

How Can Modern and Emerging Eco-Friendly Power Solutions Be Implemented into Current UK Infrastructure ?

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Abstract

Renewable energy projects have been increasing in popularity over the last 2 decades and for good reason. These renewable energy projects like wind farms and solar panels offer a cheaper and more ecofriendly solution to the environmental crisis. But with an aging infrastructure and more sophisticated energy generation systems being introduced, we must look for innovative ways to connect the future of energy to our modern energy infrastructure. There are a multitude of new technologies that allow the UK to harness power more efficiently and from sources that hadn't been considered until recently. The British Government has been laying a framework of legislation to help support future development of eco-friendly power generation, but it may not be enough to support large renewable energy projects. This leads people to look for alternative renewable power solutions that are much smaller and offers adaptability and versatility when being installed.

Introduction

Climate change is one of the most significant threats that humanity has been forced to face in recent years. With rising temperatures, rising sea levels, and extreme weather patterns, the ability of humanity to prevent decline is becoming increasingly limited (IPCC, 2023). However, with changes in the way we generate energy, we can potentially reduce the impact we have on our planet's climate. According to the Met Office, "Even if we were to stop all emissions today, we would not prevent some changes" (MET office, 2024). Fortunately, the UK has been reducing its reliance on fossil fuels in recent years and has decarbonised faster than any other G7 country. Notably, greenhouse gas emissions have reduced by 48% since 1990 (UK gov, 2023). This steep decline has largely been due to implementation of the UK Climate Change Act (2008) and the Environment Act (2021), which has given the UK the strong legal framework it needs to reach Net Zero by 2050.

The UK has historically been a leader in energy sector innovation, having been the birthplace of the Industrial Revolution in the 18th century. This period saw the development of the coal-powered steam engine, which significantly boosted production rates in factories (Hudson, 2014). In more recent years, the UK has been a leader in moving from the use of fossil fuels to generating energy using cleaner and greener methods. The UK's first renewable energy plant completed construction in 1991 off the coast of Cornwall. This was the first step into the UK's vast renewable energy resources and is the reason that there are now over 2,000 wind farms, which, as of March 2023, is generating 32.4% of the country's electricity, surpassing fossil fuels for the first time in history (Ukpanah, 2024).

However, whilst wind power is the UK's largest renewable resource, it is not the only source of clean energy. The UK also has an array of solar farms contributing to about 5% of the UK's total electricity generation, as well as a number of hydropower stations that contribute a further 1.8% towards the UK's total electricity generation (National Grid, 2024). All of these changes in recent decades clearly demonstrate that good progress has been made when it comes to becoming a net zero country, although there is still more that can be done.

Many of these projects need to be built on a large scale to be worthwhile and are limited by their connection to the national grid, which leaves many suitable locations for renewable and clean power sources out of reach. That is why there is a desperate need for new technologies to be developed to access these natural resources and have them stay close to national grid link-up points. There are some small projects that are being implemented locally across the country, but they are not being taken advantage of fully. There are also multiple small clean power solutions that are run by private companies to power their own buildings. However, these are not connected to the national grid.

This essay will explore the opportunities and barriers for UK renewable energy projects, with a particular focus on the status of renewable energy technologies and the UK's electricity grid infrastructure. It will also consider legislative and social drivers. Conclusions will be drawn about the future of energy generation technologies in the UK, based on the discussions presented.

Theoretical framework for energy transition

Unfortunately, it is not possible to simply incorporate renewable energy projects into a nation's power grid and expect global warming to just go away; we must make use of Energy Transition Theory (Markard, 2012).

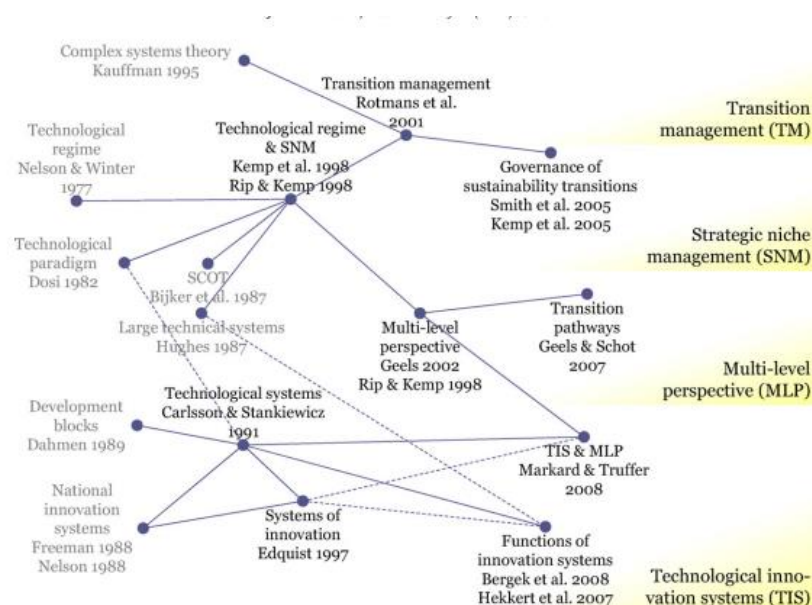


Figure 1- Map of key contributions and core research strands in the field of sustainability transition studies (Markard, 2012)

The theory explores how a society shifts from one primary energy source to another, such as the change from fossil fuels to renewable energy, and how it affects and is affected by a society's technological readiness, governance and economy, as well as many other aspects of modern society. This theory is particularly useful for exploring the enablers and barriers of renewable energy generation in the UK. It is evident that it has partially been taken into consideration when it comes to incorporating renewable energy into existing infrastructure, as the majority of clean energy projects currently operating have been rolled out in stages, with many projects running at smaller energy capacities, also known as phases, as a trial period before running at full capacity to check that the power source is commercially viable and socially acceptable as well as to see if it actually works. For example, MeyGen tidal turbines, are currently generating 6 MW from four 1.5 MW turbines out of a planned potential capacity of 398 MW (SAE renewables, 2024). Therefore, whilst it is clear that the transition from fossil fuels to renewable energy is underway, there are still a number of economic, technological and governance barriers that need to be overcome via the many trial stages before the UK can operate a solely renewable energy national grid.

Historical Overview of Fossil Fuel Consumption in the UK

In our current climate, the UK has a wide range of renewable energy sources that are used to power large portions of the country at its disposal. However, it was not always this way. The UK has had to adapt to changing times and adopt newer and cleaner ways to generate its power over the last 80 years due to the dwindling fossil fuel reserves that are having to be shared across the globe. Since 1965, the total global consumption of fossil fuels to generate power has been on a steady incline, going from 40,000 TWh (terawatt hours) globally used to around 140,000 TWh (Ritchie & Rosado, 2024). However, unlike many other countries, the UK's usage of fossil fuels has been on a steady decline, going from 2,259.64 TWh used in 1965 to 1,421.88 TWh used in 2023 (Ritchie & Rosado, 2024).

Fossil fuel consumption

Measured in terawatt-hours¹.

Our World
in Data

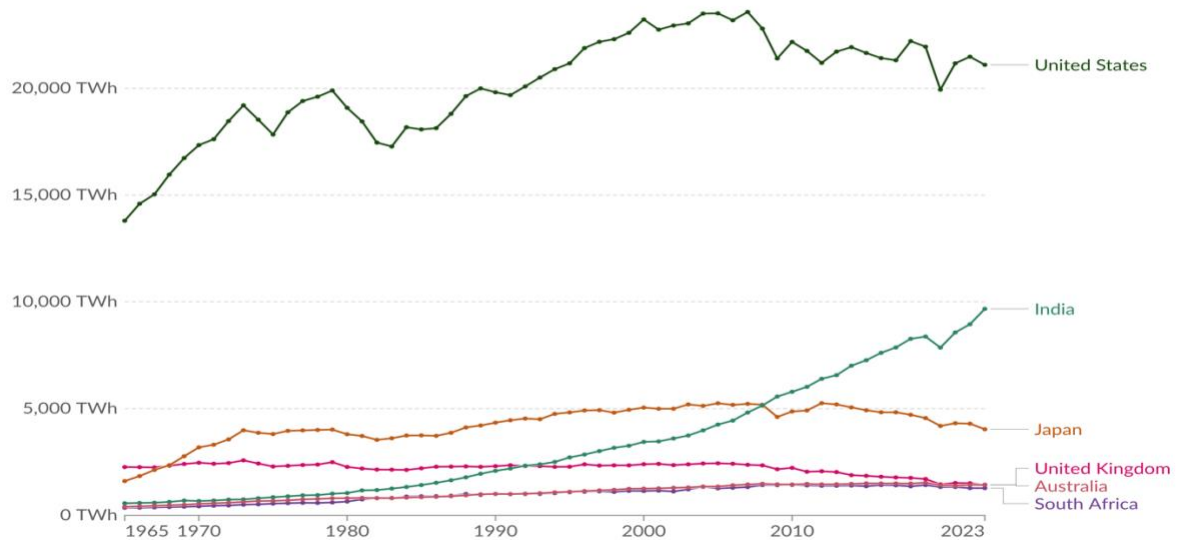


Figure 2- Fossil fuel consumption (Ritchie & Rosado, 2024)

This is mainly due to the UK's introduction of renewable energy projects into the country's infrastructure. These renewable energy projects have been more successful in reducing the UK's fossil fuel consumption in recent years primarily as a result of the 2008 Climate Change Act. The Act states that "It is the duty of the secretary of state to ensure that the net UK carbon account for the year 2050 is at least 80% lower than the 1990 baseline" (HM Government, 2008). This target is legally binding, therefore is directly driving the development of the UK renewable energy sector.

Opportunities

Introduction

So what new emerging technologies are there that may help the UK reach its goal by 2050? There are many possibilities that could be useful for making Britain a greener nation. The first part of this extended essay discusses opportunities in the form of hydropower, solar farms, wind farms, geothermal systems, hydrogen and kinetic energy systems. The second main part of the essay will discuss barriers.

Hydropower

There have been a number of tidal and wave power projects in proposal and early implementation stage, such as the MeyGen tidal turbines off the northern coast of Scotland (SAE renewables, 2024) and the Swansea tidal lagoon scheme in South Wales (NIP, 2020). Both of these projects use the tide surrounding the UK in different ways. The

MeyGen project relies on fast-flowing water currents to turn large turbines underneath the water. This Scottish site has some of the fastest flowing waters in the UK, which has allowed for 68 GWh to be generated over the past 6 years (SAE renewables, 2024). The MeyGen project has a potential energy capacity of 398 MW once all the phases have been implemented, making it the largest planned tidal stream project in the world (SAE renewables, 2024).

Swansea Tidal Lagoon, which was granted planning consent, but which did not progress due to a lack of Contract for Difference agreement, would have relied on the rise and the fall of the tide to generate its power using bi-directional turbines placed on the outer wall of the lagoon (NIP, 2020). The location of the tidal lagoon would be vital to its success. The Severn Estuary has the second highest tidal range in the world, surpassed only by the Bay of Fundy in Canada. The capacity of the Swansea project would have been 320 MW (Tethys, 2022), which may be a modest amount compared to other projects, but more importantly would have acted as a catalyst for future tidal lagoon development schemes.

There are a multitude of emerging technologies that the UK could implement into its infrastructure in order to help reduce the release of greenhouse gases when it comes to the production of energy. As an island nation, we should be taking advantage of one of the planet's greatest resources, the ocean. The aforementioned MeyGen and Swansea Tidal Lagoon projects are arguably the hydropower projects with the most potential when it comes to generating large amounts of energy using the power of the ocean. As previously mentioned, the MeyGen project's current phase of four 1.5 MW turbines has been running for the past 6 years and has generated around 68 GWh of electricity in that time. After the power is run through a conversion unit onshore, the tidal energy system is capable of supplying power to around 6,000 homes annually (MeyGen, 2024). With the expansion of this technology by growing the project and using the same technology in new locations around the country, we would be able to power thousands or tens of thousands more homes using the power of the ocean. Similarly, the Swansea Tidal Lagoon, whilst still in the planning stages, is revolutionary in its use of bidirectional turbines that allow us to harness the energy of the tide going both in and out. The unique advantage of bi-directional turbines is that energy can be generated on both the incoming and outgoing tide. This doubles the standard generation time and gives it a distinct advantage over other uni-directional hydro schemes (Tethys, 2022). Overall, the Swansea lagoon scheme would have had an installed capacity of 320 MW and would be capable of powering around 155,000 homes for 120 years (House of Commons Library, 2018).

Solar Farms

Hydropower is not the only use for water when it comes to renewable energy. Lakes, reservoirs, and rivers could be used to accommodate floating solar farms, although there are some concerns around their environmental impact, particularly the blocking of light, which can lead to decreased photosynthesis for plant species directly below the panels. However, studies suggest that as long as floating solar farms occupy less than 10% of the total surface area, they should not significantly impact local ecosystems (CEH, 2024). A study by the UK Centre for Ecology & Hydrology suggests that the UK would be capable of generating 2.7 terawatt-hours annually using floating solar farms, which equates to about 1% of the UK's total national power usage, which is enough to power 1 million homes (CEH, 2024). The UK already has a small number of floating solar farms, the largest of which is on the Queen Elizabeth II reservoir near London. This solar farm is currently generating around 5.8 million kilowatt-hours annually, allowing it to power roughly 1,800 homes and making it the largest floating solar farm in Europe (lightsource bp, 2022).

Other advancements in renewable technology allow us to take great steps to reach our net zero goal by 2050. The introduction of floating solar panels is going to dramatically increase due to the creativity when it comes to the use of space. There are approximately 390 lakes in the UK that are larger than 5 hectares (BBC Countryfile, 2023) and 290 reservoirs that account for 90% of the UK's water storage (Environmental Information Data Center, 2020). Even if only the largest 10 reservoirs in the UK gave up 10% of their surface area to floating solar panels, it could generate upwards of 7MW of energy, assuming 1 square meter of solar panel generated 1KW of power, or power around 3,400 homes. These floating solar farms could also be ideal for hydropower dams and reservoirs as there is already infrastructure connecting to the national grid, significantly reducing the cost of installation and grid connection.

Innovative developments for solar panels are also one of the many ways in which we can advance our renewable energy capabilities. With the introduction of perovskite cells, the efficiency of solar panels has greatly increased, with companies such as Oxford PV being able to reach efficiency levels of 30% (Oxford PV, 2020), a large leap from the current efficiency levels of current photovoltaic cells, which sit between 18% and 24% (Sunsave, 2024) at a fraction of the cost that it takes to make current solar panels. If the UK government decided to implement these perovskite cells into our infrastructure and update our current photovoltaic solar farms with these new solar panels, the country would be generating more renewable energy at a lower cost. Not only that, but in the event that floating solar farms become the mainstream for solar farming, the maintenance cost would also greatly decrease as the water keeps the solar panels from overheating, also boosting efficiency.

Designers and engineers are constantly seeking to find new ways to place solar panels. Whether it's on the side of buildings, on top of car parks, in solar farms, or even on floating solar farms. However, the only way that we can use solar power more effectively is by improving the core technology. In recent years, researchers have been looking into new perovskite solar cells, which are proving to be a viable replacement for the photovoltaic cells used in traditional solar panels. The majority of current domestic solar panels have an efficiency rate of between 18% and 24% (Sunsave, 2024); however, there are companies such as Oxford PV that have been able to get to a 29.52% efficiency using a perovskite-on-silicon tandem solar cell, and they are on a clear roadmap to achieving above 30% efficiency (Oxford PV, 2020). Not only are perovskite solar cells more efficient than the regular photovoltaic solar cells, but they are also cheaper to produce. According to the National Renewable Energy Laboratory, photovoltaic cells used in solar panels for residential purposes cost around \$2.70 per watt to make (NREL, 2021). In contrast, perovskite solar cells cost around £0.11 per watt to make (Solar Square, 2022), proving that perovskite solar cells are far superior to photovoltaic solar cells due to their improved efficiency and their lower production costs.

Wind Farms

There are also advancements in wind power technology, such as the Dogger Bank wind farm. The planned wind farm would become the largest wind farm in the world and would use the new Haliade-X offshore turbines developed by GE Vernova to generate a planned 3.6 GW of energy, or enough power to power 6 million homes annually (Dogger Bank Wind Farm, 2024). The company states that a singular installed turbine is capable of powering a UK home for 2 days with 1 rotation and that the turbines have an efficiency of 61% (GE VERNOVA, 2024). This leaves the opportunity of these turbines being installed in future wind farms and the option to add them to current wind farms, boosting the overall power generation of that farm.

In addition to traditional high altitude and offshore locations for wind farms, consideration might also go to less traditional locations. For example, highways in India are placing vertical turbines in the middle of highways so that when vehicles drive past at high speeds, they rotate (The Independent, 2021). The UK has 2,300 miles of motorway and 29,500 miles of A roads (Department of Transport, 2022), both of which are suitable for the placement of the vertical turbines and would generate a considerable amount of power, which could be stored to power the lights on the road at night, which would significantly bring down the cost of operating them, possibly leading to fewer accidents.

Enhanced Geothermal Systems

There are also controversial renewable power sources that many people may have never even heard of such as enhanced geothermal systems. This system of renewable power generation relies on pumping fluids deep into the earth's surface where there are hot rocks that allow for pre-existing fractures to reopen, letting the fluids transport heat to the surface that can then be harnessed and turned into energy (DOE, 2016). The MIT Technology Review states that this technology of using the earth's underground temperature to produce power has the capability to produce a constant power output, something some other renewable power stations may struggle to do (MIT technology review, 2024). However, there remain unanswered questions about safety and ground stability.

Stepping away from the conventional means of renewable power, geothermal energy is becoming more and more suitable as a renewable source. It can be used to generate electricity or can be used as a source of heat for buildings. For example, the Eden Project in Cornwall uses geothermal energy to heat its buildings (eden project, 2024). Iceland uses geothermal energy plants to power 25% (Government of Iceland, 2024) of the country's electricity by syphoning steam from deep underground and using it to turn turbines that generate electricity. There are highly carboniferous limestones in the north of England fairly carboniferous limestones that have geothermal potential, meaning that geothermal energy could be generated across the country (British Geological Survey, 2023). If implemented into British infrastructure, it could have a huge role to play, not just for electricity generation, but also to help overcome heating problems during winter months.

Hydrogen Power

Hydropower is not the only place where new technologies are emerging. Hydrogen is becoming an increasingly popular choice for renewable energy. Hydrogen is created through the process of electrolysis, which separates the hydrogen atoms from the oxygen atoms in water by running an electrical current through it (Iberdrola, 2024). Hydrogen is a very versatile substance that can act as a source of energy to power our homes and businesses as well as being fuel for our cars. To create electricity using hydrogen, we must use a hydrogen fuel cell. These cells break down the hydrogen into electrons and protons and then force the electrons through a circuit to generate an electric current. These fuel cells can come in all shapes and sizes and can be implemented in many different places. For example, Hynet, a company in the north of England, is committed to creating an infrastructure that supports hydrogen energy generations as well as capturing and locking away CO₂ that is emitted by heavy industry. HyNet states that this project would directly provide 6,000 jobs and would help

support around 75,000 jobs in heavy industry factories across the UK as well as generate an estimated £31 billion for the UK by 2050 (HyNet, 2024). The Hydrogen Centre in Port Talbot, south Wales is also exploring how to commercially extract hydrogen power from water with a grant from the European Regional Development Fund (H2Wales, 2024).

Kinetic Energy

In addition to the introduction of the technologies discussed above, we can take inspiration from other cities by using the general population to create kinetic energy. For example, a case study in Paris conducted by Iberdrola placed turnstile turbines in the Parisian subway to generate 0.2 watts for every person that walks through it, which is said to be enough to power a subway line and reduce carbon emissions by 30,000 tonnes annually using the 4.5 million people that use the Paris subway system (Weber Shandwick, 2024). From June 2023 to June 2024, there were 1.6 billion journeys recorded (Office of Rail and Road, 2024). If turnstile turbines were implemented into all train stations, it would generate 320 MW of electricity, or the equivalent of 118,500 UK homes, based off of the average UK house electricity usage of 2,700 kWh (Ofgem, 2024). This could in theory substantially offset UK energy consumption.

A similar technology which involves Pavegen floor tiles are revolutionary in the sense that they generate electricity every time someone steps on them, with just one tile being able to power a light for 70 seconds with just 3 steps (McClary, 2017). The tiles have already been installed in areas with high foot traffic to promote the product as well as promote health and fitness in London (Pavegen, 2024). Again, the potential to generate electricity at local level is significant, particularly if it were to be rolled out to all cities in the UK. This is certainly an under-used energy technology to watch.

Challenges

Introduction

Inevitably, there will be a range of challenges that affect the ability of the sector to evolve. These primarily relate to economic considerations, social acceptability, technological efficiency, national grid distribution and energy storage. These are discussed in more detail below.

Economic Considerations

The cost of upgrading the UK's power grid is the main limitation that we face with the need to install more battery energy storage systems (BESS) as well as increasing the amount of offshore wind farms as well as solar farms. Mike McWilliams, CEBR chief energy advisor, states that to achieve net zero and upgrade our national grid would require "substantial investment" and has estimated the total investment to be £1.6 trillion by 2050, roughly 2.5% of the UK's GDP (McWilliams, 2024). The government has made a promise to add 50 MW of offshore wind to the energy mix by 2030 and to also increase solar deployment by almost 5 times to help meet demand (national grid, 2024). Whilst these may seem like some daunting numbers to some, the British government suggests that it could be beneficial to the economy in many other ways by creating an estimated 50,000-130,000 full-time jobs and contributing between £4-11 billion of gross value added to the economy by 2050 (Assets Publishing Service, 2023).

Energy installations are also expensive. Coastal hydropower, for example, costs billions to build and install, with Swansea Tidal Lagoon being estimated to cost around £1.3 billion to build (Department for Business, Energy and Industrial Strategy, 2018). Even inland hydropower projects such as the Dinorwig power station in North Wales cost £425 million in 1974 (The Geological Society, 2012), which translated into today's standard would cost around £4.7 billion, a truly staggering number (Institution of Civil Engineers, 2024).

Social Acceptability

The British government has a set goal in mind of being net zero by 2050; however, the way we become net zero is largely influenced by public opinion. Fortunately, the British public is largely in favour of switching to more renewable energy sources.

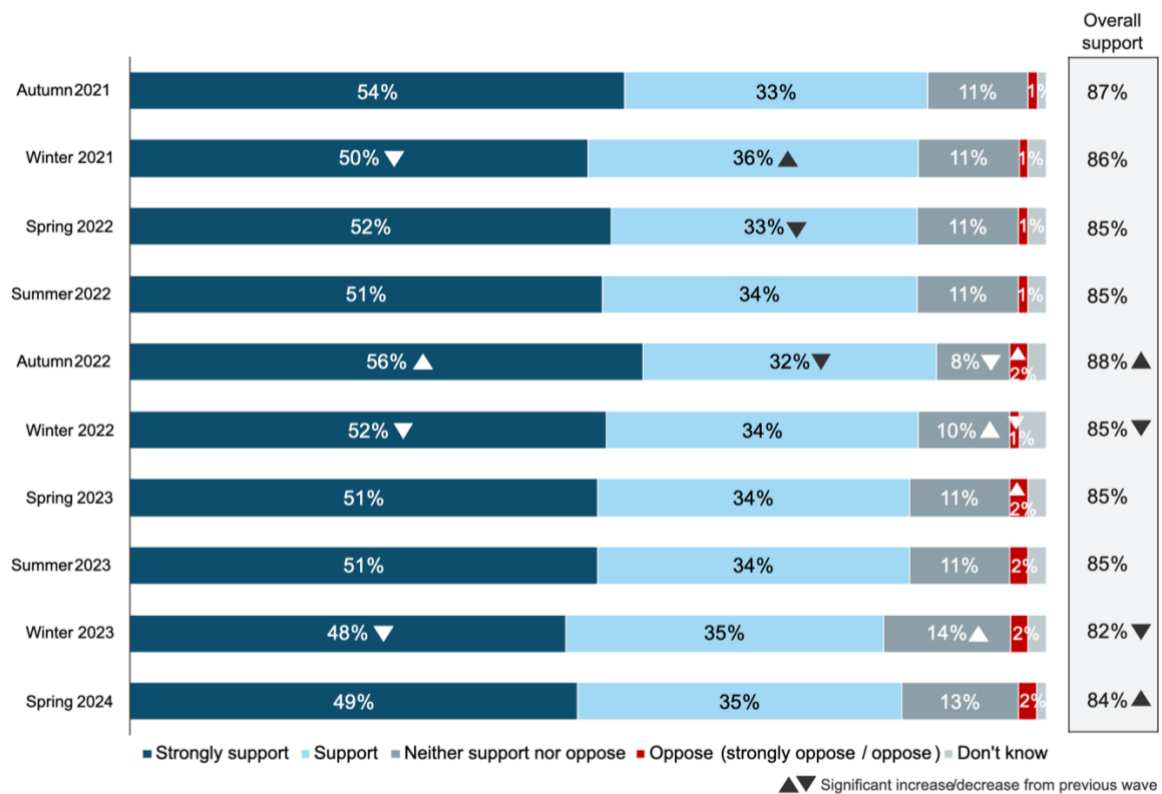


Figure 3 - Whether support use of renewable energy (based on all people), Autumn 2021 to Spring 2024
(Department for Energy Security & Net Zero, 2024)

According to the DESNZ public attitude tracker, as of spring 2024, 84% of the British public were in support of renewable energy to provide electricity, heating, and fuel to the people. With the majority of the country being in support of renewable energy projects, companies like Community Energy England are urging people to invest in local renewable energy that would be controlled and managed by local communities to supply power for their homes and businesses. The 2024 State of the Sector Report shows that community renewable energy projects have generated around 617 GWh in 2023, which is the equivalent of 228,530 homes. Local renewable energy projects saved people an estimated £13.8 million on their energy bills since 2020, as well as saved 165,980 tonnes of CO₂ in 2023 (SP Energy Networks, 2024).

Renewable energy is the saving grace that we have been looking for to help solve and reduce greenhouse gas emissions as well as help reduce the effects of global warming, and whilst these new technologies are the way forward for species power supply, there are going to be a number of hurdles that we are going to have to overcome. Each viable renewable energy source has its own issues that we must face.

Wind turbines, particularly onshore turbines, are eyesores and are widely disliked by people who live in local areas to wind farms. The turbines don't just disturb the visual landscape but also produce a large amount of noise pollution, generating

between 35-45 dB when heard from 300 m away (Duval, 2024). When combined with numerous other turbines of similar size, the combined noise would become quite irritating, especially for wildlife. Offshore wind farms avoid these problems; however, they face the same issues as coastal hydropower stations. Due to the remote locations, it costs more to build and install the wind farms offshore than it is to build them onshore. Onshore connections are often unsightly and commonly meet public objections. Perhaps we can overcome these issues by improving on the design aspects of the turbines to make them fit in more with the surrounding environment so that the turbines can complement its surroundings instead of standing out in it.

Technological Efficiency

Solar panels are the country's largest commercial renewable energy source, with 1.4 million UK households having solar panels, or around 5% of UK homes (Sunsave, 2024). However, whilst the solar panel industry seems like the way forward, it still has its problems. For example, as the temperature throughout the year increases, the efficiency of the solar panels decreases (ese solar, 2024). Meaning during the peak hours of sunshine during the summer, solar panels are worse at harvesting that solar energy into electricity. Hydrological turbines and kinetic energy technologies face similar issues, although millions are being invested in improving efficiencies.

National Grid Distribution

The UK has an impressive energy infrastructure set up, with over 1,300 power plants across England and Wales using both fossil fuels as well as renewable energies as of 2022 (Statista, 2022). In order to transmit all of this energy from its sources to where the electricity needs to go, there are thousands of miles of transmission lines around the country that connect power stations to distribution substations. These distribution substations can adjust the voltage running through the transmission network, lowering the voltage before entering our homes. There are over 300 substations located in different parts of the country for different regions (National Grid, 2023). The grid is near full capacity, therefore there are some very real challenges associated with adding to it. However, there are some locations around the country that store energy produced during times when there is a high supply of power but a low demand, so that it can be used when there is a short supply of power being produced for a large demand.

A potential solution involves smart grids. A smart grid uses modern technology to help manage supply and demand in almost real time, which would allow for a more "cost-effective system" for transporting electricity from generators to homes (OFGEM,

2014). Ofgem has already begun its plan of integrating a smart grid into UK infrastructure through the use of smart meters. Ofgem planned to have around 53 million smart meters in UK homes by 2020; unfortunately, due to Brexit and the pandemic, the deadline has been set back to 2025, as only 9 million smart meters had been installed as of 2021, although this number has grown, and as of 2022 there have been over 17 million installed as of 2022 (Cameron, 2022).

Energy Storage

Given issues around grid capacity, the storage of power is crucial if the UK wants to meet its 2050 net zero goal. This is due to renewable power sources not being able to easily boost supply when there is a spike in demand; that is where energy storage can be invaluable in helping meet the demand. The British government expects the demand for grid energy storage to increase to 10 GWh by 2030 and to 20 GWh by 2035 (House of Commons Library, 2024). Pumped storage hydro uses two reservoirs of water at different altitudes to continuously generate power. Water flows through the reservoir wall, turning turbines to generate power, into the lower reservoir. This can be turned on or increased to meet demand in a matter of minutes. When there is a low demand for power, the water gets pumped back up to the top reservoir, getting ready for the next spike in demand. One of the most notable pumped storage hydro sites is Dinorwig quarry in north Wales. This is the largest pumped storage hydro system in the UK currently and has a storage capacity of 1.7 GW. It is capable of delivering this level of power with just 16 seconds notice (NS Energy, 2020).

Conclusions

The UK has the opportunity to be at the forefront of renewable energy due to its abundance of natural resources. The Institute of Environmental Management and Assessment (IEMA) ranked the UK as the 4th most desirable country for renewable energy investment (IEMA, 2023), with EY ranking the UK as the third best country for BESS investment (EY, 2024). This leaves the country in a strong position to be a world leader in renewable energy development as well as the potential for selling our excess energy that has been generated from renewables.

The future of UK energy is undoubtedly going to be through the use of renewable technologies, and with the extensive array of ways to use our natural resources, there

are numerous possibilities for how we can power our industries and communities using our wind, water and sunlight. Thinking back to energy transition theory, we were destined to find new ways to power our homes that are more efficient for our planet. And whilst we may have an aging infrastructure, by using emerging technologies we can build upon and improve how we generate and manage our electricity usage.

There are many pilot projects that are currently stuck at proposal stage which have the potential to power entire cities, and act as catalysts for a global overhaul of renewable energy generation technologies, such as the Swansea tidal lagoon. However, these schemes come at a cost, which so far has proved to be beyond acceptable levels of UK Government, as well as being eye sores that some argue disrupt local scenery, thus swaying public opinion to having a negative outlook on the construction of new projects. This has significantly slowed down the development of our future renewable energy generation potential. In addition, issues with restricted grid capacity mean that national scale options are limited. Finally, geothermal schemes so far appear to be beyond acceptable safety standards. Consequently, it is concluded that the future of British energy generation is likely to be largely influenced by micro-renewable energy generation technologies such as micro-hydro. These would be best operated at urban-domestic level, in order to reach the maximum number of UK residents.

Small renewable power projects give control back to homeowners and sharply decrease their bills. It is believed that it will only be a couple of years until the majority of homes in UK can generate renewable energy to help power their homes through the use of solar panels, micro-wind and micro-hydro turbines. In addition, urban power generation could allow busy pedestrian areas in built up cities to generate clean energy by using kinetic energy as the cities bustling populations to generate power by going about their normal day to day activities.

This approach of investing in small renewable energy technologies for homeowners and local communities gives power and potentially responsibility for energy generation and usage back to the people. There will always be a need for the larger renewable energy schemes, although this approach of localising energy production would allow the larger schemes to direct their energy towards industrial usages. Together, these would significantly help UK government meet their ambitious emissions targets and reduce future climate change impacts.

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