Electronic & Electrical Engineering

Information for Stage 1 Students

November 2024

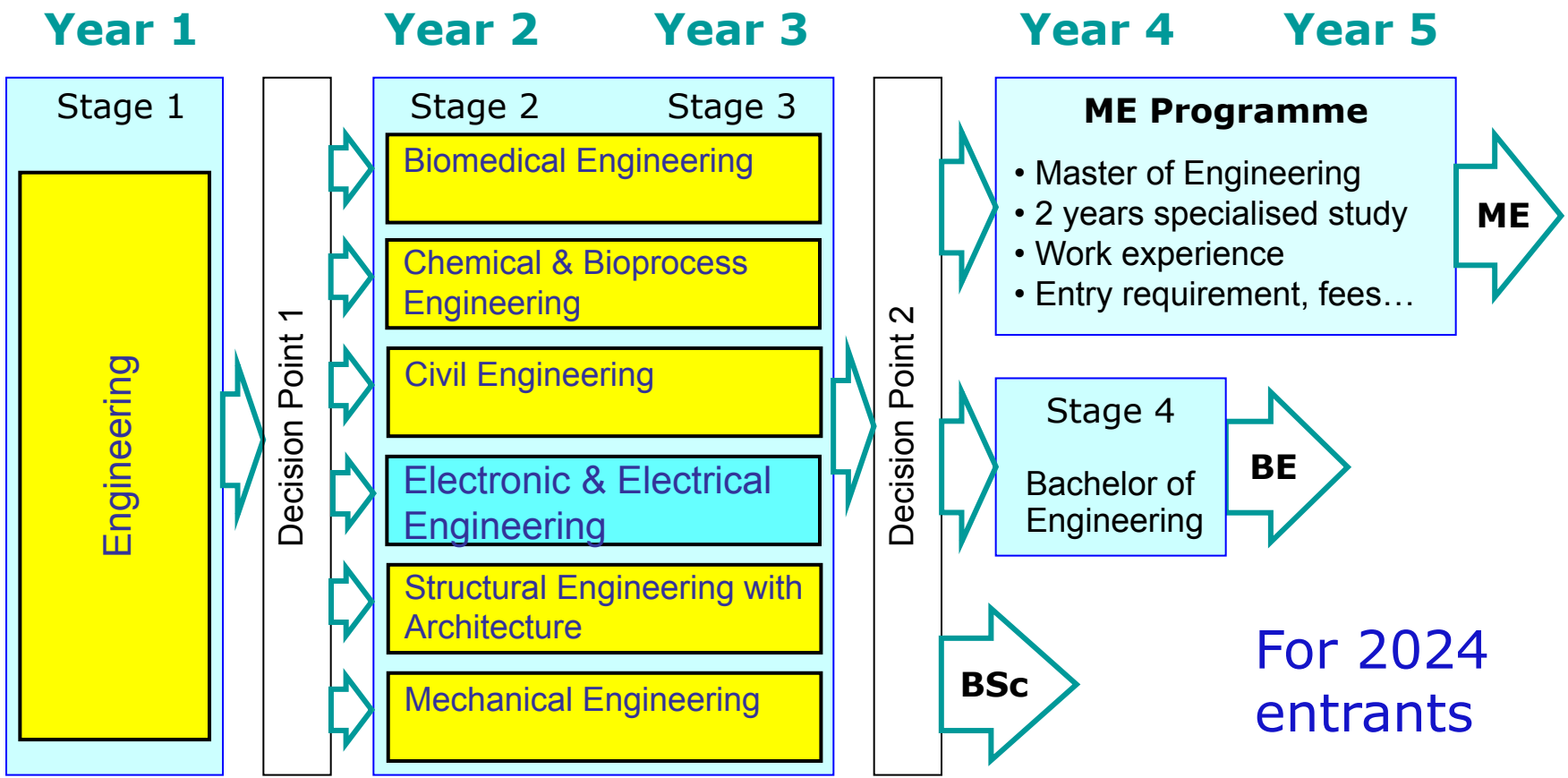
UCD School of Electrical and Electronic Engineering

Scoil na hInnealtóireachta Leictrí agus Leictreonaí UCD

Introductions

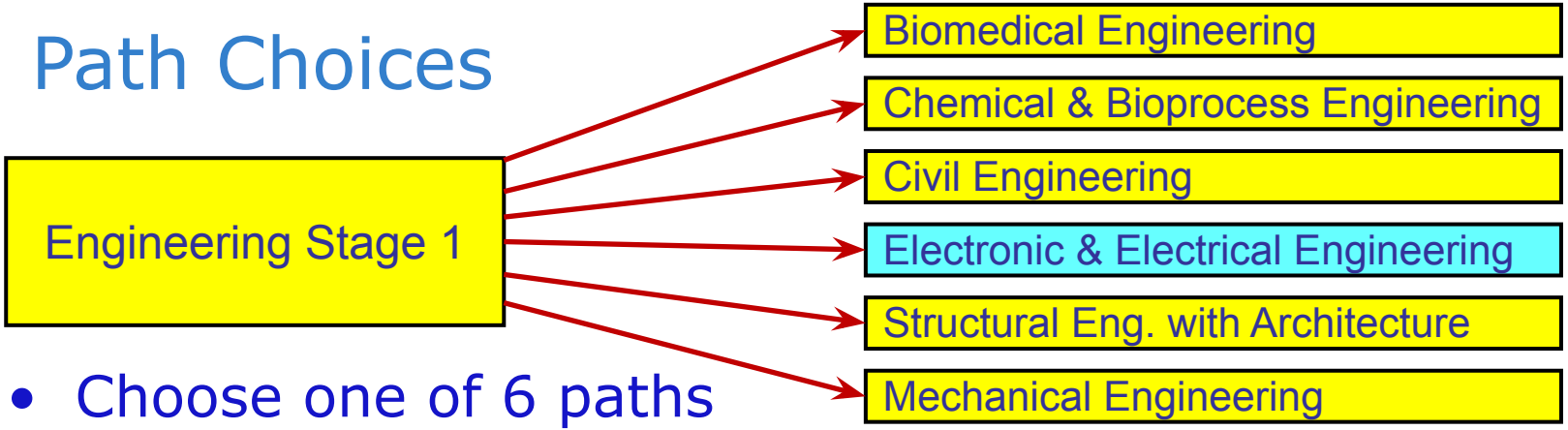
- Professor Peter Kennedy
  - Professor of Microelectronic Engineering
- Dr. Paul Cuffe
  - Lecturer, electrical engineering
- Professor Paul Curran
  - Head of School of EEE
  - Responsible for all EEEN modules
- Barbara Ziarnowska
  - 2nd Year Electrical and Electronic Student
- Assoc. Prof Nam Tran
  - Electronic engineering
  - Programme director, stage 2&3 BE E&E engineering

UCD Engineering Pathways – DN150

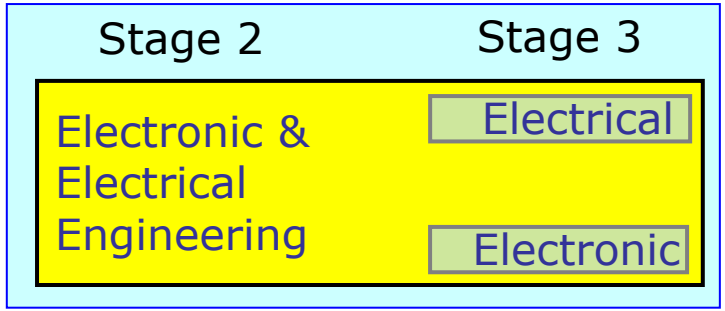


For 2024 entrants

Path Choices



- Choose one of 6 paths
  - decision in March/April 2024
- Within the Electronic & Electrical path
  - Stage 2 is common
  - start to specialise in Stage 3
    - choose options for electrical engineering or for electronic engineering



What is Electrical and Electronic Engineering?

Professor Peter Kennedy
Professor of Microelectronic Engineering
University College Dublin

What is Engineering?

"…the application of *science* and *mathematics* by which the *properties of matter* and the *sources of energy* in nature are made *useful to people*…"

Merriam-Webster

What is Electrical and Electronic Engineering?

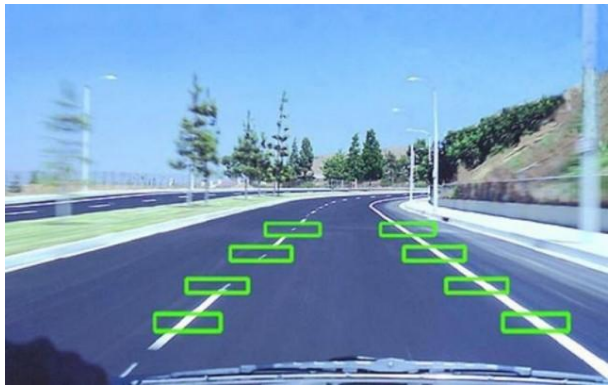
"…the application of *science* and *mathematics* by which the *electrical* *and* *electronic* *properties of matter* and the *sources of energy* in nature are made *useful to people*…"

Merriam-Webster

Electrical and Electronic Engineering

- Electrical Engineering: mainly processing energy in electrical form

- Electronic Engineering: mainly processing information in electrical form

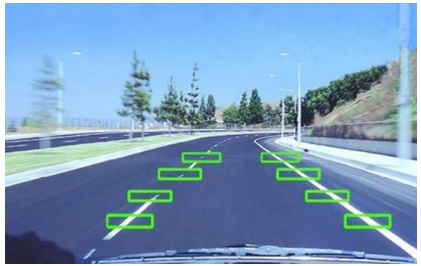


Processing *Energy* Electrically

- Thermodynamics
- Machines
- Electromagnetics
- Communications
- Systems
- Control
- Energy

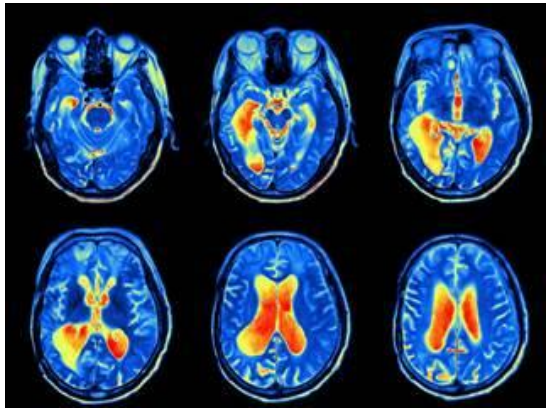
Processing *Information* Electronically

- Sensors
- Signal Processing
- Communications
- Data Analytics
- Computation
- Actuators
- Control



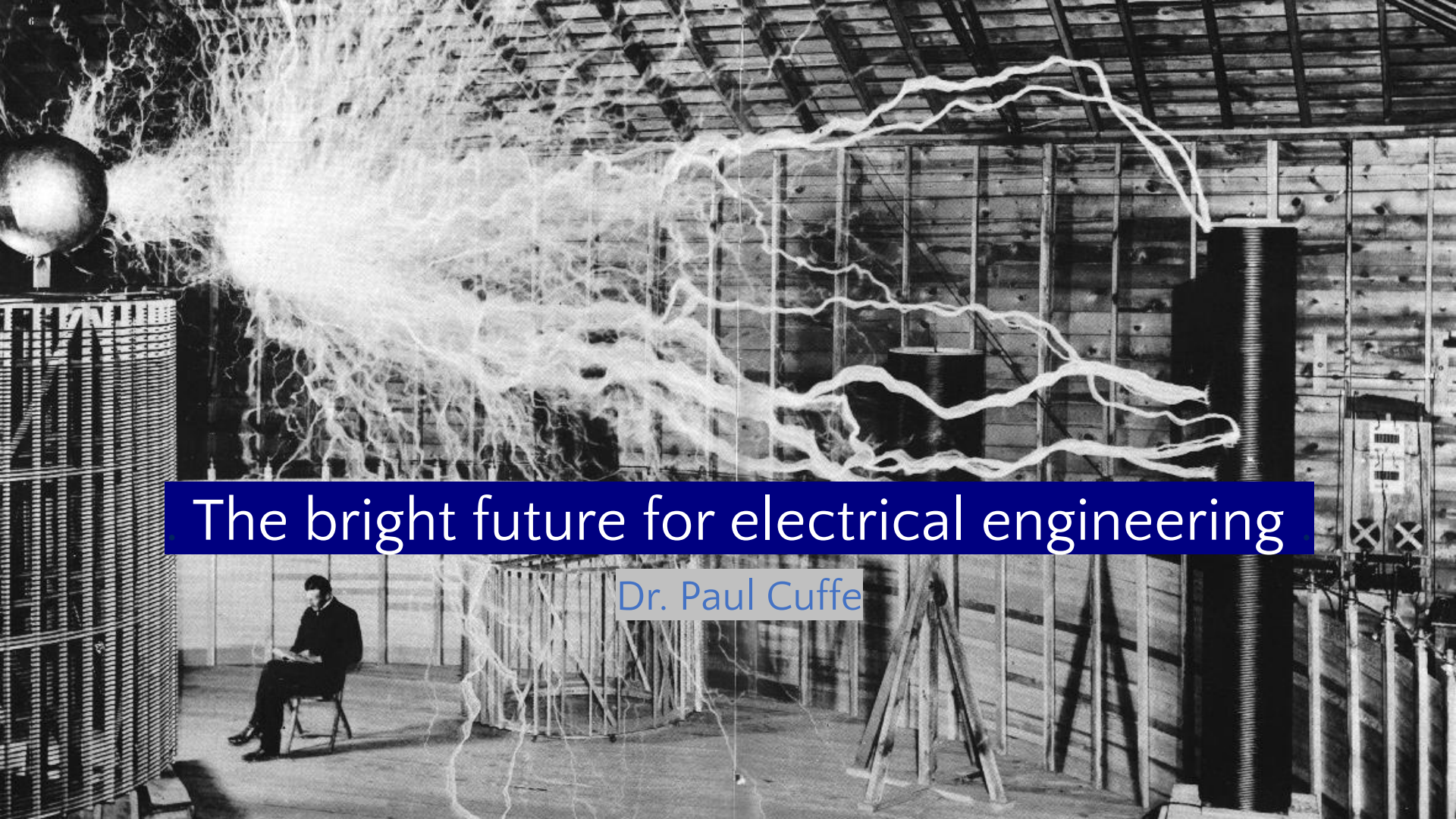
Processing (Biomedical) *Information* Electronically

- Sensors
- Signal Processing
- Imaging
- Communications
- Data Analytics
- Control
- Actuators



“Take Homes”

- Engineering is about solving problems using science, maths, and the properties of materials
- Electrical and Electronic Engineering use *electrical* properties of materials to process *energy* and *information*
- Electrical and Electronic Engineering have revolutionized society and will continue to transform our lives
- Every application domain needs more Electrical and Electronic Engineering
- The demand for core Electrical and Electronic Engineering skills is strong worldwide



The bright future for electrical engineering

Dr. Paul Cuffe

"Software is eating the world"

–Marc Andreessen of *a16z*

Thanks to cheap **batteries** and **renewable** energy, so is **electrical engineering**

Magnetic fields in three phase synchronous or induction machine

Animation: kpovmodeler

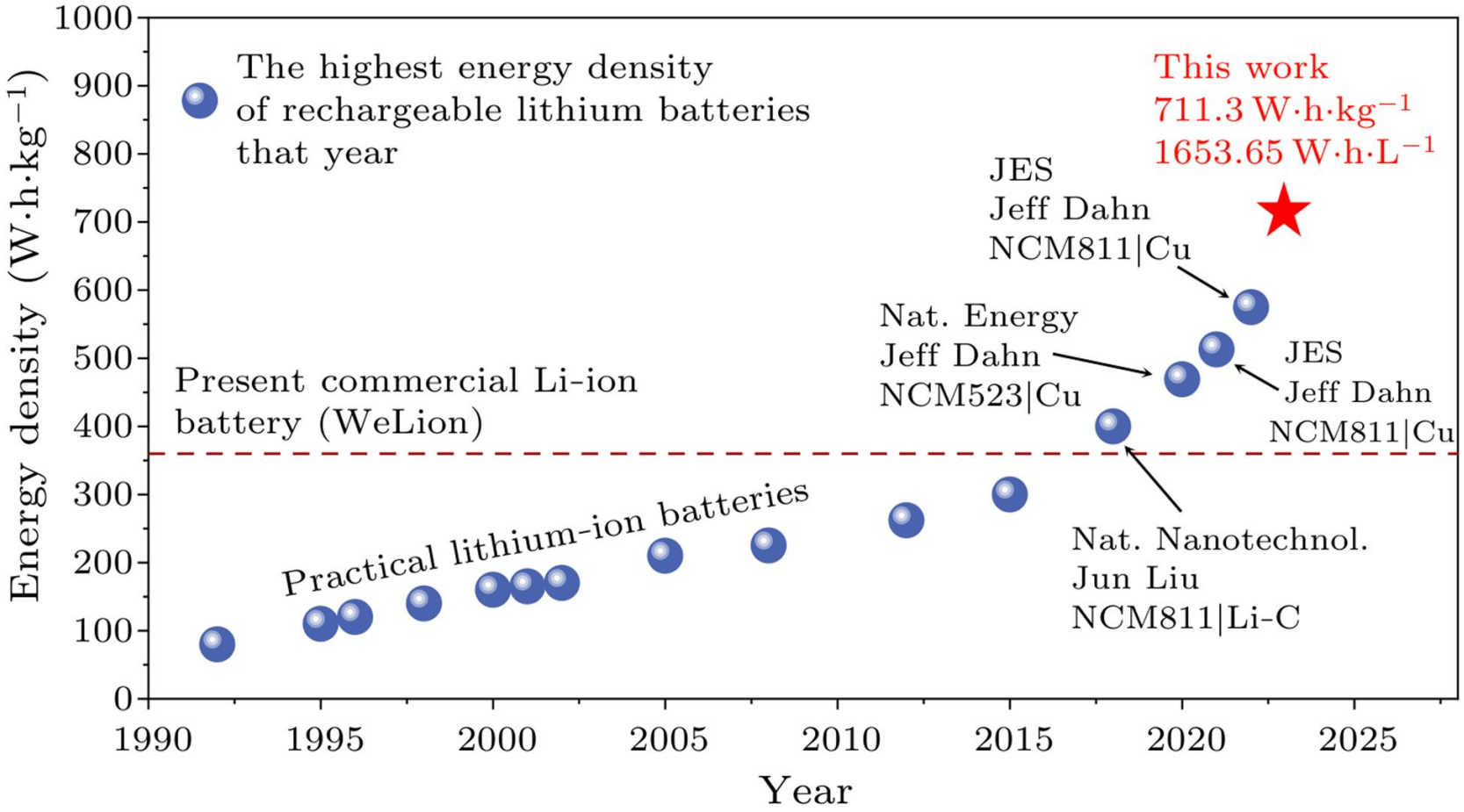


Chart: Quan Li *et al* 2023 *Chinese Phys. Lett.* **40** 048201

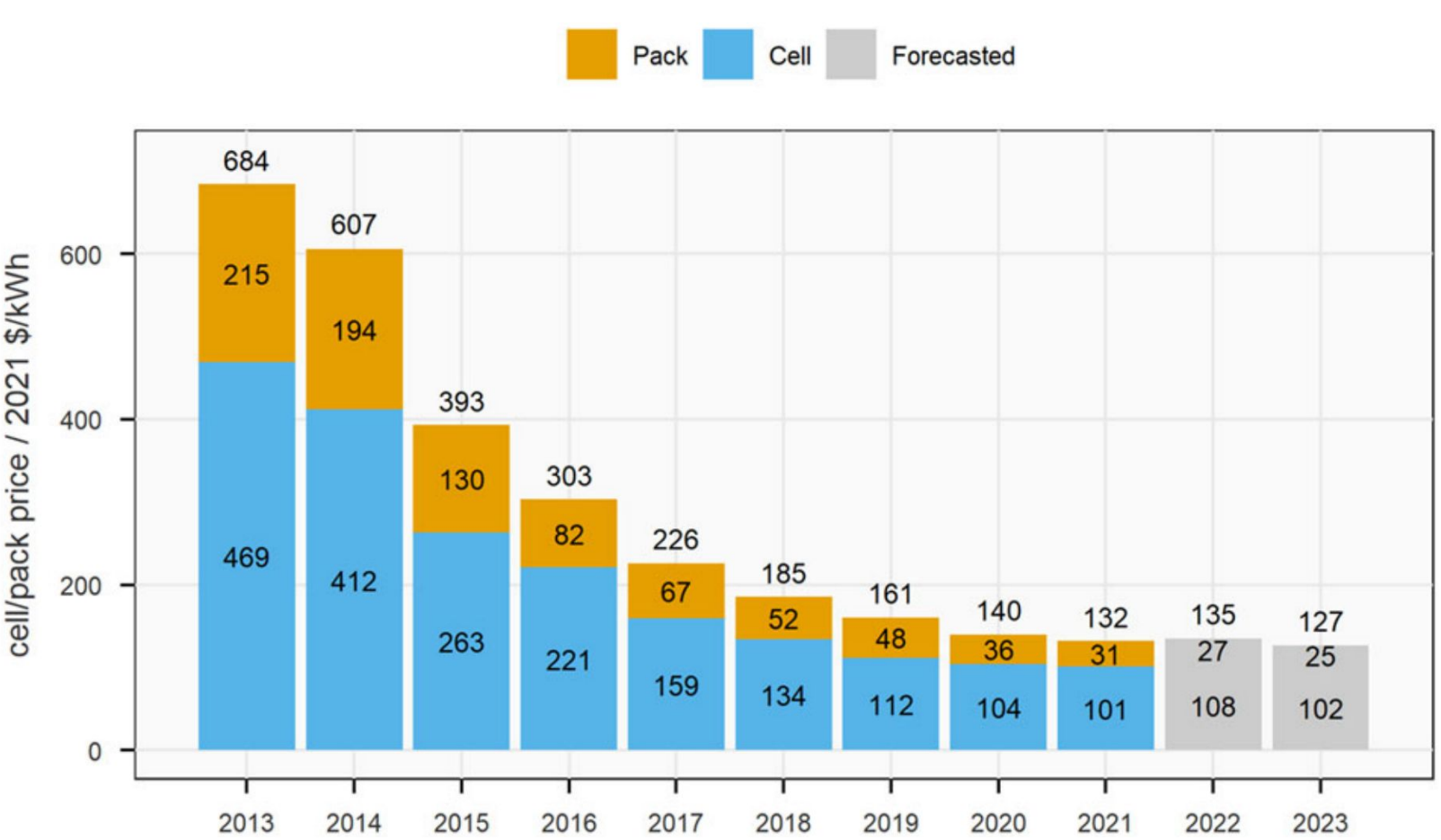
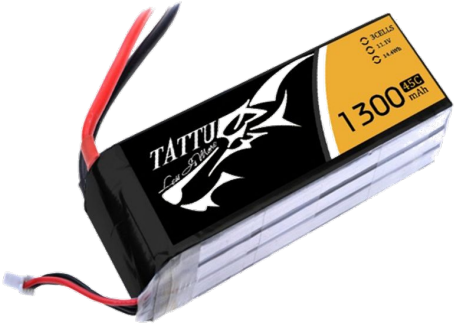


Chart: Frith, J.T., Lacey, M.J. & Ulissi, U Nat Commun 14, 420 (2023).

All transport will be **electric:**



Small, *powerful* three-phase motors

\+

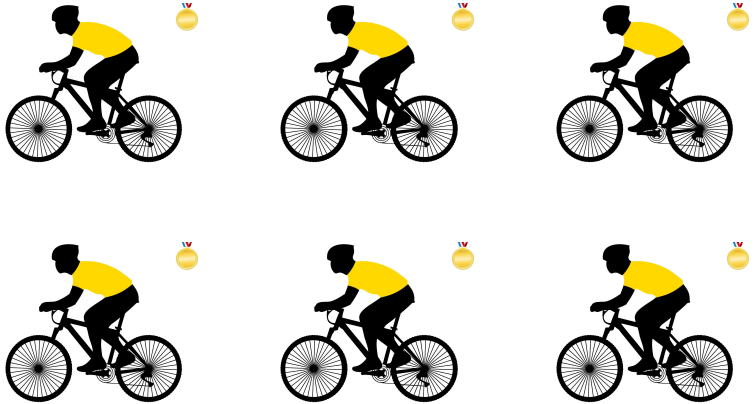
Cheap, *robust* power electronics to drive them

\+

Acceptably light, affordable batteries to power them

Motors are small, cheap and mighty:

= 2.4 kW



= 2.4 kW

© Raptor Direct Drive Skateboard

© InMotion V8 Electric Unicycle

© Harley Davidson Livewire

© EHang 184 Human Carrying Drone

© KittyHawk Cora

© Tesla Model S

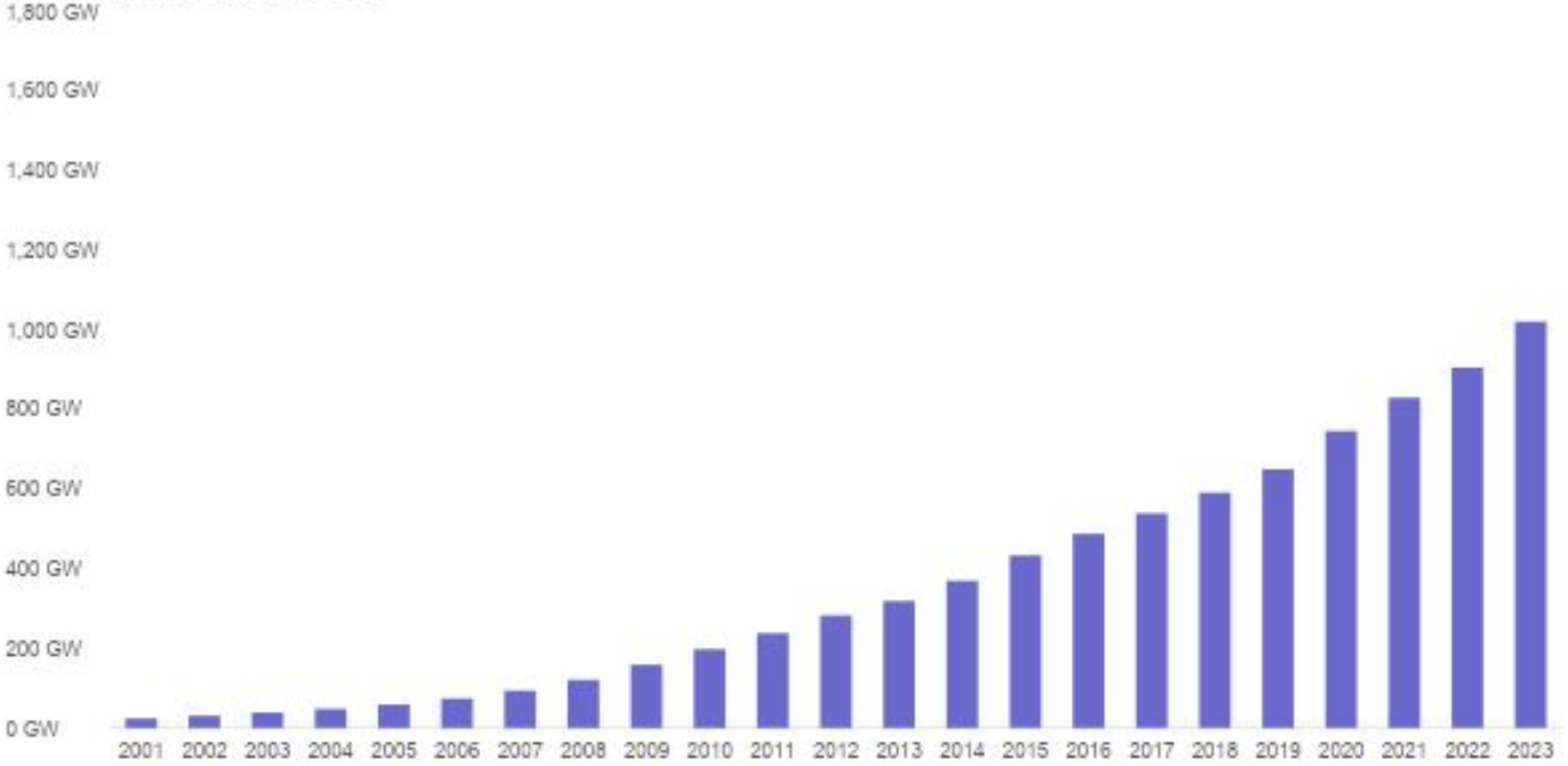
© Ampere battery electric ferry

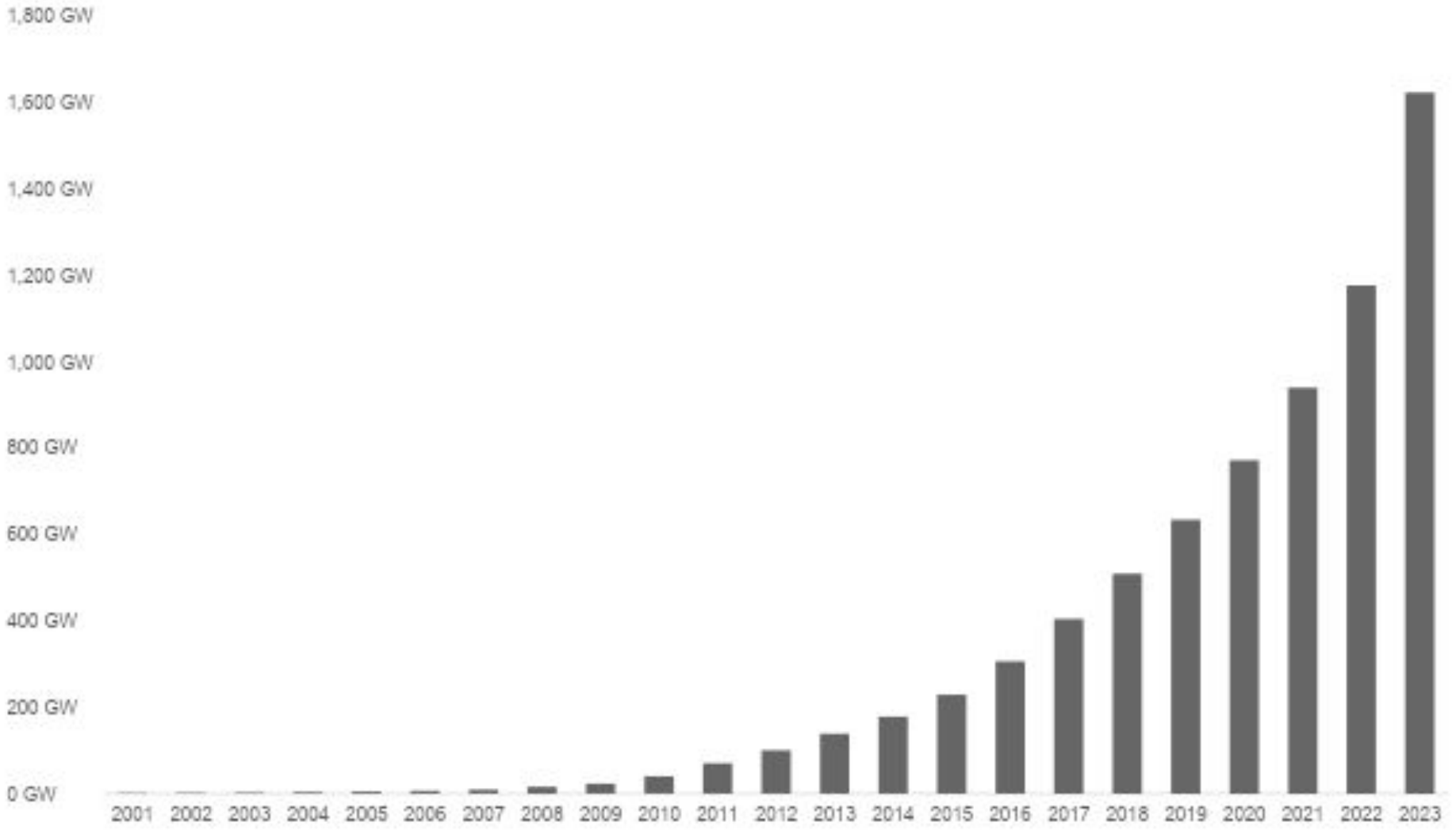
Class 230 Vivarail D-Train
© Spsmiler

Cumulative installed wind power capacity

Worldwide

from 2001 to 2023




1,800 GW
1,600 GW
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2023

© Siemens

Microsoft chooses infamous nuclear site for AI power

20 September 2024

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Natalie Sherman
BBC News

America's Three Mile Island energy plant, the site of the worst nuclear accident in US history, is preparing to reopen as Microsoft looks for ways to satisfy its growing energy needs.

The tech giant said it had signed a 20-year deal to purchase power from the Pennsylvania plant, which would reopen in 2028 after improvements.

The agreement is intended to provide the company with a clean source of energy as power-hungry data centres for artificial intelligence (AI) expand.

The plan will now go to regulators for approval.

The owner of the plant, Constellation Energy, said the reactor it planned to restart was next to, but "fully independent" of, the unit that had been involved in the 1979 accident.

It caused no injuries or deaths but provoked widespread fear and mistrust among the US public, discouraging the development of nuclear power in the US for decades.

However, there is renewed interest in nuclear as concerns about climate change grow - and companies need more energy due to advances in artificial intelligence.

Constellation chief executive Joe Dominguez told analysts on Friday that the deal was

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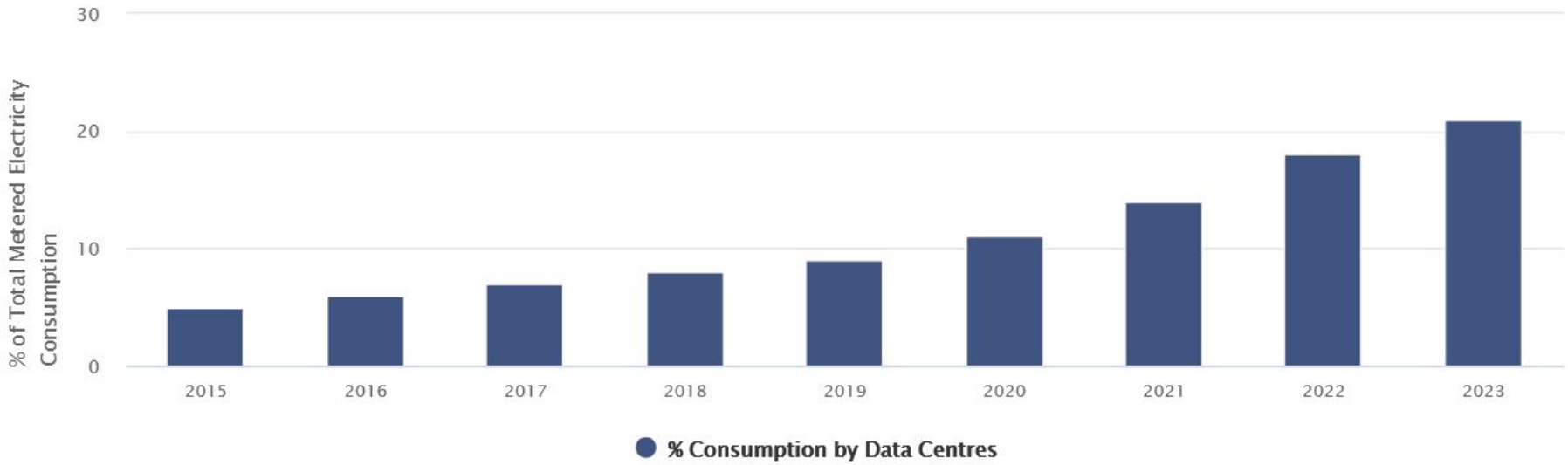
Figure 1 Data Centres Metered Electricity Consumption 2015-2023



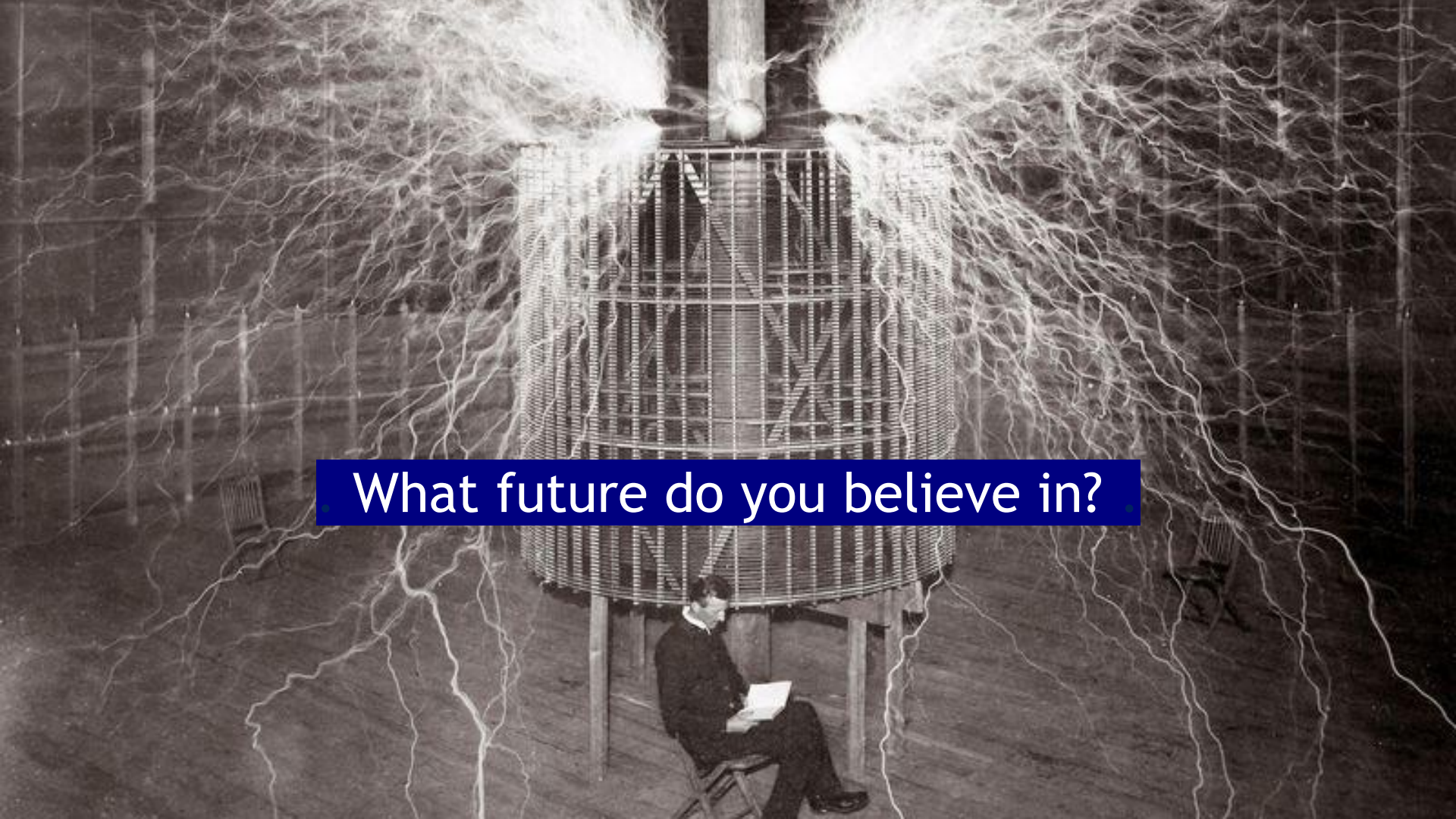
Source: CSO Ireland

Highcharts.com

CLN Data Centre, Dublin.
Photo: J. Coffey

Batteries are **cheap** and renewables have **won**

We can’t get the **toothpaste back in the tube**


What future do you believe in?

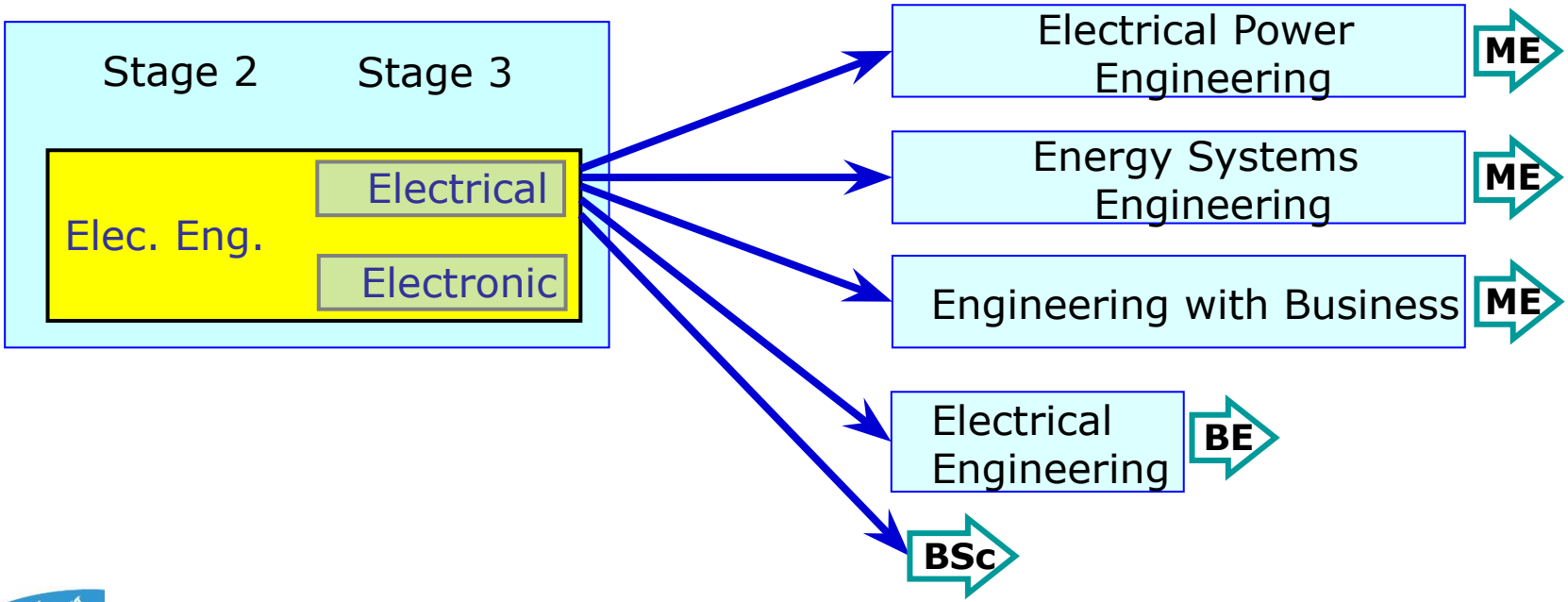
Module Choices in Stage 1 (First Year)

- Option Module in Spring – choose 1 of 4
  - not critical, but better if you choose the relevant option
    - Understanding Human Disease – Biomedical Engineering
    - Chem. Eng. Process Principles – Chemical & Bioprocess Eng.
    - Computer Science – Electrical, Electronic, Energy Eng.
    - Structures: Eng. and Arch. – Civil, Structural Eng. with Arch.
- Elective Module in Spring – free choice across UCD
  - including other options from above
  - and some modules designed for you, for example:
    - Robotics Design Project
    - Energy, Climate Change and Policy

Decision at end of Stage 3

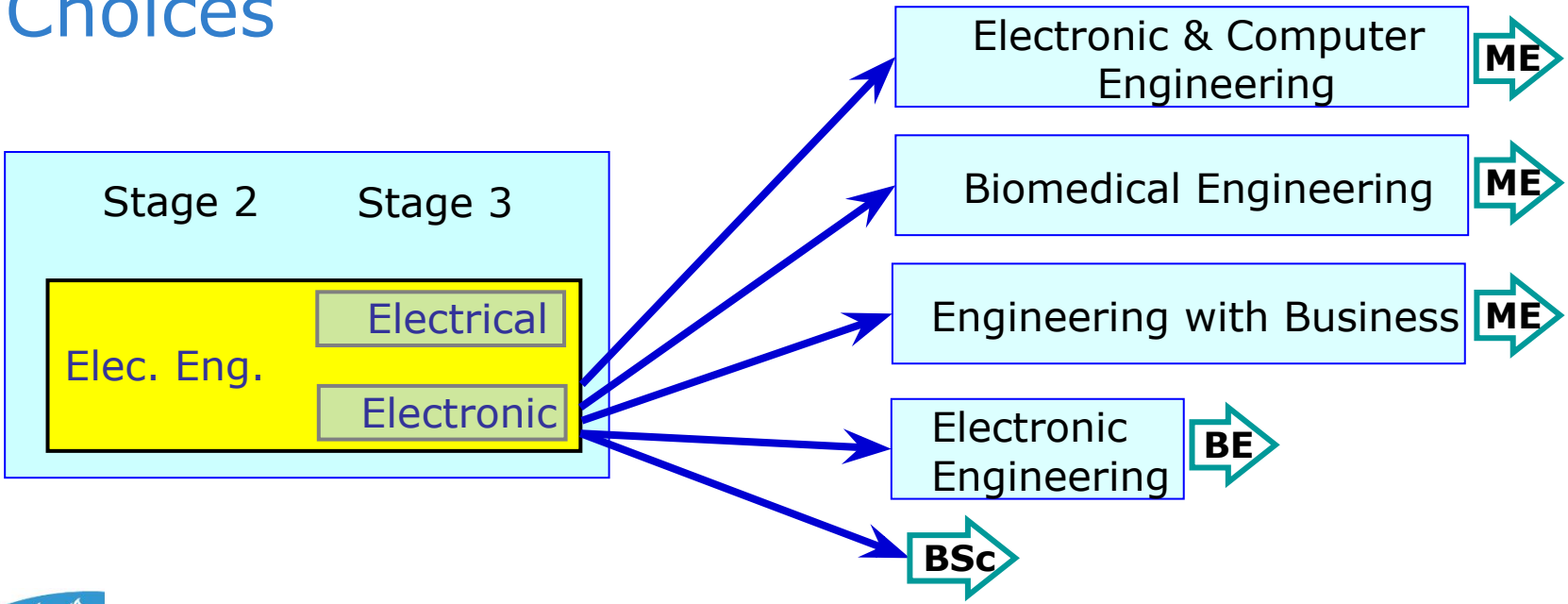
- Continue towards BE (bachelor of engineering)
  - four years study in total
  - traditional qualification for a professional engineer
- Enter ME (master of engineering) programme
  - two years specialised study (five years total)
  - various options available…
  - entry requirement, fees…
- Option to graduate with BSc (Engineering Science)
  - 3 years, 180 credits, not a professional qualification
  - for work or further study in another area
  - or for an ME programme elsewhere in Europe

Electrical Engineering Choices



- Other options are possible…
  - these are the obvious paths in UCD at present
    - ME Energy Systems is also available from the Mechanical route

Electronic Engineering Choices



- Other options are possible…
  - these are the obvious paths in UCD at present
    - ME Biomedical is also available from the Biomedical route

Electronic & Electrical Stage 2

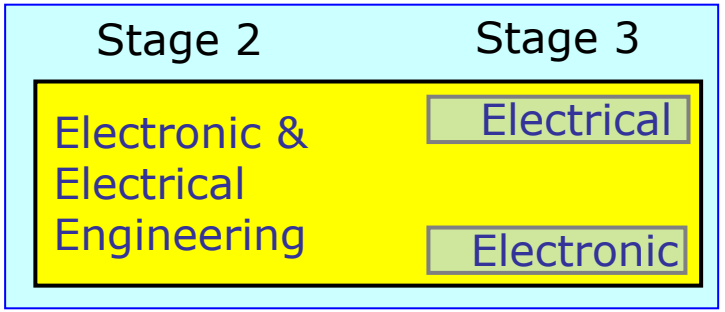
Autumn
- Computer Engineering
- Digital Electronics
- Electrical & Electronic Circuits
- Multivariable Calculus
- Solid-State Devices

Plus 2 elective modules

Spring
- Communication Systems
- Electrical Energy Systems
- Electromagnetic Fields
- Electronic Circuits
- Statistics & Probability

- Fundamentals of Electronic & Electrical Engineering
  - both areas build on the same principles
  - start to apply your knowledge to real-world problems
  - lots of lab work, normally in groups of two…

E & E Stage 3



Core modules:

- Circuit Theory
- Computer Science for Eng. 2
- Multivariable Calculus 2
- Signals & Systems
- Analogue Electronics
- Electromagnetic Waves
- Modelling and Simulation
- Signal Processing

Options: choose two of:

- Communication Theory
- Digital System Design
- Electrical Machines
- Power Systems Engineering

- Specialise further: Electrical or Electronic
  - by choosing two option modules
- More complex topics, but more interesting…
  - still plenty of laboratory & computer work

ME Programmes

- Two years of study in your chosen field
  - making five years in total
  - includes a major project at Master level (20-25 credit)
  - includes a work placement (usually 7 months, 30 credit)
    - UCD will arrange this work placement
- Entry requirement
  - based on stages 2 and 3, weighting factors 3 and 7
  - minimum GPA 2.8 (equivalent to C grade)
- Tuition fees apply
  - currently €8830 per year for EU students
  - usually arrange so you only pay for the last year…

Scholarships

- Réalta scholarships from UCD - €9500
  - for students for whom ME fees would be an issue
- Industry wants more graduates in these areas
  - so offering incentives to encourage more students
  - scholarships vary from €2000 to €3000
    - for a small number of students each year
  - terms and conditions apply!
- Arup
- Analog Devices Ireland
- Intel Ireland

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ARUP

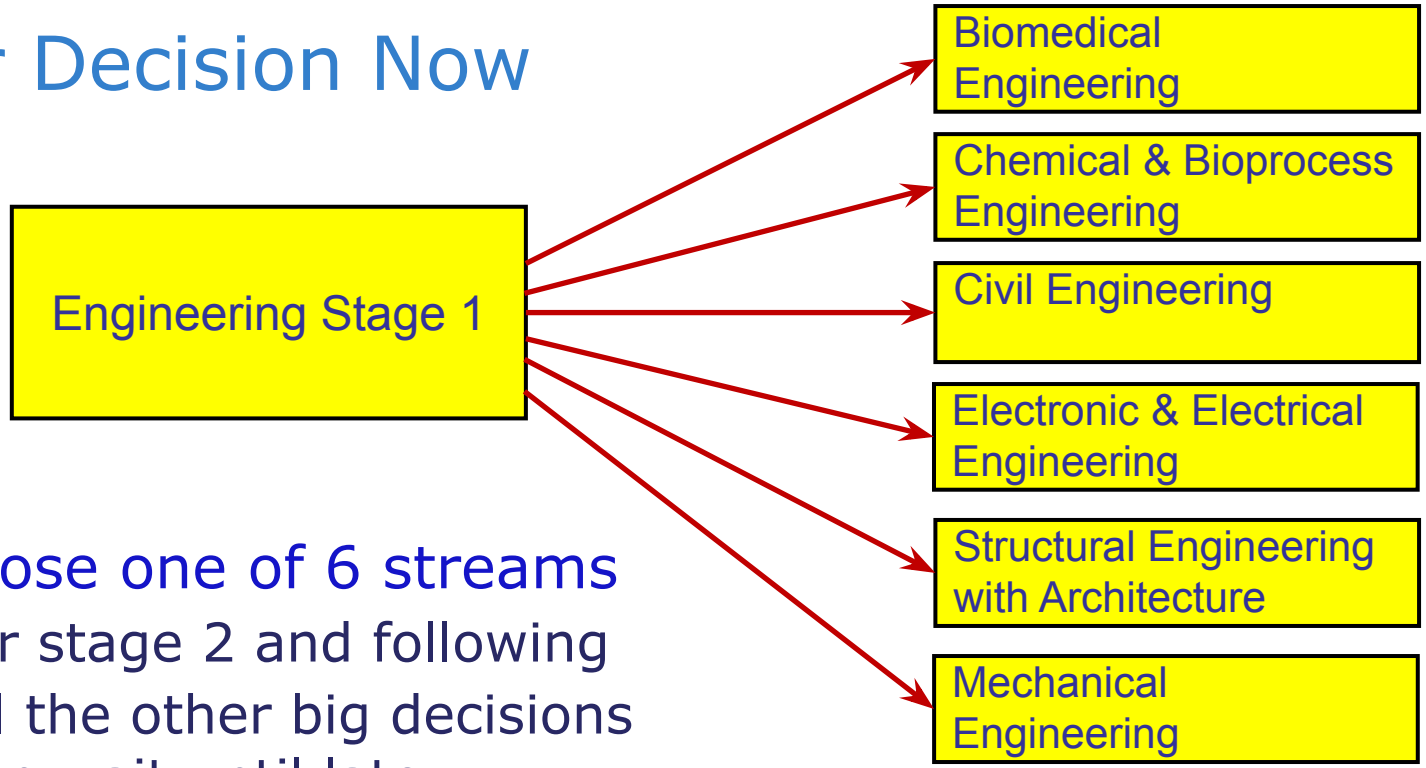
intel Ireland

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

Study Abroad

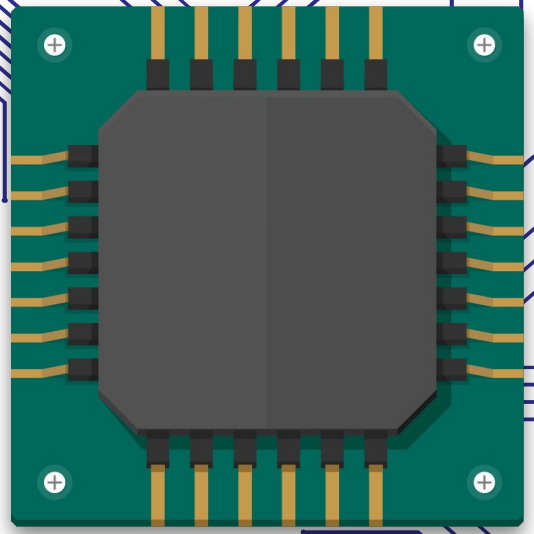
- Usually in Stage 3
  - arranged through UCD Global…
  - Erasmus exchange in Europe
  - or non-EU exchange to Australia, Canada, USA, etc.
- Requirements (for all engineering students)
  - Stage 1 complete, minimum GPA 3.0
  - Stage 2 autumn complete, minimum GPA 3.0
  - no grade less than C- in any core module
    - some exceptions allowed if GPA is at least 3.5…

Your Decision Now



- Choose one of 6 streams
  - for stage 2 and following
  - all the other big decisions can wait until later…
- Decision needed in March/April 2024
  - there will be another information session before then…

Electrical and Electronic Engineering



Presentation by Barbara Ziarnowska
2nd Year Electrical and Electronic Student

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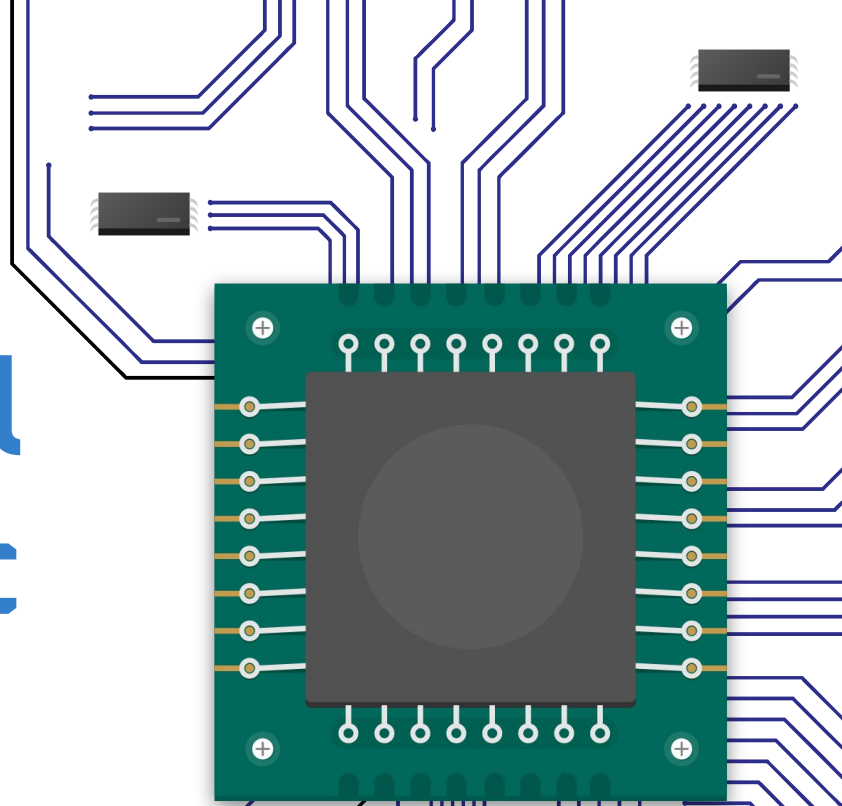
UCD School of Electrical Electronic Engineering

Scoil na hInnealtóireachta Leictrí agus Leictreonaí UCD

Introduction

- My name is Barbara and I am a 2nd Year Electrical and Electronic Student.
- I am passionate about computer hardware and software and all things AI - from computer vision to machine learning and AI chips.
- I have attended both national and international engineering competitions so far in my time at UCD.
- I am really enjoying studying Electrical and Electronic engineering and I am here to tell you about my experience as a student!

Why Electrical and Electronic Engineering?



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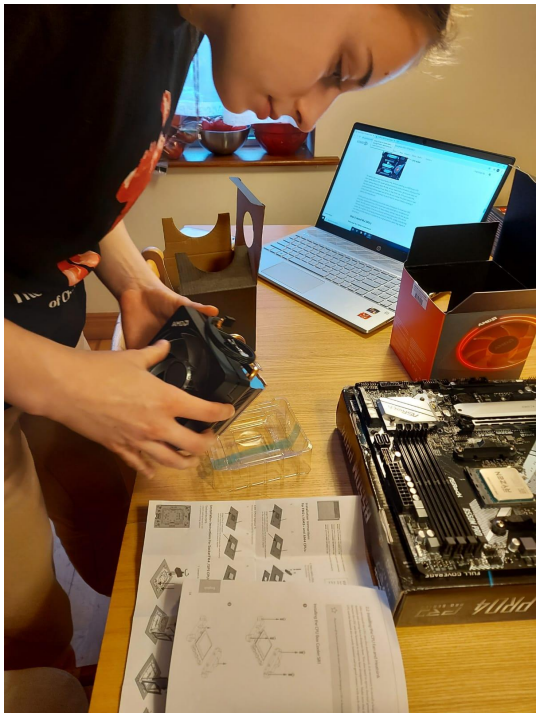
Why did I choose Electrical and Electronic Engineering?



Why did I choose Electrical and Electronic Engineering?

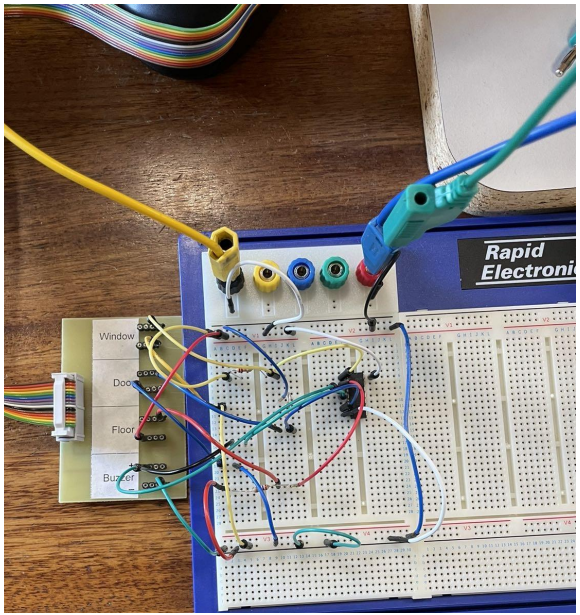
Why did I choose Electrical and Electronic Engineering?

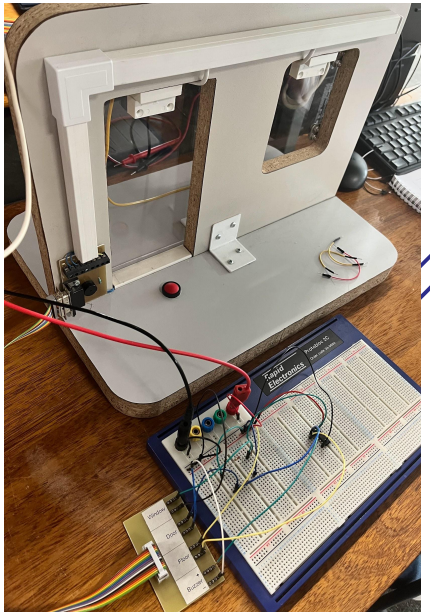
Why did I choose Electrical and Electronic Engineering?

- Member of my school's first ever Computer Science Leaving Cert Class!
- Built a fall-detector armband for the elderly and a Wordle clone for my final project - learned about topics like Logic Gates, Algorithms, and Efficiency.
- Loved Computer Science, Physics, Maths, and Applied Maths, and knew that Engineering was the right fit for me.

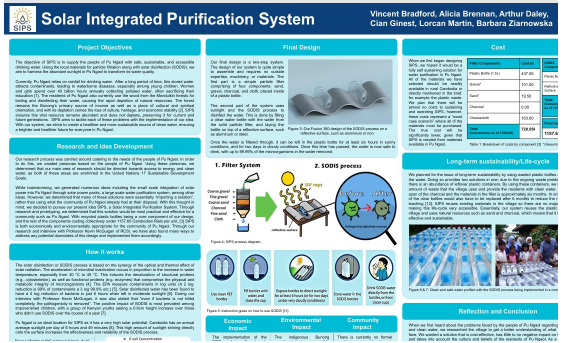
My Experience with Electrical and Electronic Engineering at UCD

- Subjects covered:
  - Computer Engineering
  - Digital Electronics
  - Electronic Circuits
  - Solid State Devices
- Coding with MATLAB, C, and Python
- Provides you with a very strong foundation that is a great mix of theory and hands-on practice
- Prepares you for a wide range of careers





My Experience with Electrical and Electronic Engineering at UCD



My Experience with Electrical and Electronic Engineering at UCD

Bentley® enactus

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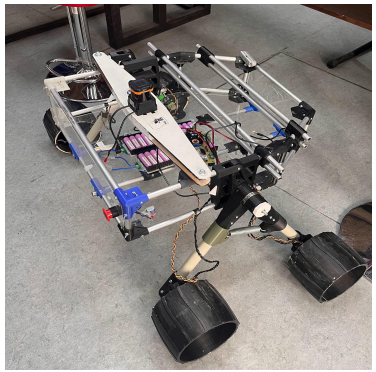
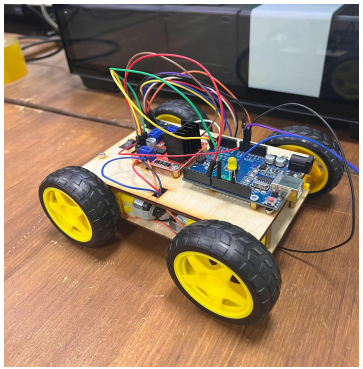
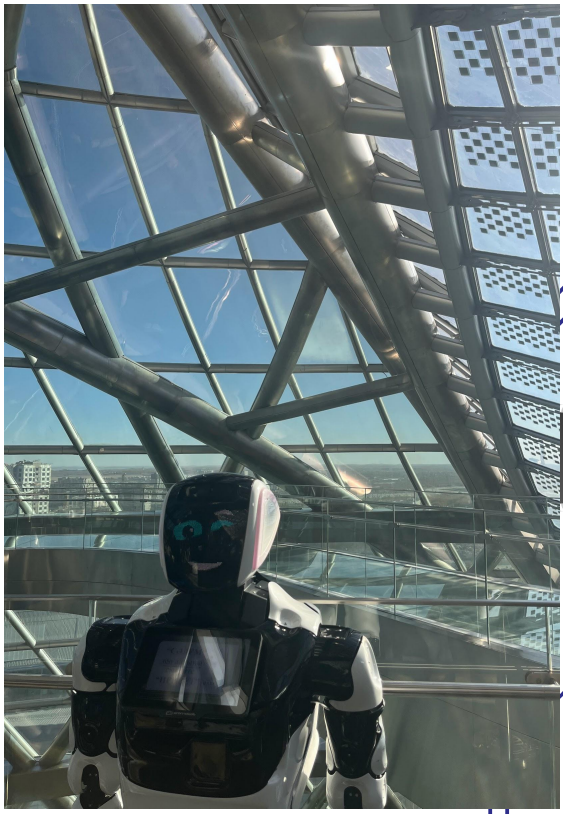
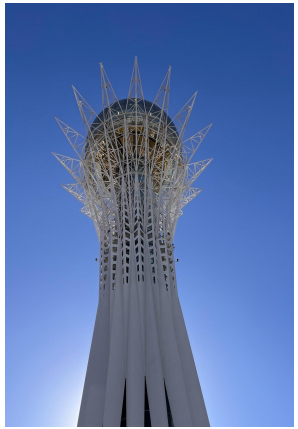
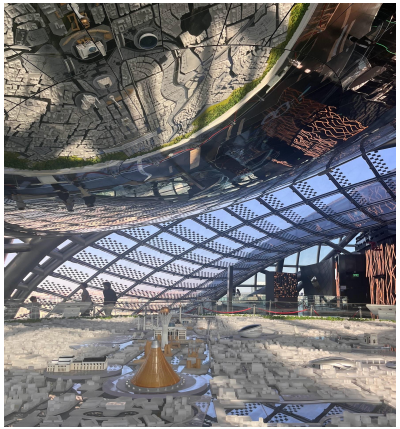
My Experience with Electrical and Electronic Engineering at UCD











Study Abroad Opportunities (3rd Year)

Career Goals and Interests

Industry Roles

Google

intel

AMD

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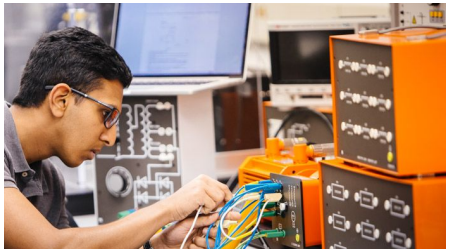
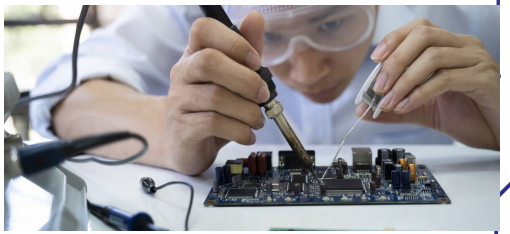
NVIDIA®

Research

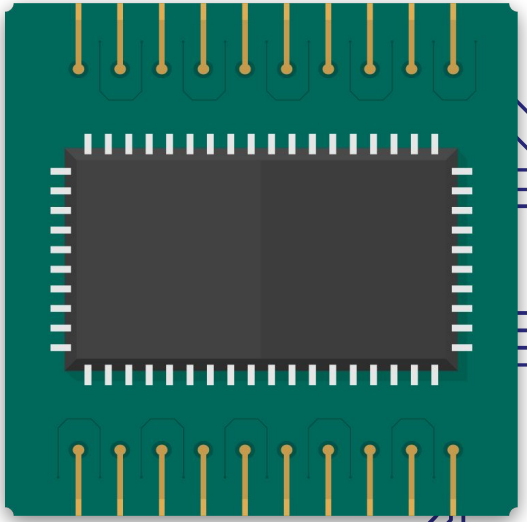


Entrepreneurship



General Advice - Electrical and Electronic Engineering

- **Build a strong foundation in Maths and Physics** - they form the foundation for all of your real-life projects!
- **Invest time and effort into your continuous assessments and laboratories** - this will help you to solidify your learning over time and takes pressure off the final exam.
- **Use your first year to explore**. Talk to older students, engineers, lecturers, join clubs, and start small projects.
- **Experimenting with projects or side work will help you find what areas you enjoy most** - whether it's hardware, software, electronic / electrical engineering, or another branch of engineering entirely.
- **Learn outside of the classroom** - apply the concepts that you learn in lectures to real-life situations. Engineering is all about practical solutions, so have a think about how things work around you!
- **Get involved in competitions, group projects, and hackathons!** They're a fun, hands-on way to apply what you're learning in class to work on real challenges.



Thanks

Any questions?

Email me any questions:

barbara.ziarnowska@ucdconnect.ie

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