Why choose Electronic Engineering?

Professor Peter Kennedy
Professor of Microelectronic Engineering
University College Dublin

Outline

- What is Engineering?
- What is Electrical and Electronic Engineering?
- What is Electronic Engineering?
- What will I study?
- Where will I work?
- Conclusion

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*…"

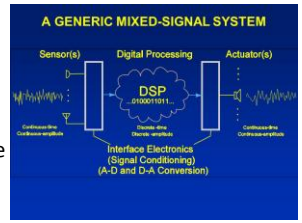
Merriam-Webster

Electrical and Electronic Engineering

- Electrical Engineering: mainly processing energy in electrical form
- Electronic Engineering: mainly processing information in electrical form

Processing Information in Electrical Form

- The Physical World is continuous; the Digital World is discrete
  - Sense physical variables (temperature, pressure, light) and convert to electrical quantities (charge, voltage, EM waves)
  - Represent real variables as binary numbers and symbols (quanta of voltage or charge, packets of EM energy)
  - Process these symbols
  - Convert electrical quantities back to physical quantities (pressure, light)

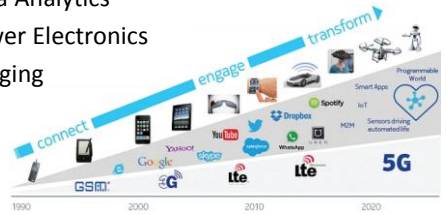


Processing Information Electronically

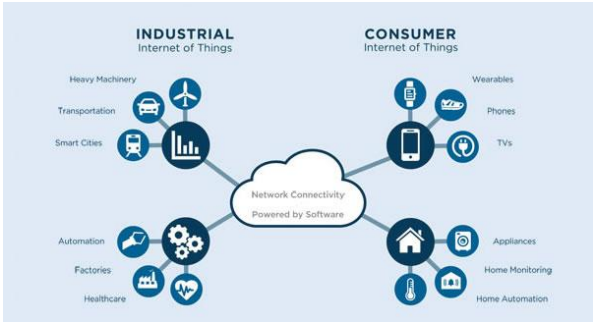
- Sensors
- Signal Processing
- Communications
- Data Analytics
- Control
- Actuators

Electronic Engineering Drivers

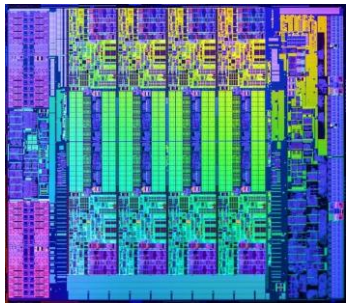
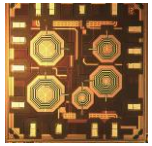
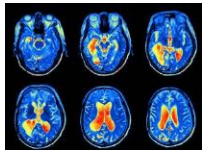
- Computation/Signal Processing
- Communications
- Data Analytics
- Power Electronics
- Imaging



Electronic Engineering Transforming the World



Electronic Engineering Transforming the World

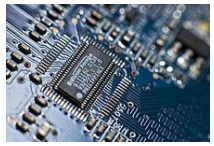
Electronic Engineering Transforming the World

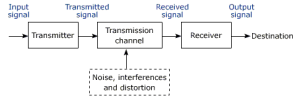



FROM ADAS TOWARDS AD

Electronic Engineering Fundamentals

- Sensors & Actuators
- Electronic Circuits
- Signal Processing
- Communications
- Data Analytics
- Control



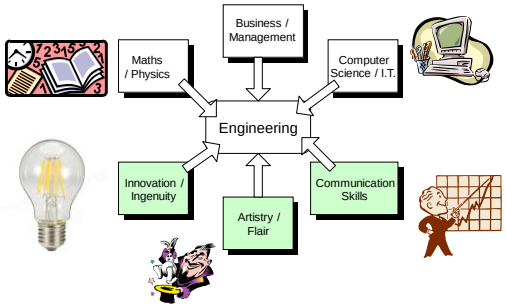



Sample Electronic Engineering Employers…

Conclusion

- Engineering is about solving problems using science, maths, and the properties of materials
- Electronic Engineering uses *electrical* properties of materials to process *information*
- Electronics has revolutionized society and continues to transform our lives
- Every application domain needs more Electronic Engineering
- The demand for core Electronic Engineering skills (signal processing, communications, analytics) is strong nationally and internationally

What makes an Engineer?



Electrical Engineering

Dr Terence O'Donnell
Associate Professor,
School of Electrical and Electronic Engineering

What is Electrical Engineering?

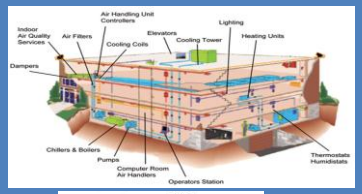
Electrical Engineering is concerned with the generation, transmission and use of electricity for powering the world.

Generating and Transmitting Electrical Energy



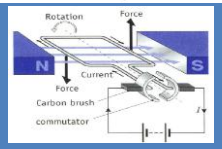


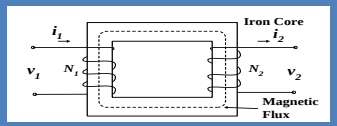
Use of Electricity



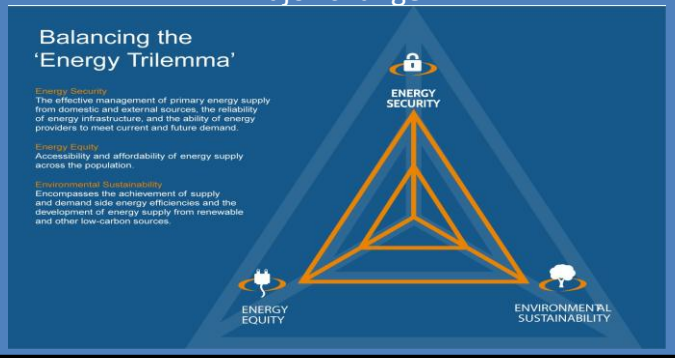






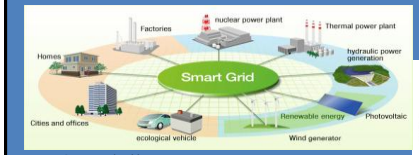


The generation & use of electricity is undergoing a major change

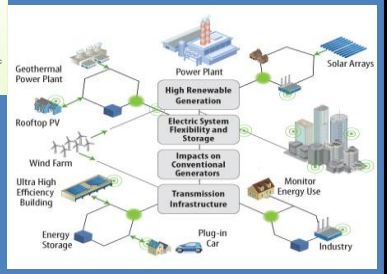


Renewable Energy Technologies

The Power Grid must become Smart



Source: Hitachi



Source: NREL

Transportation is going all Electric

Supergrids

- Source: DESERTEC

DC Transmission

- DC Transmission of electricity is making a comeback due to advances in power electronics.

Electrical Engineering subjects

- Power Systems
- Electrical Machines
- Power Electronics
- Renewable Energy
- Energy Economics

Example Electrical Engineering Projects

- Impact of Data Centres on the Dynamics of the Power System
- Scope for cyber attacks on electrical power systems
- Modelling and Simulation of PV Solar farms
- Geographic Optimisation of Renewable Asset Portfolios to Reduce Risk of Market Exposure *
- Design of a micro-combined heat and power (CHP) system*
- Balancing Electrical Markets with Large-Scale Hydro Storage *
- Desing of a power converter for a dual battery (48 V and 12 V) hybrid vehicle*

Electrical Engineering Opportunities

- Many new technologies: -Renewable technologies, Electric Storage, Control and communication systems, Decentralised Energy Production, Electrification of Transport, Control of the demand
- Energy Policy will demand a strong focus on sustainability and renewables
- Huge challenges in power system operation with very high levels of renewable energy
- Strong multi-disciplinary focus: economics, sustainability, climatology…

Electrical Engineering in UCD

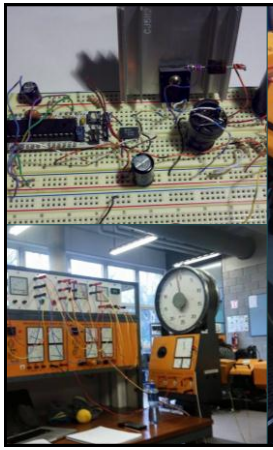
DANIEL LEVIE – FINAL YEAR MASTERS STUDENT IN ELECTRICAL ENERGY ENGINEERING

2013 – 2017 My Experiences

UCD DUBLIN

EIRGRID

September 2013	September 2015 – July 2016	January 2017 – August 2017	September 2017 – May 2018



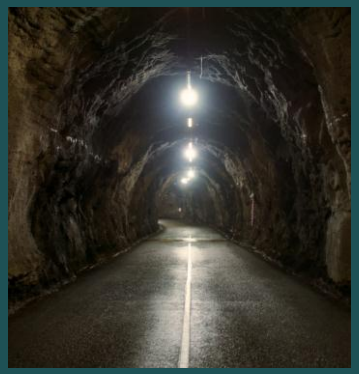
Electrical Engineering Labs

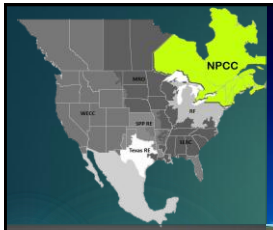
Electrical Engineering Projects

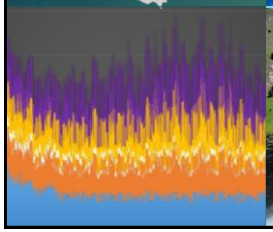
- Defending against Cyber attacks on the electrical grid
- Impact of Data Centres on the Dynamics of the Power System
- Grid Emulator for Real Time, Hardware in the Loop Testing
- Modelling and Simulation of Wind Turbines

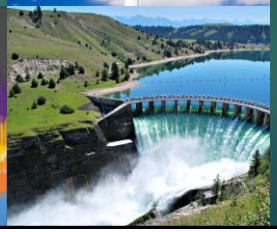
Masters Work placement at EirGrid

- The Oval – Ballsbridge
- Worked in Operations, Performance and Innovation Department
- Lots of visits to Generation Stations









Masters Research project – Balancing Electrical Grids with Large Scale Hydro Storage

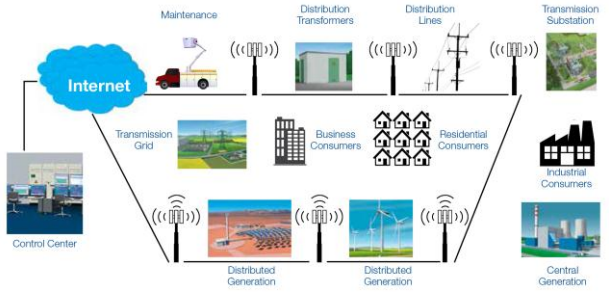
Things Happening in Industry Now.

Floating Solar Farms

Offshore Wind

Electric Cars

The Future – Smart Grids



Maybe even designing Electrical Systems for a Mars Base..

Thank You! Any Questions