



MONARCH PARTNERSHIP
Utilities simplified

RENEWABLE ENERGY GUIDE

SEPTEMBER 2022



A RENEWED FUTURE

Temperate, surrounded by sea, and exposed to particularly windy weather, the United Kingdom is prime for renewable energy generation. From wind and solar power already being harvested across the countryside and off the coasts to the untapped geothermal resources waiting beneath the earth's crust, we have the potential to lead the world in renewable power generation.

There's no denying a clean energy transition is already underway in the UK. The past couple of years have seen a promising upward trend of renewable investment, capacity and production. In 2019 renewable electricity surpassed fossil fuels for the first time since 1882 when the first power plant was established. Then in Q1 of 2020, renewables generated a record-breaking 47% of the UK's electricity. The most impressive increase came from offshore wind, with a 53% rise in generation in 2019 from the previous year.¹

Due to the Covid-19 pandemic, the International Energy Agency has warned that investment in global energy could fall by \$400 billion this year.² However, renewable energy is expected to be the most resilient area of the energy industry moving forward. While there are still problems to be found with harvesting power from natural sources, innovations are quickly creating solutions that can safely, reliably, and sustainably power the planet.

A balance does need to be found between renewable energy generation and nature conservation, an ongoing conflict between two synonymous

philosophies. While the reduction in carbon emissions is essential for the conservation of life on this planet, renewable energy takes up more space and therefore impedes on the wildlife around it. Solutions are beginning to emerge, solar farms can be managed to support ecosystems; providing sanctuaries for wildlife, pollinators and even sustainable food production. Endangered species and bird migration patterns can be considered when planning solar and wind farms.

“If we can solve the problems of storage and transmission, the world is ours. We have all the power we need. Why should we go on poisoning life on earth?”

Sir David Attenborough

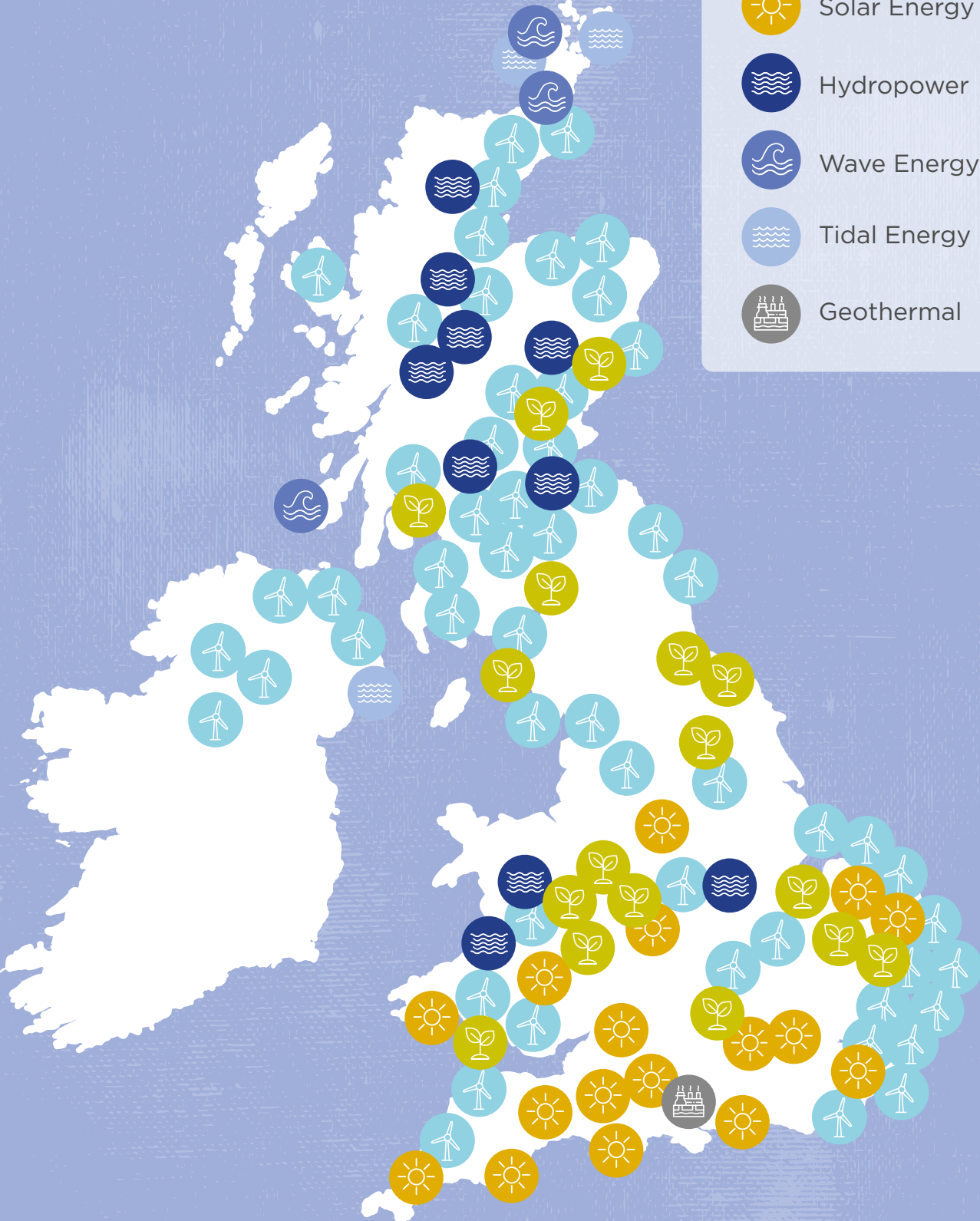
While the economic impact of Covid-19 makes this a difficult time to invest in a sustainable future, a recent Carbon Trust report shows that more than 70% of businesses believe that the coronavirus pandemic will lead to a greater emphasis on sustainability initiatives. People are realising that sustainability is no longer an option for the future, but our only hope at having one.

In this guide we look at renewable power sources: how they work, their strengths and weaknesses, and their future here in the UK. Then we look at how they can benefit you, and how we can help integrate sustainability into the core of your business.

Current renewable electricity sites

KEY

- Wind Power
- Bio Energy
- Solar Energy
- Hydropower
- Wave Energy
- Tidal Energy
- Geothermal



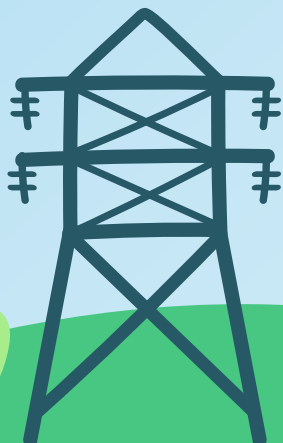
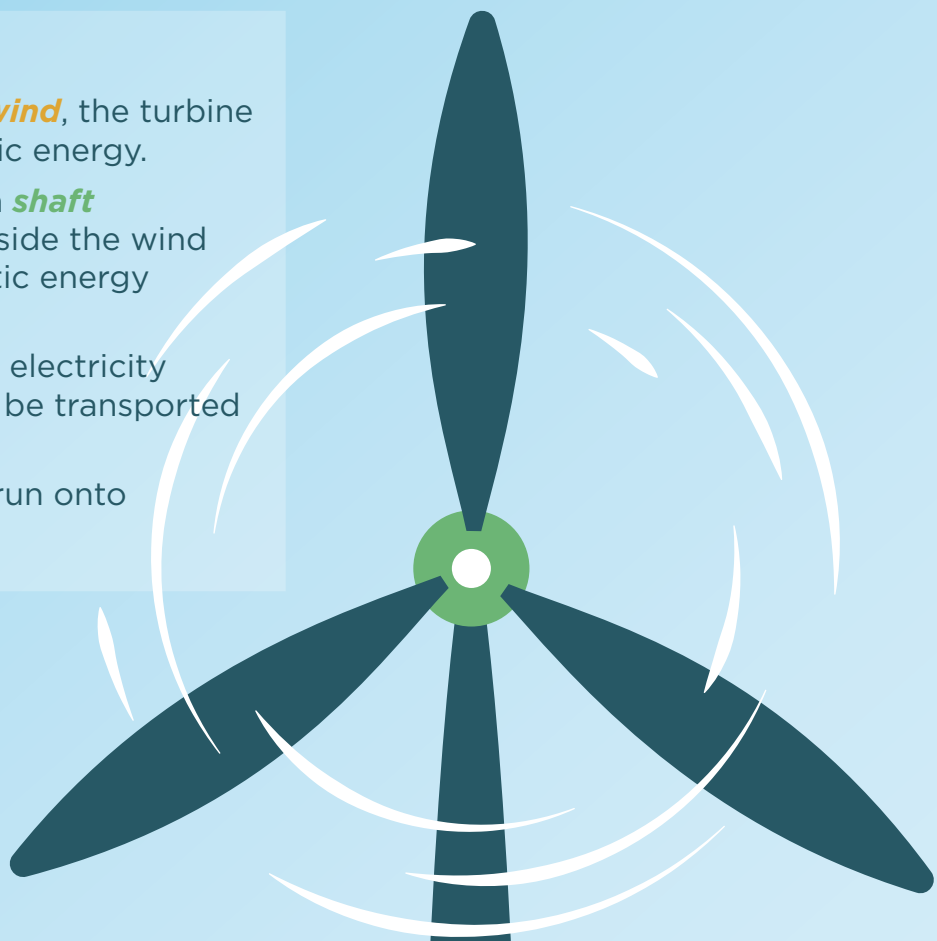
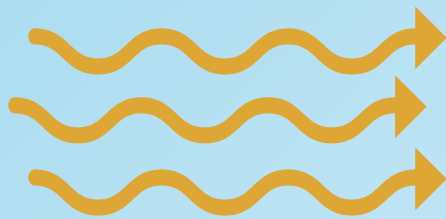
WINDPOWER

The UK's wet and blustery weather makes wind one of our most reliable renewable energy sources. In Q1 of 2020 wind power generated 30% of the UK's electricity and it continues to climb.³ Offshore wind has seen the largest increase in capacity, with government plans to quadruple offshore wind power by 2030. Not only will this be a boost for the economy and provide energy stability, but it could be a huge step towards net zero.

Wind farms scattered across the countryside or anchored offshore feed electricity to the National Grid. Smaller turbines can be sourced to generate onsite electricity for businesses.

How wind turbines work:

- 1 Pushed by the force of the **wind**, the turbine blades rotate, creating kinetic energy.
- 2 This spinning motion turns a **shaft** connected to a generator inside the wind turbine, converting the kinetic energy into electrical energy.
- 3 A **transformer** ramps up the electricity to a high enough voltage to be transported to the grid.
- 4 The **electricity** can then be run onto an electricity grid.



Pros

Wind power is a potentially infinite energy supply, and it's the most cost-efficient renewable in the UK. The price of offshore wind has fallen by nearly 50%³ in just over two years, making it cheaper than fossil energy. Wind power's economic benefits also extend to creating thousands of jobs, not to mention they reduce our reliance on imported energy. Finally, the construction of wind turbines also creates a relatively low carbon footprint compared to other renewables.

Cons

Wind turbines have a comparatively limited lifespan around 25 years, and can be aesthetically unappealing. They can also be inconsistent depending on the location and wind conditions.

The Future of Wind Power

The Prime Minister recently committed £160 million towards wind power. He pledged that within a decade "offshore wind will be powering every home in the country". This recent initiative is just a drop in the pool of capital propelling wind to the forefront of energy generation in the UK. About £19 billion is being invested in offshore wind in the UK between 2016 and 2021.³

The UK currently has the third-largest installed wind capacity in the EU, but that could soon change. Two impressive offshore wind farms, Dogger Bank and Hornsea One, are currently under construction off the Yorkshire coast. Each will have the capacity to power over 1 million homes.

An Oil and Gas Authority report said offshore renewables could account for 30% of the emissions reductions needed by 2050.⁴ This will be led by new wind power technology like floating wind turbines, which can be anchored further out to sea. This will bring into play the strong and steady winds off the west coast of Scotland.



44,100
wind industry jobs

This represents approximately one-third of all renewable jobs. With new projects on the horizon, that number is expected to grow exponentially.⁵



29,278,678
tonnes reduced

The amount of carbon that would have been emitted annually if the energy generated by wind power was produced by fossil fuels.⁶



18,143,778
powered homes

The number of homes onshore and offshore wind has the capacity to power in the UK every year as of 2019.⁵

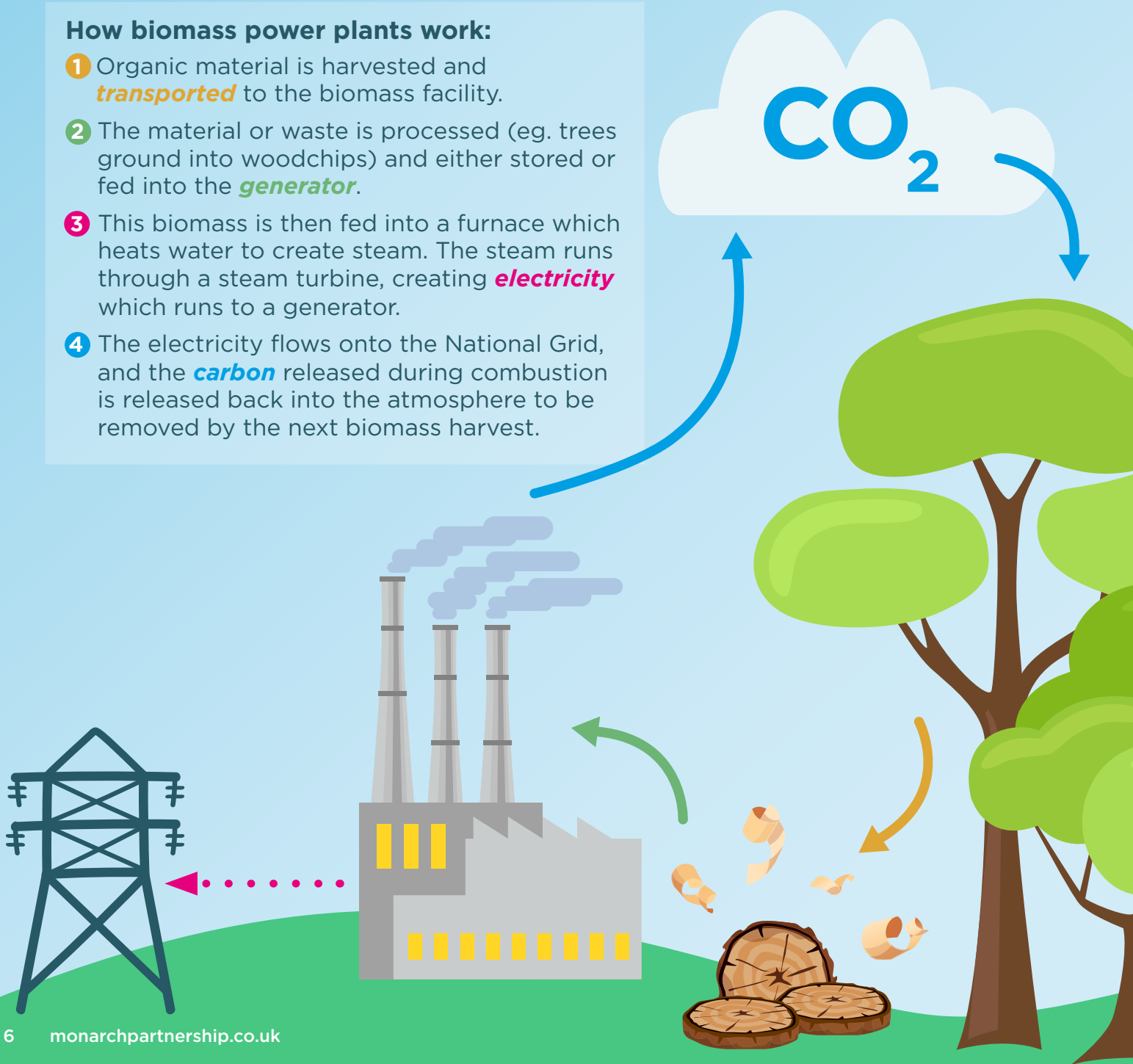
BIOENERGY

Perhaps one of the most versatile renewables, bioenergy is the process of turning organic matter into electricity, carbon-neutral gas, and even transport fuels. According to BEIS, bioenergy accounted for 11.3% of UK power generation in 2019 and 16.7% of capacity. This makes it the second largest renewable energy generator in the UK after wind power.

It's clear from a recent REA report that bioenergy will be an integral part of the UK's path to net zero by 2050. It has already provided a 4% reduction in greenhouse gas emissions, and the biomass industry is worth £6.5bn to the UK economy and sustains 46,000 jobs.⁷

How biomass power plants work:

- 1 Organic material is harvested and **transported** to the biomass facility.
- 2 The material or waste is processed (eg. trees ground into woodchips) and either stored or fed into the **generator**.
- 3 This biomass is then fed into a furnace which heats water to create steam. The steam runs through a steam turbine, creating **electricity** which runs to a generator.
- 4 The electricity flows onto the National Grid, and the **carbon** released during combustion is released back into the atmosphere to be removed by the next biomass harvest.



Pros

Bioenergy could be the quickest and most affordable route to carbon reductions in the heating and gas sector. It can also deliver more energy security to the UK by reducing electricity demand and filling the gap created by recently shelved nuclear projects. Biomass deployment could also prompt a shift towards improved waste management and forestry practices.

Cons

Unlike other renewable energy sources burning biomass does release carbon dioxide, but because carbon was absorbed in the process of harvesting biomass (plants or trees), it is still seen to be a clean energy source by many. Another issue is the transportation of biomass. Wood pellets have been sent to the UK from as far as the USA and Canada, emitting more greenhouse gasses.

The Future of Bioenergy

Bioenergy can make a substantial contribution to the UK's heating needs, thus providing much needed energy stability in times of peak demand. Increased electrification of the energy system is crucial to the UK decarbonisation strategy set out in the Clean Growth Strategy. This will mean an increased need for integration and flexibility across the energy landscape, of which biomass could be the key.

As the UK moves towards its net zero target, "negative emission" technology will trump "low emission" generators. Technology is already emerging that will link bioenergy generation to carbon capture, utilisation or storage (CCUS).⁸ Looking forward, this could then set the scene for carbon negative technologies to be linked to the production of more complex fuels such as biomethane and advanced biofuels.



46,000
jobs created

The total number of jobs from all sectors of the bioenergy industry in 2020 including solid biomass, biofuels, and biogas.⁵



£6.5 billion
economic value

The total economic value of all sectors of the bioenergy industry over the past 10 years in the UK.⁷



291 million
litres of fuel

The amount of verified renewable fuel, mostly comprised of biodiesel and bioethanol, supplied to and used in the UK in 2020.⁹

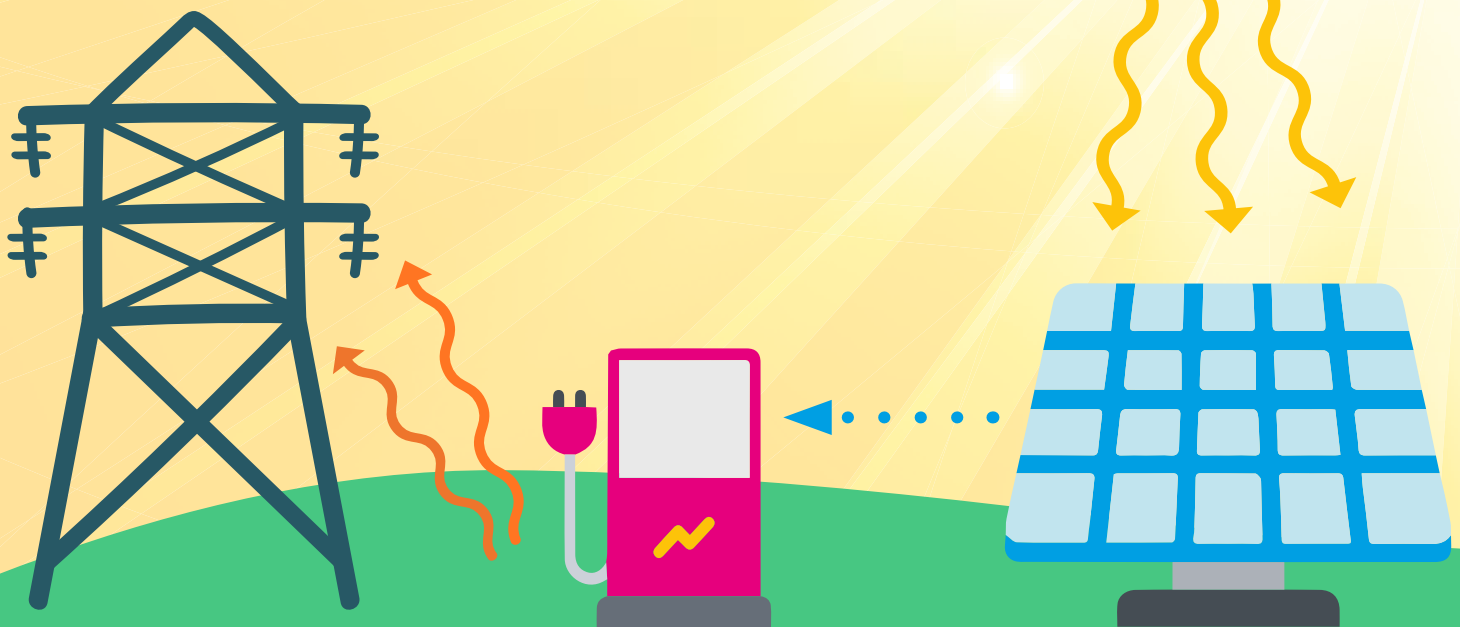
SOLAR ENERGY

Solar energy is the conversion of sunlight into usable forms of energy. Considering the UK isn't renowned for its abundance of sunshine, one would think this isn't a renewable we produce a wealth of. Yet, despite our reputation for particularly moody weather, the UK is the third-largest solar power generator among the EU member states and the sixth-largest worldwide.¹⁰

This is in part because solar has seen impressive growth in the UK, starting with just 95 MW capacity in 2010 and climbing to 13,000 MW in 2019.¹¹ Continued developments in solar technology will sustain that growth; making solar technology longer-lasting, more efficient, and less expensive.

How solar panels work:

- 1 **Sunlight** activates the photovoltaic (PV) cells on the solar panels which convert the sun's energy into electricity.
- 2 Semiconducting materials that sandwich the photovoltaic cells on the **solar panel** energise, creating an electric current.
- 3 This current runs through an **inverter** that converts the DC current into an AC current.
- 4 This **electricity** can now run onto the National Grid or be used by the home or business the solar panels are attached to.



Pros

When the sun is shining, solar power can offer consistent clean energy throughout the day. The modular nature of solar technology also allows for a wide range of applications, from small scale personal units to larger generation facilities. They are an ideal option for homes and businesses to cut utility costs as they are safe, soundless, and require little to no maintenance.

Cons

While the cost of solar technology continues to fall, it is still expensive to install, and though solar power can be generated on cloudy days, they're far more efficient in bright sunshine - making them unreliable in the UK. Lack of storage has been a key disadvantage for solar, but fortunately, storage solutions are improving as technology evolves.

The Future of Solar Power

Plans for the largest solar farm in the UK are currently underway in Kent. Cleve Hill Solar Park was approved in May 2020 and will generate 350MW of electricity.¹² This alone could power 110,000 homes and save 150,000 tonnes of CO₂ annually. Beyond photovoltaic solar, solar thermal electricity and solar heating and cooling systems could revolutionise the energy landscape through integration, saving consumers money, creating jobs, and reducing our dependence on imported energy in the future.

However, due to Covid's economic impact as well as dwindling support from the government, solar energy's steady rise may begin to see a slight decline. The popular feed-in tariff scheme that prompted last year's surge in solar installation by homes and businesses across the UK ended in April 2019, and growth consequently slowed. While offshore wind has become 2020's renewable champion, solar cannot be overlooked or forgotten.



20,400
solar industry jobs

The number of workers employed in both solar photovoltaic and solar heating/cooling in the UK in 2019.⁵



2,728,646
tonnes reduced

The carbon emissions avoided in generating energy through solar capacity instead of fossil fuels.¹²



4,525,958
powered homes

The number of homes that could be powered based on the total solar capacity in the UK in 2019.¹³

HYDROPOWER

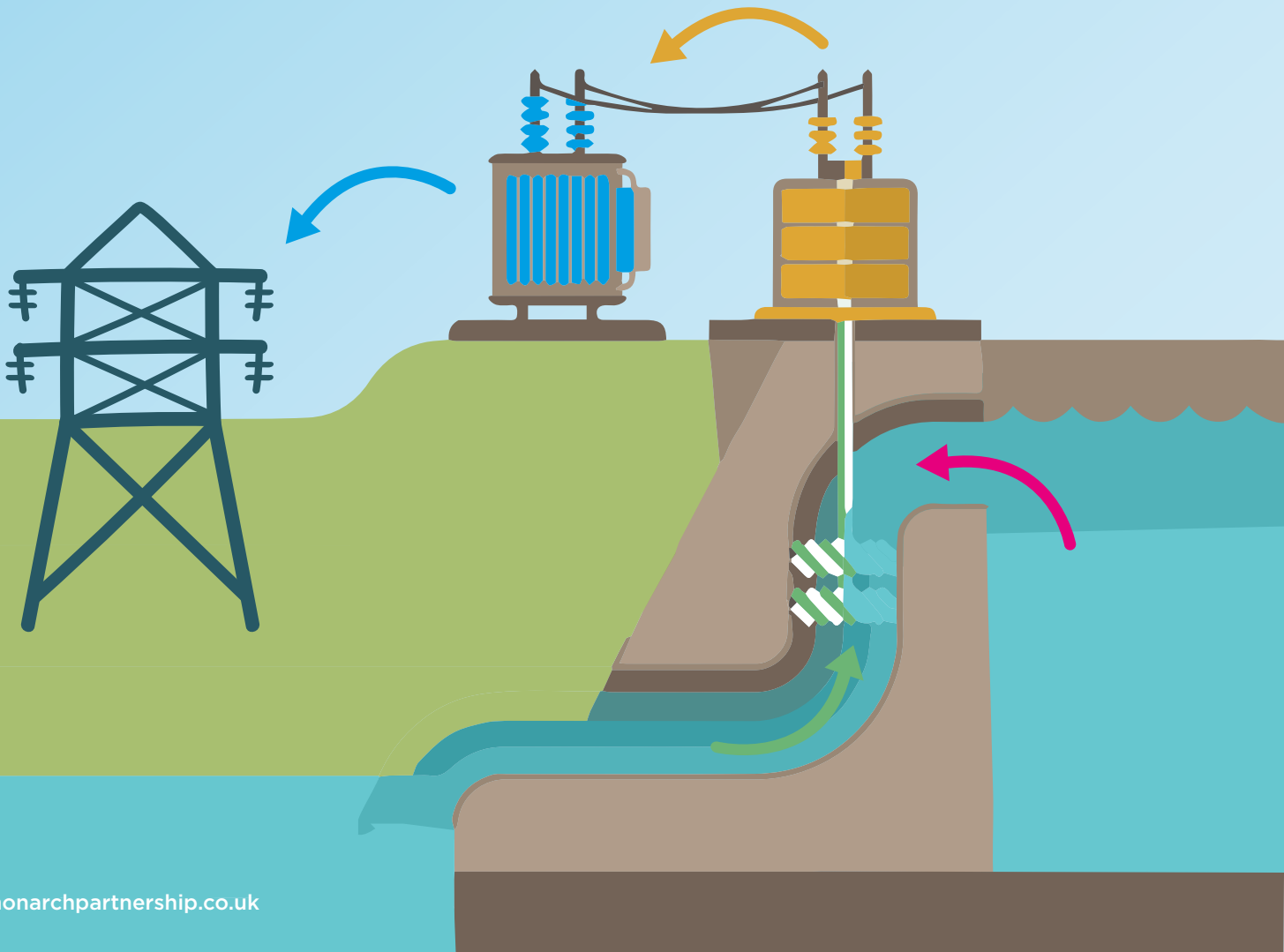


One of the oldest power sources on the planet, hydropower is clean, reliable, and cost-efficient. While it hasn't seen substantial growth in the UK over the past 10 years, it still continues to add to the UK's clean energy mix, contributing around 5% to renewable electricity generation in 2018.¹⁴

There are different types of hydropower, the most widely used being hydroelectricity.

How hydroelectric dams work:

- 1 **Water** is released through the dam.
- 2 The force of water spins a **turbine** connected to a generator.
- 3 The **generator** produces electricity, while the water carries on to the river.
- 4 The electricity is run through a **transformer** and onto the grid.



Pros

Generated by a constant flow of water, hydropower is reliable, efficient, flexible, and cost-efficient. Hydropower plants can easily control the amount of electricity produced and the energy created from water can also be stored in large quantities and fed onto the grid as and when it's needed.

Cons

Whilst the energy generation itself is inexpensive, the initial construction of hydropower dams is costly. They've also been known to have a negative impact on wildlife and surrounding communities.

The Future of Hydropower

Looking forward, hydropower could have the potential to compete with nuclear power. However, so far, growth in hydropower capacity in the UK has been slow overall. Scotland and Wales continue to lead the way, but the government's rejection of the ambitious 'Swansea Bay Tidal Lagoon' project off the coast of South Wales was a setback for the industry. For the rest of the UK, repurposing existing watermills may make a modest but not insignificant contribution to the local energy landscape.

Ocean Energy

Tidal and wave power are extremely untapped resources in the UK. Especially considering Europe holds around 30% of global tidal resources, most of which can be found in and around the coastlines of the UK. In fact, the UK's coastlines have 50% of Europe's tidal energy and 35% of its wave energy. If the UK was to monopolise on the benefits of being surrounded by ocean, this global market could grow to £76 billion by 2050.¹⁵ Not to mention, tidal and wave are consistent, predictable power sources that can help balance other renewable energy generators. Like all renewables, ocean energy has its flaws, most importantly the environmental impact tidal power has on marine life. However, these are renewables to be further embraced and improved upon, as a way to reach our net zero goal by 2050, and revitalise the UK's coastal communities.



5,900
jobs created

The number of jobs in hydropower as of 2019. This covers both large scale plants and small scale micro-generation projects.⁵



£639 million
annual turnover

The approximate annual industry turnover from hydropower in the UK as of 2018.¹³



25,229,000
powered homes

The number of homes that could be powered based on the capacity of the three largest hydroelectricity plants in the UK.¹³

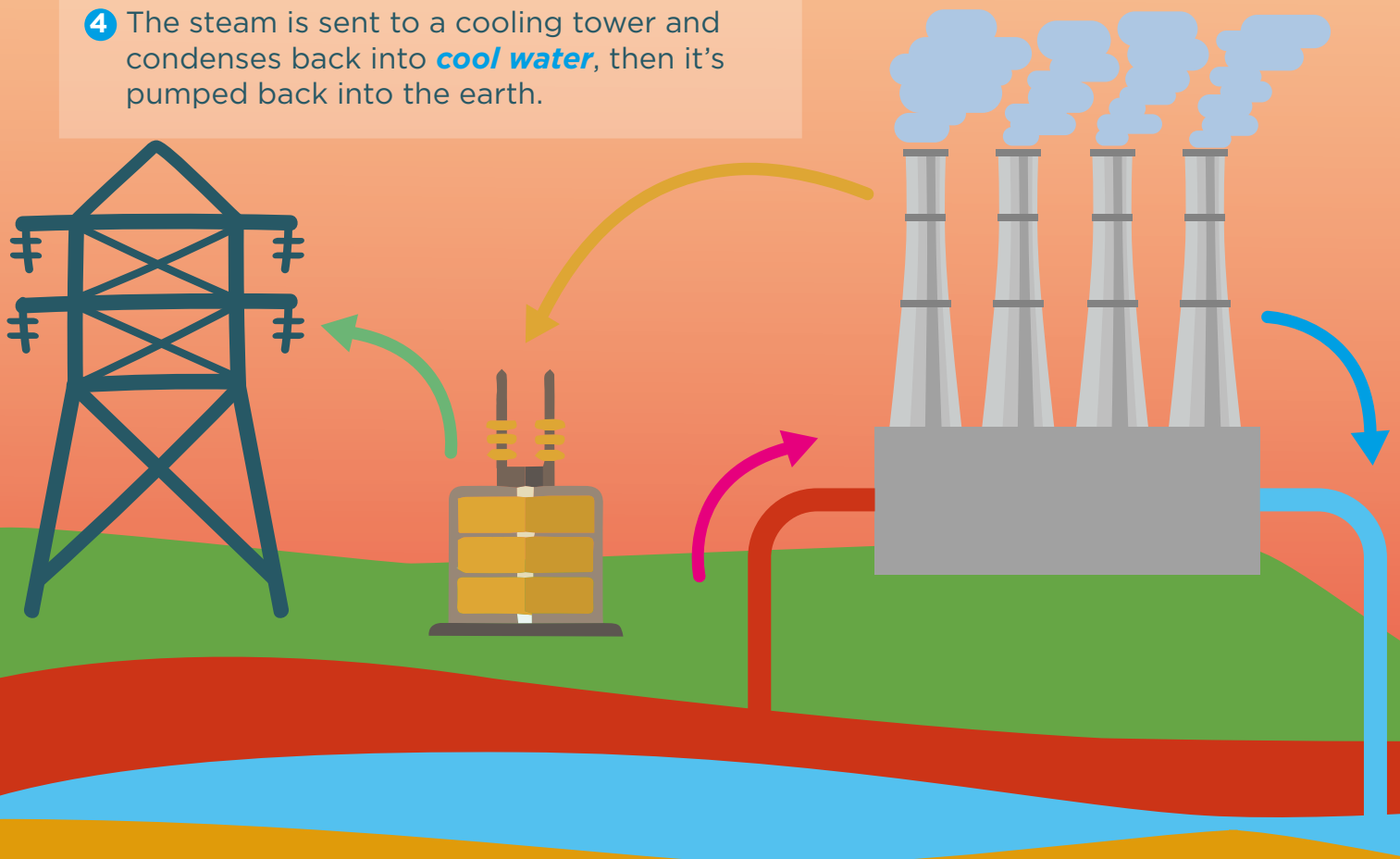
GEO THERMAL

Geothermal energy is, quite simply, heat stored beneath the earth's surface. Whilst it's made very little impact on the energy landscape in the UK thus far, we were once pioneers of the power source. Bath's Roman thermal baths are just a taste of the UK's geothermal potential. Geothermal electricity generation could challenge nuclear power in the UK, and its heating applications could revolutionise district heating systems across the country, playing a huge part in energy integration as we stride towards net zero.

There are different types of geothermal power generation. Geothermal heat pumps are already being used in the UK, while deep geothermal power generation is beginning to be explored.

How geothermal power plants work:

- 1 **Hot water** is pumped from deep underground under high pressure
- 2 The pressure drops when the water reaches the surface, turning the water into steam. This turns a turbine connected to a **generator**, creating electricity.
- 3 The electricity is sent to a **transmitter** and then onto the national grid.
- 4 The steam is sent to a cooling tower and condenses back into **cool water**, then it's pumped back into the earth.



Pros

When it comes to deep geothermal power generation, it is strong and consistent enough to challenge nuclear power, especially considering safety. It's very durable with a long lifespan and low maintenance costs. The financial benefits to consumers for both Geothermal heating and electricity generation are also significant. Geothermal electricity can offer savings up to 80% over conventional energy usage, and heat pumps can use 25% - 50% less electricity than conventional systems. It's also scalable, which for renewable energy is a huge advantage.

Cons

The extraction of geothermal energy from the ground does lead to a release of greenhouse gases, although the amount is nowhere near that emitted by fossil fuels. And whilst the costs for upkeep are fairly low, and there are financial gains once installed, the initial cost of exploration and installation is high.

The Future of Geothermal

The geothermal industry is currently lagging behind other renewables,

contributing only 4.4% of the UK's renewable energy generation in 2017.¹⁶ This is in part because geothermal has historically relied on large plants that require ample space and resources. However, the next generation of geothermal is likely to offer modular, scalable solutions as well as powerful new applications that could make geothermal an essential part of the UK's clean energy future.

Currently, Southampton is the only UK city to benefit from a geothermal district heating station, which provides heating for many of their main buildings, hotels, flats, and the Southampton port. Cornwall will be stealing that crown though, with the Eden Project securing £17 million for their geothermal well and construction of the recently completed United Downs, the deepest well in the UK.¹⁷ Then there's the Aquarius North Sea Geothermal Consortium, recently formed by dCarbonX Ltd, ZeGen Energy Ltd & Ross DK A/S, which will focus on exploring and developing the UK's deep offshore geothermal resources.

Overall geothermal in its various forms could have plenty to offer the UK if we are willing to explore its full potential.



9300 MW
generation capacity

Whilst not yet exploited, there is enough geothermal activity in England alone to generate as much electricity as 9 nuclear power stations.¹⁸



166%
UK homes heated

There is enough geothermal activity to supply heat for 166% of homes in the UK if fully utilized. Wessex alone could heat 80% of the UK's homes.¹⁶

NEXT STEPS

How Can We Help

The importance of being an environmentally responsible business has never been more prevalent. With ambitious carbon reduction goals being set by the government, as well as a huge push for renewable energy, it's clear that sustainability is the way forward.

Monarch takes a holistic approach to sustainability management; finding longevity in every aspect of your organisation from renewable energy procurement and carbon compliance to efficient cost management.

Our energy and sustainability consultants have extensive experience working with organisations to identify, prioritise and monitor the required steps to strategically reduce their carbon footprint and environmental impacts.

There are many ways you can make your business cleaner and greener. Here are a few of the services we offer to help you reach your sustainable goals.

“Policy demands robust efforts for climatic impact, so why not utilise government subsidies? By investing in cheaper utility costs, it helps sustain an organisations future.”

Stephanie Strange, Carbon Consultant at Monarch Partnership

A Sustainable Management Plan

Our consultants use industry-leading insight across the sustainability sector to provide advice on key policies and actions.

Carbon Compliance

We provide bespoke reporting to ensure that you have real visibility of your energy and carbon emissions both at organisational and site level.

Renewable Energy Procurement

We secure a higher proportion of energy from onsite low-carbon/renewable energy sources as well as reviewing your utility providers to identify opportunities for CO₂ and financial savings.

On-site Generation Projects

From solar and wind to combined heat and power, we can help you discover new ways of generating and storing energy.

Get in touch TODAY!

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www.monarchpartnership.co.uk



USEFUL WEBSITES

Want to learn more about renewable energy?
These organisations offer useful resources.

International Renewable Energy Agency

<https://www.irena.org/>

Renewable Energy Association

<https://www.r-e-a.net/>

Carbon Trust

<https://www.carbontrust.com/>

Cornwall Insights

<https://www.cornwall-insight.com/>

International Energy Agency

<https://www.iea.org/>

BEIS

<https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy>

Monarch Partnership Insights

<https://monarchpartnership.co.uk/news/>

**To view the detailed references
for this guide, visit:**

<https://monarchpartnership.co.uk/wp-content/uploads/Resources.pdf>

Funding & Grants

ECAs

Enhanced Capital Allowances provides businesses with tax relief for investments in energy-saving equipment.

Bio-energy Capital Grants Scheme

Run by the Department of Energy and Climate Change (DECC), this grant supports biomass-fuelled heat, and combined heat and power projects in England.

Renewable Heat Incentive (RHI)

This UK government scheme aims to encourage the use of renewable heat solutions.

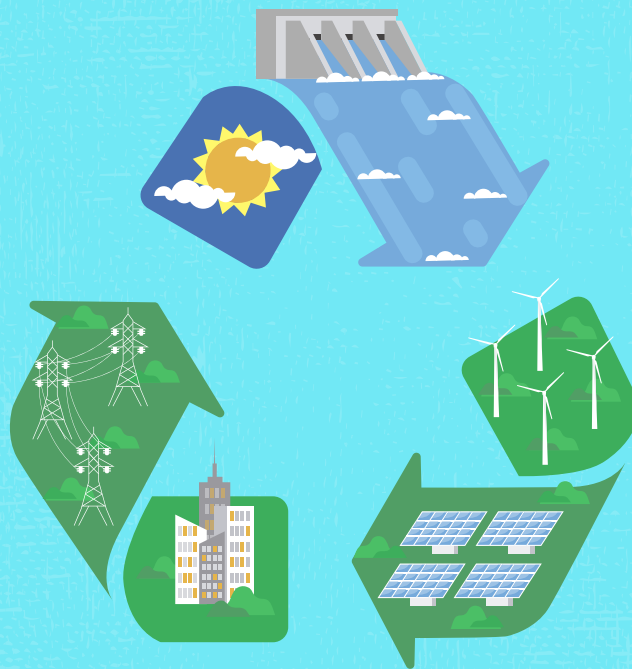
Green Business Fund

Carbon Trust's Green Business Fund is a support service for small and medium-sized businesses.

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