

Our Ringside Seat in the Great Game of Power Generation

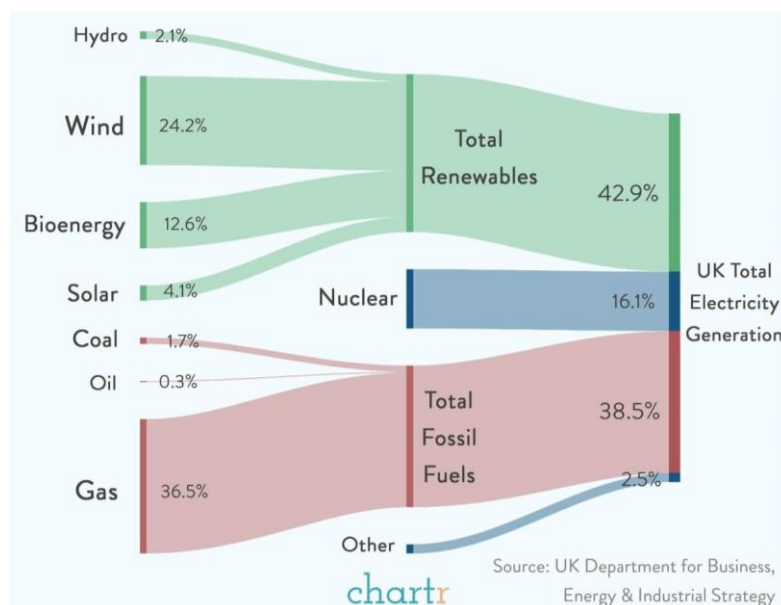
A short drive from our homes in Eastertown to the coast at Brean gives us a spectacular view (with binoculars) of one of the largest building sites in Europe. Across the Bridgwater Bay is the seaside industrial site called Hinkley Point, where a new generation of nuclear reactors are being installed to succeed the existing power stations that have come to the end of their working lives.



The renewed interest of successive Governments since the turn of the century in nuclear powered electricity generation, comes after decades of anxiety and ambivalence towards all things nuclear. The UK was, for a period, the world leader in the technology after the first commercial-scale nuclear power station became operational at Calder Hall in Cumbria in 1956.

Concerns about the safety of nuclear reactors and the disposal of nuclear waste have not diminished over the years but the changing nature of attitudes towards climate change and other risks have affected our perceptions. The major nuclear accident at Fukushima in Japan, following a tsunami incident, has curiously not significantly undermined public confidence in the nuclear industry as badly as expected.

In 1920, UK electricity generation capacity stood at just 2.5 Giga Watts (GW). Over the next 100 years, capacity increased substantially, and by 2020 total installed capacity stood at 101.1 GW, a 41-times increase in total installed capacity over the period. Coal burning power stations dominated the previous decades, but the 1970s saw diversification into oil-fired and nuclear capacity, before the shift to gas generation in the 1990s.



Whilst a majority of the British public remain of the view that renewable energy is a better way of tackling climate change than nuclear power, there has been a relative shift in favour of nuclear power in recent years.

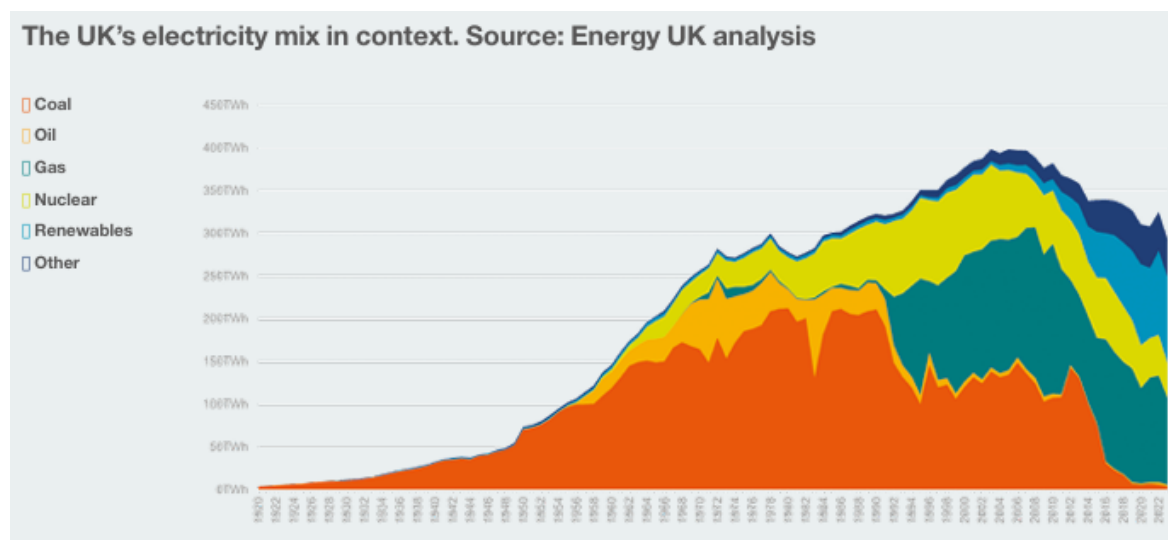
The desirable and astonishingly rapid growth of renewable energy technology is now beginning to introduce new problems for the reliable supply of electricity. A recent power blackout in Spain and Portugal this month has demonstrated the risks associated with relatively

minor fluctuations that can unbalance a national electricity grid.

Maintaining consistent voltage is crucial for a reliable energy supply. The UK operates on a nominal voltage of 230V, with an acceptable tolerance range of 6% above and below. Our National Grid employs various technologies to regulate voltage, automatically adjusting it to compensate for fluctuations. Daily and seasonal variations in electricity demand heavily influence grid voltage. Peak demand periods, typically evenings and during cold winters, place significant strain on the network.

A sudden surge in demand can cause voltage drops. These can be unexpected events, like extreme weather causing widespread power outages. When there is insufficient “head room” within the whole grid, there is the potential for cascading failures and widespread disruptions. The growing integration of intermittent renewable energy sources, such as solar and wind power, presents a significant challenge. Their unpredictable output can cause fluctuations in electricity generation, directly impacting grid voltage. For example, a sudden drop in wind speed can lead to a voltage dip, requiring rapid adjustments by the grid's control systems. Balancing intermittent renewables with conventional power sources is a complex, ongoing task. For this reason, it is desirable that the grid can draw on a reliable “baseload” capacity at all times.

Any delays in the completion of the nuclear power stations that are intended to compensate for the phasing out of thermal power generated by burning gas or oil (coal has almost gone completely,) may bring about conditions where similar blackouts become a greater risk.



For many years there have been arrangements to have readily available energy on tap. Older methods have included the pump-storage of water in hydro-electric power stations. The water is pumped into the reservoir when consumption is low at night and then released, if there is a sudden demand in the daytime. Unfortunately, such arrangements are only available in a few places where water is plentiful. The UK has four pumped storage hydro power stations in Scotland and Wales, with a total capacity of just 2.8 GW.

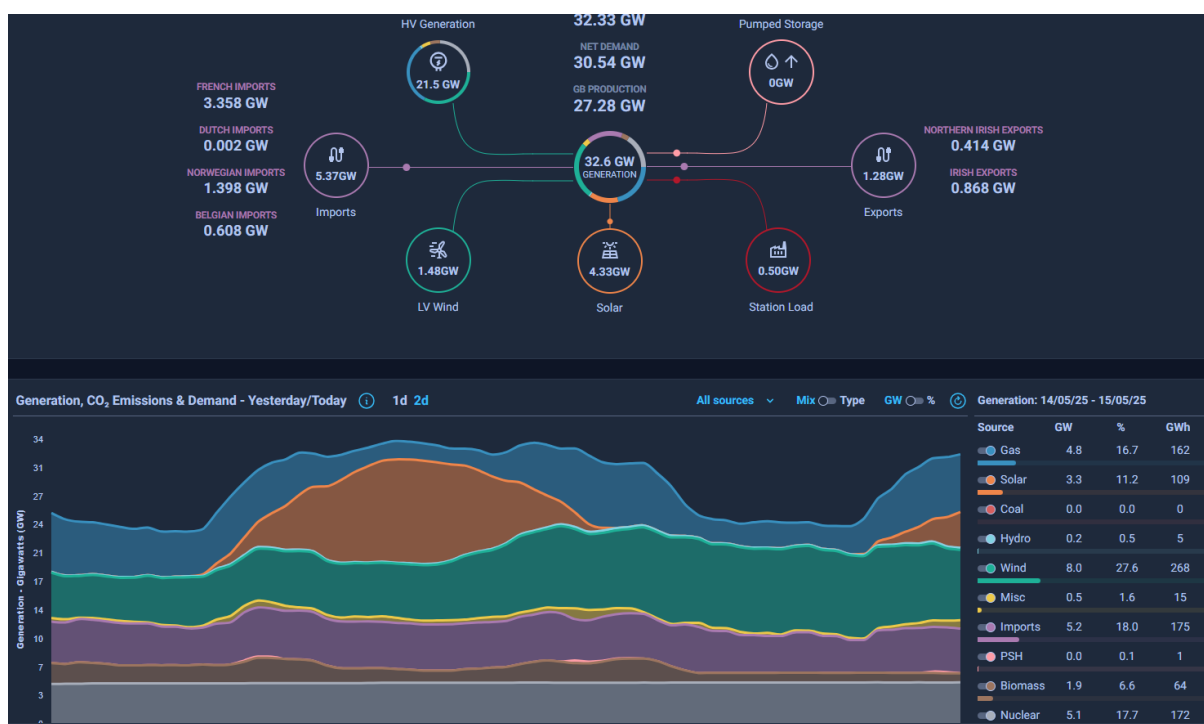
Other alternatives are batteries. The UK's total battery storage projects in the “pipeline” currently amount for a respectable total of 127GW of capacity but only 8% are operational or under construction now. That is just over 5GW of capacity and may get to 10GW before the end of the decade, which falls a long way short of the sort of security we may need. (1/3rd of battery projects are approved and 2/3rd are awaiting planning approval.)

New ideas for keeping the voltage stable include possibly modifying old generators to take energy from the grid and keep them spinning. The kinetic energy ‘stored’ in these spinning parts

is called system inertia. The inertia that they hold by rotating at high speed can very quickly be tapped when a sudden fluctuation occurs and restore energy to the grid.

The opposite to power shortages can also occur, as seen recently in Spain and Portugal. There is now an abundance of renewable energy from solar and wind in the Iberian Peninsula. However, at times of low demand, the excess has to be stored or exported. Having pumped all the water to the top of their reservoirs, there was only export to Europe through France, but it was not wanted elsewhere. Rapidly, the voltage changes tripped safety mechanisms and that burdened the rest of the grid with excess energy, resulting in a cascading shut down.

Presently, the delicate balance of energy supply and demand is managed almost second by second and it involves importing energy from abroad at times of need. To view the way in which the supply is generated and distributed, there is an elegant, real-time display that we can view on the internet, presented and maintained by the Energy Dashboard (see the web link below).



The Hinkley C project is an example of how delays and escalating costs are beginning to cause some degree of anxiety. It is not expected to come online until 2029, when it will deliver around 7% of the electricity within the national grid. The country could potentially be left with a shortfall in secure dispatchable and baseload capacity, with only one nuclear plant (Sizewell B) online in 2028. In the meantime, we will have to hope that we do not experience a disturbance to the grid that could bring darkness to our homes in the midwinter. Maybe it is time to find a small petrol generator to keep the freezer going, at such times.

[Public Attitudes to Nuclear Power and Climate change in Britain synthesis report.pdf](#)

[UK Electricity capacity and generation by fuel between 1920 and 2020](#)

[Energy Dashboard - real time and historical GB electricity data, carbon emissions and UK generation sites mapping](#)