Renewables are leaping ahead – sort of

At the start of the 21st century, about 98% of the UK's electricity came from burning coal and gas. Since then, the UK and other European nations have invested heavily in renewables, especially wind and solar-PV, which have increased by a staggering 9000%. Only 10 years ago, renewables contributed about 14 % but currently contribute over 42 % of the UK's electricity with 24.8 % from gas and 0.5 % from coal (National Grid data).

Percentage contribution of renewables to UK electricity supply January 2024 – January 2025

All renewables	Wind	Biomass	Solar	Hydro
42.3	29.5	6.8	4.7	1.3

The renewables industry has grown tremendously over the last 20 years driven by the UK policy of achieving net zero greenhouse gas emissions. The technology continues to advance rapidly with more efficient and cheaper solar panels and wind turbines. The UK aims to have 40 GW (giga Watts) of solar power generation by 2030, reaching 54 GW by 2035. Globally, the International Energy Agency predicts that this year (2025) over one third of the world's electricity will come from renewables and they further forecast that before the end of this decade, most of the additional generative capacity will also be from renewables. Both India and Brazil are rapidly expanding their solar and wind capacity and even in the USA, renewables are still expanding.

This expansion risks being limited by the distribution grid which cannot currently deliver the power from where it is and will be generated to users. The electricity grid in the UK was built to distribute power from coal and gas power stations to consumers. Solar-PV and wind turbines are sited in different places such as across hillsides and out at sea. If we wish to continue using electricity in the same way, then the structure and operation of the grid has to change. The network has to become much smarter and the use of artificial intelligence (AI) can help. More household appliances are connected to the internet – the Internet of Things (IoT) and we are encouraged to have smart meters installed. Collectively, AI, smart meters, and the IoT can work together to optimise electricity supply and demand which will enable smarter grids and integrate the use of intermittent renewable sources.

Many people have homes that have roofs onto which solar-PV panels can be installed but there are also many where the roofs are unsuitable. In such cases, community solar projects can allow people to benefit from solar panels. Solar farms in Australia and the USA are already powering whole neighbourhoods. In the UK, it isn't compulsory for new builds to have solar panels but it is becoming more common for developers to install them as one way of meeting energy efficiency standards. Between October and December 2024, 42 % of new homes were built with solar panels. However, developers tend to only install sufficient panels to achieve the necessary standard which usually means the panels are too small to be effective. The present government is reluctant to make it compulsory to

install panels and and the financial benefit is not sufficient to make them worthwhile. The government rejected the ‘Sunshine Bill’ introduced by Max Wilkinson MP on the grounds that forthcoming changes to building standards would be more effective.

Even with increased renewables and a smarter grid, there is still a major obstacle to our strategy and that is the problem of storage. The main renewables, solar-PV and wind are subject to the variations in sunshine (light) and strength of the wind. In many cases, supply outstrips demand, for example on warm, sunny days or on windy nights. Conversely, demand can be high during dull, winter days or in very cold, calm weather. Renewables are intermittent. There is a great need for better storage technology. It is fairly easy for individual households to have batteries linked to their solar panels but much harder to have similar solutions for the national grid.

Storage at the gird level requires more advanced systems compared with home use. Whilst it is possible to have very large battery systems, usually based on lithium batteries, the cost and size of these limits widespread use. Research is currently directed at using excess electricity to hydrolyse water producing hydrogen that can be stored for burning later. Another form of battery is the flow battery in which liquid electrolytes are stored in external tanks and brought together to generate power. Electricity is used to regenerate the positive (posolyte) and negative (negolyte) electrolytes so storing the power. When these are brought together on either side of a special membrane, they release the stored power. The materials used are cheaper and safer than lithium and systems can be scaled up. However, currently they are not as efficient.

Other power storage systems include thermal energy storage in which electricity is used to heat up water, molten salts or materials that change phase (eg ice-water). Compressed air can also be used by using electricity to pump air into containers or underground caves. When power is need, the air is released through turbines. There are also pumped storage, flywheel systems and super capacitors.

It may be hoped that with the increased capacity from renewables, the advancement storage technologies and developments in smart grid operations that the cost of electricity might go down, However, this is unlikely on several accounts. Demand continues to increase, production costs are rising and prices are linked to the price of gas, which is affected by global supply pressures. The cost is also affected by the weather, particularly increasing during prolonged cold weather both within the UK and across Europe. In addition, geopolitical conflicts, such as the war in Ukraine have a significant effect.

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