


Mike Bamford





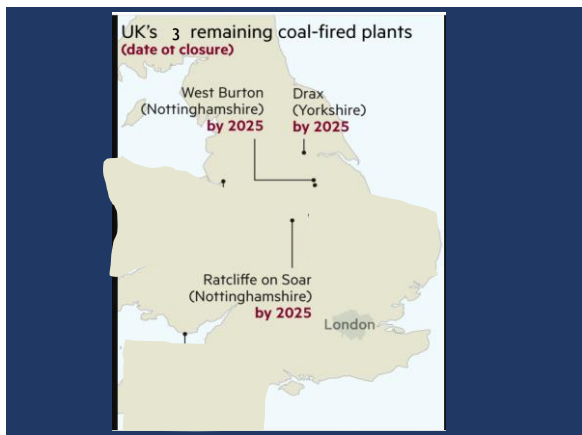
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UK to end 140 years of coal power by 2025

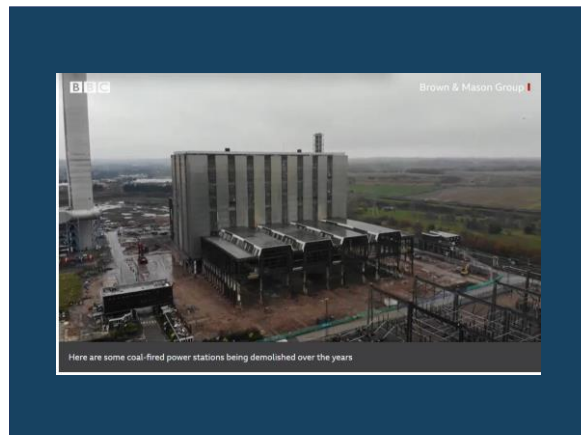


BBC News Feb 2020
 Britain has increasingly managed to wean its electricity supply off coal. In 2019 the country's power networks went for more than a fortnight without burning a single lump, thought to be the first time since the 1880s. Coal was supplying only 2% of the country's energy needs. It has largely been replaced by gas, which provided 50% and wind, 17%.

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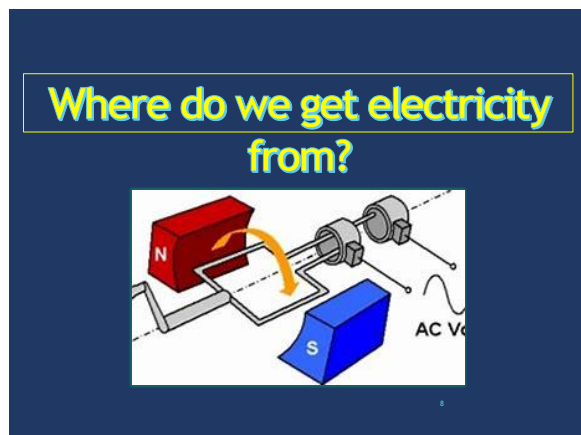
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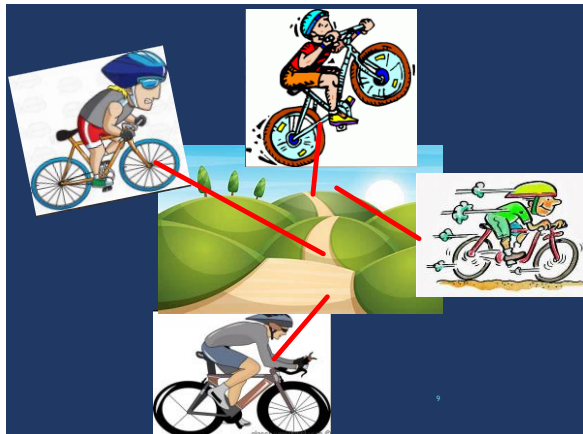
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How is electricity made and controlled?

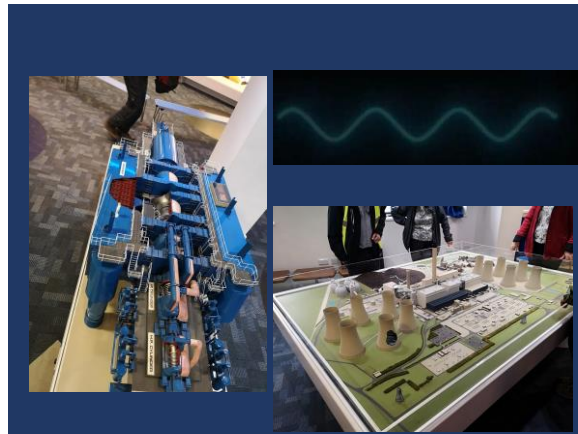
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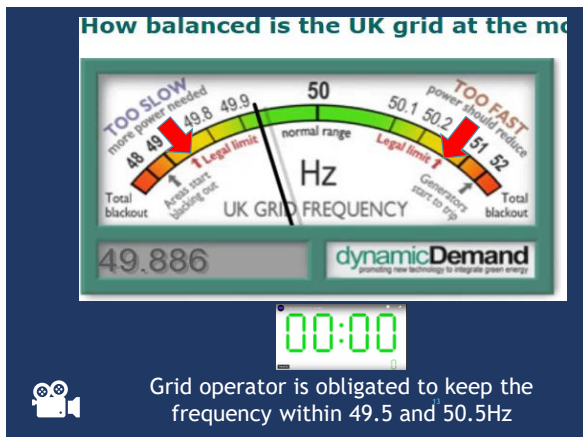
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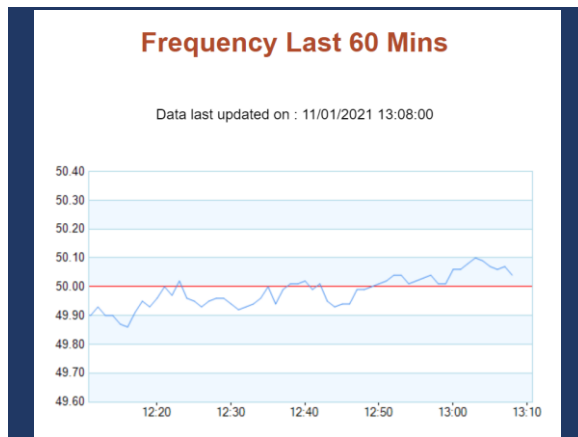


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Grid operator is obligated to keep the frequency within 49.5 and 50.5Hz

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January 2021
Pakistan power cut plunges country into darkness. A countrywide blackout has been caused by a sudden plunge in the frequency in the power transmission system Pakistan power minister Omar Ayub Khan wrote on Twitter in the early hours of Sunday

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Hundreds of renewable energy projects may be asked to turn off this weekend to avoid overloading the grid as the UK's electricity demand plummets to record lows. Britain's demand for electricity is forecast to tumble to a fifth below normal levels due to the spring bank holiday and the shutdown of shops, bars and restaurants mandated by the coronavirus lockdown. National Grid is braced for electricity demand to fall to 15.6GW on Saturday afternoon - a level usually associated with the middle of the night - and continue to drop even lower in the early hours of Sunday morning. National Grid warned last month that the low demand for electricity could mean that renewable energy is turned off to avoid overloading the grid with more electricity than the UK can use.

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Saturday 10 August 2019 at 1:20am

Britain was hit by an unprecedented power outage, with hospitals, airports, rail and road networks - as well as towns and cities across England and Wales - left without electricity.

The “unexpected and unusual” blackout was caused by two generators shutting, triggering a drop in frequency in the National Grid network.



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A one bar electric fire uses 1,000 watts. Its known as a kilo watt [kW].
Use the fire for 1 hour, and you use 1 Kilo watt hour. This is a **UNIT** of electricity and costs on average 15.5p per kWh.

The power of a main generator is given in Mega watts, it is 1 million Watts [MW].

A Giga watts is 1 billion Watts [GW]

A very large power stations such as Drax has a total capacity or 4GW. Hinckley C nuclear power station will have a capacity of 3.2GW. A typical 5-MW wind turbine can be used to power >1,400 households

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What about kWh, MWh, GWh and TWh? Well these are just orders of magnitude of energy, k is kilo, M is mega, G is Giga and T is Tera.

- 1 kiloWatt - 1000 Wh
- 1 megaWatt - 1,000,000 Wh
- 1 gigaWatt - 1,000,000,000 Wh
- 1 teraWatt - 1,000,000,000,000 Wh

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A high-speed electrical train on average consumes 1 MWh of energy and the train can travel 40 km.

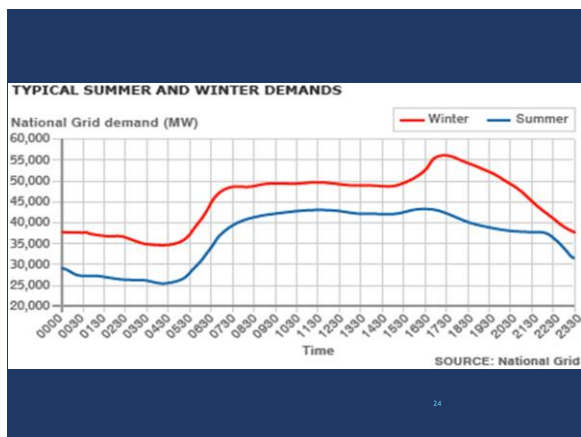
It is about 400 km from Newcastle upon Tyne to London, so the train would require about 10 MWh of energy.

Electrical energy requirement in Scotland is about 1 GWh every 20 minutes on average.

Total energy demand in the world in 2015, was 160,000 TWh.

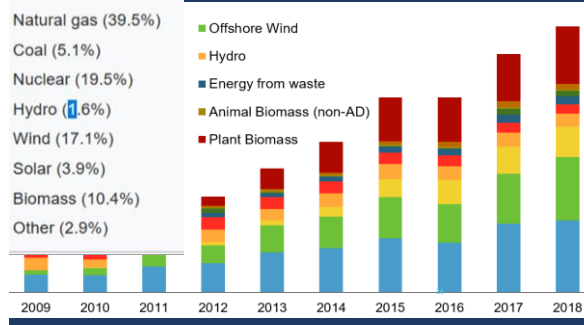
With the USA using 88000 kWh per person and Africa on average 7000 kWh per person

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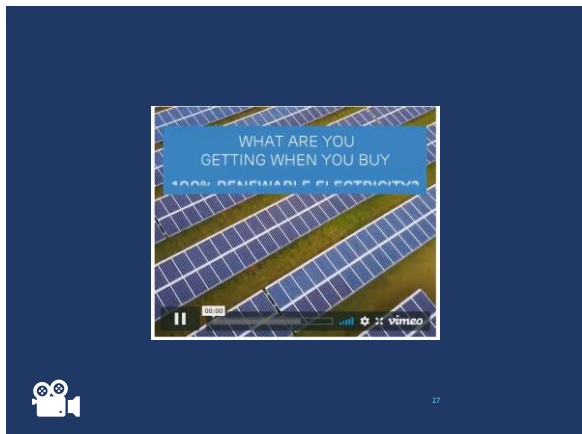


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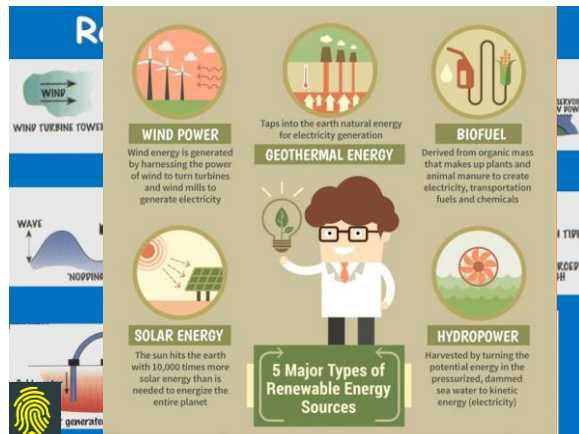
Renewable Mix.



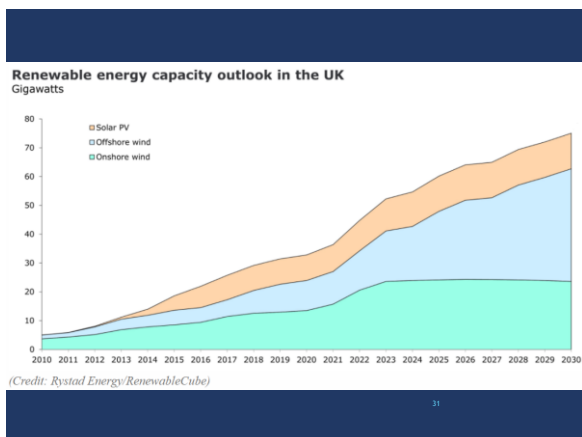
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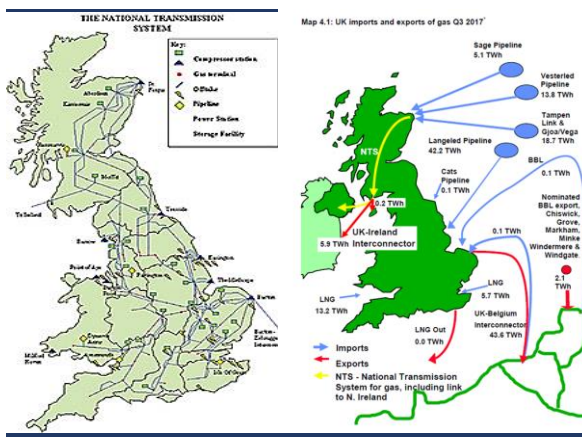
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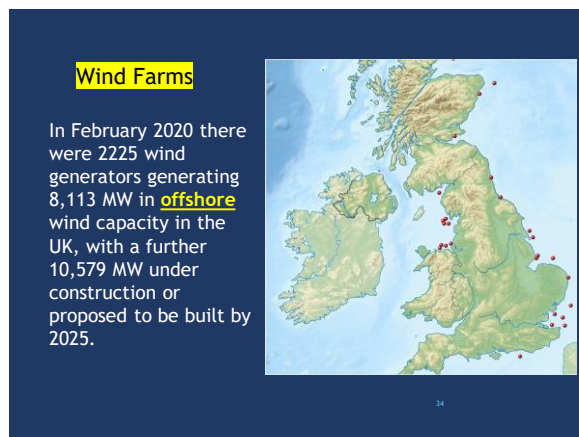
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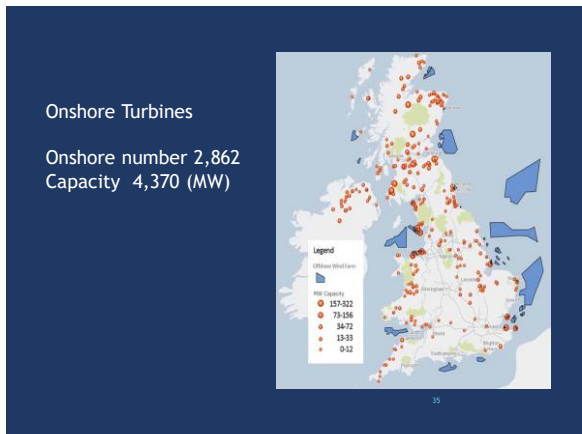
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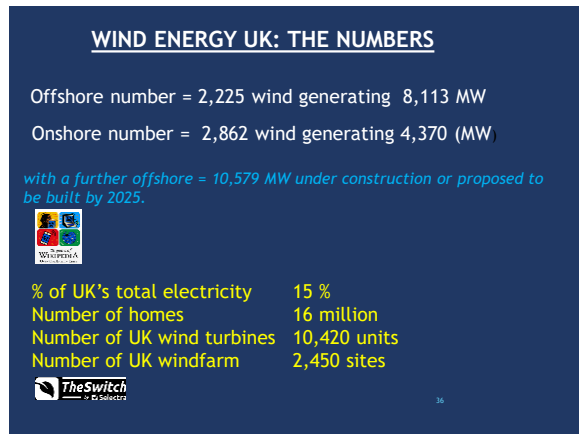
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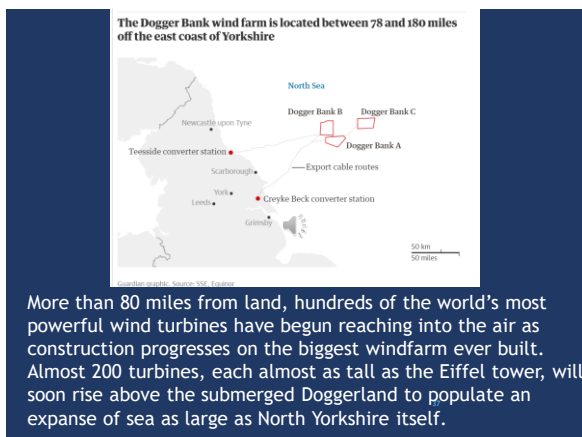
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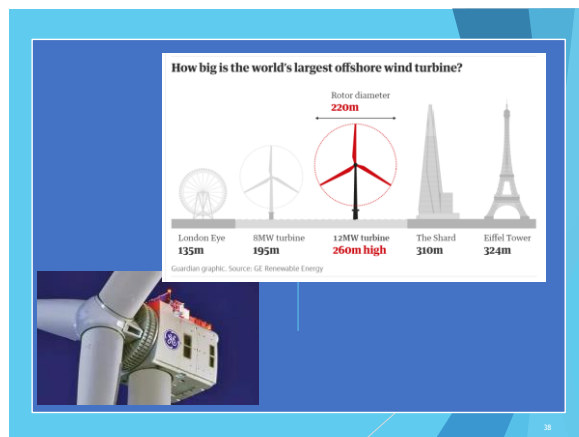
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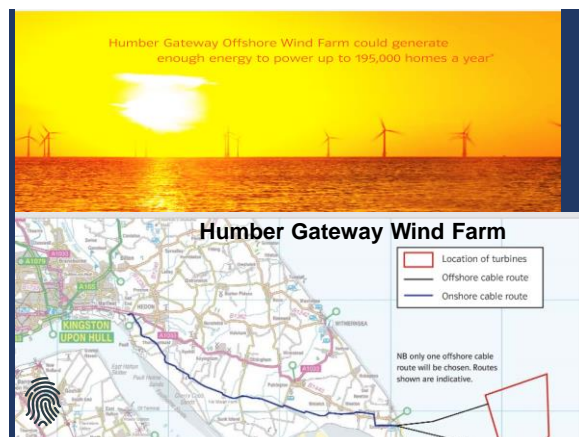
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▲ Newhaven lighthouse and the harbour wall on 27 December as Storm Bella continued to hit the south coast of Britain. Photograph: Glyn Kirk/AP/F/Getty

More than half of Great Britain's daily electricity came from wind turbines for the first time on Boxing Day, as the country headed for its "greenest year on record", due in part to the coronavirus.

As Storm Bella arrived, bringing gusts of up to 100mph, wind provided 50.7% of Great Britain's electricity according to data charting the power generation mix.

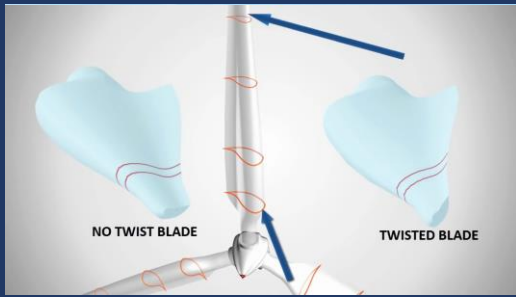
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ecoincity

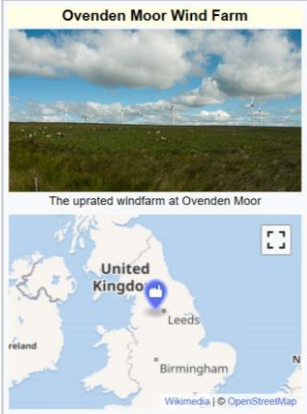
AVONMOUTH DOCKS

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NO TWIST BLADE TWISTED BLADE

43



Ovenden Moor Wind Farm

The uprated windfarm at Ovenden Moor

United Kingdom

Leeds

Birmingham

Wikimedia | © OpenStreetMap

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KEY


- Operational
- Consent granted
- Submitted
- Under construction

WINDFARMS NEAR YOU

There are 357 wind farms (onshore and offshore) currently operational in the UK, comprising 3,873 turbines. There are 278 further wind farms under construction, 278 have been given consent and 370 are in the planning stage.

SOURCE: FROM RENEWABLES UK

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Ovendon Moor

The power output from the site was fed via a sub-surface 11 kilovolt cable eastwards into the National Grid near to the village of Denholme. The first-generation site provided enough power for 5,600 homes.

The development of the wind farm included many groundworks to locate the foundation.

During the building phase, a crack in the bedrock, as a result of the earthworks, diverted a watercourse and the cabling works caused the peat to dry out.

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How much green energy does the UK produce?

- In 2019, renewable production generated 37.1% of total electricity produced in the UK.

What is the power output of ONE wind turbine?

- An average **ONSHORE** wind turbine can power more than 1,500 households
- An average **OFFSHORE** wind turbine can power more than 3,312 households.

What speed of wind do turbines require:

- A minimum wind speed 8-9 mph/hr. is needed to begin turning blades and generate electricity. **BEAUFORT 3**
- Strong winds of 35mph/h generate at full capacity. **BEAUFORT 7**
- Winds of more than 55mph/h - beyond that speed, the turbines must be stopped to avoid damage. **BEAUFORT 10**

Why are so many wind turbines NOT turning?

- The most common reason is because the wind is not blowing fast enough. Technicians will also stop turbines to perform routine maintenance or repairs.

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Why are so many wind turbines not turning?

Why do the turbines not spin at times? The most common reason that turbines stop spinning is because the wind is not blowing fast enough. Most wind turbines need a sustained wind speed of 9 MPH or higher to operate. Technicians will also stop turbines to perform routine maintenance or repairs.

How much do farmers get paid for wind turbines?

Wind lease terms vary quite a bit, but general rules of thumb are: \$4,000 to \$8,000 per turbine, \$3,000 to \$4,000 per megawatt of capacity, or 2-4% of gross revenues.

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Bi mas.



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During planning the CEBG decided Drax would be a good opportunity for the installation of their first 660MW turbogenerator sets. The station consists of 6 such sets, with a total generating capacity of almost 4 gigawatts

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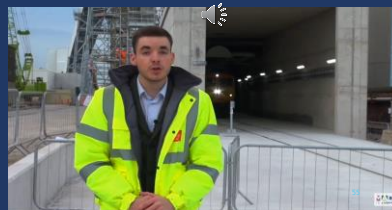


A shipment of 63,907 metric tons of wood pellets arrives at Immingham Docks. The pellets were transported from the U.S. Port of Baton Rouge in Louisiana produced at Drax's three U.S. pellet mills.

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Drax does not take high quality wood from other industries. Sustainable biomass is largely made up of low grade wood and low value residues produced as a by-product of the production and processing of higher value solid wood products (e.g. saw-timber for construction and furniture). These feedstocks can be used for renewable, low carbon energy



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Hydro



The upper reservoir (Llyn Stwlan) and dam of the Ffestiniog Pumped Storage Scheme in North Wales. The lower power station has four water turbines which generate 360 MW of electricity within 60 seconds of the need arising

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Water Storage



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Wave Power



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Solar Power



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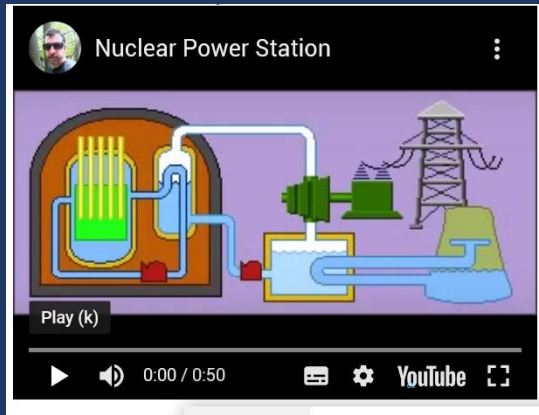
Nuclear Power



Nuclear power plants in United Kingdom (view)
 ● Active plants
 ● Closed plants
 ● Planned plants
 ● Cancelled plants

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Other renewables



This Geothermal power plant in Reykjavik, Iceland, is using their underground reservoirs of steam and hot water to generate electricity and to heat and cool buildings directly.

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Ground Source Experts

Free quote for design, install, supply and commissioning your Ground Source Heat Pump.

HERO renewables

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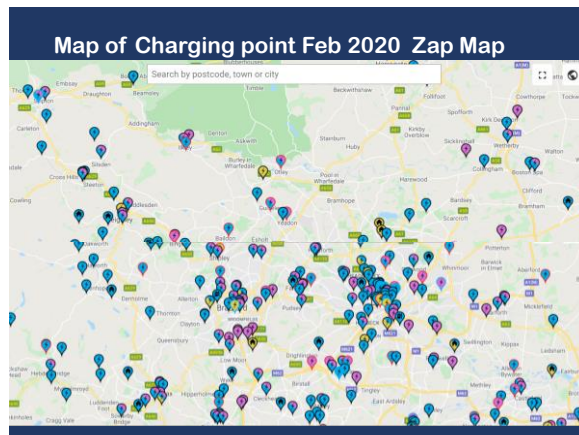


The Future - Electric Cars

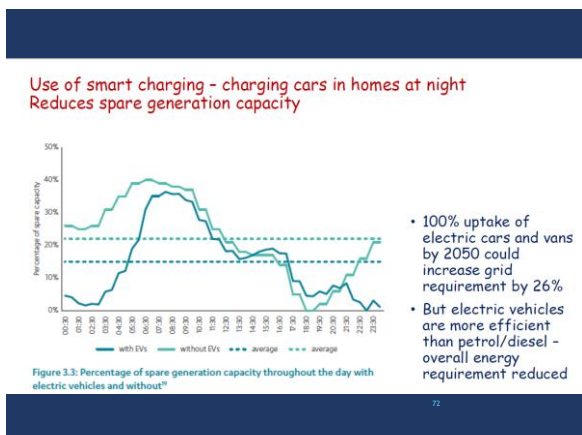
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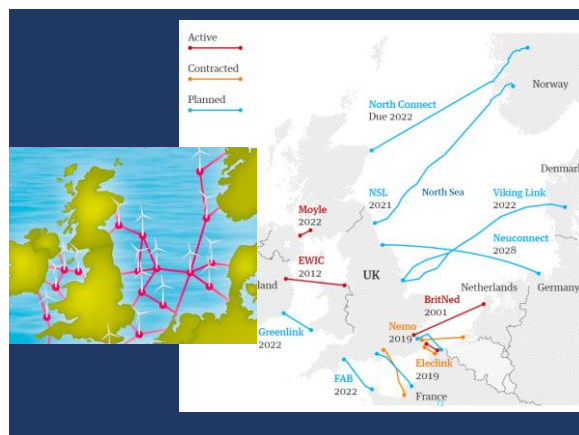
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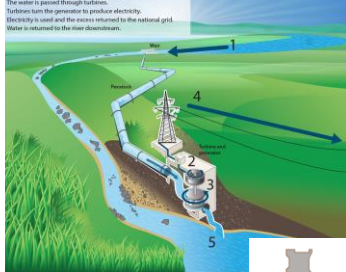
UK Electricity Interconnectors.
 There are undersea interconnections to northern France (HVDC Cross-Channel), Northern Ireland (HVDC Moyle), the Isle of Man (Isle of Man to England Interconnector), the Netherlands (BritNed) and the Republic of Ireland (EWIC).

CLICK _ Section through a submarine cable

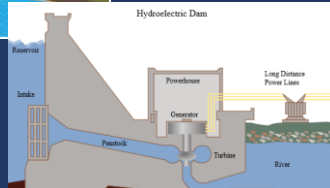
Overall these interconnectors have contributed significantly to UK electricity supply over the last few years. In the third quarter of 2018 they in fact delivered almost as much electricity to the grid as wind and solar (6,031GWh vs. 6,680GWh).



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The water is passed through turbines.
 Turbines turn the generator to produce electricity.
 Electricity is used and the excess returned to the national grid.
 Water is returned to the river downstream.

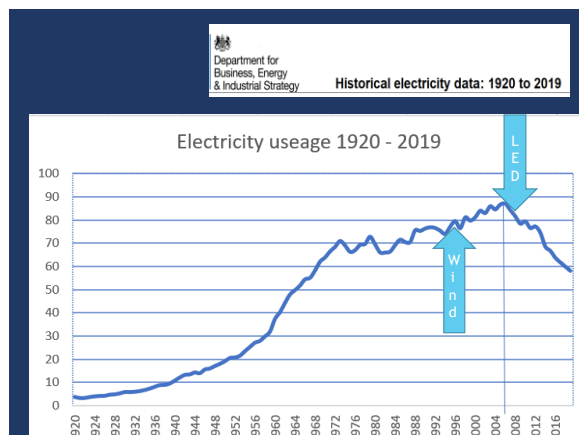


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Welcome to the **Toyota Mirai**
 the world's first mass produced dedicated hydrogen fuel cell vehicle.



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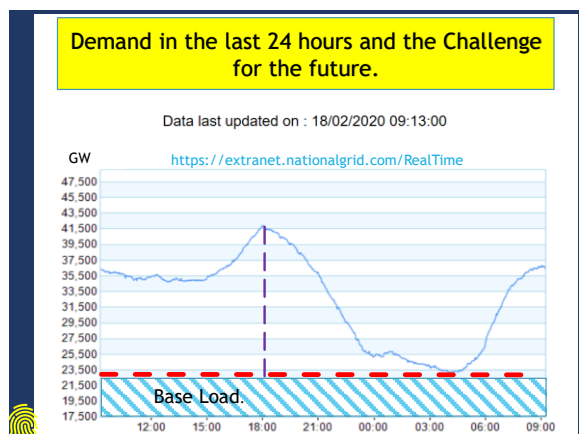


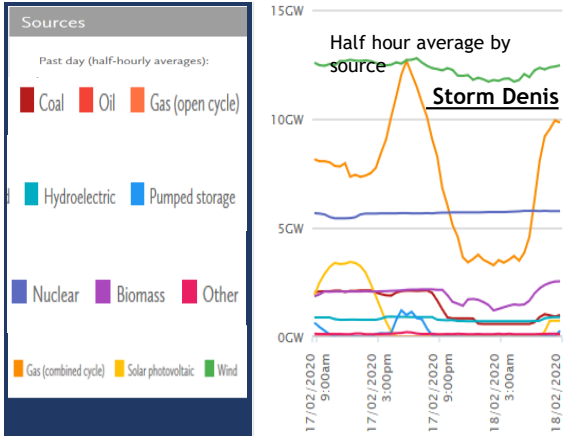
The Guardian UK edition

UK ELECTRICITY USE FALLS - AS REST OF EU RISES

Slowing economy, mild weather and energy-efficient appliances among possible reasons for decline Simon Evans, the policy editor at analysts Carbon Brief, said: "This is one of the least-reported and most significant stories in the UK power sector. Since 2005, the UK has saved the equivalent of two-and-a-half Hinkley Point Cs [a nuclear power station], a trend that started several years before the financial crisis.

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DEMAND: 40060 MW 13:05:00 Frequency: 50.07 Hz

SYSTEM TRANSFERS

- Northern Ireland to Great Britain: 274 MW
- Ireland to Great Britain: 342 MW
- France to Great Britain: -452 MW
- Netherlands to Great Britain: 0 MW
- Scot - Eng: 4915 MW

Monday 11/01/2021 13:05:00

84



87

800 conventional power stations.
Future >>10,000 mainly wind output.

Each PowerStation would give a cost per unit of generation and would be called up as demand grew.
With at least 10 times that number it becomes near impossible to accurately control.

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National Grid ESO will launch a new service to help balance the power grid this week.

Dynamic Containment is designed to bring frequency back to 50Hz as fast as possible. Maintaining system frequency is an increasing challenge for the Electricity System Operator as large thermal plant retires or runs less often, and more renewables come onto the power system.

Without lots of big spinning turbines from thermal power systems to help provide inertia as a bi-product, the effect of lower system inertia is that frequency can change much more quickly - a small wobble can have large impacts if not quickly addressed.

So the ESO has developed Dynamic Containment, a service that kicks in after frequency has started to deviate. It will become a 1GW day ahead marketplace that brings procurement closer to real time.

Providers with assets that can act very quickly to address frequency excursions, such as batteries, are being onboarded this week. From Thursday (1 October), they can start bidding for contracts, with National Grid ESO initially running tenders seven days a week for low frequency services only up to 500MW. High frequency auctions for up to 500MW will follow next year.

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Response speeds
There are three response speeds for frequency response.

Providers may offer only one of these or a combination of different response times.

Primary response - Response provided within 10 seconds of an event, which can be sustained for a further 20 seconds.

Secondary response - Response provided within 30 seconds of an event, which can be sustained for a further 30 minutes.

High frequency response - Response provided within 10 seconds of an event, which can be sustained indefinitely.

Providing FFR
The FFR service is open to both Balancing Mechanism (BM) and non-BM providers who can meet the technical requirements. This might include generators connected to the transmission and distribution networks, storage providers and aggregated demand side response.

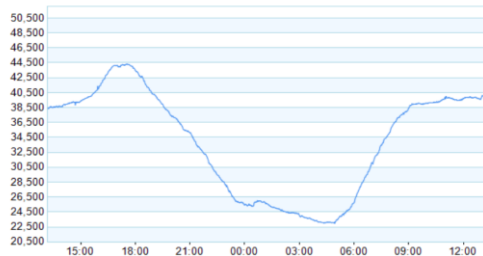
Providers can offer other balancing services outside of their tendered FFR windows.

Units must be ready and in frequency sensitive mode at the start of each FFR window.

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Transmission Demand Last 24 Hrs

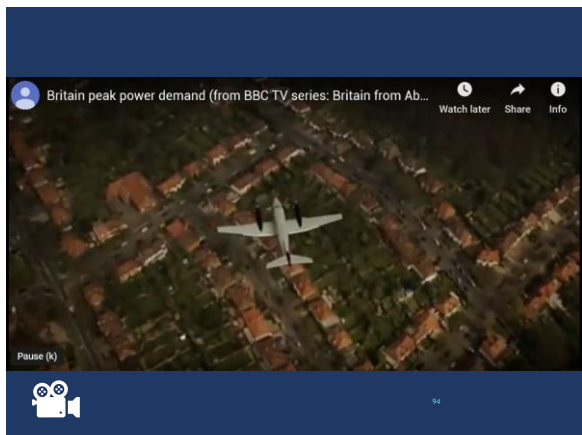
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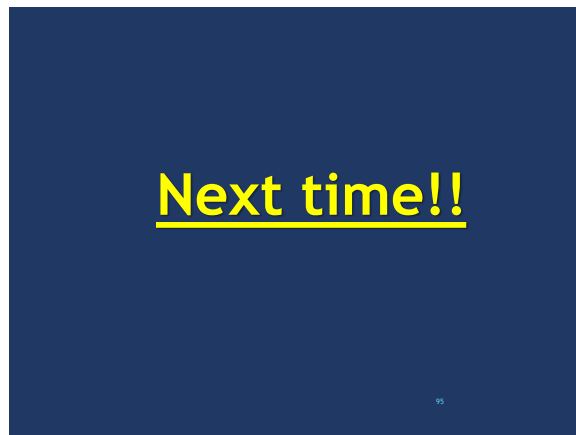
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Pickup demand MW	Date	Programme
		England v West Germany World Cup semi-final penalty shootout
2800	04-Jul-90	
2600	22-Jan-84	The Thorn Birds - Final episode
2570	21-Jun-02	England v Brazil FIFA World Cup quarter-final
2340	12-Jun-02	Nigeria v England FIFA World Cup group match
2290	05-Apr-01	EastEnders - "Who Shot Phil?"
2290	22-Nov-03	England v Australia Rugby World Cup Final
2200	16-Jan-84	The Thorn Birds[13] - Episode 4/5
2200	20-Jul-89	The Thorn Birds
2200	05-Aug-85	Dallas
2200	28-Apr-91	The Darling Buds of May
2200	12-May-91	The Darling Buds of May
2200	18-Apr-94	EastEnders & Coronation Street (combined)
2100	30-Jun-98	Argentina v England FIFA World Cup round of 16 half time
2100	19-Feb-86	The Colbys
2010	07-Apr-02	Coronation Street
2000	01-Apr-91	Coronation Street
2000	03-Jul-90	Italy v Argentina FIFA World Cup semi-final
2000	02-Apr-84	Coronation Street & Blue Thunder (combined)
1960	01-Jul-06	England v Portugal FIFA World Cup quarter-final
1900	05-Apr-94	EastEnders
1830	20-Jun-06	Sweden v England FIFA World Cup group match

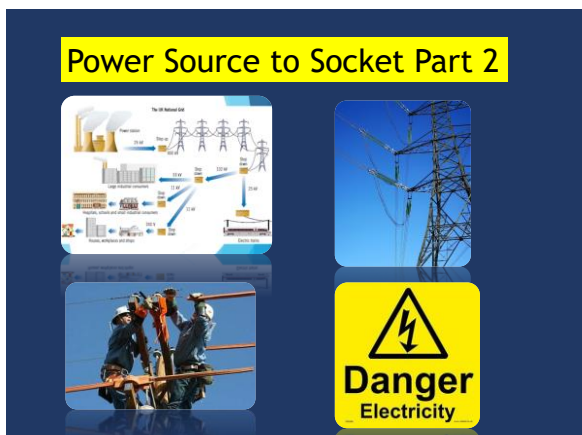
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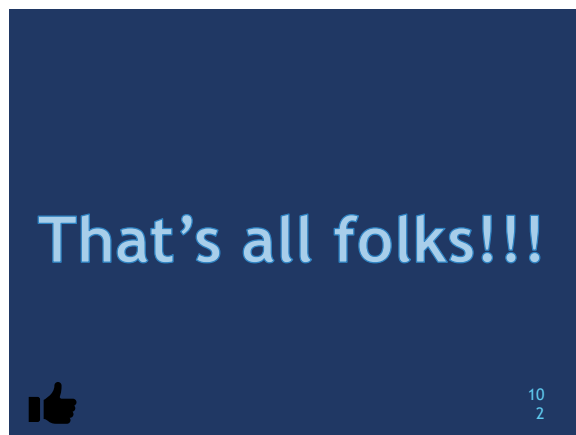
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