

Electrical Power Systems (in Scotland) Past, Present and Future



**THE QUEEN'S ANNIVERSARY
PRIZES 2019 & 2021**
For Higher and Further Education



**UNIVERSITY OF THE YEAR
2012 & 2019**
Times Higher Education

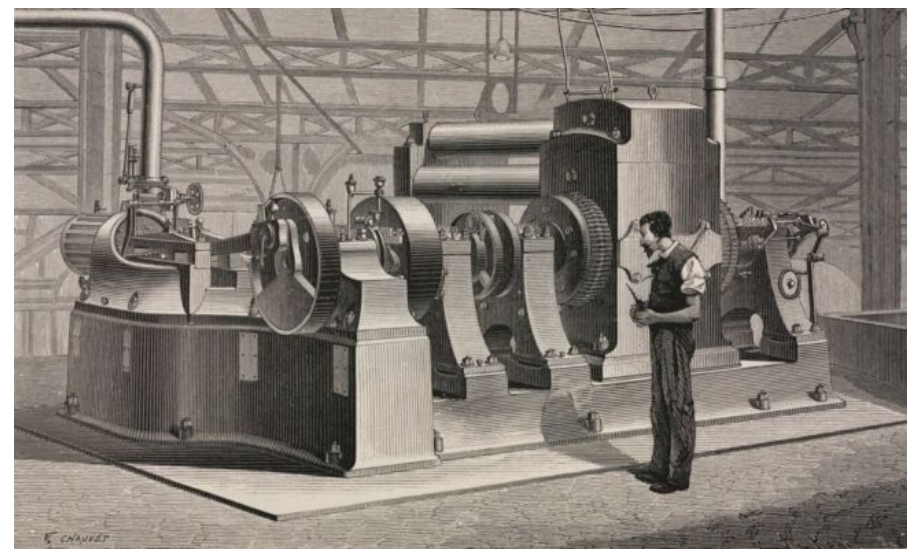


**SCOTTISH UNIVERSITY
OF THE YEAR 2020**
The Times & The Sunday Times



Overview

- Who am I? What is Strathclyde?
- History of electrical power systems (Scotland)
- How is electricity 'made'?
- Evolution of power systems
- Future developments and challenges – some research projects
- Skills (and AI?)



Who am I?

Campbell Booth

1987 – present: University of Strathclyde

BEng, PhD, RA/RF (Rolls-Royce UTC), Lecturer (2007), HoD EEE (2017), Vice Dean – Research (2021), Dean (September 2025-)

Research in power system protection – major projects with [National Grid](#), [ScottishPower](#), EPSRC (CDTs, lead investigator on active an [UK/China grant](#) and a [Prosperity Partnership](#)), teaching (CDTs, director of [Hong Kong Dual Masters](#), CPD...),

2014 – present: [Synaptec](#) (co-founder of spinout)

Distributed optical sensing (voltage, current, temperature, vibration) - 45 employees, many projects, clients and new products developed – recent alliance and investment for growth

<https://www.strath.ac.uk/staff/boothcampbellprof/>

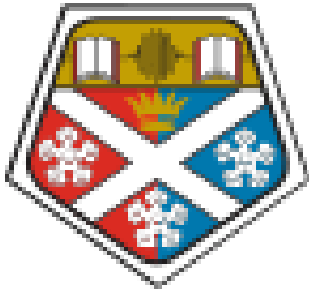


Megger and Synaptec announce strategic alliance to provide grid infrastructure monitoring solutions - Synaptec

Who are we?

University of Strathclyde

Business



University of
Strathclyde
Glasgow



Professional Directorates

**UK UNIVERSITY OF THE YEAR
2026**

Daily Mail University Guide

**THE QUEEN'S ANNIVERSARY PRIZES
1996, 2019, 2021 & 2023**

For Higher and Further Education



AFRC
ADVANCED FORMING RESEARCH CENTRE
UNIVERSITY OF STRATHCLYDE

**UK UNIVERSITY OF THE YEAR
2012 & 2019**

Times Higher Education



UNIVERSITY OF STRATHCLYDE
PNDC

INSTITUTION
National Manufacturing
Institute Scotland

ENGINEERING RANKINGS

- Architecture – 9th in UK (Times and Sunday Times Good University Guide 2025)
- Biomedical Engineering – 6th in UK (Complete University Guide 2026)
- Chemical Engineering – 9th in UK (Times and Sunday Times Good University Guide 2025)
- Civil Engineering – 3rd in UK (Guardian University Guide 2025)
- Product Design – 6th in UK (Guardian University Guide 2025)
- Manufacturing and Production Engineering – 6th in UK (Complete University Guide 2026)
- Electronic and Electrical Engineering – 2nd in UK (Guardian University Guide 2025)
- Mechanical Engineering – 7th in UK (Times and Sunday Times Good University Guide 2025)
- Naval Architecture, Ocean and Marine Engineering – 1st in UK/9th in the World (Shanghai Academic Ranking of World Universities 2024)





Global Partners: Research

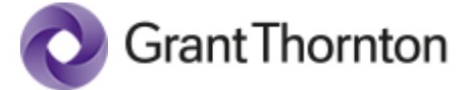


Global Partners : Education and Learning



Global Partners: Social & Economic and Global Policy Influence



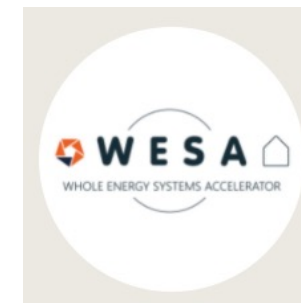




Our Wide Reaching Net Zero & Energy Centres



UNIVERSITY of STRATHCLYDE
**CENTRE FOR
SUSTAINABLE
DEVELOPMENT**



Scottish Energy
Advisory Board



UK Research
and Innovation



**Centre for Water,
Environment,
Sustainability
& Public Health**



Centre for Energy Policy



**Institute for Energy
& Environment**



UNIVERSITY of STRATHCLYDE
**ADVANCED NUCLEAR
RESEARCH CENTRE**



**TIC Low Carbon
Power & Energy
Programme**



**SUSTAINABLE
GLASGOW**

**Centre for Environmental
Law and Governance**



UNIVERSITY of STRATHCLYDE
**FRASER OF ALLANDER
INSTITUTE**



**SUSTAINABLE
STRATHCLYDE**

Our Industrial Centres

Strathclyde has a history of working with industry to develop, evolve and grow centres that drive impact with industry.



- Advanced Forming Research Centre
- Established in 2009



- Power Networks Demonstration Centre
- Established in 2013
- Unique whole energy systems demonstration facilities to enable the acceleration of novel multi-vector and consumer-facing energy innovations that will be needed to support the delivery of Net Zero emissions



UNIVERSITY of STRATHCLYDE
CENTRE FOR
ENERGY POLICY

- Founded in 2015, to support with ongoing transition to Energy Markets and supporting journey to Net Zero



UNIVERSITY of STRATHCLYDE
CENTRE FOR
SUSTAINABLE
DEVELOPMENT

- Launched in 2020 to support our ongoing SDG work across the globe



- CPI as founding company behind MMIC, along with Strathclyde, AZ and GSK



- >9,000m2 innovation space, office, accommodation and meeting space
- Electricity, hydrogen, heat...
- Demonstration and TRL acceleration

2009

2025



- Continuous Manufacturing and Advanced Crystallisation
- Established in 2011



- Advanced Nuclear Research Centre
- Established in 2015



- National Manufacturing Institute Scotland
- Established in 2019



- Strathclyde hosts the Driving the Electric Revolution – Industrialisation Centre for Scotland, Hosted with PNDC.
- Founded in 2019.



- Whole Energy Systems Accelerator, coming together with PNDC and Energy Systems Catapult from 2022.

EPSRC and related portfolio

- Strathclyde: 70 awards with a value of £116.4M - 18th overall and higher than 10 of the 24 Russell Group universities
- Engineering: 27 awards with a value of £44.5M
- Engineering lead/partners in 6 Centres for Doctoral Training –partners in 9 CDTs from 24/25
- 5 Prosperity Partnerships (of 66)
- Hubs, programme grants, Network+ on EDI in Engineering
- 6 Future Leader Fellows, 3 EPSRC, 6 RAE, 2 Iberdrola, 1 ESRC, 1 Leverhulme, 1 RSE



The place of useful learning

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Strathclyde
Glasgow

History of Electric Power

Brief History of Electricity

<https://www.geograph.org.uk/photo/116551>

[https://www.smartgrids-electricity-](https://www.smartgrids-electricity-vehicles.com/Heritage/Cultural/Godalming/Surrey/Electricity/Street/Lighting/1881/Public/Power/Supply/First/British/English/Waterwheel/Hydroelectric.htm)

[vehicles.com/Heritage/Cultural/Godalming/Surrey/Electricity/Street/Lighting/1881/Public/Power/Supply/First/British/English/Waterwheel/Hydroelectric.htm](https://www.smartgrids-electricity-vehicles.com/Heritage/Cultural/Godalming/Surrey/Electricity/Street/Lighting/1881/Public/Power/Supply/First/British/English/Waterwheel/Hydroelectric.htm)



English: Powerhouse of the Fort Augustus Abbey hydro-electric scheme. This is the power house of the first hydro-electric scheme in Scotland to supply electricity to the public. It was built by the monks of Fort Augustus Abbey in 1890 and supplied the Abbey and 800 residents in the village. Water was supplied to the 18kW turbine via an aqueduct. The North of Scotland Hydro-Electricity Board required the closure of the scheme as a condition of the supply of mains electricity to Fort Augustus in 1951.



<https://www.sse.com/about-us/our-heritage/>



In April 2025, we submitted an application to the Scottish Ministers under Section 36 of the Electricity Act 1989 to convert Sloy into a pumped storage hydro scheme with a proposed pumping capacity of up to 100MW.

Our plans for Sloy

An adapted pumped storage scheme would take excess energy from the grid and use it to pump water from Loch Lomond to the upper Loch Sloy where it would be stored before being released to power the grid when wind output is low and customer demand is high.

If progressed for development, the proposed pumped hydro storage project at Sloy would become SSE's second such flexible electricity storage scheme in development, alongside the company's plans for its proposed 1.3GW Coire Glas scheme between Fort William and Inverness in the Scottish Highlands.



This Room Is Equipped With
Edison Electric Light.

Do not attempt to light with
match. Simply turn key
on wall by the door.

The use of Electricity for lighting is in no way harmful
to health, nor does it affect the soundness of sleep.

<https://www.sse.com/about-us/our-heritage/>



Brief History of Electricity in Scotland

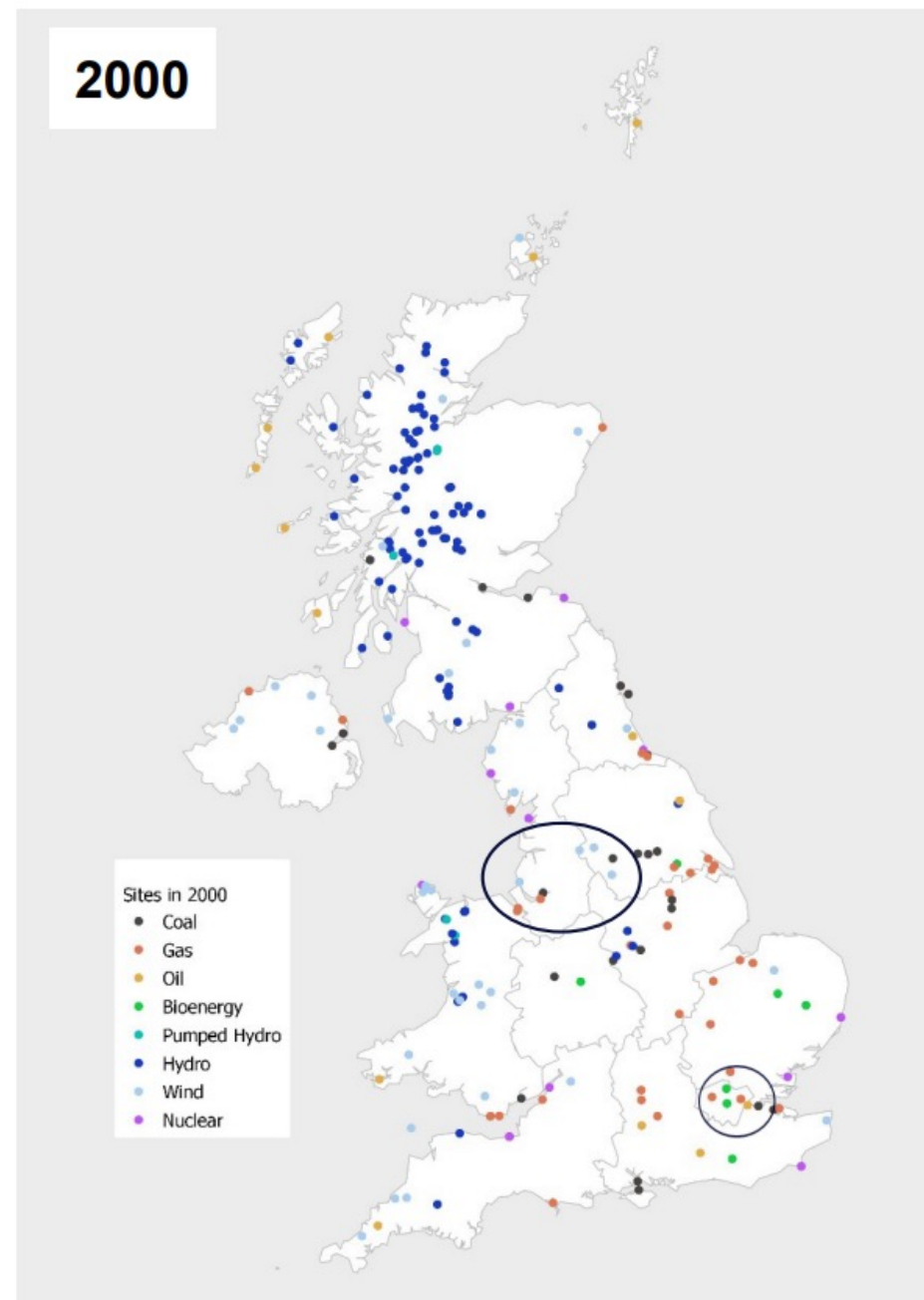
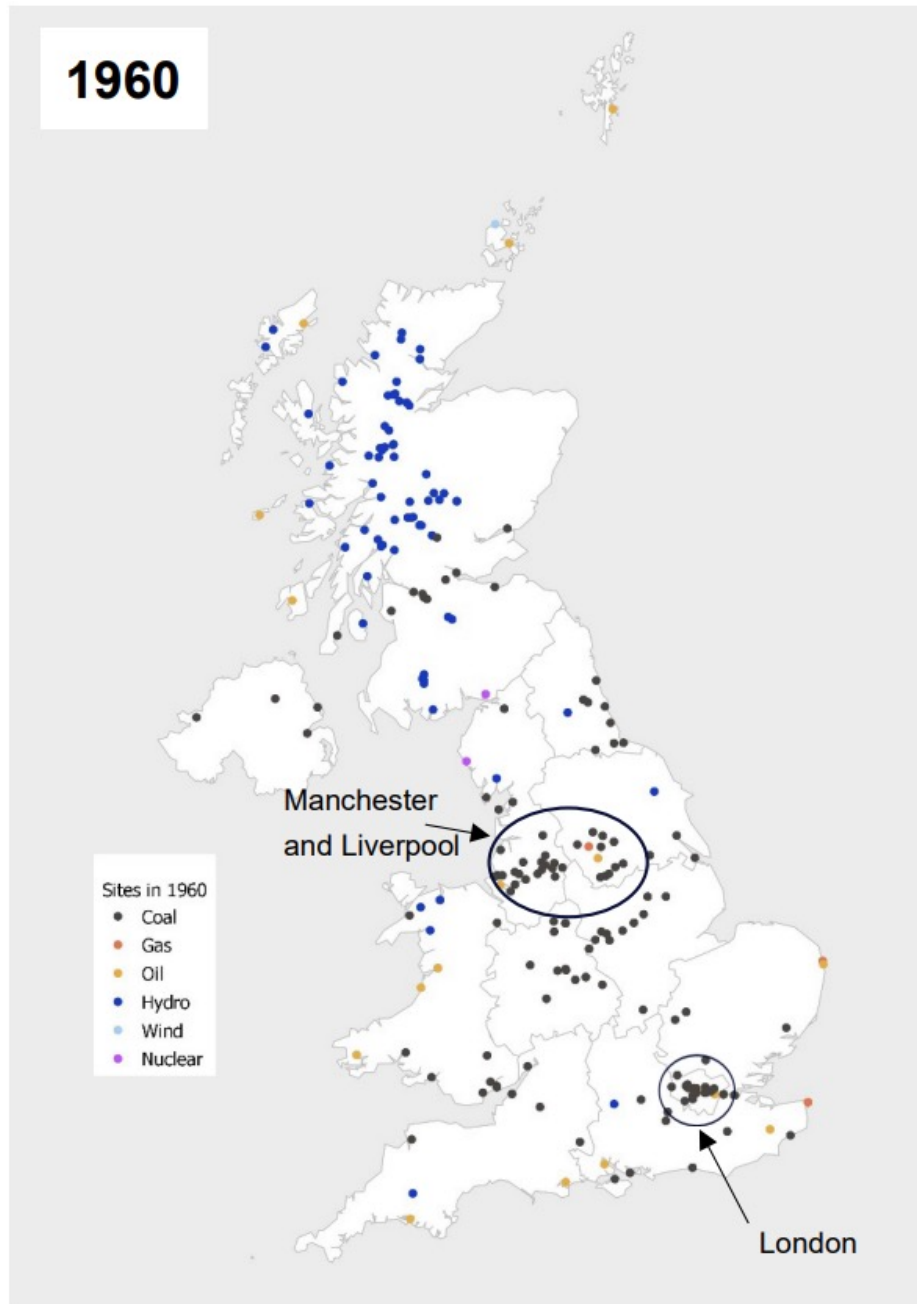


1940s

Dawning of a new era

Against the backdrop of World War II, Churchill's Secretary of State for Scotland, Tom Johnston, is the driving force behind bringing power to the Glens while in England the nationalisation of energy supply in 1947 brings opportunities to expand business.

Image: Tom Johnston, Morar opening ceremony 1945



Brief History of Electricity in Scotland

Coal-fired [edit] Oil- and gas-fired [edit]

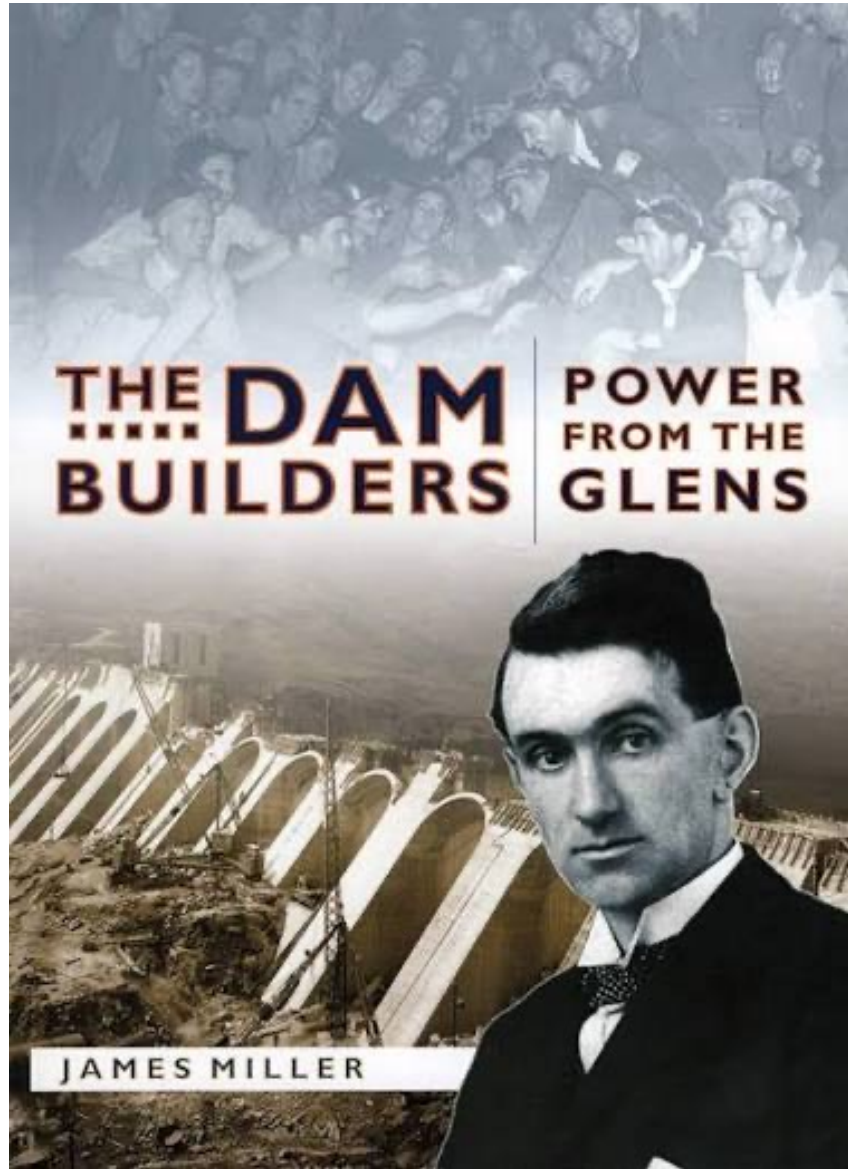
Name	Name
Aberdeen ^[4]	Arnish
Barony	Barra ^[8]
Bonnybridge ^[4]	Bowmore ^[9]
Braehead	Brodick ^[4]
Clyde's Mill ^[4]	Campbeltown ^[4]
Cockenzie	Daliburgh ^[4]
Dalmarnock ^[4]	Grangemouth
Dundee (Carolina Port) ^{[4][5]}	Inverkip
Dunfermline (Townhill) ^[4]	Kirkwall
Falkirk ^[4]	Lerwick A and B
Galashiels ^[4]	Lochalsh ^[4]
Kilmarnock ^[4]	Loch Carnan ^[11]
Kincardine	Peterhead
Longannet	Stornoway
	Sullom Voe Terminal ^{[12][13]}
	Tiree ^[14]
	Tobermory ^[4]

Conventional hydro-electric [edit]

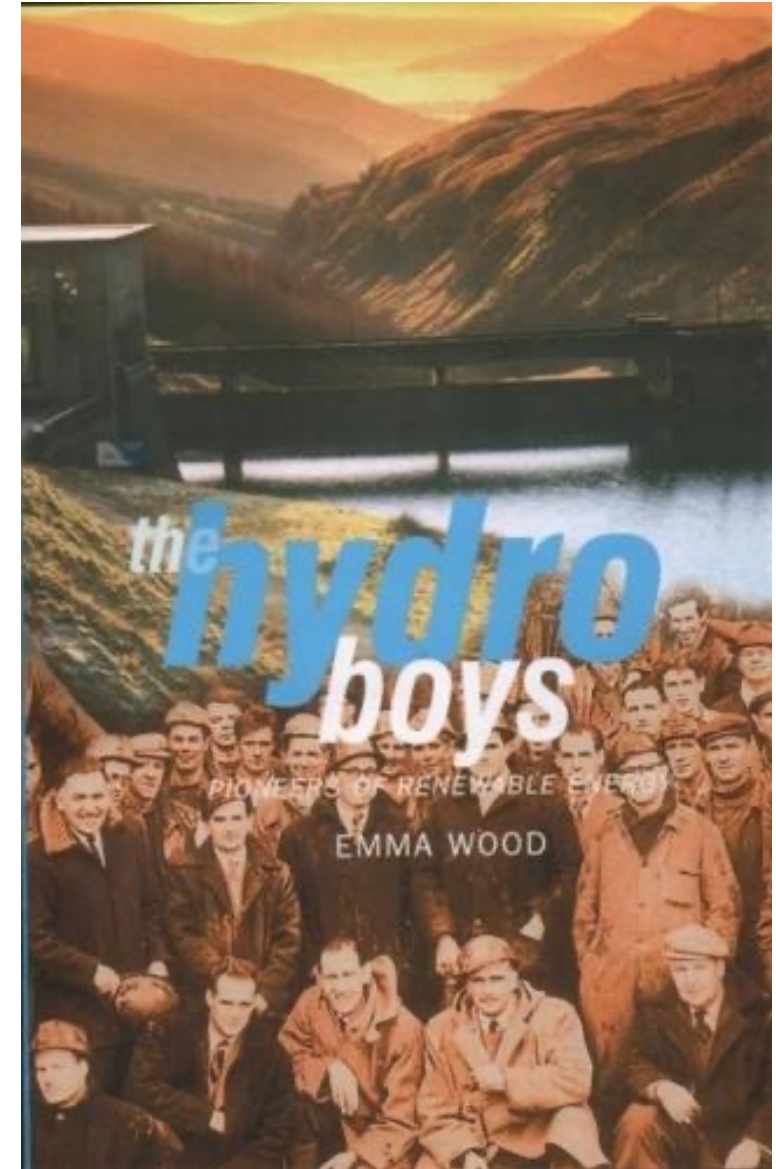
Several of Scotland's hydro-electric plants were built to power the [aluminium smelting](#) industry, but many more were built in the mid-20th century by the [North of Scotland Hydro-Electric Board](#) to supply the communities of the [Highlands](#). These were built in several "schemes" of linked stations, each covering a [catchment area](#), whereby the same water may generate power several times as it descends.

Name	Operator	Scheme	Location (UK grid reference)	Council area	Gross head (m)	Capacity (MW)	Year commissioned
Achanalt ^[44]	SSE Renewables	Conon	NH308619	Highland	20	3	1956
Aigas ^[45]	SSE Renewables	Affric-Beauly	NH474436	Highland	18	20	1962
Allt Fionn ^[46]	Osspower/Glenfalloch Estate	-	NN331209	Stirling	180	2	2012
Allt-na-Lairige ^[47]	SSE Renewables	Shira	NN231136	Argyll and Bute	249	6	1956
Allt na Moine ^[48]	Allt na Moine Hydro Ltd	-	NG692541	Highland		2	2023
Auchtertyre ^{[49][50]}	RWE	-	NN353290	Stirling	-	0.7	2000
Blantyre ^[51]	Blantyre Hydro Ltd	-	NS695583	South Lanarkshire	-	0.575	1995
Bonington ^[52]	Lanarkshire Hydro-Electric Co. / Lanark Diesel	Lanark Diesel	NE994416	South	30	11	1927

Brief History of Electricity in Scotland



<https://www.amazon.co.uk/Dam-Builders-Power-Glens/dp/1841582255>



<https://luath.co.uk/products/the-hydro-boys?srsId=AfmBOoqYNBmgE78s1Vg9aKwdswwOWnYNrPVJqZgDKImVB9bT0Xlmzi7>

The place of useful learning

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Glasgow

Electricity

What is electricity – and electric power?



High-ish
pressure,
low flow
(high-ish
power)

Voltage (pressure) is required to cause current to flow (if it can) – power is the product of voltage and current

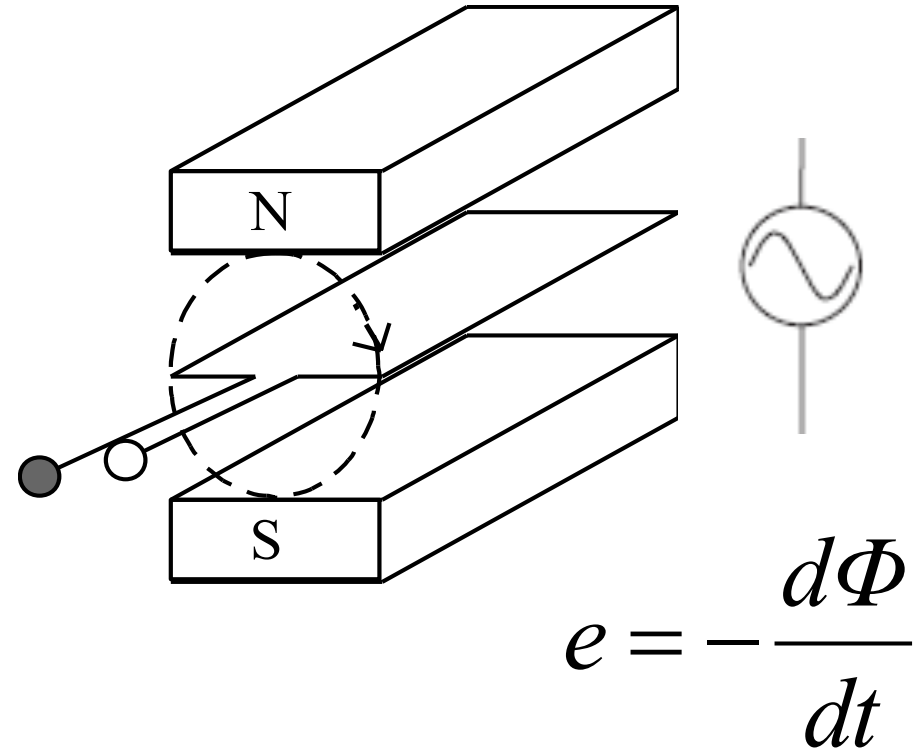
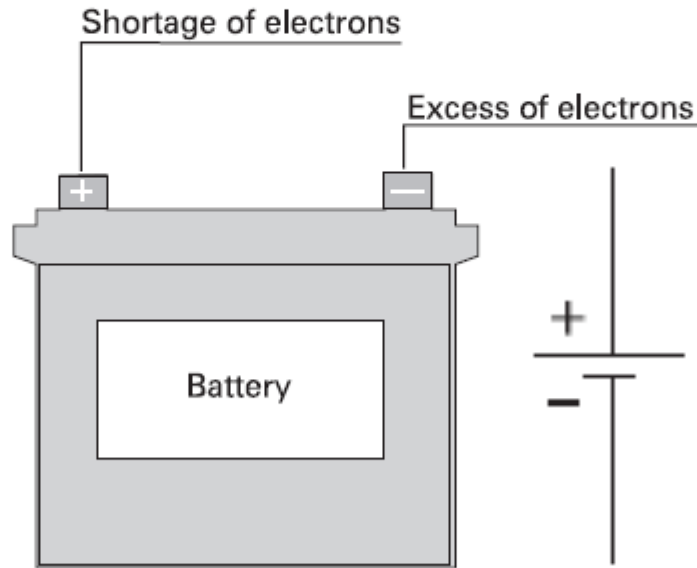
What is electricity – and electric power?



Low
pressure,
(mega) high
flow, mega-
power

Voltage (pressure) is required to cause current to flow – power is the product of voltage and current

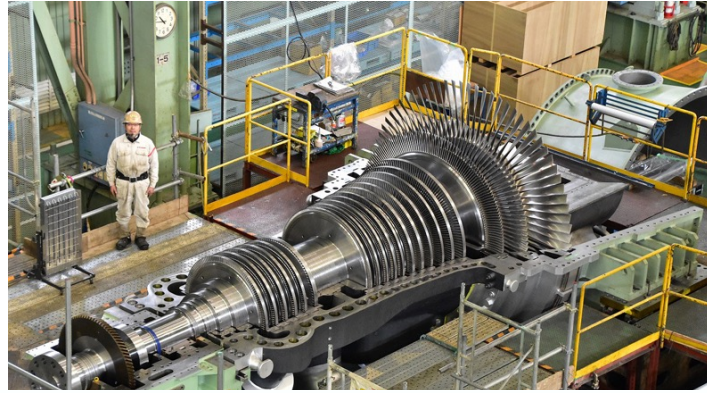
How is voltage produced?



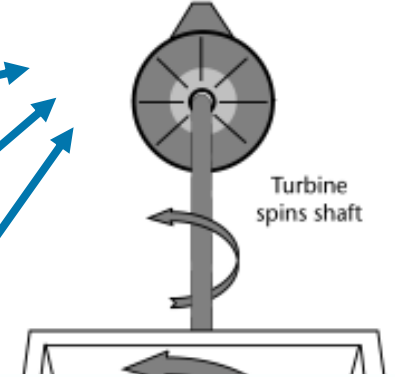
Voltage (pressure) is required to cause current to flow (in a circuit)

How is electricity 'made'?

Coal, oil, nuclear
to raise steam
from water

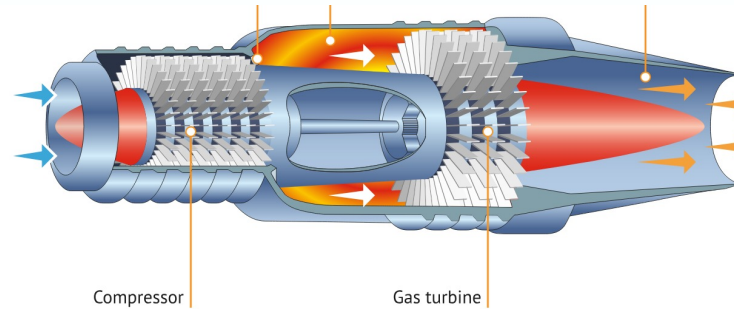


TURBINE GENERATOR

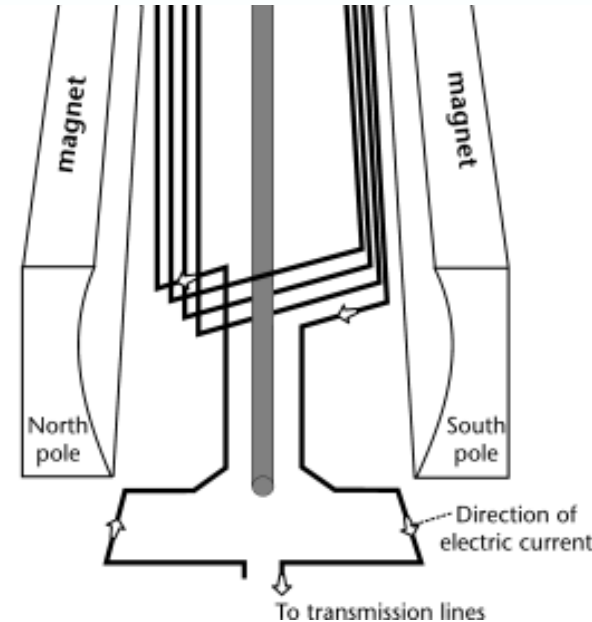
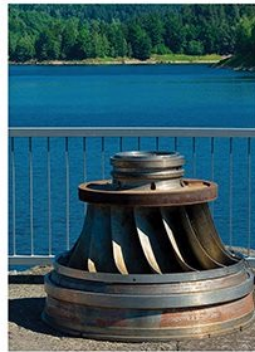


All very controllable and predictable

Gas combustion
to directly drive
turbine

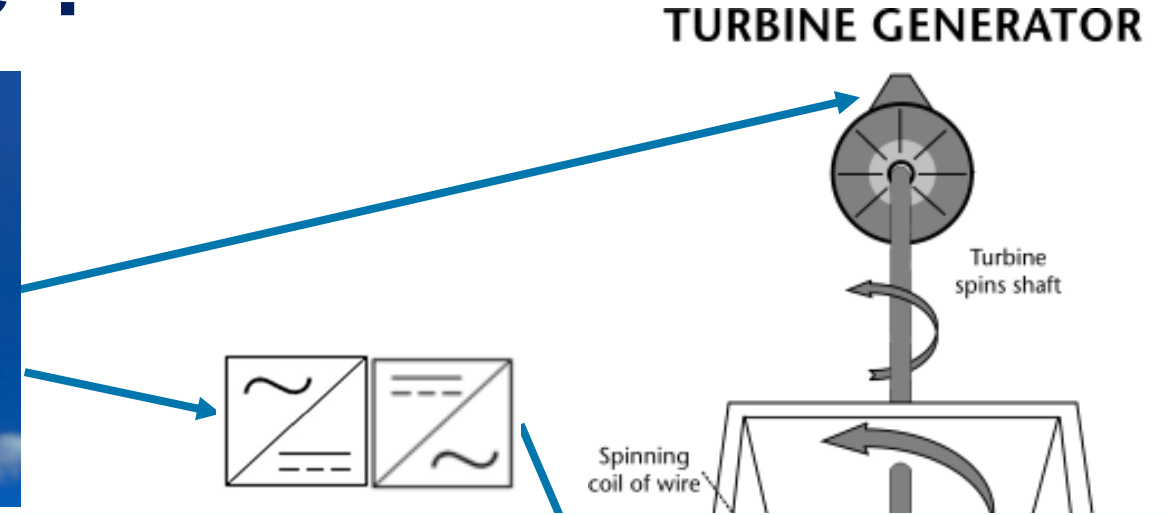
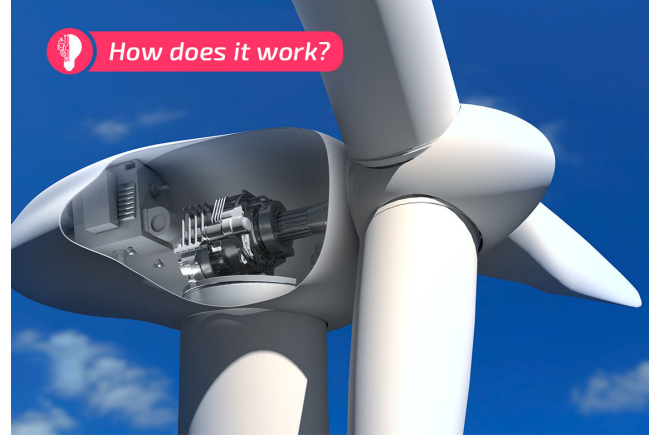


Water flow to
directly drive
turbine



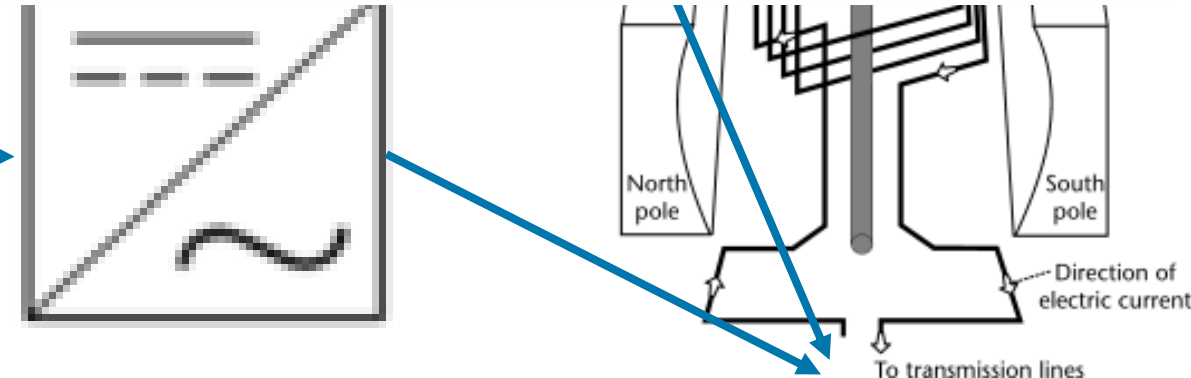
How is electricity 'made'?

Wind drives a turbine directly



**Not so controllable and predictable
(converters often required too)**

Solar drives chemical reaction to create a DC voltage

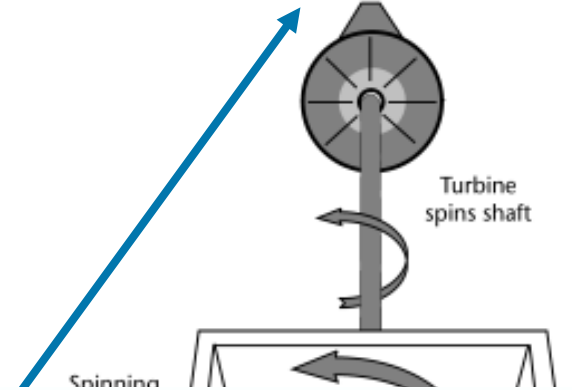


How is electricity 'made'?

Battery electric storage
(storing energy from
"excess" renewables
ideally)



TURBINE GENERATOR



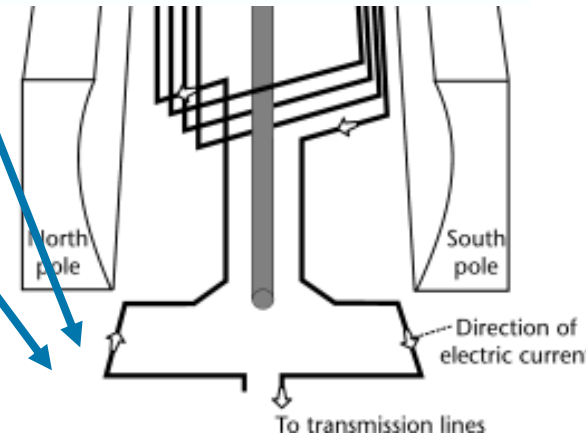
More controllable and predictable,
but £££?

directly for gas
turbines?)

Anode Electrolyte Cathode



Geothermal to
raise steam for
turbine



How is electricity 'made'?

Rolls-Royce plans mini nuclear reactors by 2029

🕒 24 January 2020 · 💬 940 Comments



ROLLS-ROYCE

<https://www.bbc.co.uk/news/business-51233444>

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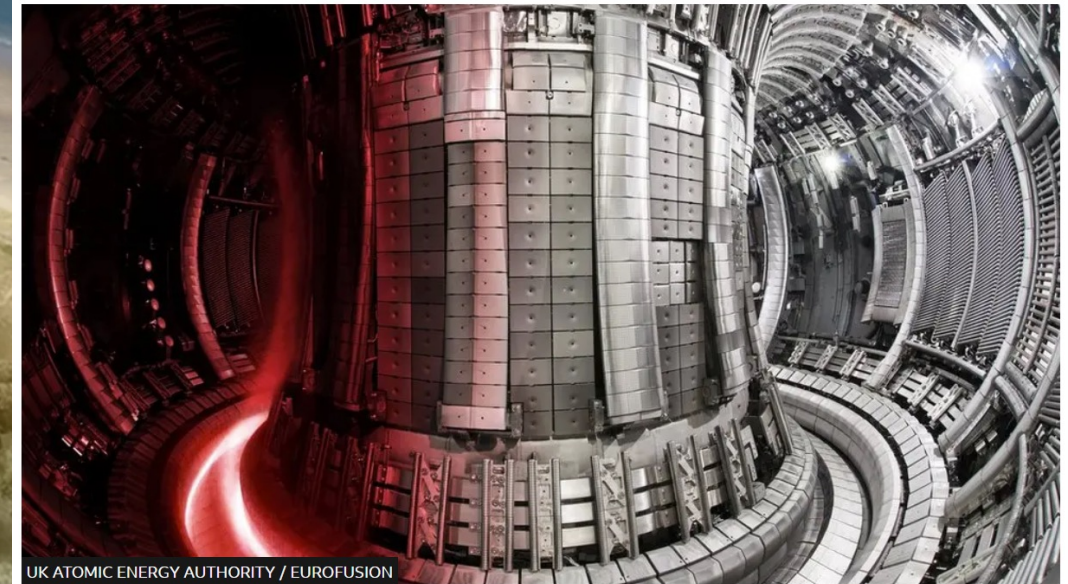
Science & Environment

Nuclear fusion: new record brings dream of clean energy closer

🕒 8 February 2024 · 💬 1050 Comments



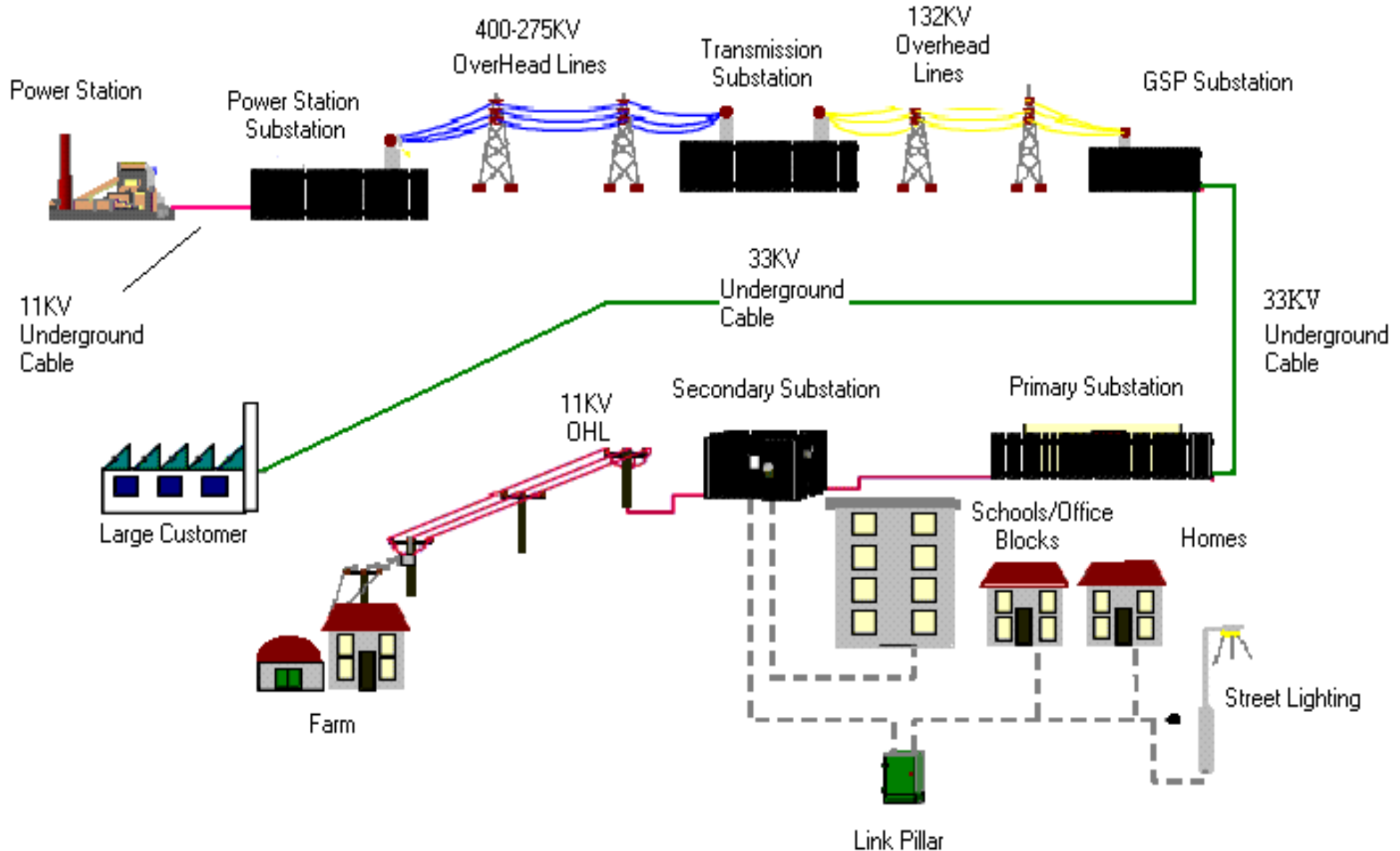
Brexit



UK ATOMIC ENERGY AUTHORITY / EUROFUSION

<https://www.bbc.co.uk/news/science-environment-68233330>

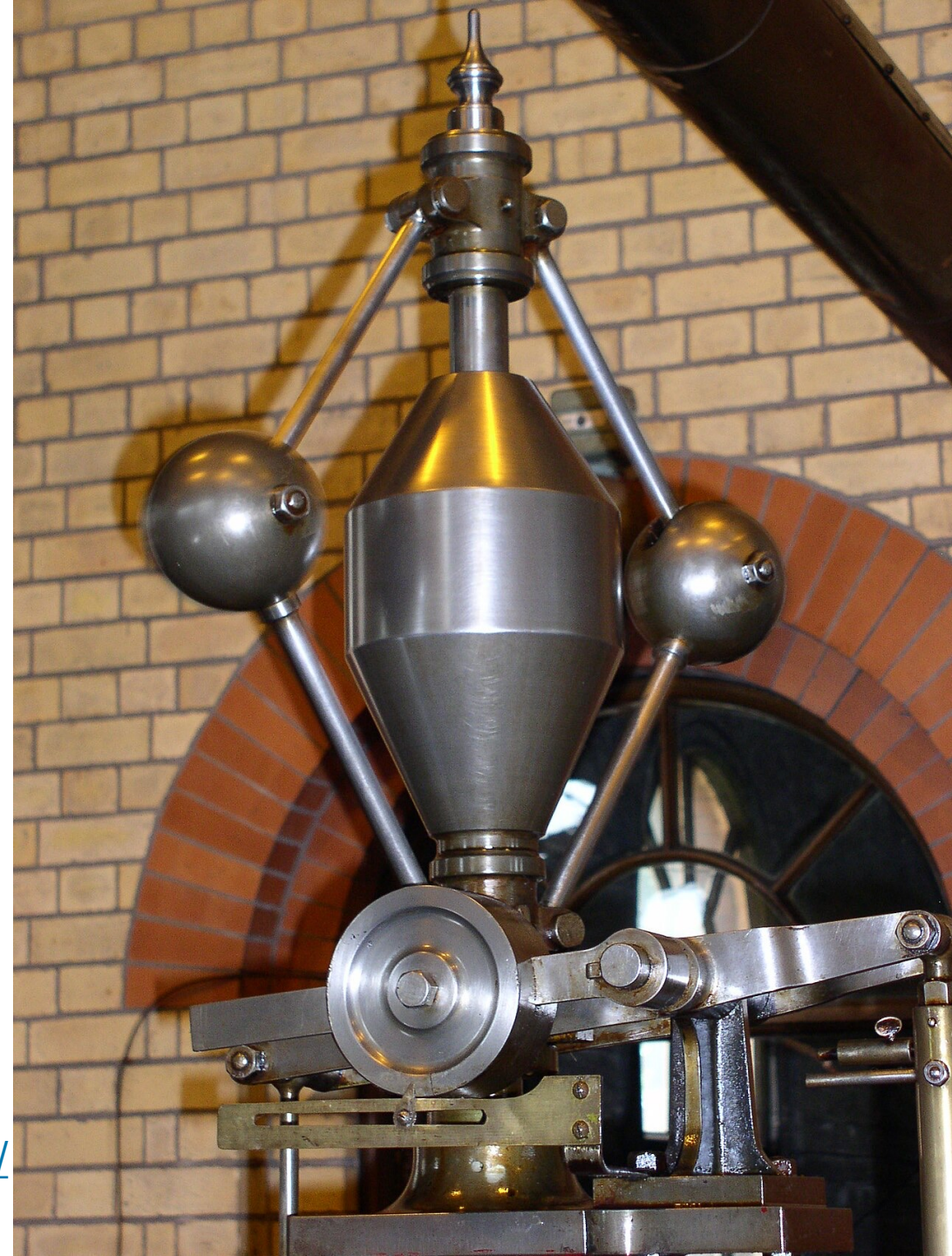
How is electricity transmitted and distributed?



How is (was) it all controlled?



https://www.reddit.com/r/MachinePorn/comments/px9y8q/a_beautiful_centrifugal_governor_of_a_steam_engine/



How is (was) it all controlled?



Everyone must go at same (predetermined) speed, but some put in more effort (power) than others

The place of useful learning

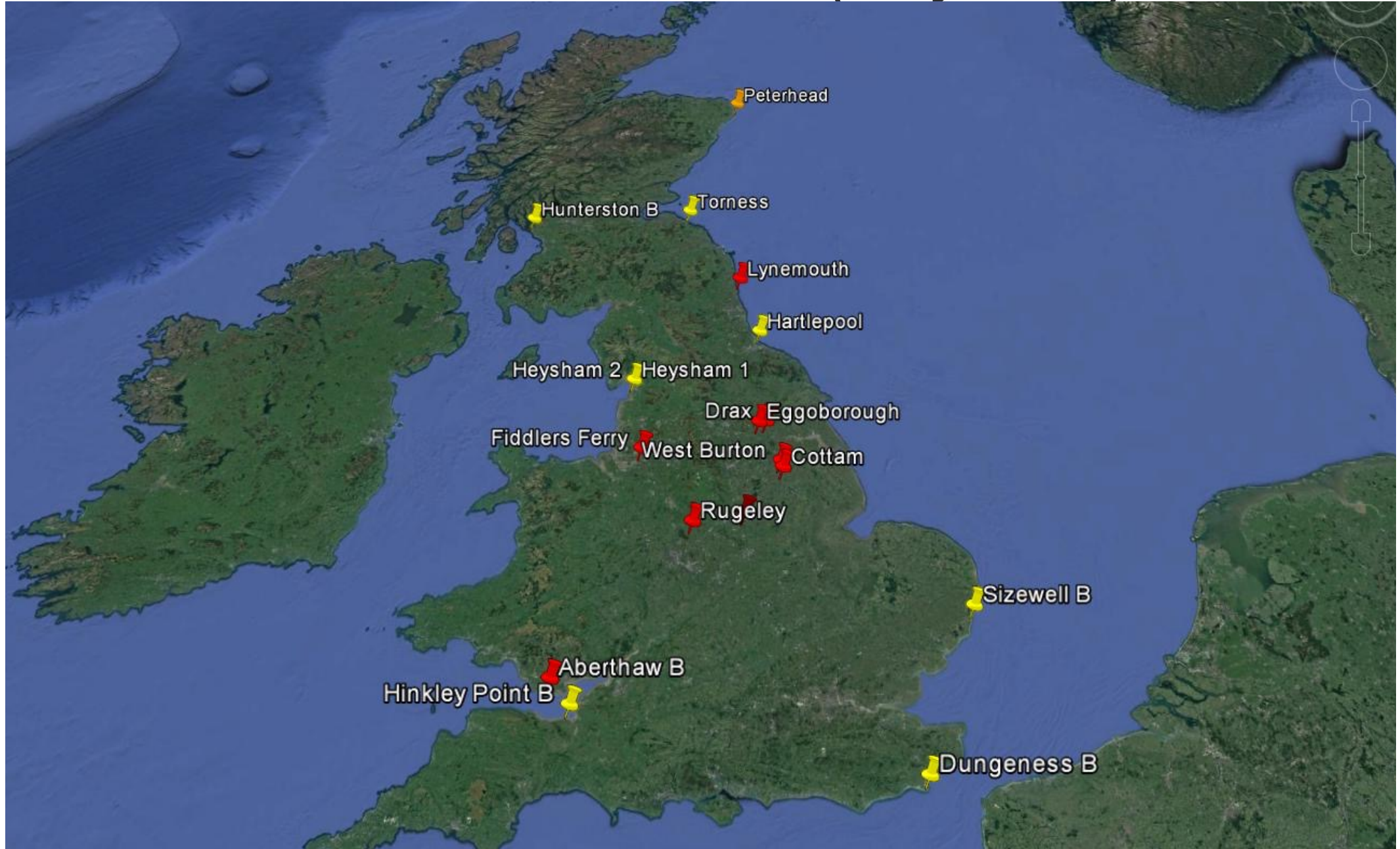
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Evolution and Future

GB: Coal & Nuclear Power Stations (early 2000s)



GB: Post 2025 Coal & Nuclear Power Stations...



April 2017
First no-coal day since late
1800s

Birmingham, 01 October 2024

The end of an era -
Ratcliffe-on-Soar
power station ends
coal generation



The UK's last coal-fired power station will
close its doors for the final time today (30th

October 2024
No-coal days forever

generation at midnight – marking a key

Evolution of Electrical Power Systems

- Increased offshore and onshore wind farms
- Increased solar
- Distribution connected generation
- Storage



...electrification is accelerating

- Heat
- Transport

...plus

- Hydrogen, Heat, Cooling, “prosumers”...

1
co

Almost



*All models are wrong,
but some are useful.*

wables,
consumers

-GEORGE BOX, UW-MADISON

MIT Technology Review

The power grid system is often described as the most complex machine ever built. Because the grid is so vast, it is impossible for any one person to fully grasp everything happening within it at a given moment, let alone predict what will happen later.

tha

and

By 2035:

Offshore wind



4.5 to 6 times
growth in capacity

Solar



2.5 to 5 times
growth in capacity

Interconnectors



2.5 to 3 times
growth in capacity

Battery storage



4.5 to 10 times
growth in capacity

Building over
**5 times
more**



transmission overhead or
underground lines than we
have built in the last 30 years.

Building around
**4 times
more**



transmission marine
cables than our current
offshore network.

nationalgrid



**Delivering
for 2035:**

Upgrading the grid for
a secure, clean and
affordable energy future

<https://www.nationalgrid.com/deliveringfor2035>

Renewable energy in China

[Explainer: The numbers behind China's renewable energy boom | Reuters](#)

Fossil fuels now make up less than half of China's total installed capacity for power generation.

In 2020, China committed to have 1,200 GW of renewables capacity by 2030, but is on track to meet that

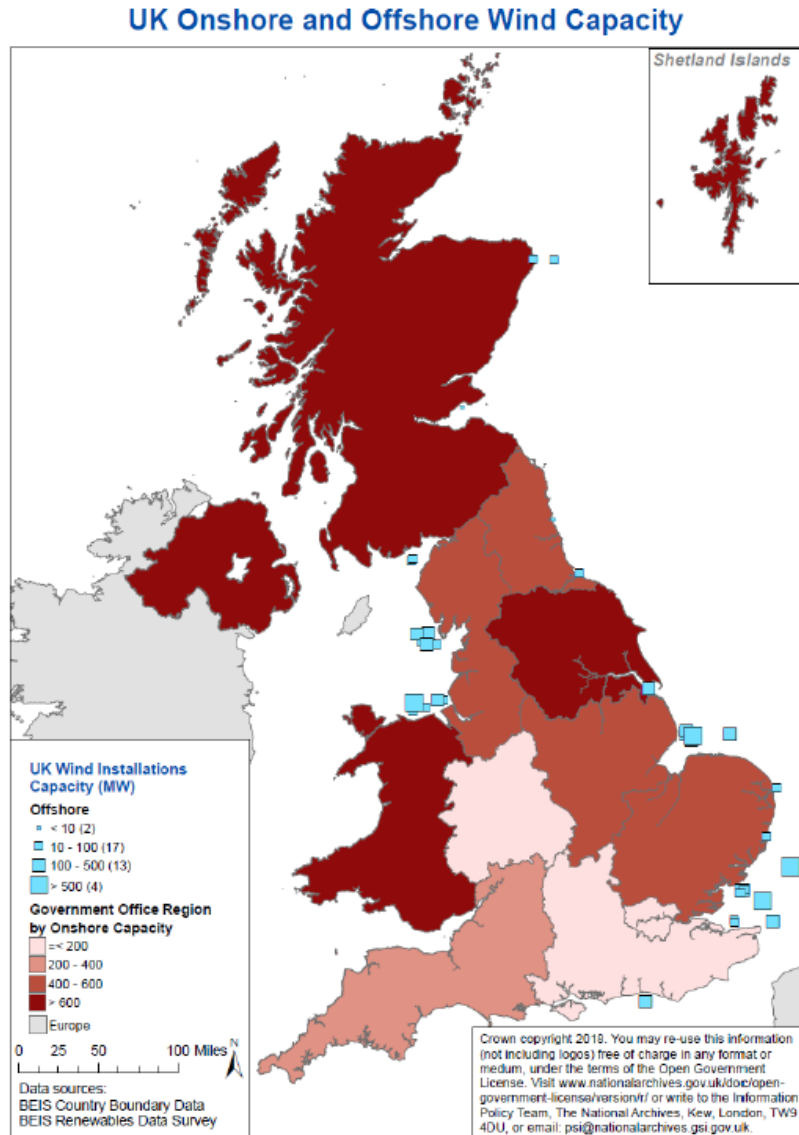
China has built **over 31,000 miles (50,000 kilometers) of high-speed rail**, making it the largest network of its kind in the world. Accounting for roughly two-thirds of all high-speed track on the globe, the system connects over 96% of cities with populations exceeding 500,000.  Wikipedia +3

The UK's HS2 high-speed rail project is now estimated to cost between **£87.7 billion and £102.7 billion**. **The initial London-to-Birmingham phase is delayed to open between 2036 and 2039**, with trains not reaching the central London terminus at Euston until at least 2040.  The Guardian +2

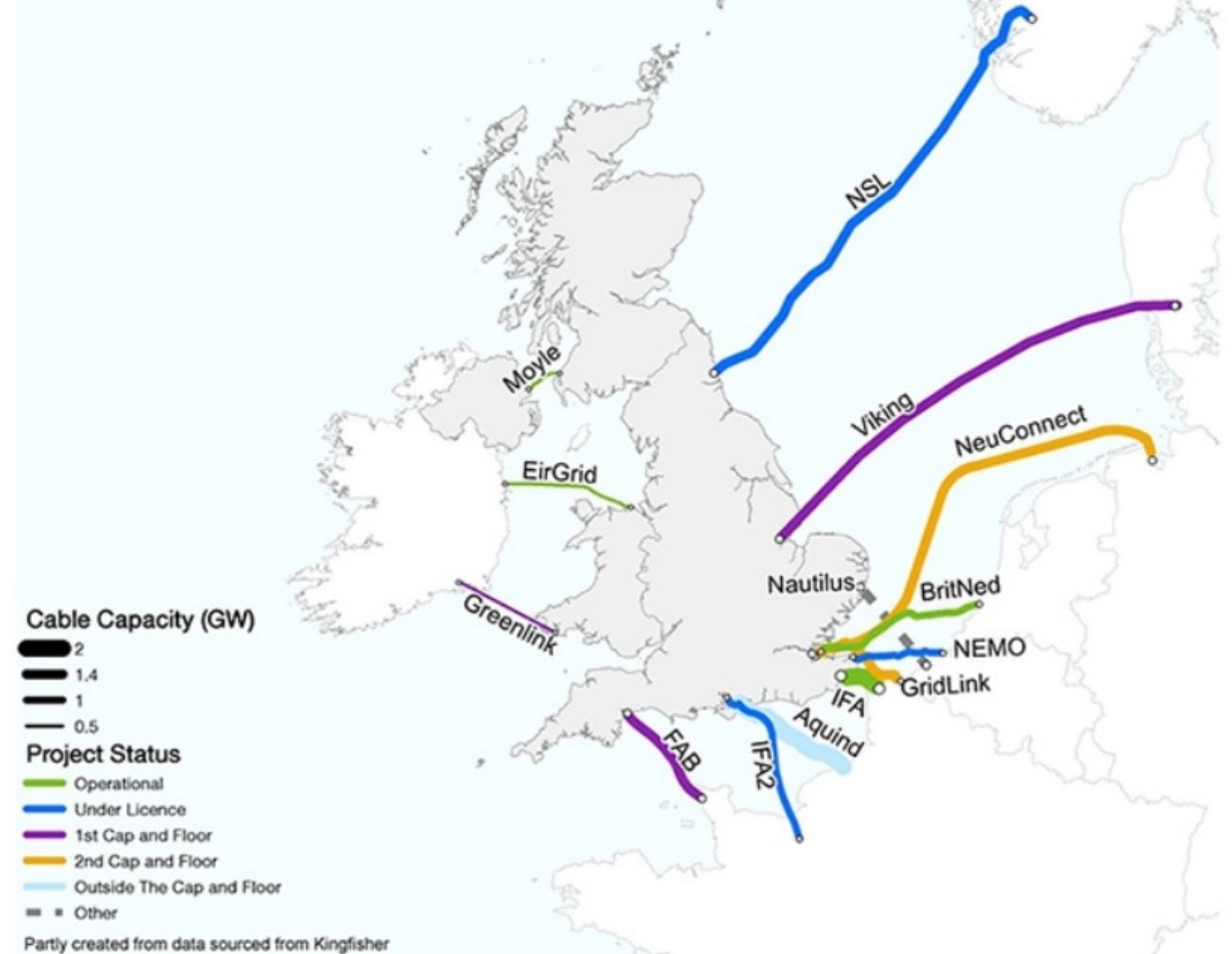
**Trillion
Grid by**

[wall-china-](#)

Power converter dynamics play an increasing and dominant role in the GB power system



Electricity Interconnectors England, Wales and Northern Ireland



<https://images.theconversation.com/files/504434/original/file-20230113-19-etdgtm.jpeg?ixlib=rb-4.1.0&q=45&auto=format&w=1000&fit=clip>

Potential issues “converter-dominated” power systems

Frequency stability issues

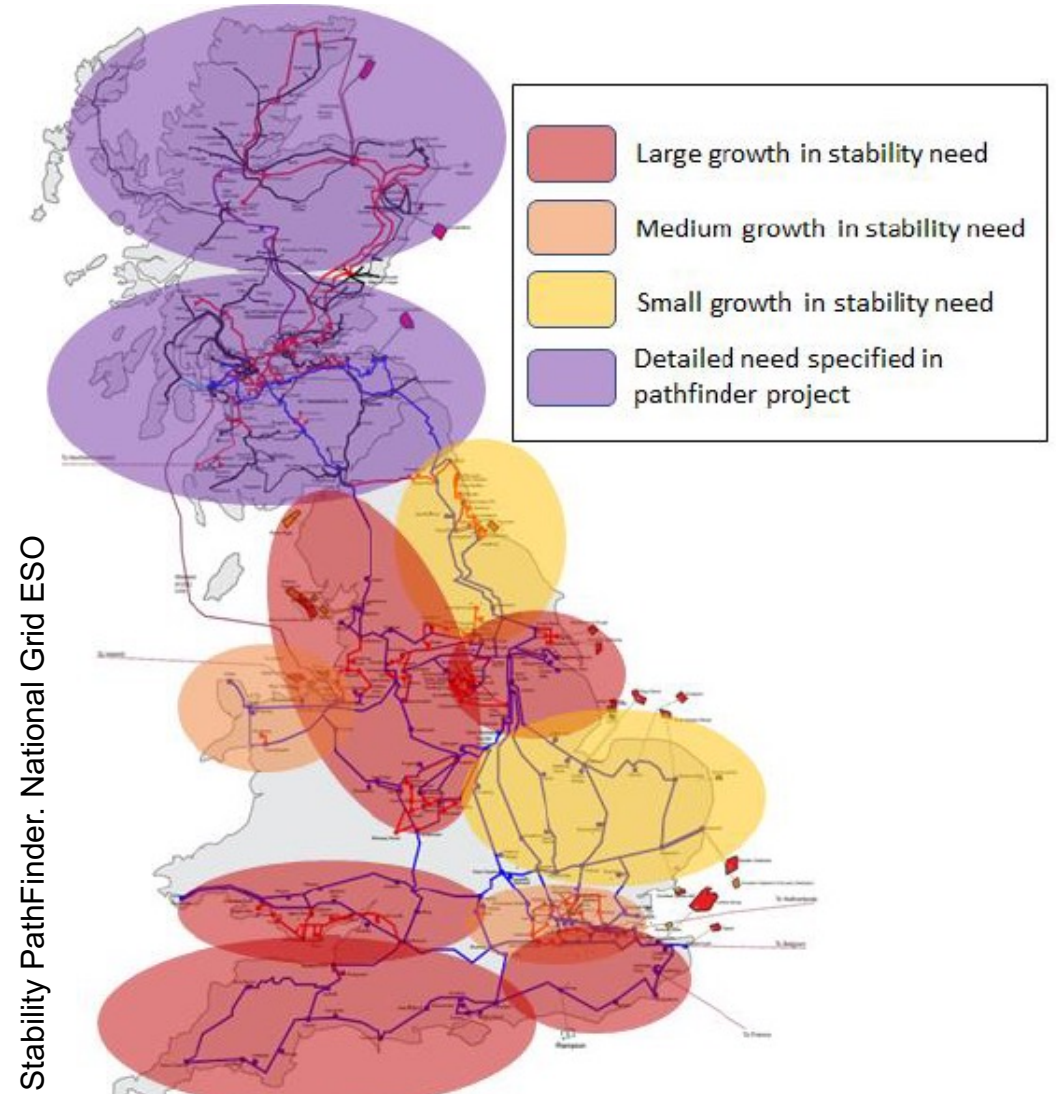
- Less time for primary controllers to react
- Increasing RoCoF and dynamics

Voltage stability issues

- Faster voltage control might be required

System strength issues

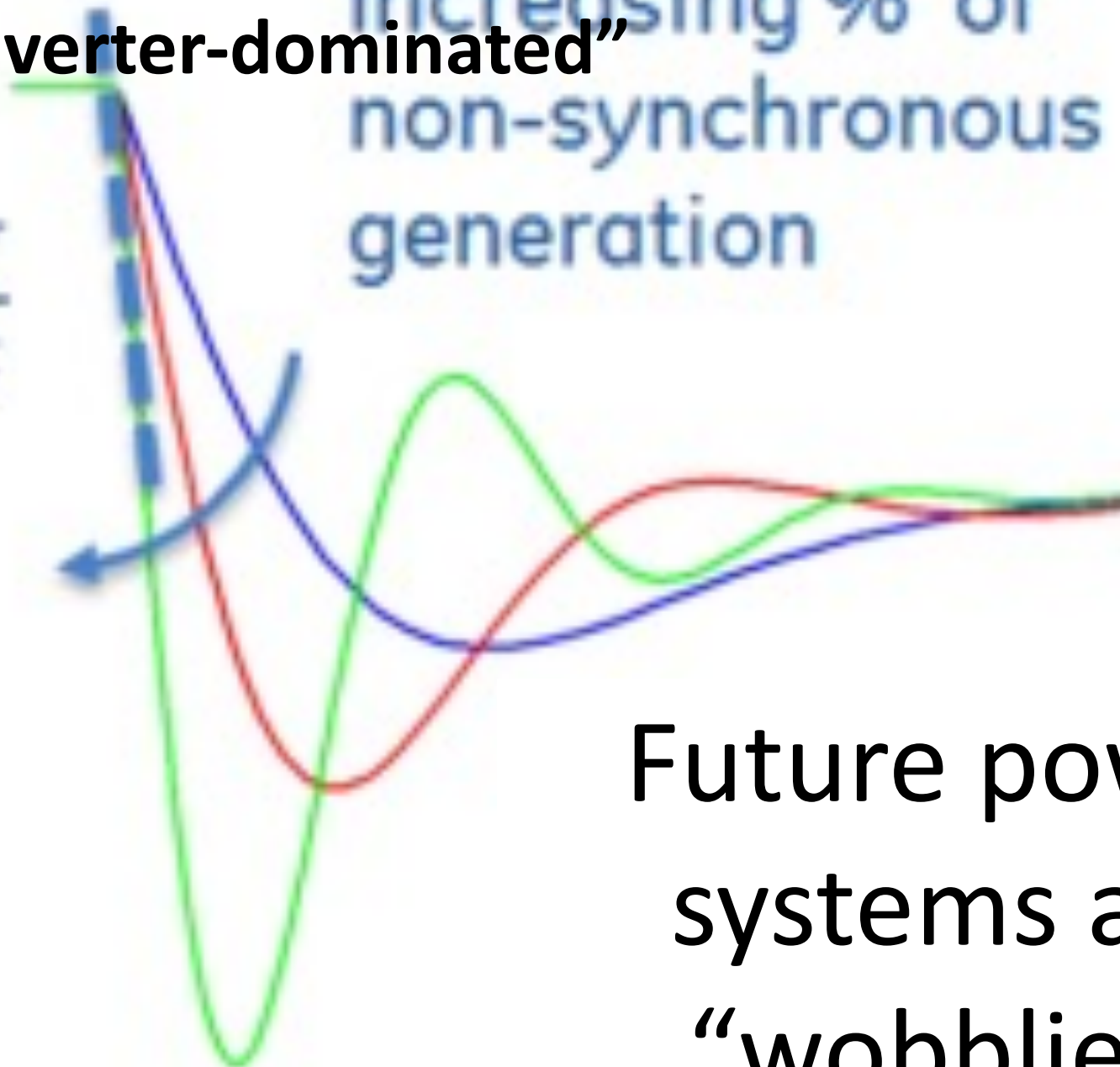
- Protection – detection/speed/stability
- Fault “ride through” – for generators and loads



Potential issues “converter-dominated” power systems

$$\text{RoCoF} = \frac{df}{dt}$$

Increasing % of non-synchronous generation



Future power systems are “wobblier”

The place of useful learning

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Power and Energy Research at Strathclyde

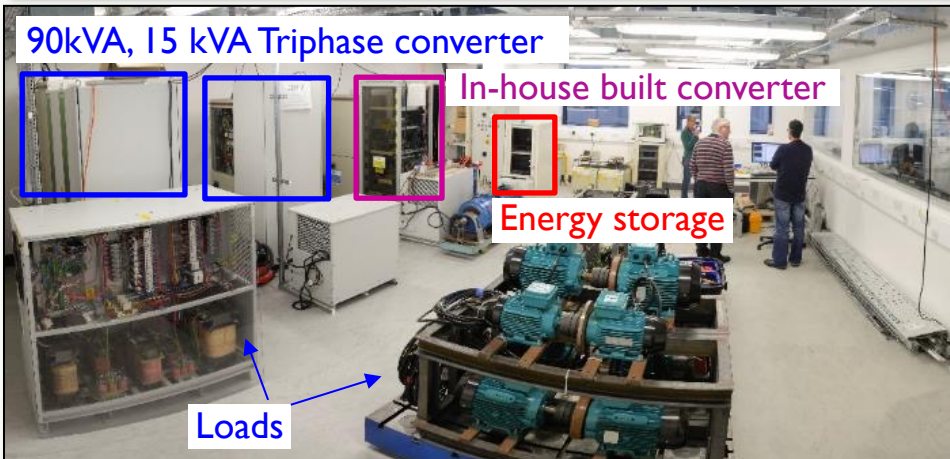
Dynamic Power Systems Laboratory

400 V microgrid,
power converters, machines, loads

Control room area



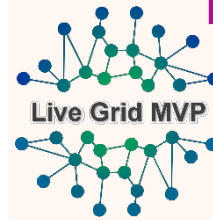
90kVA, 15 kVA Triphase converter



In-house built converter

Energy storage

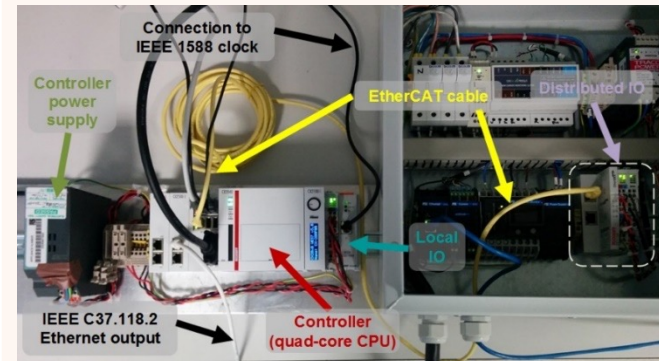
Loads



Real-time simulation, measurement, and
protection testing

<https://livegridmvp.herokuapp.com/>

Micro-PMU prototype

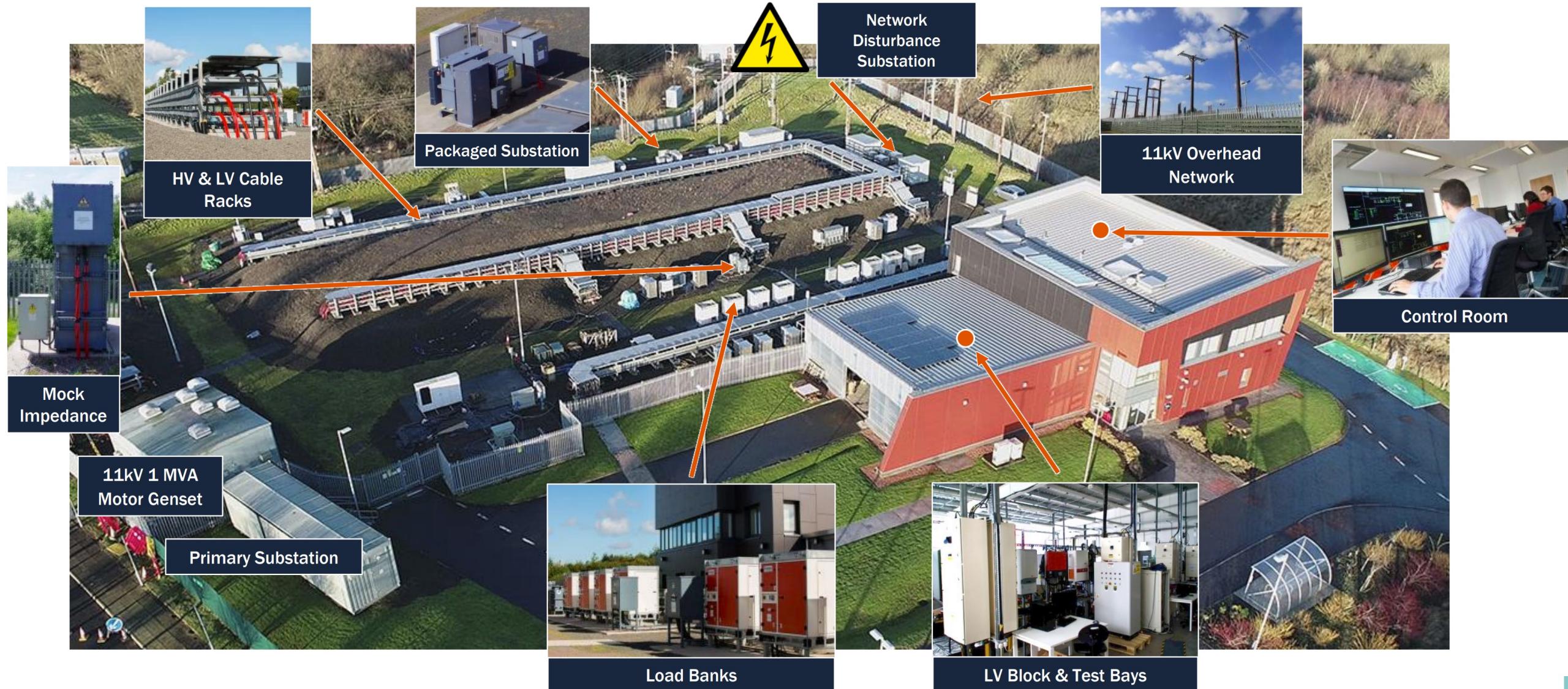


Wide area monitoring
protection & control
demonstrator (64 PMUs)



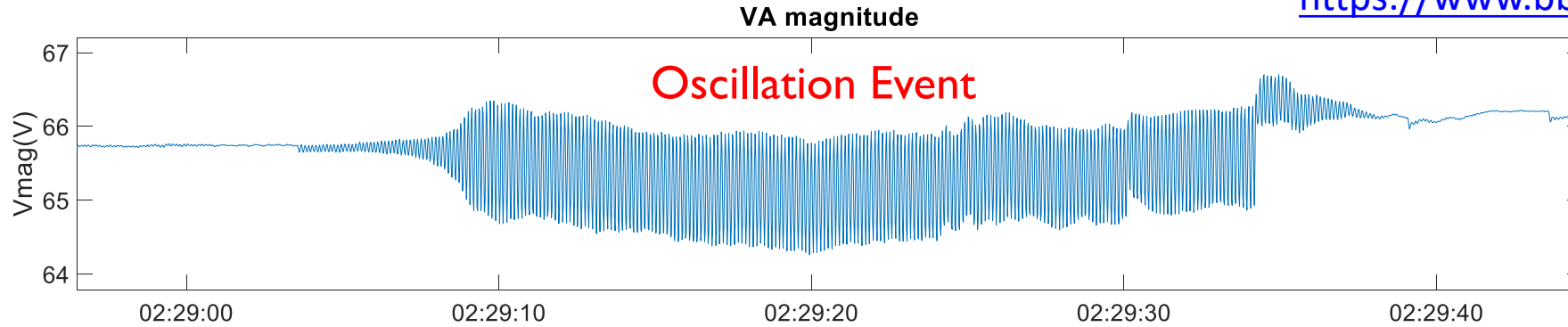
Power Networks Demonstration Centre

<https://pndc.co.uk/>



Oscillation Events in GB Power System

<https://www.bbc.co.uk/news/articles/c3ggnz6296do>



- Multiple events:
 - Aug 2021
 - Jun/Jul 2023
 - Jan, May, Oct 2024
- Range: 3-20 Hz



RENEWABLE ENERGY NEWS ■ ISSUE 509

Scottish grid issues shut down Seagreen

By Stephen Dunne

SSE Renewables and TotalEnergies' 1.1GW Seagreen wind farm off east Scotland has been offline for over a month due to grid stability problems.

The project, which is in the commissioning phase, was "shut down" in early July, according to network logs. Export of power was expected to restart soon after but the 114-turbine transmission system in Scotland, which are understood to have prompted the decision to power down the wind farm 27km off Angus.

There have been five days since mid-June when the grid north of the border experienced the stability issue, although recent weeks have been clear, it is understood.

Such oscillations have occurred before, but their frequency within a short transmission system in Scotland, which are understood to have prompted the decision to power down the wind farm 27km off Angus.

There have been five days since mid-June when the grid north of the border experienced the stability issue, although recent weeks have been clear, it is understood.

Such oscillations have occurred before, but their frequency within a short



OFFLINE: The 1.1GW Seagreen wind farm
Photo: Seagreen Wind Energy

for Scotland and will get worse every year. We're going to have to factor it into future projects," said a source. Experts said the country's offshore wind farms is a complex process," said a source.

A Seagreen spokesperson said the project team is

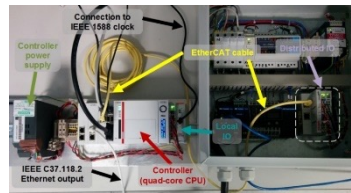
Root Causes:

- Control interaction
- Controller mistuning
- PLL issue

Current measures:

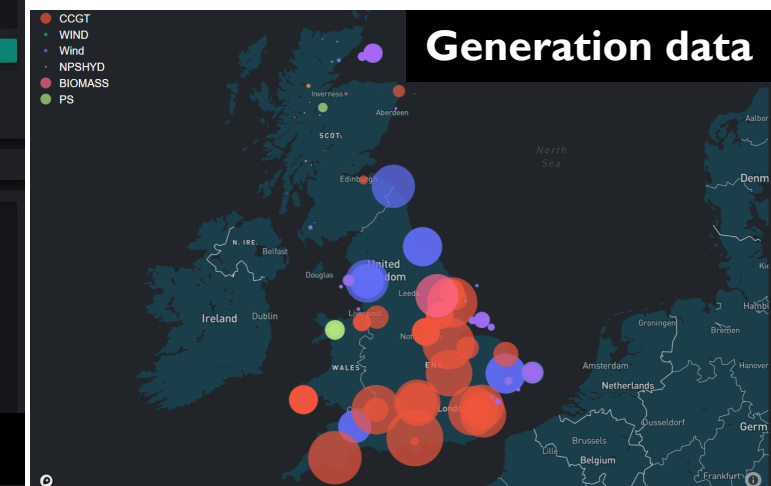
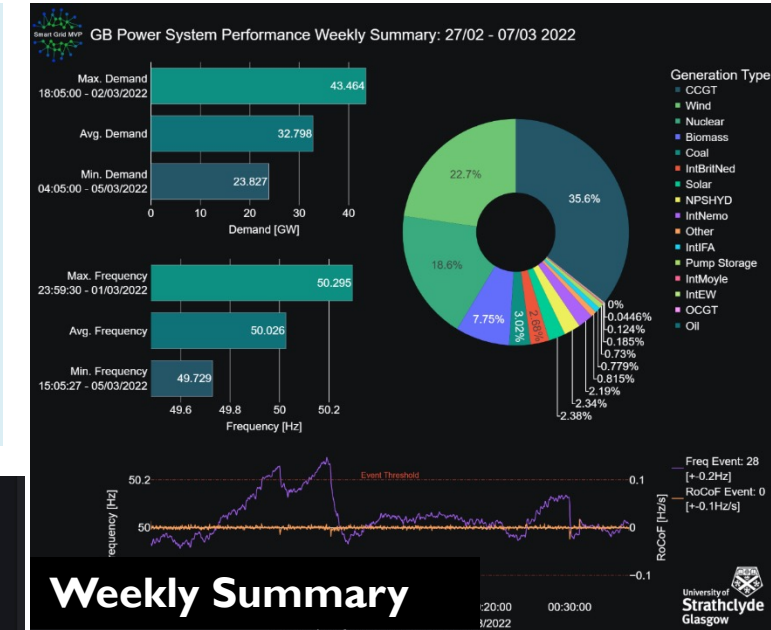
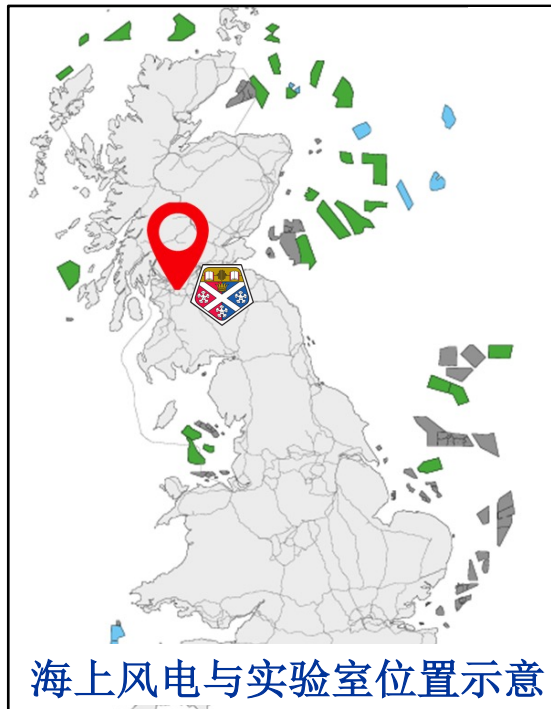
- Enhanced real time monitoring
- EMT modelling/stability analysis
- Compliance testing

LGMVP – Strathclyde’s Real Time Monitoring System



LGMVP英国电网实时动态监测系统（思克莱德大学）

- PMU data (实时 50 frames/s)
- Demand and generation data (每15 分钟)
- Freq and oscillation events detection and records



Integration of renewables – some other projects

Dr Adam Dysko, Dr Agusti Egea-Alvarez

How can inertia be provided from offshore wind farms?

nationalgridESO

Dr Qiteng Hong, Dr Adam Dysko, Dr Agusti Egea

Testing of a grid forming controlled battery



nationalgridESO

BELECTRIC®

Dr Adam Dysko, Prof Campbell Booth

Hybrid grid forming and synchronous condenser



Dr Agusti Egea-Alvarez, Dr Panos Papadopoulos

First grid forming test in a real wind farm



Member of **National Grid ESO** working group on VSM, Member of the **ENTSO-E** working group on power systems with high penetration of converters

Dr Agusti Egea-Alvarez

Investigating the potential of harnessing offshore wind & marine renewable energy to produce zero carbon hydrogen & ammonia fuels



Ocean REFuel is a five year research programme created to establish a fundamental scientific and engineering understanding for the conversion of Ocean Renewable Energy to liquid and gaseous fuels.

The £10 million research project funded by the Engineering and Physical Sciences Research Council.



University of
Nottingham
UK | CHINA | MALAYSIA



Funded by



Engineering and
Physical Sciences
Research Council

Tidal Range schemes as configurable Grid-scale Energy sTorage facilities (TARGET)

Supergen Offshore Renewable Energy Hub



'Digital twin' project will inform future innovation in the UK energy industry



23 May 2023

A major 'Prosperity Partnership' project, awarded to a consortium of partners led by SP Energy Networks and the University of Strathclyde, has received industry and government funding of almost £10 million.

The project will create a 'digital twin' of future multi-vector energy networks, and will assist with the drive to meet the UK's 2050 net zero emissions objectives.

News

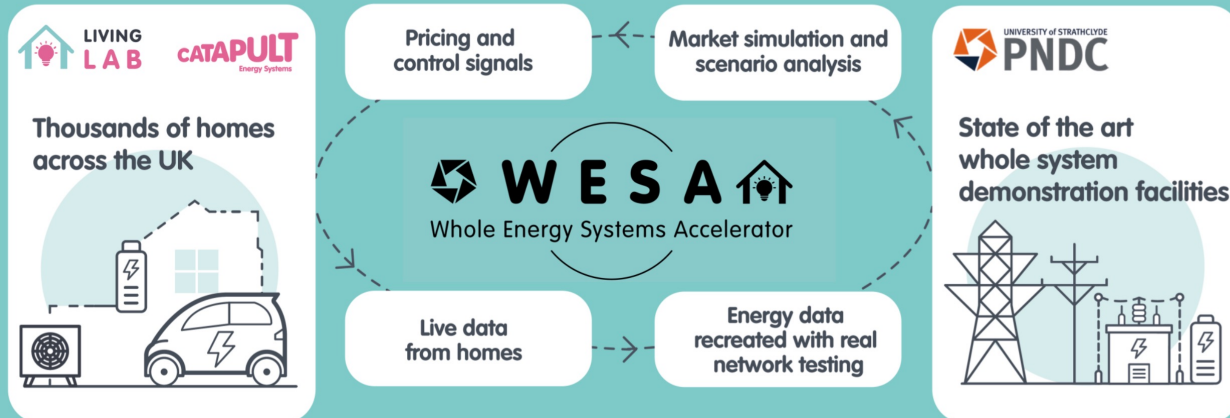
£1.3M grant to develop pioneering superconducting electrical machines for zero emission aviation



STEAM GigaWatt-Hour Subsurface Thermal Energy storAge: Engineered structures and legacy Mine shafts



Contact: Professor Zoe Shipton, University of Strathclyde
zoe.shipton@strath.ac.uk



- In 2020, wind curtailment payments in the UK were £282M: enough to power 1.25 million homes and equivalent to £4 per MWh of energy generated.
- 120GW of 'spare' electricity in East Ayrshire alone = close to the regional annual heat demand of 188GWh (26,000 people + industrial demand)
- 1% of known UK mine entries = potential thermal store of ~1900GWh(th)
- equivalent to worst-case weather week demand for ~10% of UK homes (2.8M)

STEAM researchers will answer:

1. What is the mineshaft thermal energy storage (MSTES) opportunity in the UK?
2. What are the risks (e.g. subsidence or water contamination)?
3. How can we optimally 'plug MTES in' to the grid?



In early 2024 we will deliver a world-first fully monitored demonstrator site injecting heat into a mineshaft



- **Real-time monitoring and historical data** for homes at device and whole-home level
- **Network impact studies** – *in silico* and real-world via Power-Hardware-in-Loop (PHIL)
- **Future LCT uptake scenarios** by tailoring consumer population
- **Future electricity market** emulation
- **Feedback for pricing/control signals** to participating homes to influence demand
- **Consumer insight** into experiences of new technologies and propositions

Ensign (Energy System Integrated Digital Twin)



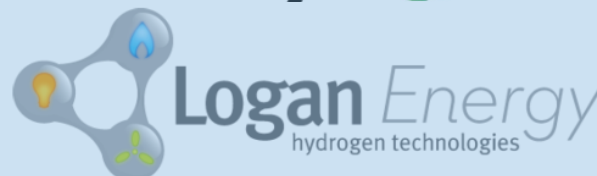
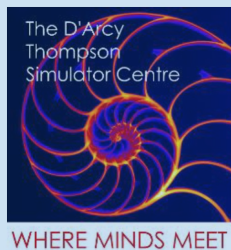
Funder
(UK Government)
£10m total funding



Co-Funder & Delivery Team



Partner & Support Team

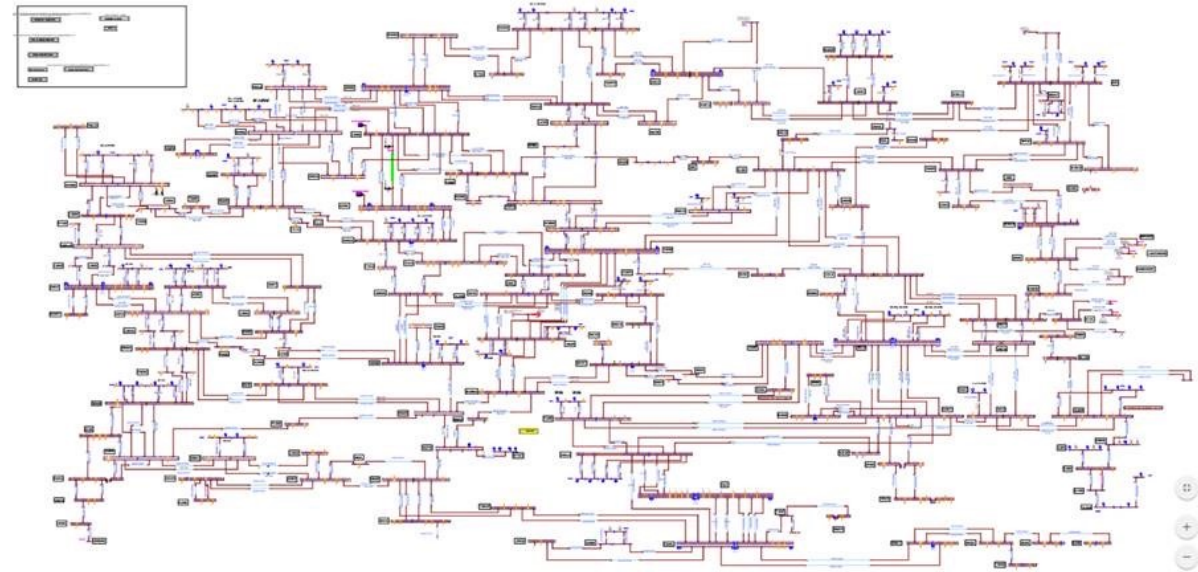


Why Ensign?



<https://ensign.ac.uk/>

- The most complex machine ever built is getting (much) more complex
 - ...with increased uncertainty
 - ...and more volatility
- But we have more data
 - ...to build our understanding
 - ...creating and using Digital Twins
 - ...create new (better models)
- Then we can identify and quantify challenges, opportunities and solutions



Power

GN

rs,



Fig. 9
Display and



The place of useful learning

www.strath.ac.uk



University of
Strathclyde
Glasgow

People and Skills

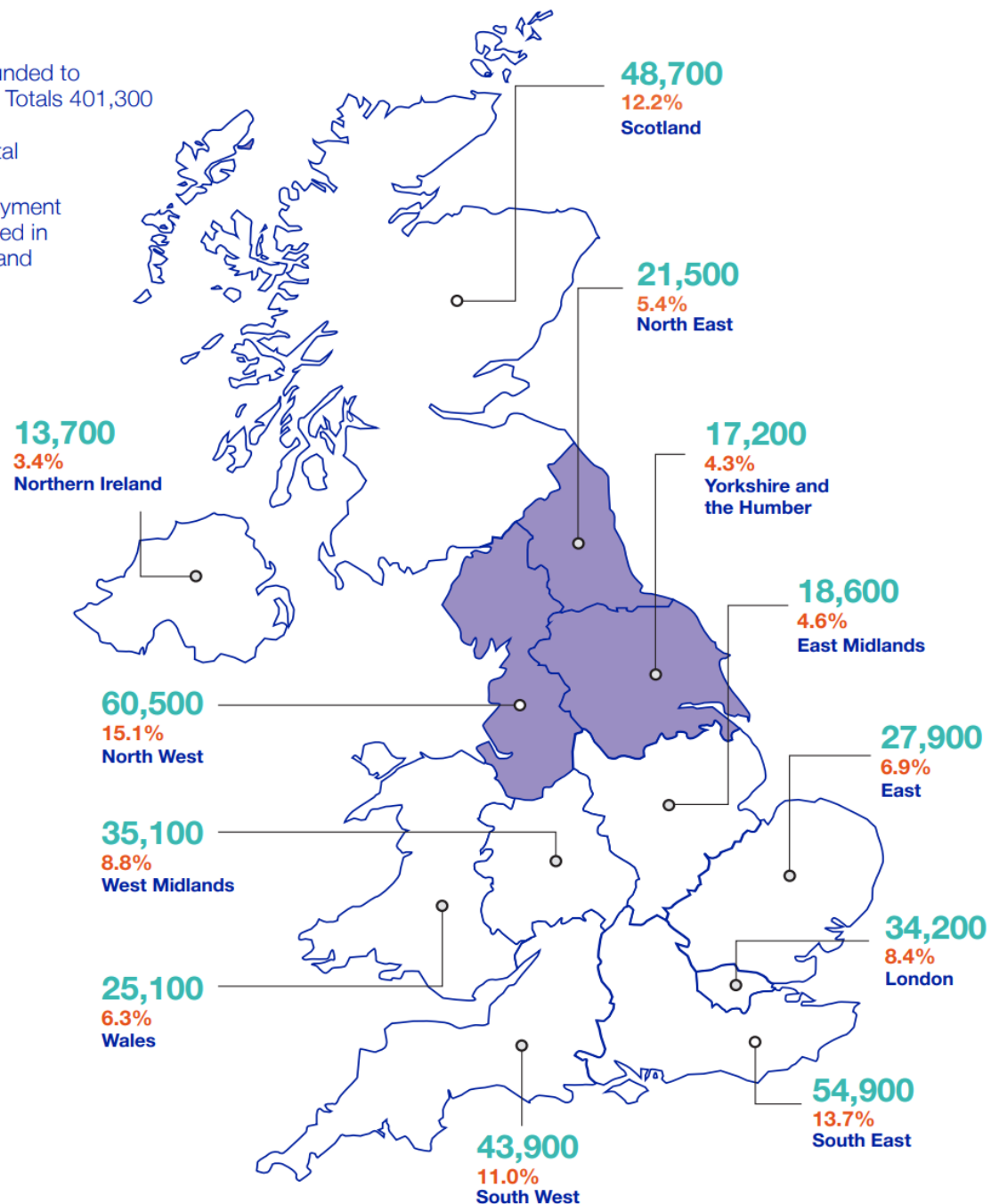
(New) jo

Figure 3: Geographical breakdown of jobs needed to get the UK to net zero by 2050

◆ Regional jobs rounded to nearest hundred. Totals 401,300

◆ Percentage of total

◆ Significant employment opportunity created in the north of England



isting roles



2050

1000

2050

<https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>

Jobs, jobs, jobs

We're Recruiting - 1,000 New Green Jobs



LinkedIn

<https://uk.linkedin.com/jobs/energy-jobs>

83000+ Energy jobs in United Kingdom (5217 new)

83,000+ **Energy Jobs in United Kingdom** (5,217 new) · Energy Engineer · Graduate Energy Consultant · Energy Analyst · Sustainability BDM · Energy Management

7,000

number of vacancies in the
energy and utilities sector;
recorded March 2020³

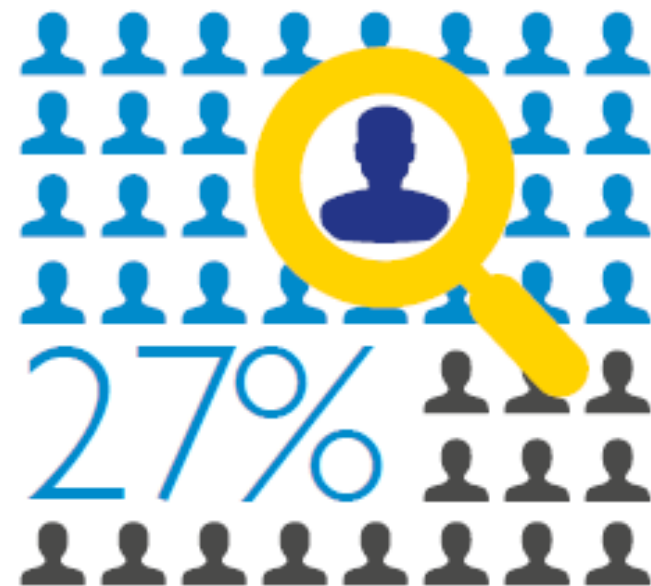


NUMBER OF
VACANCIES IN THE
SECTOR IS INCREASING

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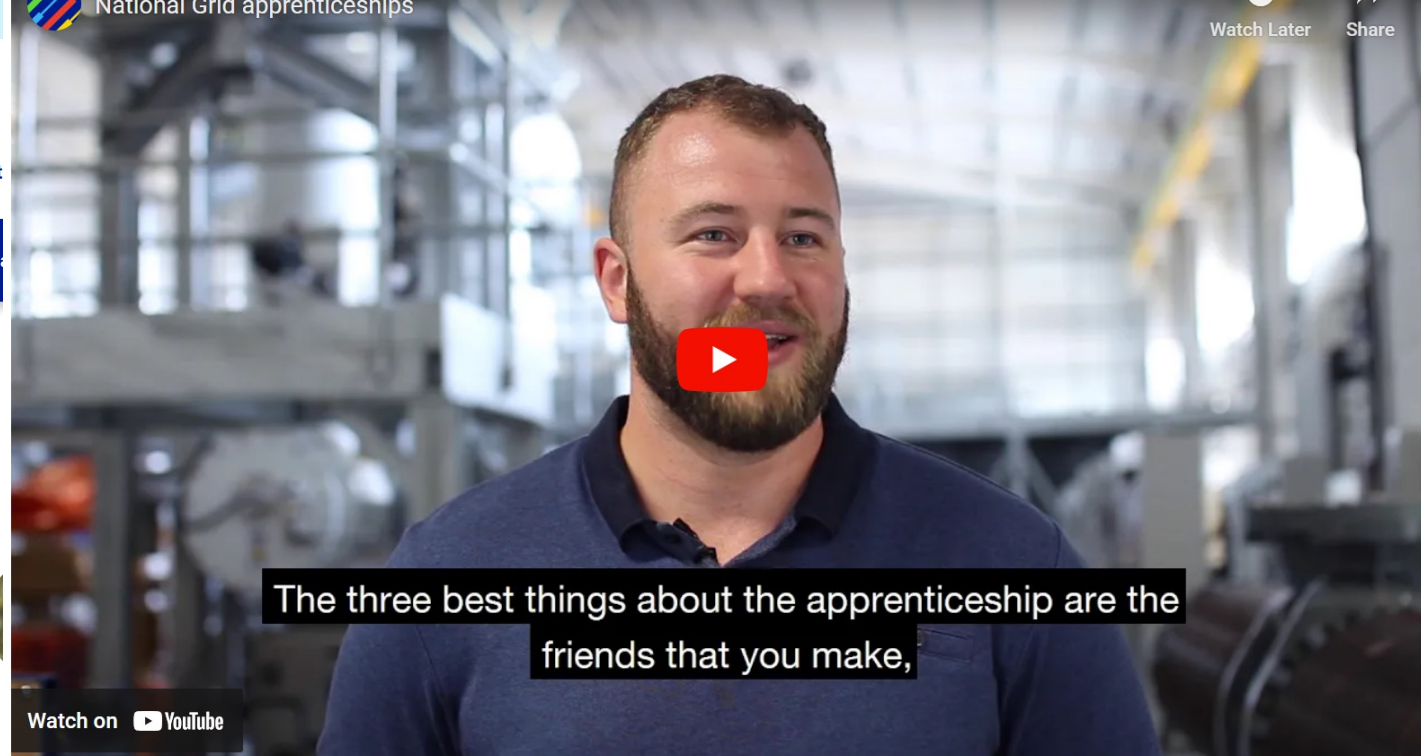
of hard-to-fill vacancies are
challenging because of skills
issues⁴

- 1 Infrastructure and Projects Authority (Spring 2016), 'National Infrastructure Pipeline'.
- 2 ONS (2016), Business Register and Employment Survey.
- 3 ONS (2016), ONS Vacancy Survey.
- 4 UKCES (2016), UK Employer Skills Survey, 2015.

7 reasons to choose an apprenticeship

[Home](#) > [Stories](#) > [Community spirit](#)

<https://www.nationalgrid.com/stories/community-spirit/7-reasons-choose-apprenticeship>



1. You join the Net Zero Energy Workforce

The UK is on a journey to cut carbon emissions and reach **net zero** by 2050. The energy sector needs to play a major part in achieving this – but, to do so, we'll have to build the **Net Zero Energy Workforce**. Our research shows that the energy sector needs to recruit 400,000 roles by 2050. By choosing an apprenticeship, you can learn the vital skills required to fill some of the roles that will help us build a greener, cleaner energy system.

2. Skip those student loans

Heading to university is by no means cheap. By taking on tuition fees and funding your living costs too, many students graduate not just with a degree but with hefty debts. With an apprenticeship, there are no fees to pay for now or further down the line.

3. Earn from day one

As an apprentice, you'll receive a salary throughout your apprenticeship. On top of this, as a National Grid apprentice you'll get free, full board accommodation when attending our academy and we'll cover travel costs associated with your training.

4. Kickstart a career

Doctoral Training



University of Strathclyde Engineering

PhD@Work Programme

What is the PhD@Work programme?

The programme is aimed at graduate engineers and scientists in full-time employment who are conducting, or are interested in conducting, high-quality research in their place of work. Candidates will be jointly supervised by their employer and experts from the Faculty of Engineering at the University of Strathclyde, allowing them to carry out research and gain a PhD qualification while remaining in their current employment, making valuable and impactful contributions to academia, their company, and society.



Find out more

https://www.strath.ac.uk/media/1newwebsite/departmentsubject/engineering/researchimages/PhD@Work_Programme_flyer_2023.pdf

Accelerating the affordability, scalability and sustainability of green hydrogen and wind energy

EnerHy brings together three leading universities and 60+ partners to translate cutting-edge research into real-world energy solutions.

ABOUT US

We build the talent and technology for a Net Zero future and give researchers, industry, and stakeholders a platform to turn bold ideas into measurable impact.



How do you coat a live gas pipeline for hydrogen?

Our first PhD cohort designed and built a pipeline inspection gauge to apply hydrogen-resistant lining – responding to a real-world challenge set by Cadent Gas, the UK's largest gas distribution network, to overcome hydrogen embrittlement.



Our work

We're advancing hydrogen and wind energy research and innovation while shaping the Net Zero workforce.



Future leaders

Shape the future with EnerHy – get paid to work on cutting-edge projects alongside leading industry.



Partner with us

Tailored partnerships to support your organisation's goals, and raise your profile as a Net Zero leader.



<https://enerhy-cdt.ac.uk/>

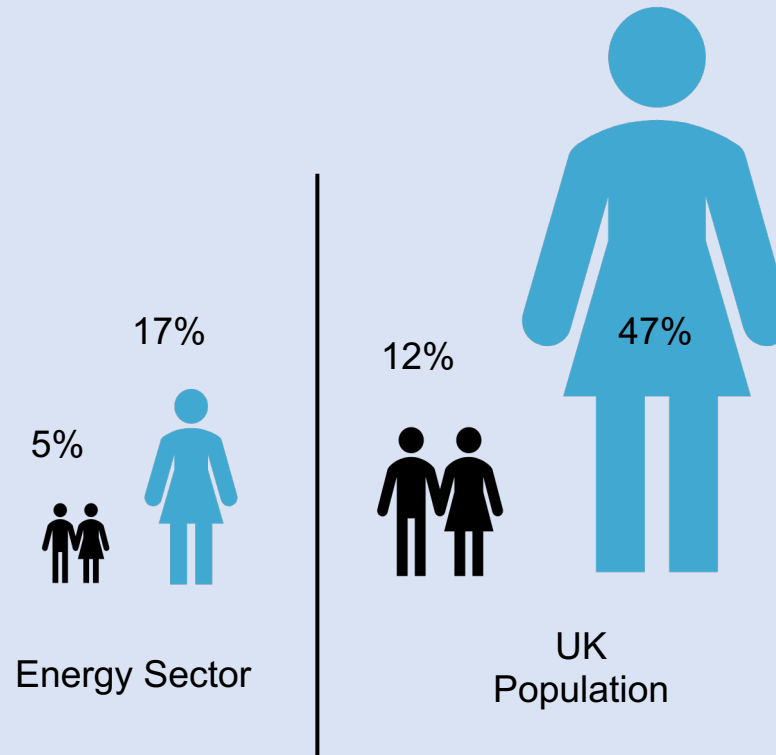
Innovation and Growth Needs Inclusion and engagement of all Talent in Energy research

Prof Becky Lunn, Head of the Centre for Ground Engineering and Energy Geosciences
Department of Civil and Environmental Engineering, University of Strathclyde

£1M EPSRC Network (2022 – 2026)

“to support sustainable, abundant, clean and equitable energy for all, by harnessing the talents of energy researchers from all backgrounds”

Diversity in the UK Energy Sector



There are great opportunities...

Summary

- Massive increase in:
 - Complexity and uncertainty – new vectors
 - Data and information
 - Active units (distributed generators, energy storage, controls, V2G, etc.)
 - Comms infrastructure and security requirements
- Research in monitoring, control and protection continues
- System changing - learn a lot from data – with caution
- **...need skilled people (HI) – and AI...?**

What could go wrong



Power goes out. People have enough food and water in their homes for only the first day or so. Key installations rely on generators at first.



Government cannot communicate with people. Few have battery powered radios. No phones, no internet, no television. No one knows what's going on.



Water goes and people cannot flush their toilets or get drinking water. Hygiene plummets quickly.



Initial fuel reserves run out. More fuel cannot be fetched from storage tanks without electricity. Lorries cannot run for deliveries. Generators cannot run.



People need food and water, but no shops, no money, ATMs, banking or contactless payments. Looting starts in some places and order breaks down. Lack of communication means people still do not know what's happening and distrust of the government festers.



Cities uninhabitable within days if sanitation not up and running, particularly in hot weather. Possible disease outbreaks. May need evacuating.



Grid eventually restarted, but removing contamination from water supply may take months.

System turning “upside down” and is more **complex and uncertain** than ever before – we must (re-)**learn and understand**

Research on how future systems will operate and be controlled and protected is critical

AI has a place in **learning/discovering/assessing** behaviour – but for such a “critical” system like ours, we must be **careful** about applications

Thank you



Re-purposing into Lighting: Never one to waste resources, the resourceful young inventor stripped down his telephone network and used the copper wires to construct an electric generator and lighting system for his parents' house. [1, 2]

Strathclyde students bring Baird's pioneering television invention back to life



27 May 2025

Students at the University of Strathclyde have reconstructed a working version of John Logie Baird's original mechanical television, ahead of the centenary of the Scots inventor's groundbreaking demonstration.

https://www.linkedin.com/posts/university-of-strathclyde_strathengineering-stem-innovation-activity-7334152573467181056-HiWH