD School of Mechanical and Materials Engineering

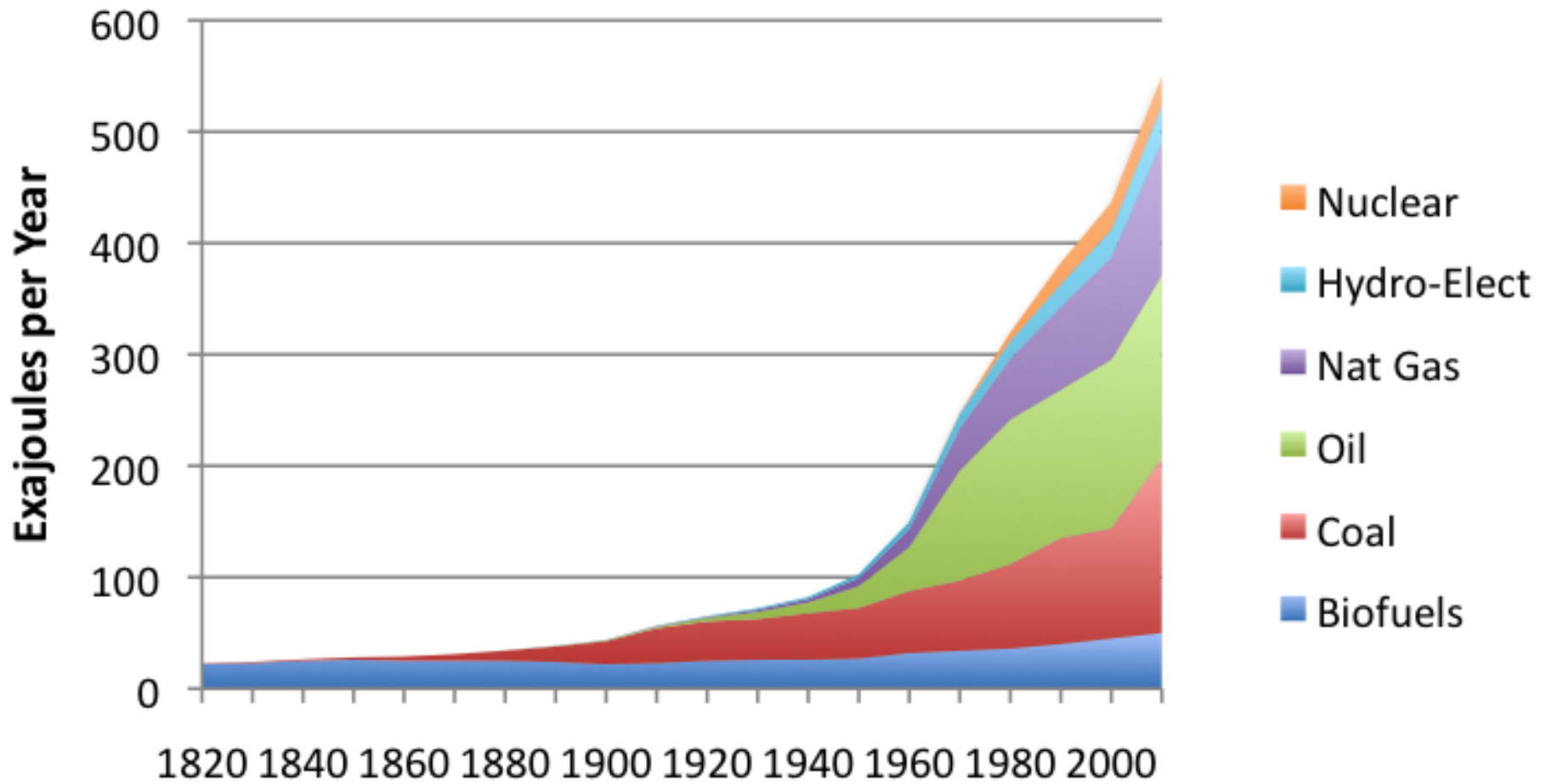
Information Session for Stage Three Engineering Students

Energy Systems Engineering

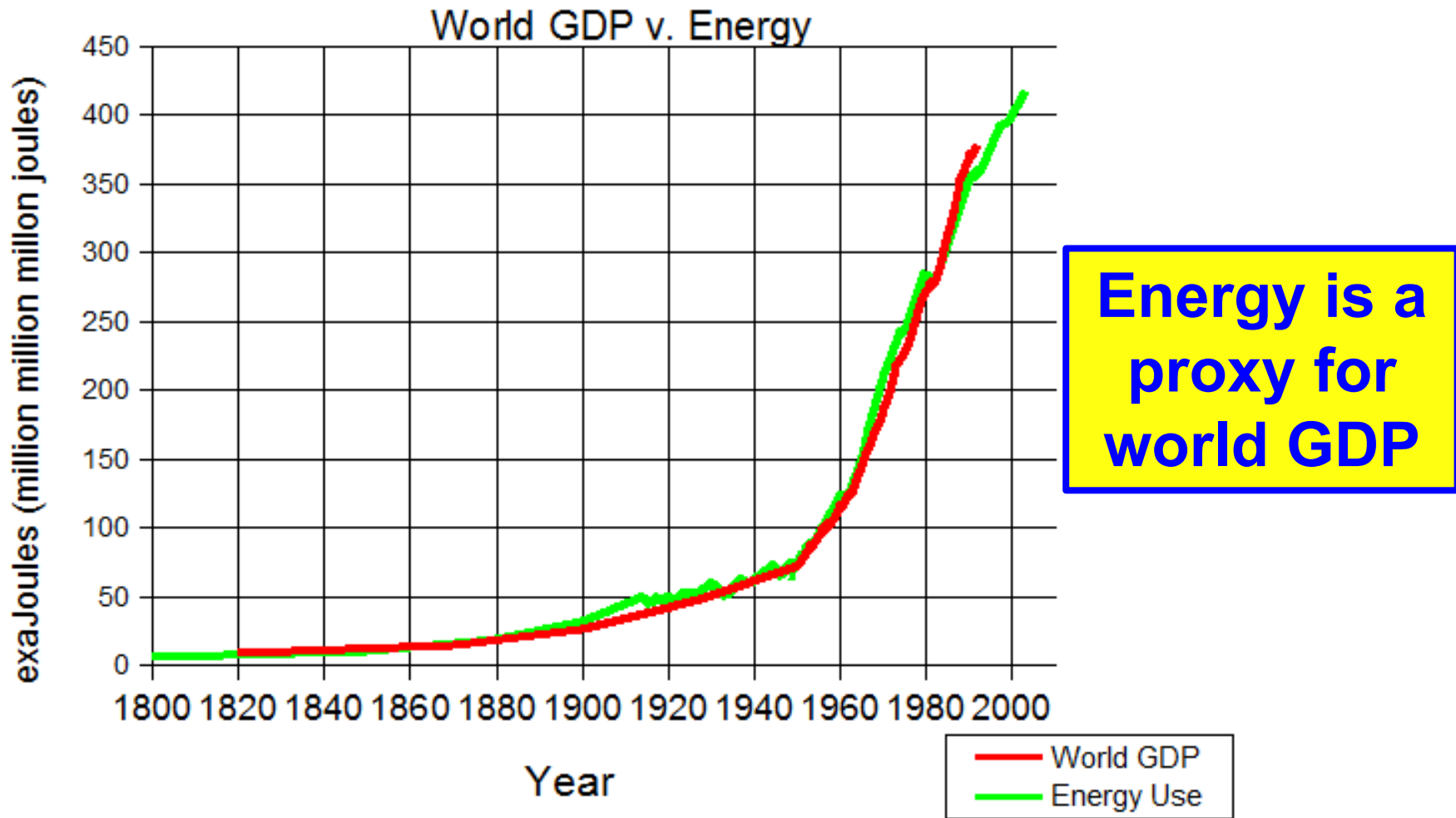
Dr. David Timoney,

Programme Director, ME (Energy Systems)

World Energy Use (1820 to 2010) Exajoules (10^{18}) Per Year

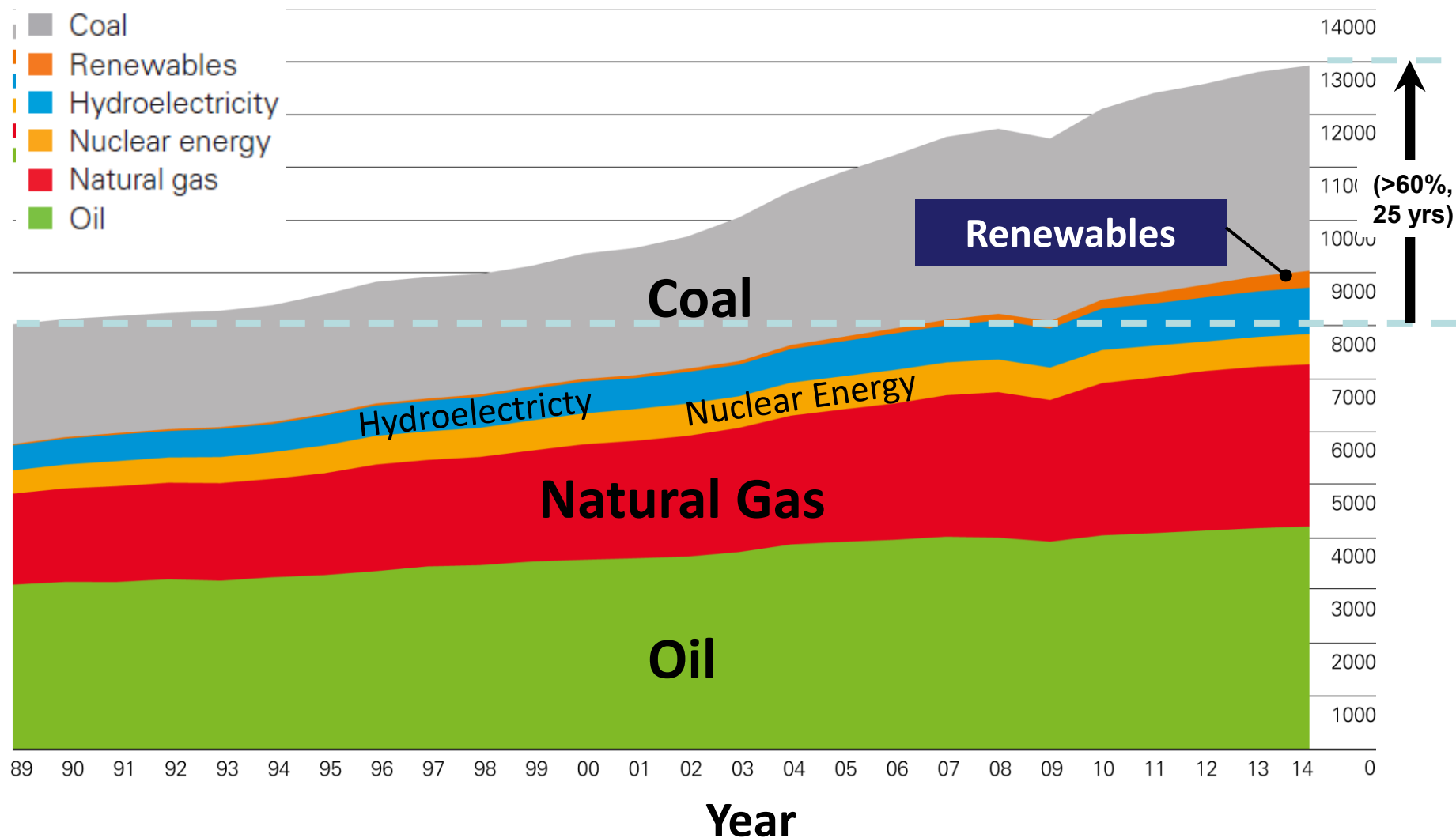


World Energy versus world GDP (scaled to fit)

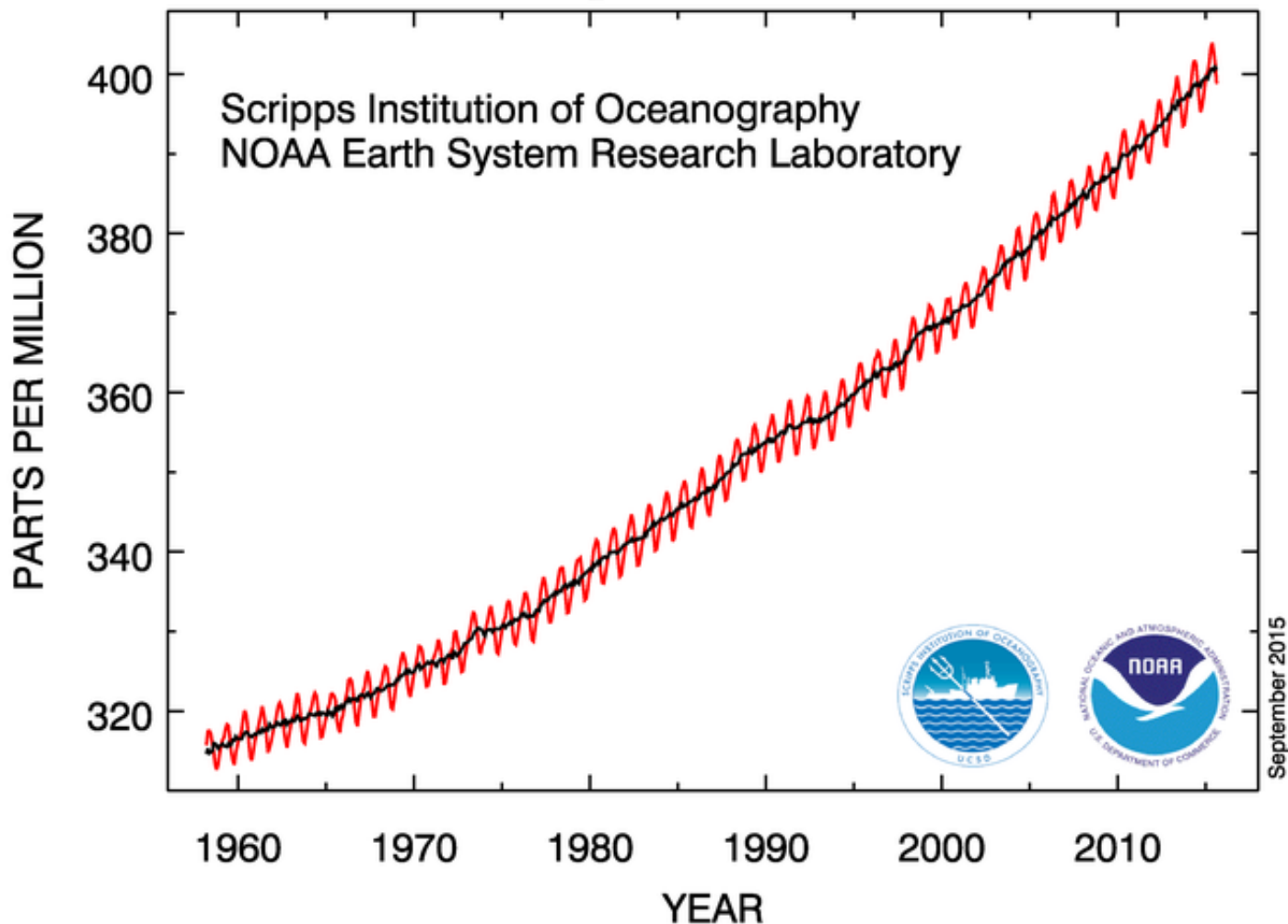


World Primary Energy Consumption by Fuel (1989 – 2014)

(in MTOE or Million tonnes of oil equivalent)



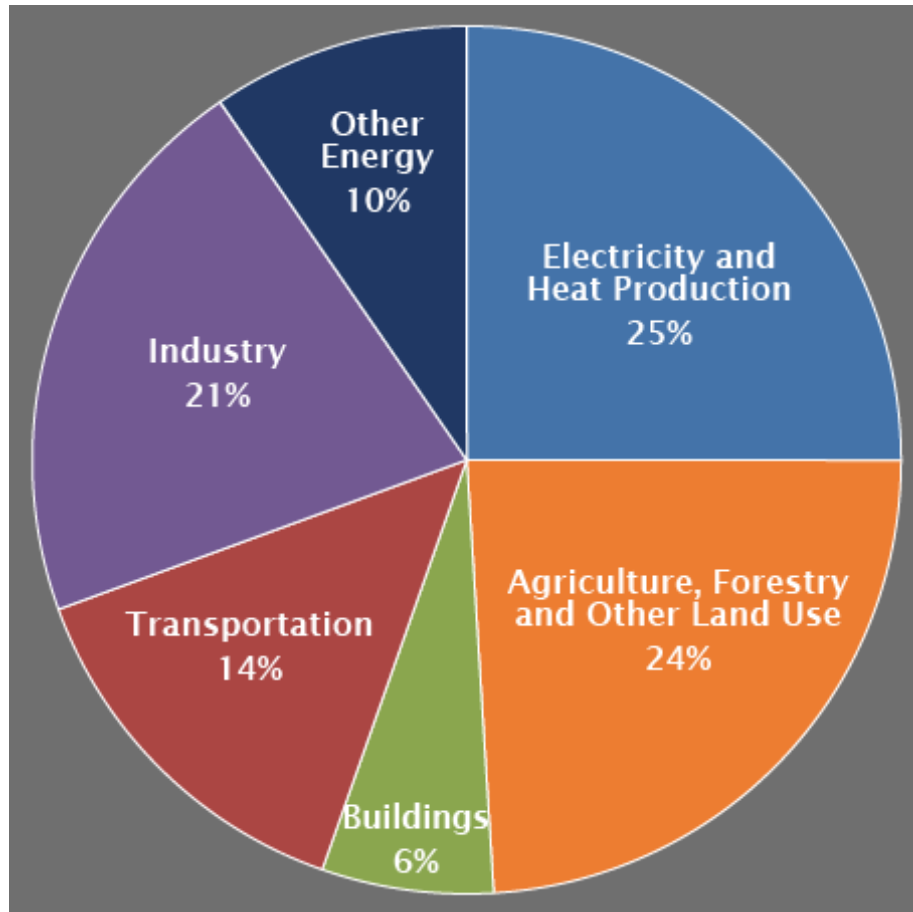
Atmospheric CO₂ at Mauna Loa Observatory Hawaii



Recent Monthly Average Mauna Loa CO₂
August 2014: 397.01 ppm **August 2015: 398.82 ppm**

Global Greenhouse Gas Emissions by Economic Sector

Source: IPCC (2014); based on global emissions from 2010.



- **Electricity & Heat: 25%**
- **Agriculture etc. 24%**
- **Buildings: 6%**
- **Transportation: 14%**
- **Industry: 21%**

These Politicians are Looking for Someone to “Sort all this out”

G7 JUNE 2015 – SCHLOSS ELMAU

Bloomberg
NEW ENERGY FINANCE

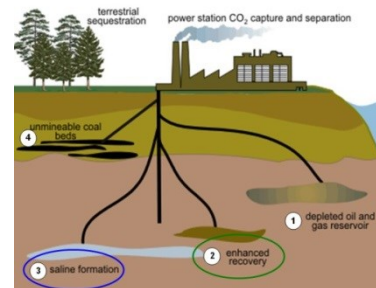
“ Emissions must be cut 40-70% by mid-century and phased out entirely by 2100 ”



Picture: Wikimedia

ME (Energy Systems) Engineering

- Aims to prepare graduates to meet the **often conflicting** engineering, economic and environmental **challenges** facing the energy systems of developed countries in the future, taking account of security of supply and climate impact / CO₂ emissions.
- Inter-disciplinary approached needed because of the future interdependence between the electricity system, building energy systems, and transport systems.
- Inputs provided by Mechanical, Electrical, Civil & Chemical Engineering, and Geological (Earth) Sciences / Physics / Economics / Business
- ~140 graduates since 2010
- Also available as 12-month, 90-credit ME



ME – Energy Systems Engineering

- Core Modules

- Energy Systems & Climate...
- Fossil Fuels & CCS
- Chem. Proc. Renew. Energy
- Eng. Thermodynamics II
- Energy Systems in Buildings
- Power System Operation
- Wind Energy
- Research Skills & Tech.
- Professional Eng. (Mgt.)
- ME Project
- Work Placement
 - long or short

- + 4 or 8 options

- Example Options

- Energy in Transport
- Instrumentation & Control
- Eng. Thermodynamics II
- Heat Transfer
- Mechanics of Fluids II & III
- Nanomaterials
- Environmental Engineering
- Air Pollution
- Entrepreneurial Mgt.
- Energy Economics & Policy
- Nuclear Physics
- Appl. Power Electronics
- Power System Design
- Power Electronics & Drives
-

Engineering with Business

- Specialise in one branch of Engineering
 - to level similar to BE degree
 - technical modules ~30 credits
- Dr. Nikos Papakostas
- nikolaos.papakostas@ucd.ie

Why Engineering with Business?

- There is a perceived lack of “industry-ready” engineers coming out of third level education.
- Industry leaders have been looking to recruit “T-shaped” individuals combining specialist skills with a broad understanding of the business environment.
- Acquiring skills related to advanced digital tools (Digital Manufacturing, Industry 4.0 technologies, ERP systems)
- The ME (Engineering with Business) produces fully qualified and accredited engineers who have a particular interest in and understanding of the business context within which engineers usually operate.
- ME (Engineering with Business) graduates can also consider careers in technical or management consulting, the financial sector and IT.

Internships



MERCK



Aer Lingus



**ANALOG
DEVICES**



JAGUAR



Nicholas O'Dwyer
CONSULTING ENGINEERS



**Boston
Scientific**
Advancing science for life™



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glanbia



abbvie



International

ESBI Energy Innovation

Engineering with Business

- Specialise in one branch of Engineering
 - to level similar to BE degree
 - technical modules ~30 credits
- Add business and management modules
 - ~55 credits
- Work placement
 - June to December
 - 20 credits
- Masters thesis 15 credits
 - 15 credits in final semester
 - mix of engineering and business
 - industry based research thesis

ME (Engineering with Business)

Civil, electrical,
electronic
or mechanical

Continuing discipline-
specific engineering subjects
30 credits

Technology management and
business subjects
50 credits

Work Placement/ Research/
Masters Project
40 credits

Entrepreneurship
Marketing
Operations Management
Business Information Systems
Organisational Behaviour
Economics
Project Management
Supply Chain Design

6 month
work placement,
research methods,
major project

ME Structure

Year 1

Sem 1

- Management and Org Behaviour
- Project Management
- Supply Chain Design
- **3 Technical Core**

Sem 2

- Operations Management
- Entrepreneurship
- **3 Technical Options**

Year 2

Sem 1

- Work Placement (June to Dec)
- Research Methods

Sem 2

- Business Information Systems
- Marketing
- Professional Eng. (Mgmt)
- Masters Thesis

ME with Business – Mechanical Engineering

- Core Business Modules

- Operations Management
- Project Management
- Supply Chain Design and Analysis
- Mgmt & Org Behaviour
- Professional Eng. (Mgt.)
- Entrepreneurial Mgt.
- Business Info. Systems.
- Marketing Management
- Research Methods/ Thesis
- Work Placement

- Technical Modules

- 4 Technical Core

- Process Instrumentation/ Control Theory
- Computational Continuum Mechanics I
- Engineering Thermodynamics III
- Process Instrumentation & Control

- 2 Options (indicative)

- Material Science and Engineering III
- Technical Communication
- Nanomaterials
-



UCD Engineering Programmes

BSc Eng, BE, ME

**Mechanical Engineering
Students**

Summary & Questions



**UCD School of
Mechanical and Materials Engineering**

Decision Time!

- Online form - to be completed by Friday 15 April
 - continue in BE (default)
 - transfer to stage 4 Engineering Science
 - specify which ME programme
 - conditional on GPA – automatic fall-back to BE
 - graduate with BSc (Engineering Science) now
 - needs 180 credits at appropriate levels...
- More information?
 - talk to relevant programme coordinators
 - postgraduate open evening 26 April
 - www.ucdpostgradopen.eventbrite.ie

