

REVIEW24

RENEWABLE ENERGY VIEW



THE AUTHORITATIVE ANNUAL REPORT ON THE UK'S RENEWABLE ENERGY AND CLEAN TECHNOLOGY SECTOR, MAPPING THE ENERGY TRANSITION ON THE PATH TO NET ZERO

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A FUTURE BUILT ON RENEWABLE ENERGY AND CLEAN TECHNOLOGY



The REA, or the Association for Renewable Energy and Clean Technology, is the UK's largest trade association for renewable energy and clean technologies with around 500 members operating across heat, transport, power and the circular economy. We represent fourteen sectors, ranging from composting, biogas and renewable transport fuels to solar and electric vehicle charging.

IF YOU believe, as we do, that renewable energy and clean technology is central to the UK's future growth, prosperity and energy security . . .

IF YOU know, as we do, that the potential economic benefits on offer from a green economy points to tens of thousands of new jobs, and billions in added value . . .

IF YOU are serious, as we are, about tackling climate change, and mitigating the impacts of environmental, social and economic disaster, and know that accelerating the roll-out of renewable energy and clean technology has a vital part to play . . .

JOIN US and together, we will work towards a Net Zero future and a greener, more prosperous economy.



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Foreword

Time for Renewable Energy Action

Trevor Hutchings, REA CEO

Welcome to REview 24, the annual report from the Association for Renewable Energy and Clean Technology (REA). As one of the UK's most authoritative assessments of the renewable energy and clean technology sector, REview 24 provides a clear picture of the progress being made in the energy transition toward net zero, covering 2023 and looking ahead to 2035 and beyond.

Since the release of REview 23 in October 2023, the energy policy and regulatory landscape has undergone a series of significant developments. During the first half of the year, positive developments such as the Energy Act passing into law were offset by the weakening of key energy targets and by mounting and often ill-informed political debate on the cost of net zero.

July's general election however brought a noticeable shift in pace and priorities. The result delivered a strong mandate to pursue green policies, with a significant majority of MPs elected on a ticket recognising the enormous potential of the renewable energy sector. The new administration has moved swiftly, with major announcements on grid infrastructure, planning, and clean technology. Yet, as promising as these early steps are, questions remain. There is still uncertainty around how policies will evolve, especially concerning GB Energy and tricky areas like electricity market reform, and whether a cohesive, cross-departmental strategy can be fostered within Whitehall to achieve the government's bold target of clean electricity by 2030.

Amidst these policy and regulatory challenges, the renewable energy and clean technology sector has proven its resilience. Renewables have continued to demonstrate their reliability and cost-effectiveness, with technologies such as solar and wind now cheaper than new gas fired power stations. Advances in technology, economies of scale, and a sustained wave of investment have driven the cost of renewable electricity down sharply. Subsidy-free solar farms are already operational in the UK, proving that while government incentives help prime the market, they are not required indefinitely. With innovation pushing boundaries and capacity scaling up, this trend shows no signs of slowing, making the transition to renewable power – and with it jobs, growth, energy security and reduced emissions –

increasingly achievable.

The impressive growth in the sector ⁽¹⁾ is evident from the latest statistics set out in REview 24. The total market value of the sector reached £24.38 billion in 2022/23, marking a 6% increase from the previous year. Employment in the sector also rose, reaching 142,981 FTEs, a 1.6% increase from 140,760 FTEs. Notably, solar PV and biofuels have emerged as high-growth areas, with market values for solar PV climbing 24.5% to £1,095 million and biofuels increasing by 18% to £2,909 million. Employment in solar PV also saw a notable rise of 5.9%, bringing the total to 8,347 FTEs, while offshore wind employment grew by 4% to 32,685 FTEs. These figures underscore the sector's expanding role in driving economic growth and job creation. Looking further forward, we estimate that the UK's renewable energy sector is on a trajectory of substantial growth, with total market value projected to reach £41.14 billion in 2035.

For international comparison, the UK had the fifth highest capacity of renewables installed in Europe ⁽²⁾ and was ranked as the highest in the world for attracting global Foreign Direct Investment (FDI) in the sector ⁽³⁾.

The pace at which renewables and clean technology are scaling is also reflected in the broader economy. In stark contrast to stagnating GDP growth (just 0.1% in 2023), the UK's wider net zero economy expanded by 9% last year ⁽⁴⁾. Investments aligned with achieving net zero could create approximately 180,000 full-time jobs by 2035, with hundreds of thousands more indirect jobs created throughout supply chains⁽⁵⁾. The economic impact of transitioning to renewable energy is profound: not only is it crucial for the climate, but it also promises to drive job creation, regenerate coastal and rural communities, invest in new manufacturing opportunities, lower energy bills for families and businesses, and improve energy security.

“ THE INDUSTRY IS CURRENTLY ON TRACK TO SUPPORT MORE THAN 180,000 JOBS BY 2035. WITH THE RIGHT ENVIRONMENT, THE GOVERNMENT CAN ENSURE THAT THESE FIGURES ARE EXCEEDED, AND THE UK CAN BE A WORLD-LEADER. ”

Decision makers are tackling the need for stronger energy security and shifting public perceptions of the green transition. Renewables continue to offer a path to greater energy independence, reducing reliance on fossil fuels and enhancing

the UK's energy resilience. However, the transition to clean energy is not just about technological advancements – it requires active consumer participation. Individuals and communities must be empowered to adopt renewable technologies and energy-saving practices. Currently, the government is not doing enough to support consumers in making these crucial choices. To ensure the green transition is both effective and equitable, policymakers must implement measures that facilitate consumer involvement and address their concerns about costs and impacts. By bridging this gap, we can drive a successful transition to net zero that benefits everyone.

At the REA, we are fortunate to work alongside a dedicated group of experts whose insights and thought leadership enrich this report. Their contributions offer a thorough analysis of the current state of the sector, along with a clear path forward. Through their input, REview 24 provides a clear view that net zero and a renewable energy system is within our grasp. We will continue to serve our members' interests operating across the entire sector and in our strategic priorities areas covering power and flexibility, heat and cooling, transport, green finance and circular bioresources.

The REA remains steadfast in our commitment to support all our members across the renewable energy and clean technology landscape. As we look ahead, we are eager to see the Great British Energy Bill implemented swiftly and effectively. We also look forward to continuing cross-sector collaboration, ensuring that we take the bold, collective steps required to accelerate the green transition.

Let's make 2025 a turning point, a year defined by progress, innovation, and action. Together, we can deliver a net zero future for the UK.



Trevor Hutchings

Chief Executive, REA

¹ Our definition of the sector includes the following technologies: air and ground source heat pumps, AD, biofuels, biomass boilers, biomass CHP, dedicated biomass power, Energy from Waste (EFW), geothermal, hydro power, landfill gas, offshore wind, onshore wind, solar PV, solar thermal, wave and tidal, and the production of biomass.

² IRENA, 2024, 'Renewable Energy Capacity Statistics', Renewable Energy Capacity Statistics 2024 (irena.org)

³ FDI, 2024, 'FDI's Global Renewable Energy Leaders ranking', UK heads global renewables FDI league table | FDI Intelligence – Your source for foreign direct investment information - FDIIntelligence.com

⁴ ECIU, 2024, <https://eciu.net/analysis/reports/2024/the-uks-net-zero-economy-2024>

⁵ Smith School, Oxford University, 2024, <https://www.ox.ac.uk/news/2024-05-24-adopting-net-zero-technologies-will-save-uk-economy-billions-finds-smith-school>

Executive Summary

The 2024 report on the State of the Industry

The energy transition continues apace, as this year's REview reveals record high percentage growth in certain energies. In other areas, we have seen less growth and therefore more cause for concern.

Renewables and Organics deployment

Overall, the percentage of the UK's total energy consumption from renewables is 15.5% in 2023, up from 14% in 2022. This finally hits our legacy EU target for renewables to supply at least 15% of the UK's energy demand, our original benchmark for this report, a year after the 2022 deadline. The breakdown shows renewables providing 47.2% of power, 9.4% of heat, and 6% of transport demand. Looking at power and flexibility, renewables' share of total electricity generation increased, now accounting for 47.2% of all generation, up from 41.7% in 2022.

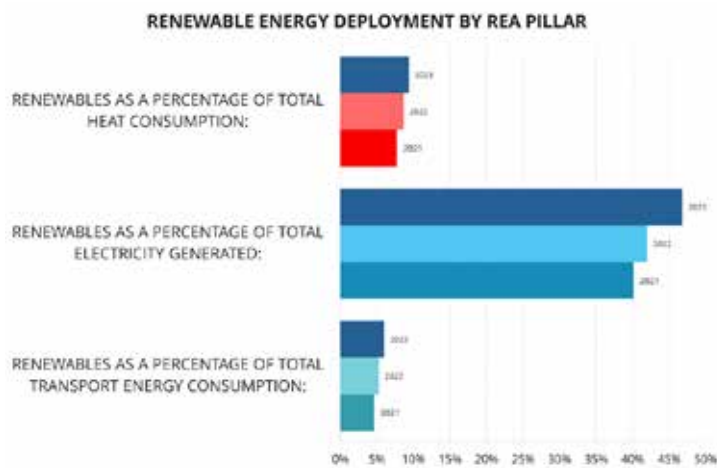


Figure 1: Share of Renewable Energy by Heat, Electricity and Transport. REA, 2024

This continues a significant upward trend, with renewable energy's contribution growing from less than 15% of total generation in 2013 to nearly half within a decade. Wind (combined offshore and onshore) is the largest source of renewable power in the UK, contributing around 28.7% of renewable power generation in 2023. Offshore wind is the larger of the two, and its share of power generation is set to grow even further through 2025 as further projects come online. Given the recent lift of the de facto ban on onshore wind, we expect to see growth in this area too. Bioenergy (including biomass power, anaerobic digestion and energy from waste) remains the second most important category of renewable power generation, contributing 11% in 2023.

In terms of heat and cooling, low-carbon heat

15.5%

UK'S TOTAL ENERGY CONSUMPTION FROM RENEWABLE SOURCES IN 2023

has increased from providing 3.7% of the UK's heat demand in 2013, to 9.4% in 2023. The bulk of renewable heat generation continues to come from biomass and wood heat combustion, reflecting the success of modern biomass boilers for businesses and households.

Recent growth in this area has been subdued, however, due to a lack of support since the end of the Renewable Heat Initiative. The other main sources of renewable heat, anaerobic digestion and heat pumps, saw modest growth, and we wait to see the Government's policy on the Green Gas Support Scheme and Boiler Upgrade Scheme to ensure continued growth in these areas. As in previous REviews, heat from geothermal energy remains heavily underutilised given its potential for the sector, and this is an area the REA is actively working on with Government.

For the circular bioresources sector (which has a lag in data compared to other sectors covered in the report) household waste recycling rose modestly in 2021, with varying degrees of improvement across the four nations. Wales is a world leader in this area, while Scotland achieved a record high rate of recycling across businesses, households and the public sector with a rate of 62%. Data collection and quality issues continue to make analysis difficult when it comes to composting. However, highlights include that England has produced 18.5% more quality compost in 2023 compared to 2022, and the UK as a whole produced 8.5% more quality digestate in 2023 compared to 2022.

Looking at the transport sector, overall, renewables powered vehicles accounting for 6% of the UK's transport demand in 2023, up from 5.3% in 2022.

The number of new zero emissions vehicles (ZEVs) continues to rise, to 250,000 new vehicles registered in 2023, although as a percentage of new sales, ZEVs have plateaued, partly due to policy uncertainty from the previous government. Both the volume and percentage numbers should rise in the coming years in line with the ZEV mandate. Encouragingly, the number of electric vehicle charging devices also continues to increase rapidly. In June 2024, there were over 60,000

public chargepoints in the UK, up by over 15,000 from the same time the previous year.

In terms of renewable transport fuels (RTFs), based on 2023 data, renewable fuels made up 8% of total road fuels supplied, saving on average 82% on GHG emissions compared to the use of fossil fuels. Biodiesel and bioethanol form the largest components consumed, yet their share of the total is declining. This is against the backdrop of development fuels, chiefly hydrogenated vegetable oil, having grown significantly in recent years.

Economic value of the sector

Once again, we have partnered with Innovas to produce estimates on employment and market values across 14 sub-sectors of the renewable energy sector. We estimate in 2022/23 the value of the sector now stands at £24.38bn, up 6% on 2021/22. In terms of employment, we estimate the sector employs 142,981 full-time equivalents, an increase of 1.6% since 2021/22. Solar PV has shown the highest growth in employment (24.5%), followed by biofuels (18%) and offshore wind (4%) also performing strongly. We have published a breakdown for each nation and region of the UK in the report.

Policy changes to drive the sector further forward

Last year's REview contained the REA manifesto ideas for the Government and all other political parties ahead of the general election this year. Many of these policies were adopted in the manifestos of the major parties, including Labour. Now that we are in the early term of a new Government, we have set out what we believe should be the foundations for successful policy across each of the REA's strategic pillars (heat and cooling, power and flexibility, transport and circular bioresources). These can be seen at the end of the respective chapter.

Supporting these policy ideas are a set of cross-cutting proposals that reach across sectors and will be vital to securing the energy transition across all areas. These proposals are outlined below. The Government should:

- Establish an Office for Net Zero Deployment, as recommended within Chris Skidmore's Net Zero Review, and further developed by the Energy Research Accelerator's Policy Commission as the Net Zero Delivery Unit, ensuring it can hold government to account against sustainability and net zero targets.
- Announce a government commission to

identify any gaps in existing guidance, building on the strength of existing regulations, to ensure best practice in relation to installations, supply chains and maintenance and operations for all technologies.

- Conduct a Treasury review of the Green Book, which is used to assess government policies, programmes and projects and ensure full integration of the findings from the 2021 Treasury Net Zero Review.
- Announce a UK Green Taxonomy which will institute strong definitions for UK green financial activities. This will ensure a transparent definition for 'green' investments, as well as further UK global leadership in green financial products.
- Consult on a comprehensive programme for green jobs training including re-skilling from existing industries, beyond the North Sea transition deal, to ensure there are enough skilled staff available to roll out Net Zero technologies at scale in the UK.
- Guarantee an effective environment for Net Zero hydrogen production, by ensuring delivery of allocation rounds for the Low Carbon Hydrogen Business Model in 2025.
- Address planning and grid constraints across energy infrastructure and the Circular Economy.

State of the Industry 2023 – Key Facts and Figures from REview 24

Energy Transition Progress

- **UK's Total Energy Consumption** from renewables has risen to **15.5% in 2023** (up from 14% in 2022), finally meeting the EU target.
- **Renewable energy sources** supply **47.2% of electricity, 9.4% of heat, and 6% of transport demand**.

Sector Highlights

Power and Flexibility

- **47.2%** of UK electricity is now from **renewable sources** (up from 41.7% in 2022).
- **Wind Power** leads the way, contributing **28.7%** of renewable power.
- **Bioenergy** provides **11%** of renewable electricity, with biomass as a key source.

Heat and Cooling

- **Low-carbon heat** meets **9.4%** of heat demand, up from **3.7%** in 2013.
- **Biomass** remains the largest source, but growth has slowed since the end of the Renewable Heat Incentive.

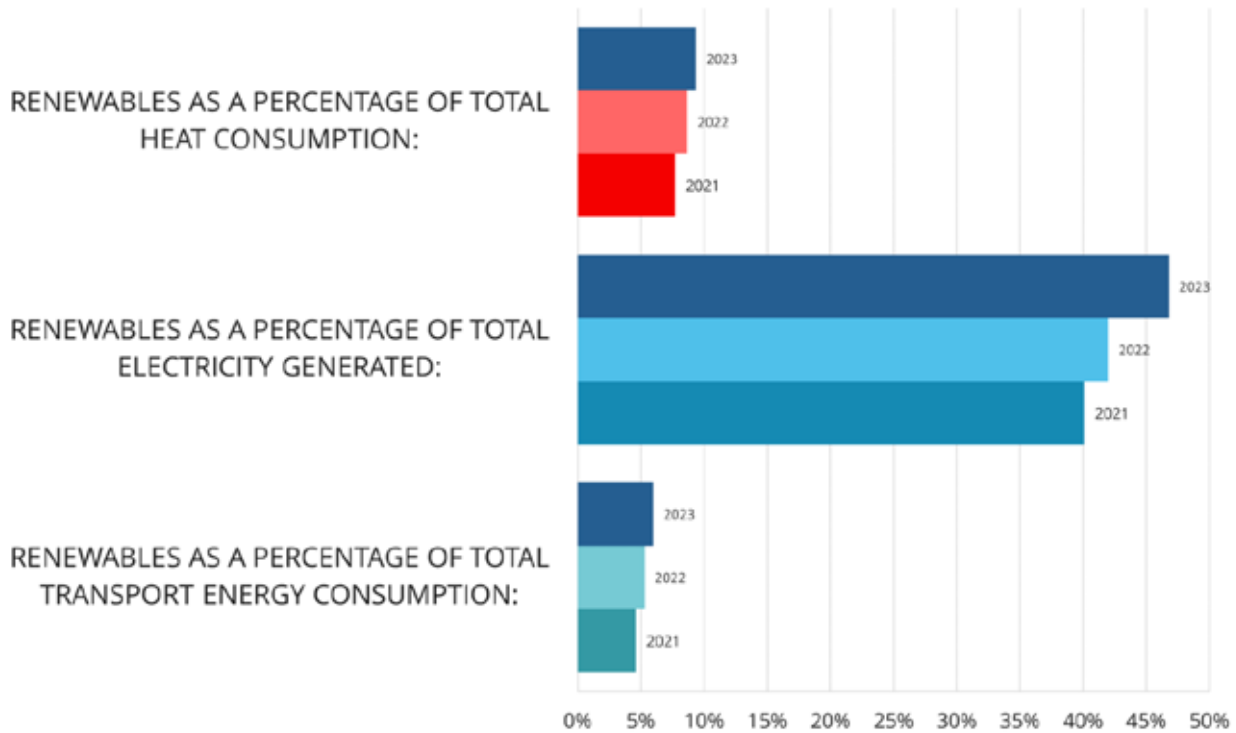
Circular Bioresources

- Overall **UK** household waste recycling was 44.1%; **Wales** leads globally, and **Scotland** achieved a **62%** recycling rate.
- Compost and digestate production rose by **18.5%** and **8.5%**, respectively.

Transport

- **Renewables in transport** rose to **6%**, and **250,000 zero-emissions vehicles (ZEVs)** were registered in 2023.
- **Over 60,000 EV charge points** now available in the UK, a **15,000+ increase** from last year.
- **Renewable Transport Fuels (RTFs)** make up **8%** of road fuels, saving **82%** in GHG emissions compared to fossil fuels.

RENEWABLE ENERGY DEPLOYMENT BY REA PILLAR



Economic Value and Employment

- The **renewable energy sector** is valued at **£24.38 billion**, up **6%** from 2021/22.
- Employs **143,000 people** across 14 sub-sectors.
- **Solar PV** leads job growth at **24.5%**, with **biofuels** at **18%** and **offshore wind** at **4%**.

Policy Recommendations for Growth

- **Establish an Office for Net Zero Deployment** to monitor targets.
- **Launch a UK Green Taxonomy** to standardise definitions for green investments.
- **Expand green jobs training** programmes to reskill workers and meet Net Zero goals.
- **Address planning and grid constraints** to support infrastructure and the Circular Economy.

Conclusion

The UK's renewable sector shows robust growth, yet critical policy changes are needed to meet net zero targets and accelerate the energy transition.

A message from our sponsors

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There is one re-occurring theme in all recent climate reports: we're not doing enough to tackle carbon emissions to avoid the very worst impacts of climate change. In its most recent publication, the United Nations Intergovernmental Panel on Climate Change (IPCC) stated that to preserve a sustainable environment on Earth, carbon emissions need to reach their highest point by 2025 and then decline by 43% by the close of the decade. Instead, we are currently on track for a 14% projected rise in the amount of carbon dioxide being emitted to atmosphere.

Adding complexity, the UK will face an energy security crunch point later this decade due to challenges in bringing new, clean baseload and dispatchable capacity online in time to meet increasing energy demand. By 2028 the UK's power demand is set to exceed secure dispatchable and baseload capacity by 7.5 GW at peak times which equates to power for about 17.5 million homes.

This all underlines a clear need for a transformation of our energy system, and a critical role for renewable and dispatchable sources of power within it.

At Drax we are well prepared to rise to this challenge – innovation and transformation is part of our history.

Drax Power Station generated its first watt of electricity half a century ago – 2024 is our 50th anniversary. When it was first commissioned, the power station represented the cutting edge of coal power technology and following expansion in the early 80s, it became the largest coal-fired power station in Western Europe.

Since then, the world has woken up to the threat of climate change and we have seen nothing less than a seismic shift in the energy landscape.

Drax has wholly embraced this, transforming from coal power into the largest single site renewable energy generator in the country, providing power for 4 million homes. We converted our coal units to run on sustainable biomass – pellets made from woody fibre sourced from sawmill residues, harvesting residues, and fibre which has little other use or market value. This change reduced our generation scope 1 and 2 emissions by ~99% since 2012.

And over the next 5 years, we plan to convert from the UK's largest power station to the world's largest carbon removal project using bioenergy with carbon capture and storage – or BECCS for short.

BECCS is the only technology that can generate reliable renewable power while simultaneously removing carbon dioxide from the atmosphere.

This dual functionality places it at the heart of the UK's strategy to combat climate change and decarbonise the power system. The latest National Grid ESO Future Energy Scenarios report shows that BECCS will be needed from 2030 on all pathways to net zero. BECCS, and other carbon removal technologies like it, quite literally put the 'net' in net zero.

With government support to unlock our £2 billion investment, we plan to have BECCS up and running by 2030. BECCS at Drax will create and support up to 10,000 high quality jobs during construction and help government deliver its clean energy mission. While 2030 may seem a long way away, in the world of engineering and construction, it is tomorrow – particularly for a project of this size, scale and ambition. Time is of the essence.

Our plans extend beyond BECCS and we're simultaneously progressing with our planned £500m expansion of our Cruachan Pumped Storage Hydro station in Argyll and Bute, Scotland which will add 600MW to our current generation capacity, bringing it to over 1GW – enough to power over two million homes.

With the right support from the UK Government, we can begin work on these two critical projects and deliver much needed energy security for the UK all while continuing to help decarbonise the energy system.

**Richard Gwilliam,
UK BECCS Programme Director, Drax**



REA POLICY STRATEGY REVIEW

Update on the REA's Policy Strategy Targets

The REA's 2021 Strategy set out how the sector can reach Net Zero by 2050. Below you can see updates to our interim targets.

Our recommendations for reaching the targets for each pillar are set out after each section in the report.

INTERIM GOALS ALONG THE PATHWAY

CIRCULAR BIORESOURCES

By the end of 2023 all bio-waste is either separated and recycled at source or is collected separately and is not mixed with other types of waste.

Organics recycling is recognised in the reformed Packaging Producer Responsibility System.

STATUS UPDATE:

Due to legislative delays from Covid and political changes, bio waste separation at source or separate collection is now expected to be in place by 2026. Recycling is included in reform of the Packaging Producer Responsibility System.

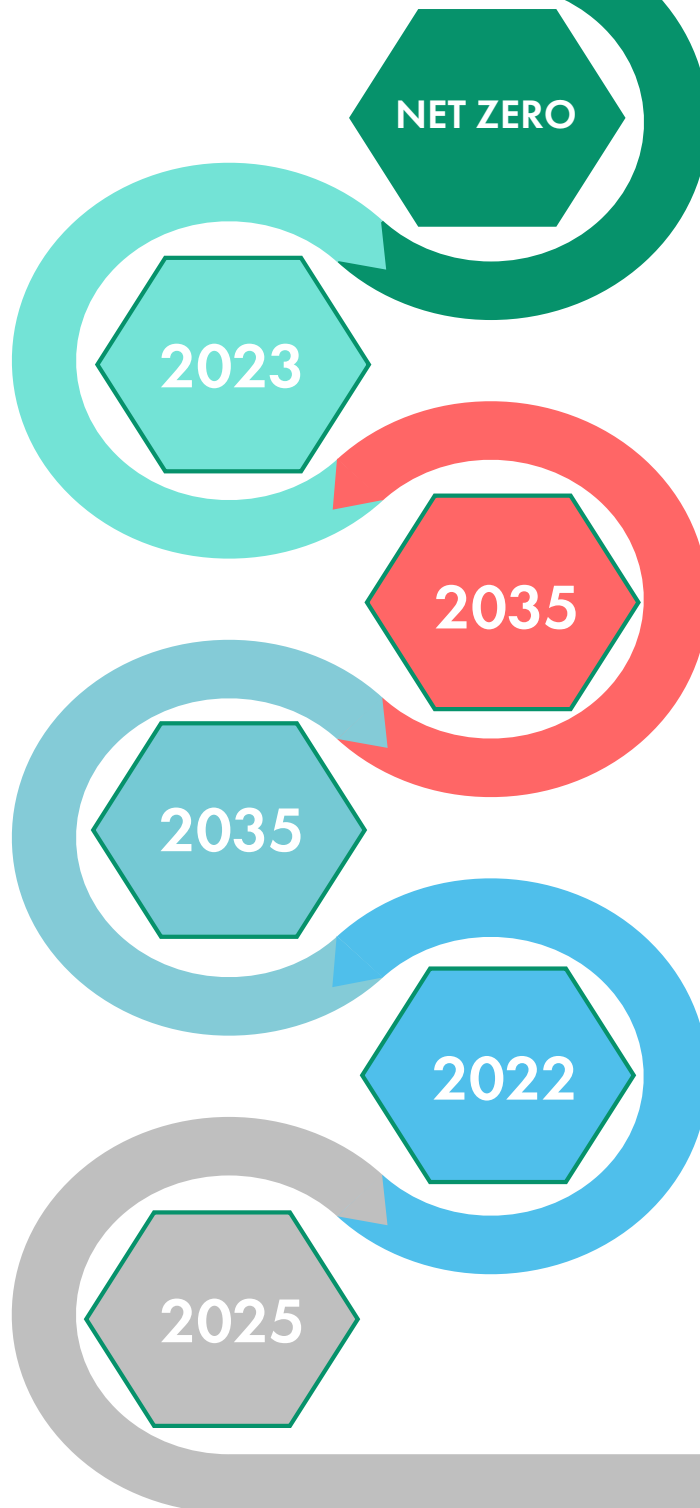
TRANSPORT

By 2035, renewable fuels and electricity are the majority source of energy used in the transport sector.

FINANCE

Finance and investment groups invest more in net zero agenda and drive corporate Environmental, Sustainability Governance (ESG).

Tipping the balance away from a fossil fuel-based economy by 2025.



The UK transitions to 100% renewable energy and clean technology by 2050 delivering Net Zero CO₂ emissions, improving and valuing natural capital.

HEAT & COOLING

Renewables and clean technology solutions are the dominant form of heat by 2035.

POWER & FLEXIBILITY

Renewable power generation is the largest producer of TWhs by end of 2022, facilitated by clean technologies which operate in a deep and transparent flexibility markets.

STATUS UPDATE

Achieved - 2023 was the greenest year for the UK's electricity system ever, with renewables providing 41.7% of the country's power supplies across 2022, the largest single source (beating fossil fuels at around 40% and nuclear at c.15%). More work is still to be done on flexibility markets to allow for national, deep markets, however the Demand Flexibility Service (DFS) service is now operational on a national basis, providing some progress here.

Deployment: Power & Flexibility

Renewable Power Generation Summary

In 2023, total renewable electricity generation remained stable with that of 2022, with just under 135,000 GWh produced from renewable sources. This is despite an increase in installed renewable generation capacity, which rose from 53.5 GW in 2022 to 56.1 GW in 2023. However, infrastructure limitations, climatic factors, and market constraints prevented an increase in overall generation.

Nevertheless, renewables' share of total electricity generation increased, now accounting for 47.2% of all generation, up from 41.7% in 2022. This continues a significant upward trend, with renewable energy's contribution growing from less than 15% of total generation in 2013 to nearly half within a decade.

Offshore wind remains the largest contributor to renewable generation in the UK, achieving a record 17% of all power generation. Combined with onshore wind, which has maintained consistent output, wind energy accounted for nearly 28.7% of electricity generation in 2023. With an additional 6,000 MW of offshore wind capacity expected to come online through the Contracts for Difference (CfD) scheme by the end of 2025, and the easing of planning regulations for onshore wind, substantial growth in this sector is anticipated.

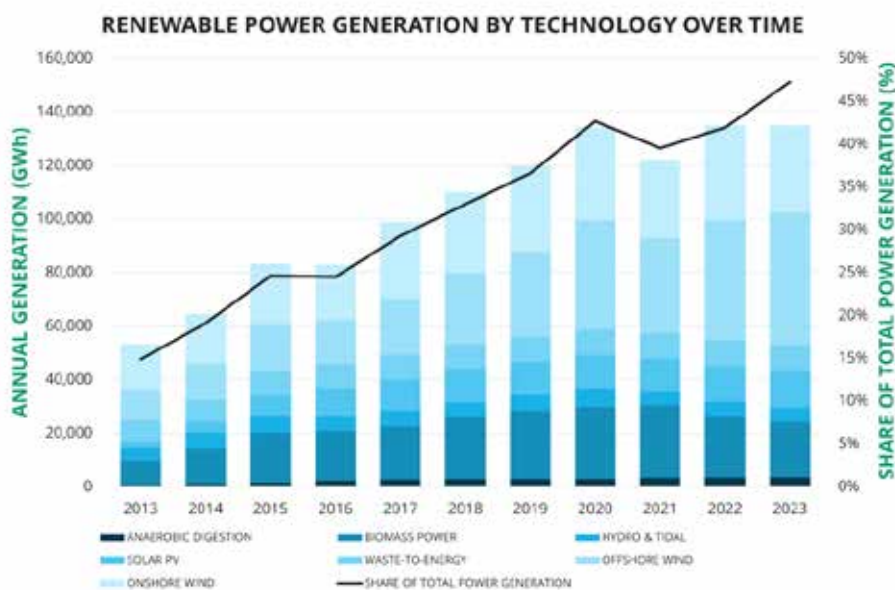
47.2%

SHARE OF UK POWER GENERATION COMING FROM RENEWABLE SOURCES

Bioenergy continues to be the second-largest source of low-carbon generation, despite modest declines in output over the past two years due to market factors. In 2023, biomass power generated 20,789 GWh, while anaerobic digestion and waste-to-energy saw slight increases. Overall, bioenergy remains crucial, contributing 11% of the UK's total electricity generation.

Solar power saw steady growth, generating 13,826 GWh in 2023, which is just under 5% of total electricity production, making it the third-largest source of renewable energy.

With the new Labour Government committed to achieving 'Clean Power' by 2030, the positive trajectory outlined in this chapter will need to accelerate. Additionally, with an aging fleet of renewable generators nearing the end of their current contracts, it is vital to focus on both maintaining existing capacity and rapidly deploying new generation to deliver an affordable, secure and decarbonised power system.



Renewable power generation in the UK 2013-2023

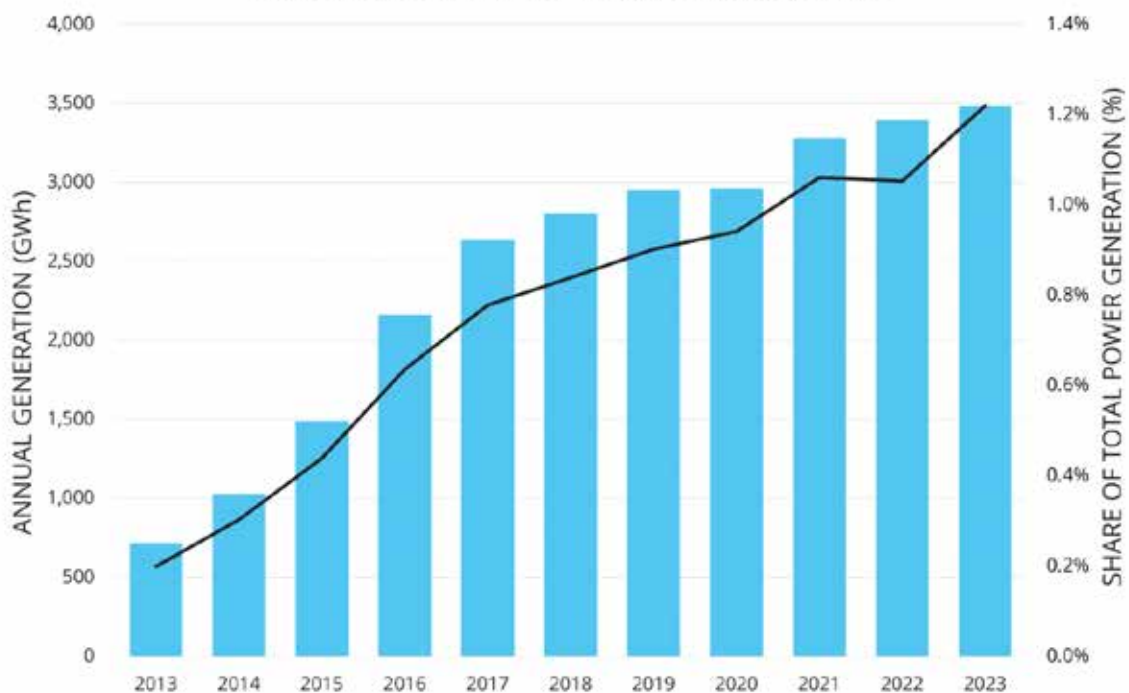
Deeper Insight: Anaerobic Digestion

Power generation from anaerobic digestion (AD) has increased slightly between 2022 and 2023, by 2.7%. This is despite capacity decreasing overall by 0.6% to 626 MW. Higher gas prices have supported increased generation, alongside modest increases in biogenic waste availability which provides more feedstock.

We are likely to continue to see steady increases in generation as rules around Simpler Recycling take effect - increasing the amount of biogenic waste collected separately which will increase feedstocks going to AD sites. That being said, given support schemes for AD are focused on decarbonising the gas grid, and the present absence of routes to market for AD power sites, we are unlikely to see future increases in AD power capacity in the near term.



ANAEROBIC DIGESTION POWER GENERATION



The chart shows the increasing amount of power generation from anaerobic digestion over the past decade. In 2023, anaerobic digestion generated 3,484 GWh of power, up from 3,391 GWh in 2022. Anaerobic digestion represented 1.2% of total power generation in 2023, up from 1.1% in 2022.

Biomass Power (including energy crops, straw and wood pellets)

In 2023, biomass was responsible for generating about 7% of the country's electricity, providing low carbon, consistent power which complements other forms of low carbon and renewable energy.

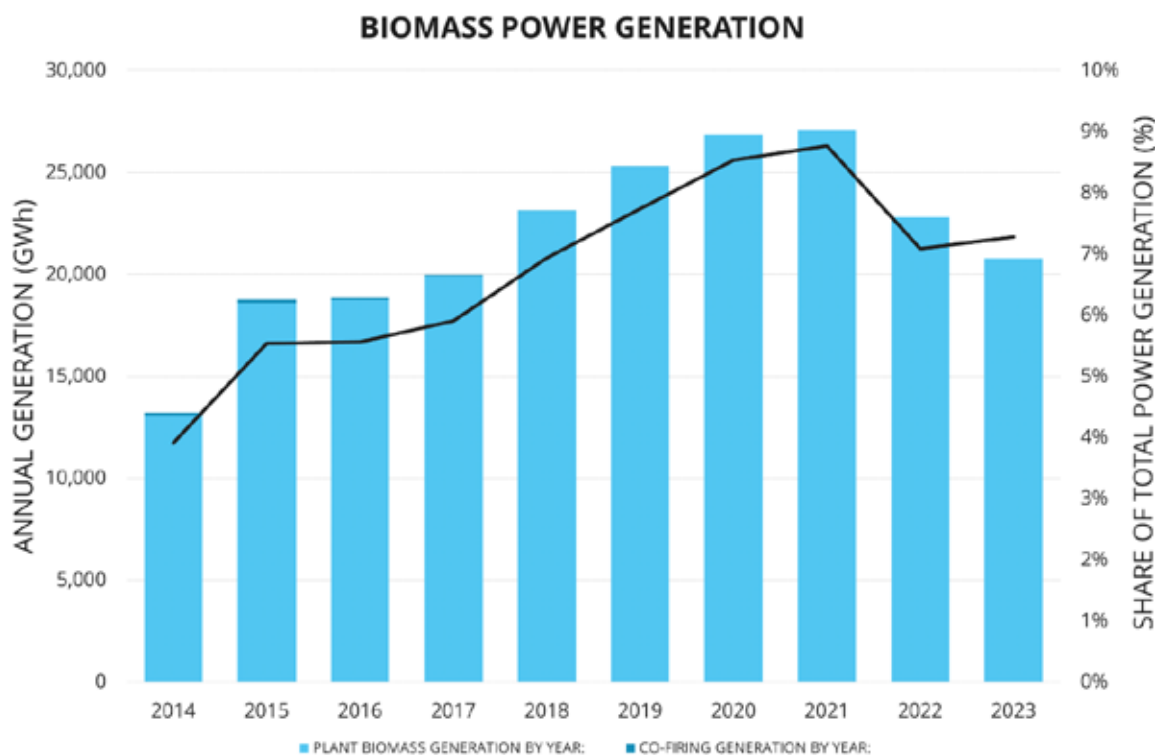
We need sustainable biomass for BECCS which has been identified as being critical to delivering carbon removals by leading climate scientists and governments alike. That is why Biomass UK – the REA's member forum for biomass power – has been busy pushing for political certainty and support for biomass generation beyond 2027, to move towards delivering carbon removals and meeting our net zero targets.

The change of government provides both opportunities and challenges for biomass power. Labour's commitment to investing in renewables is much needed and welcome and early indications suggest they recognise the role of bioenergy in the energy transition.

It is likely that we will see progress on the Cross Sectoral Sustainability Framework consultation, as committed to in the Biomass Strategy, which should further boost confidence in the production

and use of biomass. We are also likely to see much needed progress on carbon capture sequencing and further support announced for Bioenergy Carbon Capture and Storage (BECCS), which could be a requirement for future biomass sites. The biggest risk for the sector is likely to be the ongoing lack of certainty around future generation, particularly for small to medium size sites, many of whom will begin to see their Renewables Obligation contracts coming to an end from 2027.

As well as responding to key consultations, and pushing on the above issues, we are also proactively engaging with parliamentary and media stakeholders about the value and role of sustainable biomass. We have also been working with the Department for Energy Security and Net Zero to progress the work on Power BECCS and Greenhouse Gas Removals business models – something that will continue to be a focus in 2025.



The chart shows biomass power generation peaked in 2021 at 27,086 GWh. It has steadily declined until 2023, in which year it produced 20,790 GWh. Biomass power's share of total power generation was 7.3% in 2023, up from 7.1% in 2022.

Hydro & Tidal

In 2023, overall hydropower generation decreased by 8%, falling to 5,194 GWh. This decline occurred despite a relatively wet summer, as below-average rainfall during the rest of the year impacted total output.

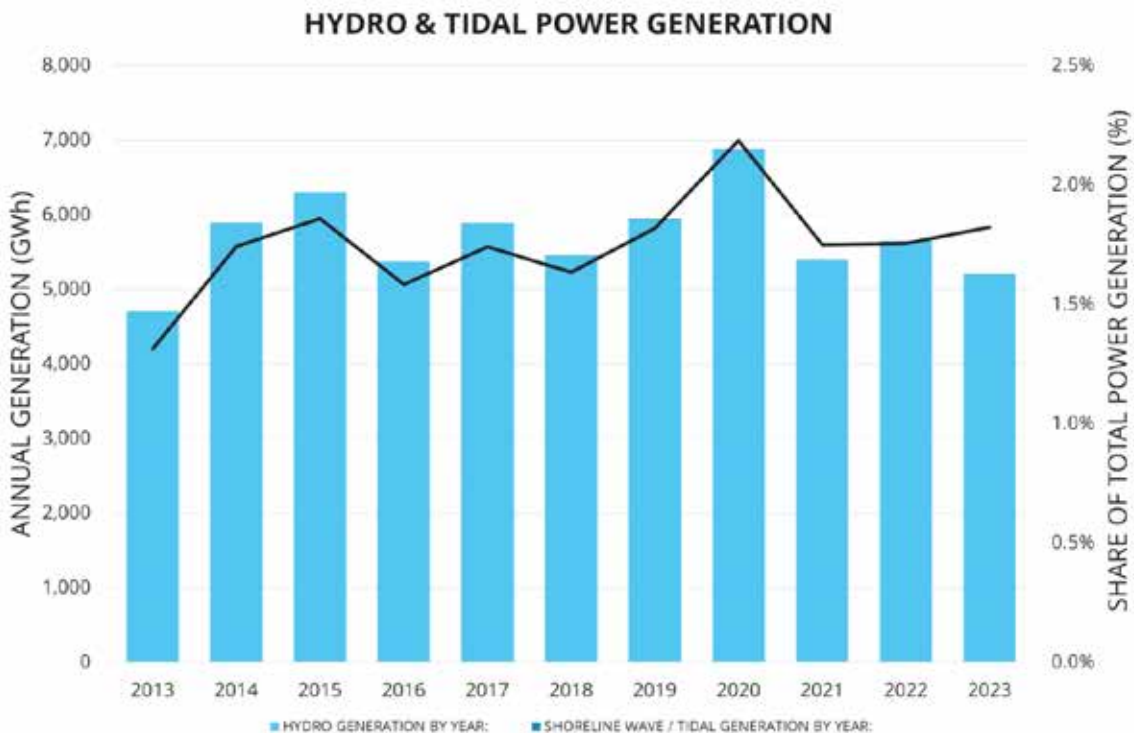
Hydropower capacity has remained stable at just over 2 GW since 2018, with most sites concentrated in the Scottish Highlands, with clusters also in North Wales and Northwest England.

Over the past decade, the UK hydropower sector has generated an average of 5,660 GWh annually, contributing between 1.5% and 2.5% of the country's total power generation.

The stagnation in hydropower development is largely due to the absence of government-supported routes to market for smaller hydro sites since the closure of the Feed-in Tariff. Additionally, the lengthy lead times associated with larger-scale hydro projects have made it difficult to compete in the Contracts for Difference (CfD) scheme. However, there is potential for growth now that the Government has committed to a new support mechanism for long duration energy storage, with a number of pumped hydro storage projects expected to be taken forward.

Wave and tidal energy generation remains minimal, with only 11.7 GWh produced in 2023 - just a 4% increase from 2022, rendering it immaterial on the accompanying graph.

Despite the UK's significant potential in this area, the high development and maintenance costs have limited installed wave and tidal capacity to just below 10 MW. However, the sector is beginning to show signs of growth. In 2023, 53 MWs of new tidal stream projects secured contracts in the CfD Allocation Round 5, and a further 28 MWs were contracted in Allocation Round 6 this year. These projects, scheduled for delivery between 2026 and 2029, are expected to gradually increase wave and tidal capacity over the next decade.



The chart shows hydropower and shoreline wave and tidal generation over the past ten years. Wave and tidal generation has been minimal over the period, generating only 12 GWh in 2023. In 2023, hydropower generation was 5,194 GWh, down from 5,640 GWh in 2022. Hydropower represented 1.82% of total power generation in 2023, up from 1.76% 2022.

Solar PV

This year's REview highlights the continued growth of solar photovoltaic (PV) power with cumulative installed capacity increasing from 14,151 MW in 2021, to 14,893 MW in 2022, and now to 16,238 MW in 2023. Solar PV power has increased in its share of overall electricity generated in the UK from 3.9% in 2021, to 4.1% in 2022, and to 4.7% in 2023.

This positive trajectory is echoed across all metrics including electricity generated with an increase of 13% from 2021 to 2023, and load factors rising from 9.9% in 2021 to 10.2% in 2023.

These figures are in spite of unfavourable weather conditions, particularly seen in Q1 of 2023, in addition to the delayed effects of the closure of various government support schemes, including the Feed-in-Tariff (FiT) scheme (March 2019) and the Renewable Obligation (RO) scheme (March 2017) which were available to consumers and developers in previous years.

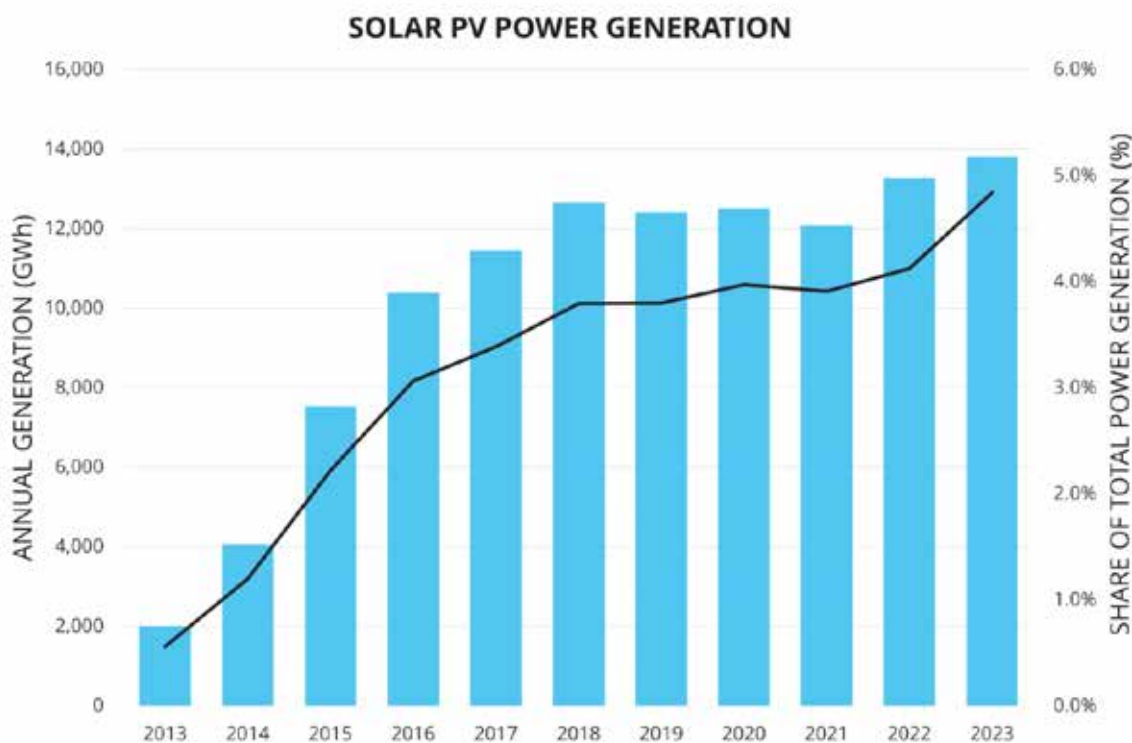
Actual growth might be even higher than reported, as data sources often omit unsubsidised installations below 150 kW. The surge in capacity is largely driven by increased domestic installations and projects exceeding 5 MW, supported by

favourable public opinion, lower costs, and the lingering effects of the 2021 energy crisis. Currently, around 3,000 solar installations are completed each week, up from 1,000 in 2020.

Solar power still remains the most favourable form of renewable energy amongst the British public, with 88% supporting overall and 55% strongly supporting, in comparison to an average of 84% for renewables as a whole ⁽¹⁾. The public are increasingly understanding the wider benefits of generation from solar PV beyond providing a sustainable source of power. This includes reducing emissions, greater energy security by lowering dependence on foreign energy sources, cheaper energy production, benefits to local economies, job creation and improved air quality.

This year, the REA has focused on championing diverse deployment of solar installations within the development of the Solar Taskforce's Roadmap, including pushing for greater use of solar canopies, agrivoltaics, social housing opportunities, and leveraging the potential of commercial and industrial rooftops across the country in order to hit the Government's target of 70 GW by 2035.

¹ DESNZ Public Attitudes Tracker, 2024, <https://www.gov.uk/government/statistics/desn-public-attitudes-tracker-spring-2024/desn-public-attitudes-tracker-renewable-energy-spring-2024-uk>



The chart shows the increasing amount of solar photovoltaic power generation over the past decade. Solar PV generated 13,826 GWh of electricity in 2023, up from 13,283 GWh in 2022. As a share of total power generation, solar PV reached 4.8% in 2023, up from 4.1% in 2022.

Waste-to-Energy (including Animal Waste Derived Biomass, Energy from Waste and Landfill Gas and Sewage Sludge Digestion)

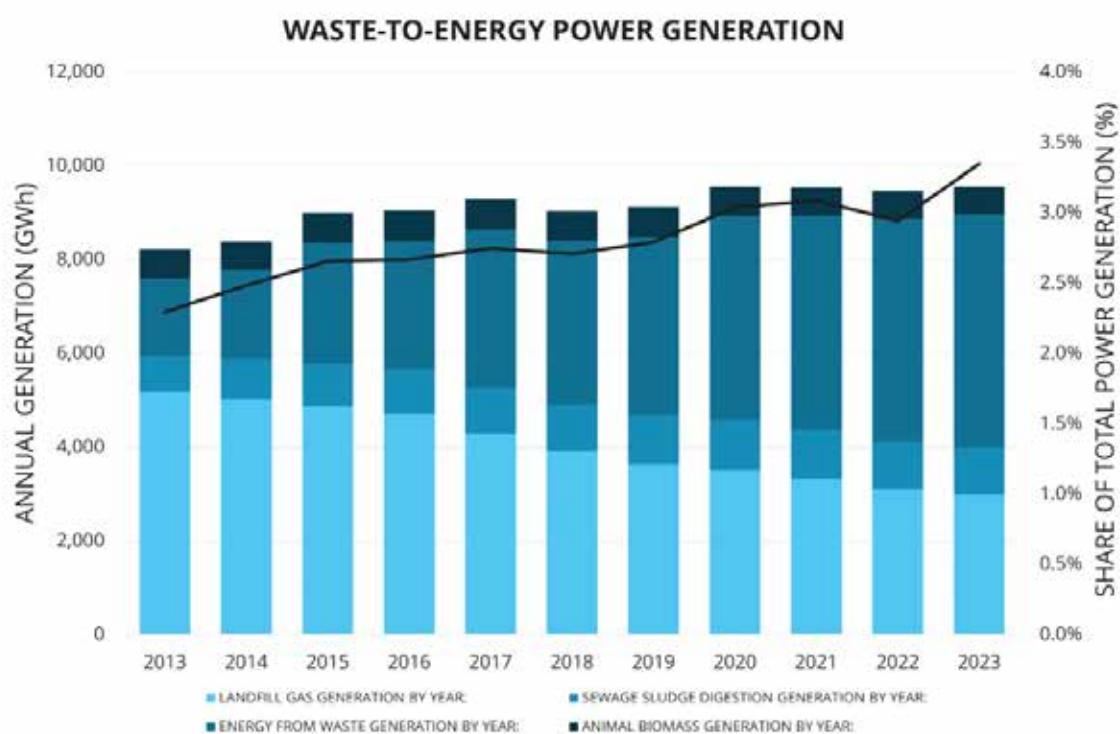
Overall, waste to energy (WtE), including energy from waste (EfW, mostly from incineration), sewage sludge and landfill gas, has seen a modest increase in power production over the past decade, rising from 8,200 to 9,500 GWh per year. Generation has remained stable due to a large increase in incineration EfW power which has tripled over the last 10 years, counteracting the shrinking of landfill gas power generation over the same period. WtE now represents 3.5% of the UK's total power generation, with EfW making up the majority (52%) of this power.

In 2023, EfW saw its highest year yet for generation, at 4,971 GWh. Growth in EfW remains strong, rising by 42% over the past 5 years recognising its role in managing residual waste, as opposed to landfilling, in the waste hierarchy. The next 5 years for EfW will be mixed as the end of government support schemes combined with the sector being brought under the UK Emissions Trading Scheme (ETS) from 2028 will increase operating costs for many plants. However, opportunities are present for those looking to retrofit carbon capture technology, as EfW represents one of the pathways for negative emissions.

Landfill gas generation reached a new low at 2,994 GWh in 2023, now representing 31% of all WtE power. Landfill gas has seen a sustained decrease over the past decade, falling by 42.1%. This is primarily due to declines in naturally occurring landfill gas sources, as gas is collected from closed landfill sites which do not receive any new waste. However, around 80% of landfill gas sites are set to see their Renewables Obligation contracts expire from 2027, which could cause a loss in capture efficacy at sites with a more rapid decline in generation in the coming years in the absence of further support.

Sewage sludge (995 GWh) and animal biomass generation (598 GWh) have both remained stable, smaller modes of generation.

NB: animal waste derived biomass includes poultry litter, meat and bone. Energy from waste includes waste (including waste wood), tyres and hospital waste, primarily incinerated. Waste-based does not include anaerobic digestion (AD) as this is treated separately and can be seen earlier in this chapter.



The chart shows the mix of waste-to-energy power by source over the past decade. In 2023, landfill gas generated 2,994 GWh, sewage sludge generated 995 GWh, Energy from Waste generated 4,971 GWh, and animal biomass generated 598 GWh. This leads to a combined total of 9,557 GWh, up from a combined 9,468 GWh in 2022. The share of total power generation from waste rose from 2.9% in 2022 to 3.3% in 2023.

Wind (Onshore and Offshore)

Wind generation continues to be the UK's leading source of renewable energy, contributing nearly 29% of the country's total power production in 2023. Total wind generation rose to 81,989 GWh, marking only a modest 2.2% increase from 2022, a contrast to the substantial 24% growth observed between 2021 and 2022.

This slower growth can be attributed to infrastructure challenges that have led to curtailment constraints for existing assets and a reduced number of new projects commissioned in 2023. Offshore wind capacity grew by 5.8%, reaching 14,653 MW. However, offshore wind generation is poised for significant further expansion, with nearly 6,000 MW of capacity contracted through previous Contracts for Difference (CfD) allocation rounds expected to come online in 2024 and 2025⁽¹⁾.

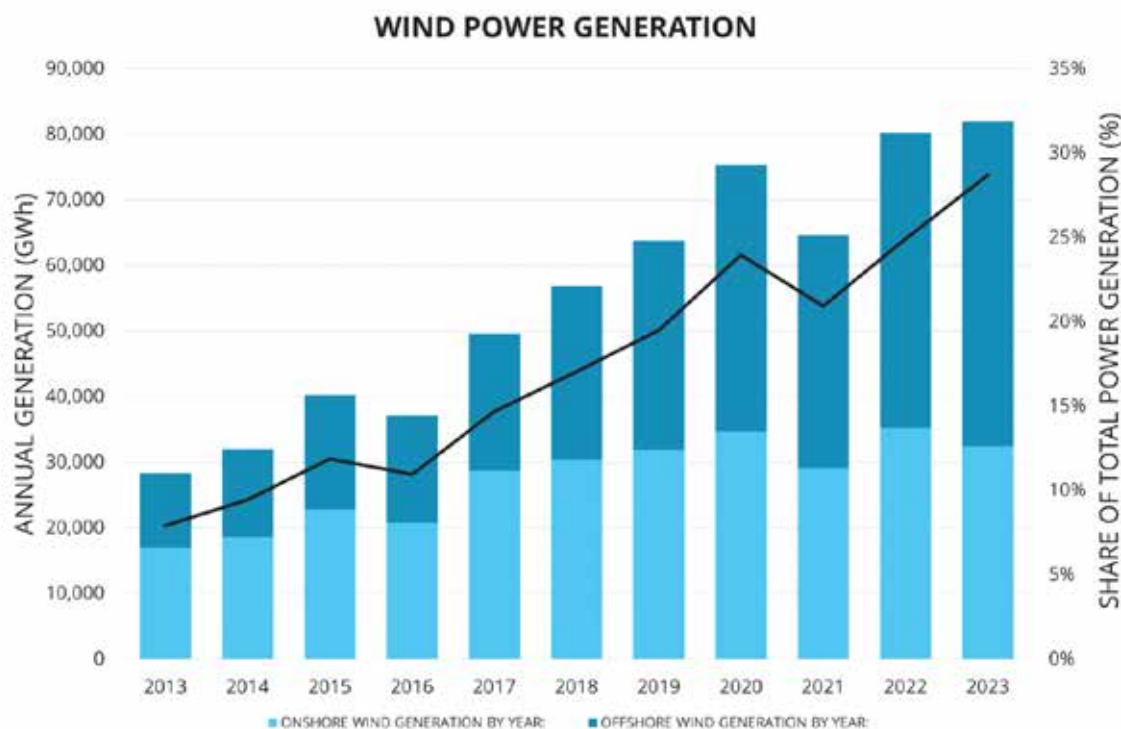
In 2024, the CfD Allocation Round 6 (AR6) had a record budget of £1.1 billion for offshore wind, boosted by a £300 million increase from the newly elected Labour Government. This resulted in a further 3,763 MW being contracted for delivery in 2028/29. [2] This helps to offset the setbacks of AR5 in 2023, which failed to contract any new offshore

wind projects due to uncompetitive administrative strike prices.

Onshore wind generation also increased in 2023, benefiting from higher-than-average wind speeds, though new capacity remains stagnant. Only 535 MW of new onshore wind capacity was added in 2023, hindered by restrictive planning rules that have effectively stalled new developments. The Labour Government has moved swiftly to address these planning barriers and 990 MW was also contracted in AR6 for delivery between 2026 – 2028.⁽²⁾

Despite a promising pipeline of projects, the most significant challenge to further wind energy deployment remains grid-related constraints. These issues are causing delays in new connections—some by as much as 10 years—and increasing curtailment pressures on operational assets when demand is insufficient. Addressing grid infrastructure is therefore a critical priority for the continued growth of wind energy in the UK.

¹ LCCC, 2024, CfD Contract Portfolio Status, <https://dp.lowcarboncontracts.uk/dataset/cfd-contract-portfolio-status>
² DESNZ, 2023, Contracts for Difference (CfD) Allocation Round 6: results, <https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-6-results>



The chart shows the steady rise of wind power generation, particularly offshore, over the past ten years. In 2023, offshore wind generated 49,550 GWh of power, and onshore wind generated 32,440 GWh of power, meaning a total of 81,989 GWh for the year, up from 80,257 GWh in 2022. Overall, wind represented 29% as a share of total power generation in 2023, up from 25% in 2022.

Getting the Clean Power 2030 Mission Out of the Starting Blocks

The Olympic athletes we saw this summer often spoke of setting ambitious goals. They committed to multi-year plans, including immense dedication to training, discipline and investment all focused on winning an Olympic medal. The new Labour Government have committed to an equally audacious goal with their Clean Power Mission: to fully decarbonise the power system by 2030. The scale of this challenge cannot be underestimated. Generators, storage providers, infrastructure developers, energy suppliers and consumers should all feel like they are in the starting blocks for a truly Olympic race.

Reflecting on our current position illustrates the enormity of the task ahead. In 2023, renewables accounted for 47% of total electricity generation, up from less than 15% in 2013 - a notable achievement. However, the deployment figures in this report demonstrate that the current steady state of growth remains far too modest. The 2024 Progress Report from the Climate Change Committee [1] was deeply critical of the last Government's inconsistent messaging, which saw key policies and targets reversed. The report concluded that low carbon technology rollout is significantly "off-track", while the REA, and others, have highlighted the damage done to investor confidence. With electricity demand expected to double as heat and transport electrify, and modern data centres drive demand, the UK will need an exceptional burst out of the starting blocks in the next twelve months.

Labour has set an encouraging pace to some extent. Quick moves to significantly increase the budget for the latest Contracts for Difference (CfD) funding allocation round; approve planning permissions for several large-scale solar sites; and reform planning rules for onshore wind, are all helping to foster renewed confidence among developers and investors. Labour's flagship Great British Energy policy should also drive progress if it focuses on higher-risk sectors where private financing currently finds it difficult to enter, avoiding crowding out readily available private capital.

However, beyond these policies, individual sectors await long overdue decisions on key policy workstreams that were paused by the early election. As highlighted in the REA's First 100 Days recommendations, this includes having a rolling timetable for CfD auctions; providing bespoke capital allowances for renewable investment; and finalising pathways for bioenergy carbon capture and storage. Additionally, it is crucial to ensure that previous progress is not undone as existing generation assets come to the end of their Renewable Obligation contracts from 2027 onwards. Clarity and support across multiple clean energy sectors, including repowering assets, are essential hurdles that must be cleared ahead of the 2030 finish line.

The success of any athlete does not just rely on their efforts, but on the support networks around them. For the power sector, it is the state of the transmission and distribution grids that has for some time been the biggest barrier to low-carbon power deployment. Significant workstreams have been underway to reform the connection process and see increased investment in reinforcing our ageing grid infrastructure. However, progress remains slow, with REA members continuing to report heavily delayed connection dates, many of which lie beyond the 2030 target and must be brought forward.

[1] Climate Change Committee, 2024, <https://www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament/>

To solve climate change, we need every tool at our disposal. Sustainable biomass will undoubtedly be a key part of the mix.

Addressing this, in 2024, the establishment of the National Energy System Operator (NESO) marks a significant step, with plans for a Strategic Spatial Energy Plan to be published next year, followed by Regional Energy Strategic Planners. These plans must be completed transparently and quickly, focusing on strategically turbo-charging existing grid reforms so that the essential backbone of the power system is ready to accept the levels of renewable and decentralised energy generation required to make the 2030 target achievable.

Finally, the rules of the race need to enable a fair, transparent and competitive outcome for all involved. For the power system, this means having a well-structured and regulated energy market that appropriately rewards desirable generation. This is not only in terms of decarbonisation but additional grid services such as flexibility, demand side response and energy storage, all of which are essential to ensuring energy security. The market must also ensure this is done at a fair price so that consumers are protected from excessive bills, with themselves rewarded if they are to continue to cheer on efforts to decarbonise our power system. The Government's Review of Electricity Market Arrangements (REMA) is now in its third year of deliberation. The conclusions to this process must be set out in the next twelve months so that the rules for engagement are clear for all those involved.

The Government can be left with no doubt that going for the Clean Power 2030 Mission will require the same laser focus and determination of any Olympic athlete focused on gold. The target is clear, and the industry is ready, but we are also fully aware of what needs to be achieved in the next five years.

The starting gun has been fired, but the finish line remains a long way off.

*Mark Sommerfeld,
Head of Power and Flexibility, REA*



REA

Sector Recommendations

Power & Flexibility

To reach net zero we need stable policy that will facilitate a fully decarbonised, secure, and affordable electricity system. The new Labour Government has set the ambitious target of delivering a clean power system by 2030. Such a system requires both a rapid increase in the deployment of all renewable technologies and flexible assets, such as energy storage, which will help the electricity grid balance both low carbon electricity generation and increased energy demand. Renewables are now the cheapest forms of generation and curtail the UK's dependence on international fossil fuel markets. However, the Government must now ensure the infrastructure for such generation is in place to manage both decentralised generation and increased demand.

To achieve this, the Government must:

- **Turbo charge existing workstreams to address grid capacity constraints, which remains the single largest barrier to renewable deployment.** This includes the delivery of the Strategic Spatial Energy Plan by 2025. Government should also task a relevant body such as the National Energy System Operator, Ofgem, National Infrastructure Commission or similar, with compiling an annual progress report on connection reforms for Parliament, requiring a government response.
- **Ensure that the current Review of Electricity Market Arrangements (REMA) is concluded in a sensible time frame, with the transition to new electricity wholesale market arrangements by 2026.** This includes the establishment of liquid, transparent and nationwide flexibility markets. There must also be a recommitment to 'grandfathering' (not changing existing schemes) and the principle of long-term certainty for investments.

- **Establish a rolling 3-year-ahead timetable for new Contract for Difference (CfD) allocation rounds, from 2025 onwards.** This should include:
 - A minimum budget so that there is a predictable route to market for investors;
 - Provide ring-fenced funding for less established technologies like geothermal and marine technologies and;
 - A separate auction to re-power existing generation assets to ensure no loss of renewable capacity.
- **Announce clear support for projects coming to the end of their Renewable Obligation (RO) contracts aligned to meet the Clean Power 2030 Mission.** Government must also ensure the UK is not losing renewable capacity as existing assets come to the end of their RO contracts from 2027 onwards. Without clarity by the end of the year, companies will start to make decisions on decommissioning valuable renewable generation.
- **Implement the cap and floor support mechanism for long duration energy storage in 2025, to support deployment of critical technologies needed to decarbonise and balance the power system.**
- **Deliver pathways for the deployment of bioenergy carbon capture and storage (BECCS) to enable critical negative emissions by 2030.** At the same time, large scale biomass projects await decisions on the government bridging mechanism, while medium and small-scale biomass generators await confirmation of how they may be able to operate beyond existing contract arrangements. Clear timelines for the delivery of these critical CCS workstreams must be set out.
- **Prioritise completion of reforms to planning guidance by 2025, to halve the time taken for planning decisions on new renewable assets.**

Deployment: Heat & Cooling

Renewable Heat Deployment Summary

In 2023, renewable heat generation saw a modest 5.5% increase, growing from 61,000 GWh in 2022 to just over 64,000 GWh, as such, low-carbon heat has increased from providing 3.7% of the UK's heat demand in 2013 to 9.4% in 2023.

The accompanying graph highlights bioenergy's continued dominance as the primary source of low-carbon heat in the UK, accounting for 62% of the total low-carbon heat output in 2023 (combining biomass and anaerobic digestion). Much of this generation comes from modern biomass boiler installations that use sustainable wood chips, pellets, or waste wood, providing efficient, high heat loads for industrial, commercial, and domestic applications. However, since 2021, when both the non-domestic and domestic Renewable Heat Incentive (RHI) schemes closed to new accreditations, the growth of biomass generation has plateaued due to limited market access. Notably, approximately one-third of biomass heat generation comes from fireplaces and stoves, which are not typically primary heat sources.

Anaerobic digestion has also experienced modest growth, with most of its renewable heat generation delivered as biomethane-to-grid. Generation increased by 4% from 2022 to 2023, reaching 5,256 GWh. This slow growth underscores the

62%

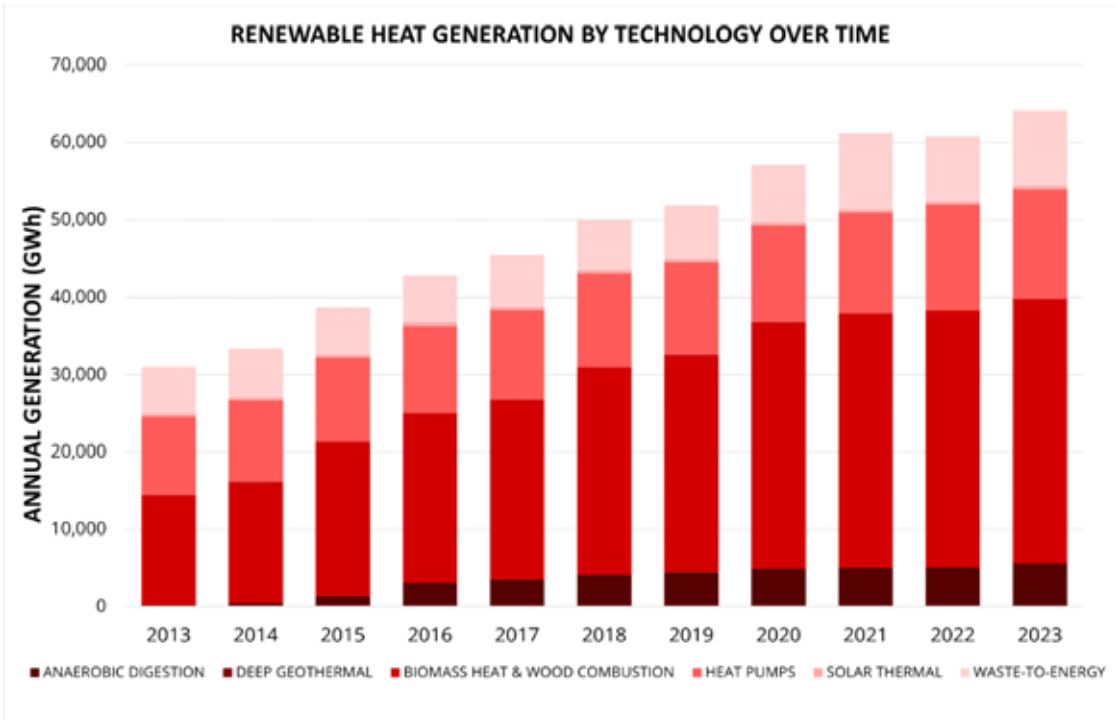
OF ALL RENEWABLE HEAT GENERATION WAS
PRODUCED BY BIOENERGY IN 2023

need for stronger policy support for biomethane production, especially with the Green Gas Support Scheme ending in 2028.

Heat pumps now contribute about 22% of low-carbon heat production, generating 14,117 GWh in 2023. Although positive, total heat generation from heat pumps also increased by only 4% in 2023. Deployment remains far below the target of 600,000 heat pumps per year by 2028 set by the previous government. While the current Boiler Upgrade Scheme is helping to address this, progress is slow, particularly given the focus on heat electrification.

Deep geothermal heat remains an underutilised resource, generating only around 9.6 GWh per year. The potential for geothermal heat in the UK is significant, and with adequate government support, several shovel-ready projects could be quickly deployed.

Overall, heat remains one of the most challenging sectors to decarbonise, with substantial policy gaps, particularly in commercial and industrial situations.



Deeper Insight: Anaerobic Digestion

Renewable Heat Deployment Summary

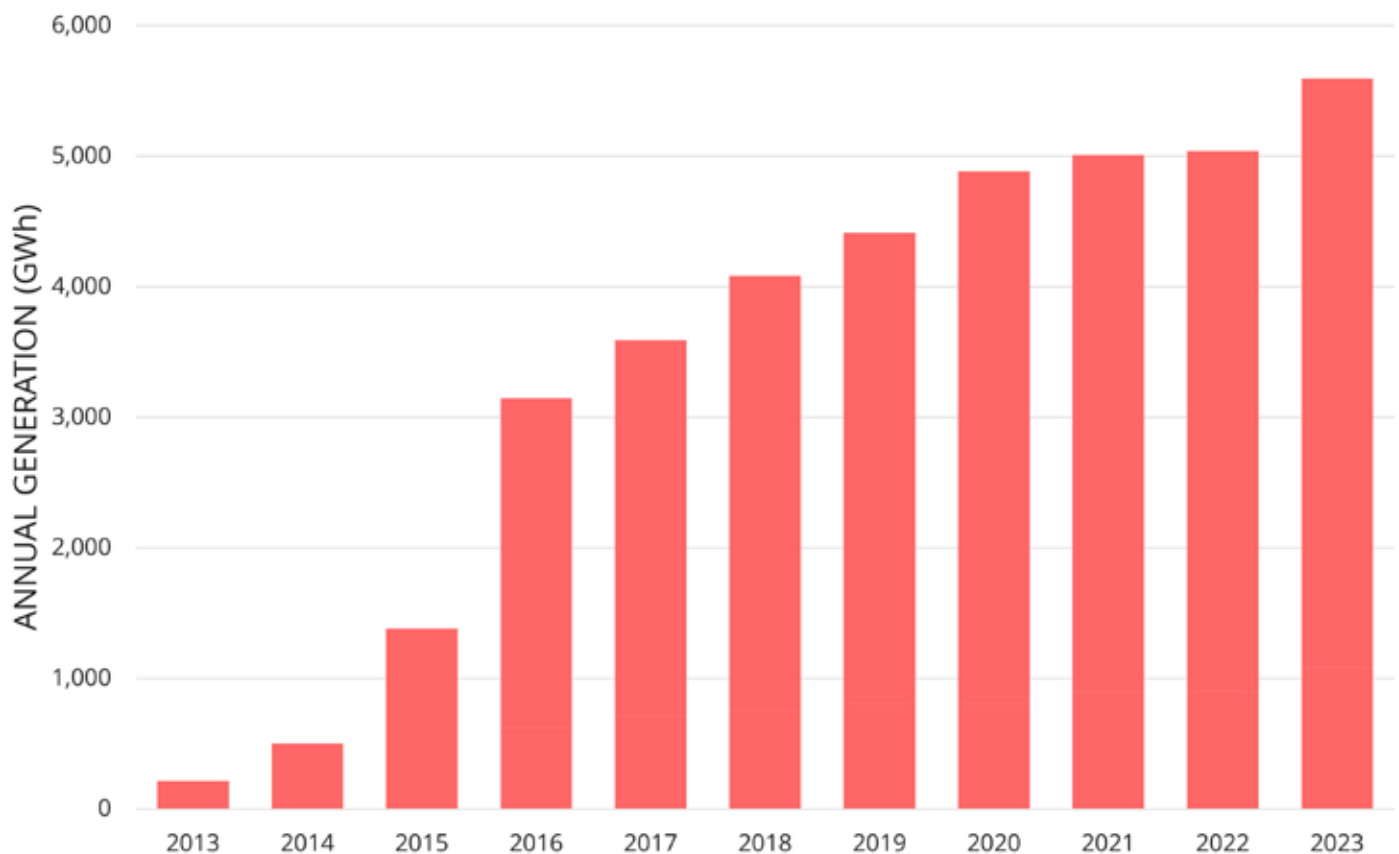
Growth continues within the anaerobic digestion (AD) sector, however, the deployment of plants since the closure of the Feed-in Tariffs (FiTs) and non-domestic Renewable Heat Incentive (RHI) this has continued to be slow. This is because capital expenditure and operational expenditure costs have been compounded by rising costs due to high inflation and supply chain issues that have arisen since Covid and Brexit.

The slight increase in AD heat generation between 2022 and 2023 is likely due to two factors. Firstly, the processing of outstanding applications, as a handful of biogas plants were granted extensions to their applications post the closure of the non-domestic RHI in March 2021. Secondly, some plants

will have come online since the introduction of the Green Gas Support Scheme (GGSS) in November 2021. However, due to limitations of the GGSS, growth has not been significant in the sector.

There is significant potential to increase biogas output and improve energy security based on a range of industrial and farming bio-residues that have not yet been fully accessed. After the closure of the non-domestic RHI there is little support for smaller off-grid biogas production - with the GGSS disincentivising smaller off-grid biogas plants.

ANAEROBIC DIGESTION HEAT GENERATION



The chart shows the increasing amount of anaerobic digestion generated heat over the past decade. In 2023, anaerobic digestion generated 5,594 GWh of heat, up from 5,040 GWh in 2022, an increase of 11%.

Deeper Insight:

Deep Geothermal

Due to a lack of government support since the closure of the Non-Domestic Renewable Heat Incentive in March 2021, renewable heat generation from deep geothermal has remained negligible. This scheme closed before several projects were able to fully commission, meaning a number of projects are shovel ready, but require some additional financial support to reach completion.

However, in 2023 there were some exciting geothermal project developments, all in Cornwall:

- The UK's first operational deep geothermal heating plant since 1986 opened at the Eden Project in June 2023.
- Allocation Round 5 of the Contracts for Difference scheme saw the first geothermal power projects clear the auction – three projects delivering a total of 12 MW of capacity by 2027.
- Langarth Garden Village became the first deep geothermal project to be granted Green Heat Network Funding to develop a heat network powered by deep geothermal.

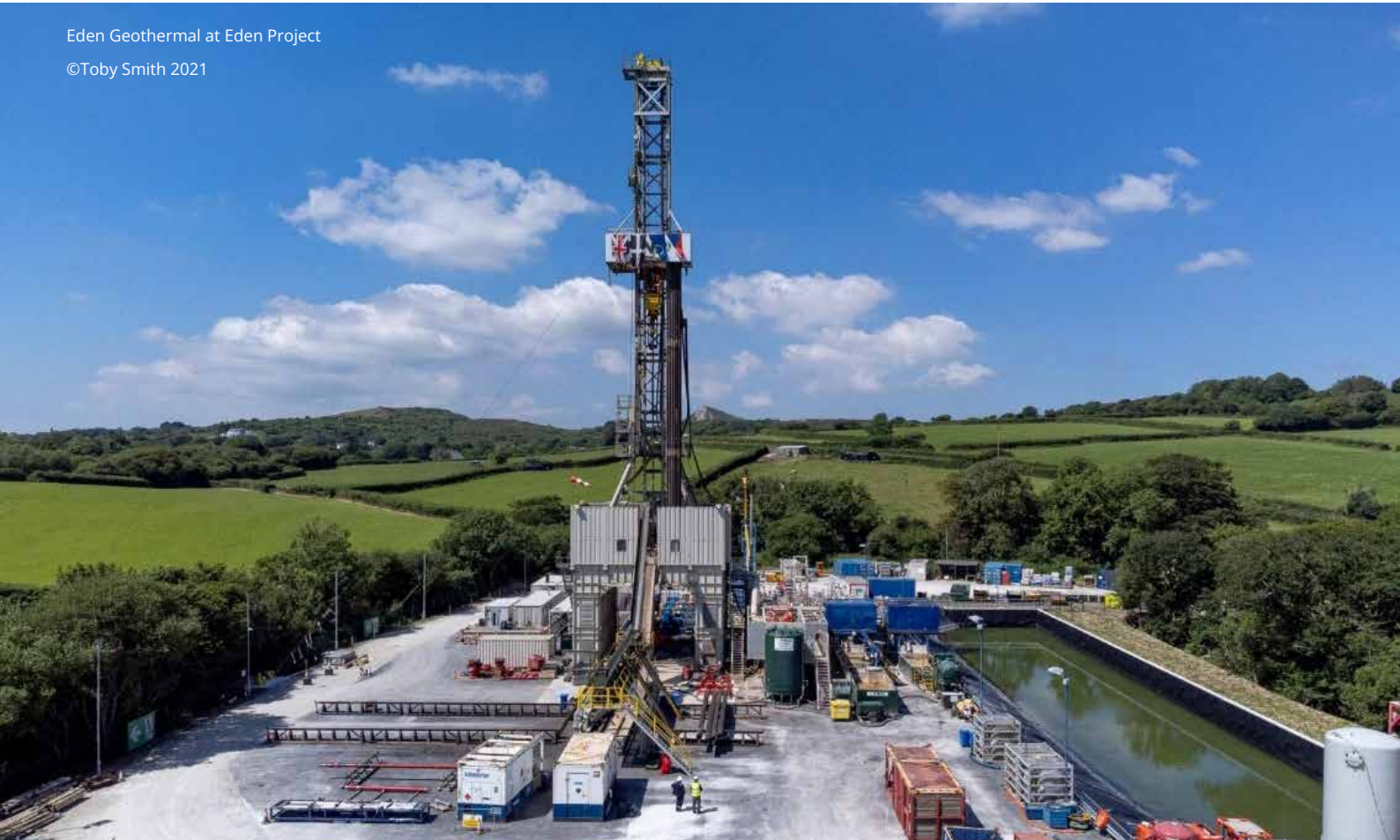
The REA continues to champion the geothermal sector, notably by supporting the establishment of the UK's first All Party Parliamentary Group (APPG) on Deep Geothermal – for which we are the secretariat. The APPG is focused on its long-term goal of establishing deep geothermal as a mainstream renewable energy source in the UK. Indeed, REA research, done in conjunction with ARUP, estimated that the UK could feasibly have 360 geothermal plants by 2050 could provide 15,000 GWh of annual heat and would save an estimated 3 million tonnes of CO₂ annually (1).

The APPG on Deep Geothermal and REA are calling on the Government to establish clear routes to market for deep geothermal, for instance by reconfiguring the Public Sector Decarbonisation Scheme to progress deep geothermal as a solution for the NHS and other public sector sites, as well as introducing a Geothermal Development Incentive.

We would also like to see the Government develop a Deep Geothermal Strategy, which would set out national targets for heat and power from the technology, and the policies and funding mechanisms that will enable industry to deliver these targets.

1. Arup, 2021, <https://www.r-e-a.net/wp-content/uploads/2021/05/Deep-Geothermal-Energy-Opportunities-for-the-UK.pdf>

Eden Geothermal at Eden Project
©Toby Smith 2021



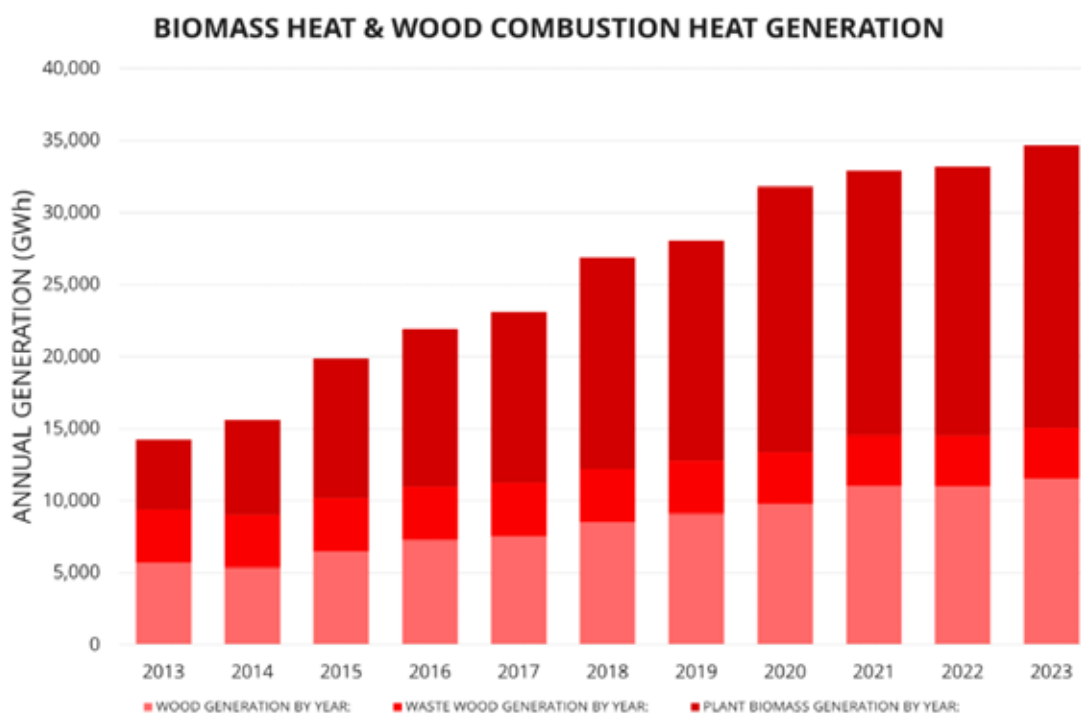
Deeper Insight: Biomass Heat (Wood Pellets, Wood Chip or Energy Crops) and Wood Combustion (Domestic and Industrial)

Biomass remains the biggest contributor to the decarbonisation of the UK's heat sector. There has been a slight increase in generation between 2022 and 2023. This will likely be due to two reasons. Firstly, the Boiler Upgrade Scheme (BUS) launched in April 2022, through which eligible applicants can receive a £5,000 grant towards the cost of a biomass boiler.

Whilst the majority of applications have been for heat pumps, there are nevertheless a few hundred biomass boiler applicants that have received grants. Secondly, the number of installations accredited under the non-domestic Renewable Heat Incentive (RHI) have slightly risen in the past couple of years, despite the closure of the scheme. This is due to re-accreditations of relocated or replaced boilers, as well as the processing of outstanding applications, including those, that under specific circumstances, were given an extended deadline (until April 2023) to submit an application.

Generation from wood and plant biomass has increased, and waste wood generation has remained consistent. Waste wood generation is unlikely to grow until there is a route to market for this sector, such as via heat networks.

However, overall growth continues to slow in comparison to previous years due to the closure of the domestic and non-domestic RHI in 2022 and 2021 respectively. Without a raise to the grant level of the BUS and an adequate replacement for the non-domestic RHI, growth will likely continue to be slow in the biomass heat sector.



The chart shows the increasing amount of biomass heat and wood combustion heat generation over the past decade. In 2023, wood generated 11,547 GWh, up from 10,977 GWh in 2022. Waste wood generated 3,537 GWh in 2023, down from 3,561 GWh in 2022. Plant biomass generated 19,568 GWh in 2023, up from 18,656 GWh in 2022. Altogether, biomass and wood combustion heat generated 34,619 GWh of heat, up from 33,194 GWh in 2022, an increase of 4.3%.

Deeper Insight: Heat Pumps (Air and Ground Source)

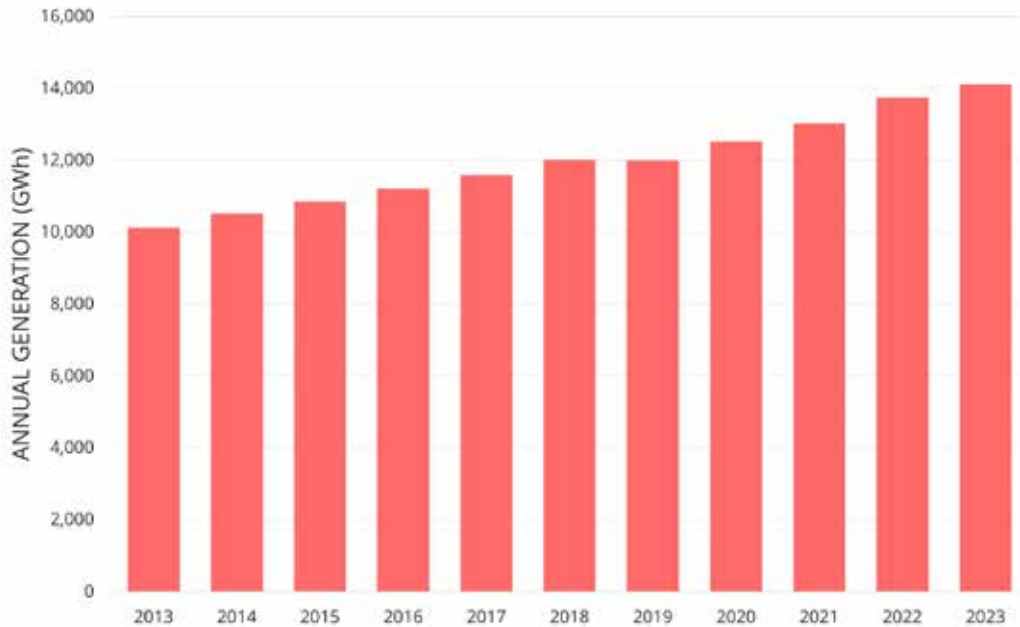
Heat pump growth continues to be steady.

The recent increase will likely be due to the introduction of the Boiler Upgrade Scheme (BUS) in April 2022. This growth has not been as rapid as might have been expected from the introduction of the BUS, but this is likely due to the grant available not being high enough to attract consumers - the original grant available for air source heat pumps (ASHPs) and ground source heat pumps (GSHPs) was £5,000 and £6,000 respectively.

Recent changes to the BUS, including the increase of the grant to £7,500, will only start to impact the numbers next year. However, growth will most likely continue to be gradual as the price of electricity remains higher than gas, and whilst the market price for heat pumps is rapidly declining, the majority remain more expensive than gas boilers. Growth in heat pump installations will need to rapidly accelerate to meet the previous Government's target of 600,000 installations by 2028.



HEAT PUMPS HEAT GENERATION



The chart shows the increasing amount of heat generated from heat pumps over the past decade. In 2023, heat pumps generated 14,118 GWh of heat, up from 13,744 GWh in 2022, an increase of 2.7%.

Deeper Insight: Waste-to-Energy (including Animal Waste Derived Biomass, Energy from Waste and Landfill Gas and Sewage Sludge Digestion)

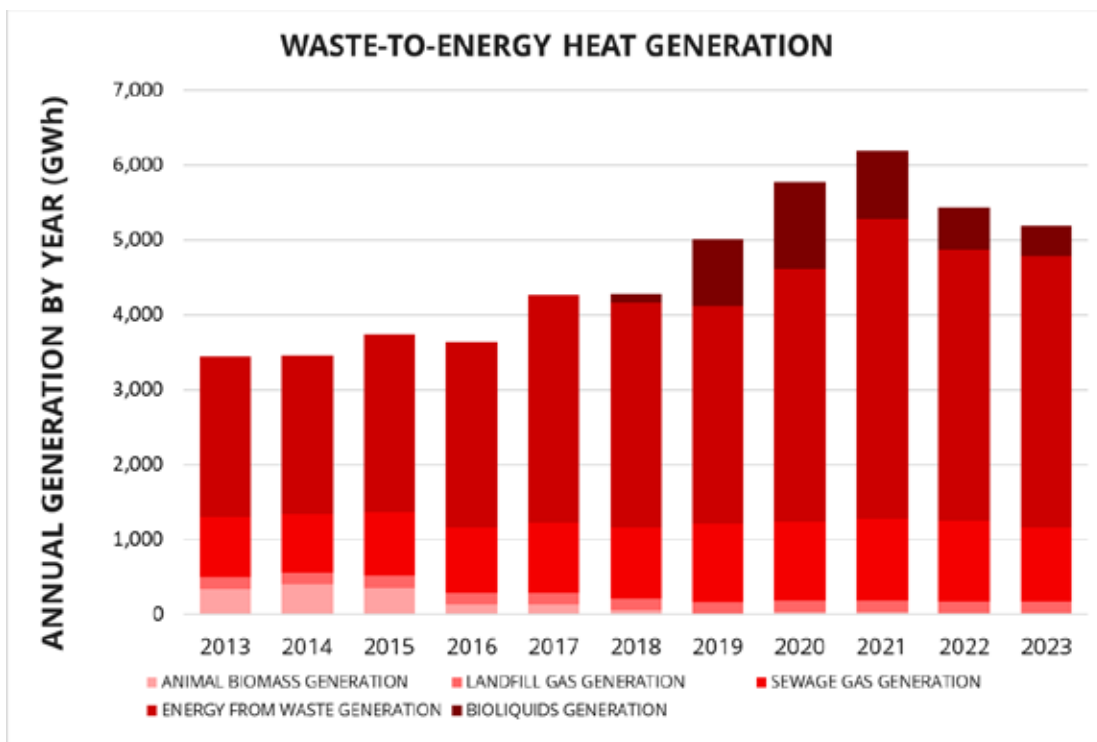
At almost 5,200 GWh, waste-to-energy remains a smaller but notable producer of heat for the UK, contributing 15.7% of renewable heat generation in 2023 (or 12.6% if discounting non-biodegradable energy from waste).

Despite another fall in bioliquids heat generation, resulting in a slight overall decrease in waste-based heat generation for 2023, generation has remained relatively stable across other technologies in the category.

Energy from waste (EfW, by which we mostly refer to incineration) continues to be the most significant heat source within the group, contributing 3,600 GWh in 2023 (40% of which is from biodegradable waste). We may see further increases in heat contributions from EfW plants in coming years given current policy direction, e.g. inclusion in heat network zoning plans or potential incentivisation via the UK Emissions Trading Scheme, all aimed at encouraging greater heat offtake from EfW plants.

Sewage gas saw a positive year in 2023 at 982 GWh, as the second-largest form of waste-based heat generation. Continuing high fossil gas prices have raised the value of low carbon gas options, encouraging further investment in their use. By comparison, demand for bioliquids from waste for heat continues to be constrained due to a lack of focused support within government heat policy to date.

NB: animal waste derived biomass includes poultry litter, meat and bone. Energy from waste includes waste (including waste wood), tyres and hospital waste, primarily incinerated. Waste-based does not include anaerobic digestion (AD) as this is treated separately and can be seen earlier in this section.



The chart shows the mix of waste-to-energy heat by source over the past decade. In 2023, animal biomass generated 18 GWh, landfill gas generated 158 GWh, sewage gas generated 982 GWh, Energy from Waste generated 3,622 GWh, and bioliquids generated 412 GWh. This leads to a combined total of 5,192 GWh, down from a combined 5,430 GWh in 2022, a fall of 4.4%.

Getting Heat Policy Out of the Doldrums

Decarbonising the UK's heat demand remains one of the toughest challenges in energy policy. While renewable electricity generation has surged from 15% to 47% over the past decade, low-carbon heat has only increased from 3.7% in 2013 to 9.4% in 2023—a pace far too slow for what is required. The use of fossil fuels for heating, cooling, and cooking accounts for around 20% of the UK's emissions, and the Climate Change Committee (CCC) has stressed that near-total decarbonisation of these emissions is essential to meet the net zero target by 2050. Despite the scale of the challenge, heat policy remains underwhelming, focusing too narrowly on specific technologies and failing to offer the full range of solutions needed to achieve net zero emissions.

The Boiler Upgrade Scheme (BUS), the previous Government's flagship policy, has made only modest progress. As of July 2024, just under 50,000 applications had been submitted, with a notable boost in uptake after the heat pump grant was doubled to £7,500, covering about two-thirds of

average installation costs. While this is encouraging, it underscores the slow pace of change in the face of a much larger challenge. To complement the BUS, the Clean Heat Market Mechanism (CHMM) was proposed to obligate suppliers to sell a certain percentage of heat pumps annually. However, the scheme's future is uncertain due to pressure from boiler manufacturers and a current lack of clarity from the new government. With no clear direction on the CHMM and the BUS only starting to gain traction, there is growing pessimism about meeting the CCC and previous Government's target of installing 600,000 heat pumps annually by 2028.

A flaw in the current approach is the overt emphasis on electrification at the expense of broader heat needs. Heat pumps are undoubtedly central to the transition and will be the best solution for a significant majority of applications, especially in the domestic sector. However, a one-size-fits-all approach won't work, and the varying heat demands of both domestic and industrial settings



require that the right low-carbon technology is used per the heat demands of that situation.

Bioenergy solutions—including biomass boilers, biomethane injection, and renewable liquid gases—are significantly underrepresented in the UK's current heat policies. Biomass, for example, remains the largest contributor to decarbonised heat, particularly in off-grid and energy-inefficient properties. Yet, the minimal support for biomass in the BUS and its exclusion from the CHMM reflect a key policy oversight.

Likewise, deep geothermal energy is a largely untapped resource in the UK, even though geothermal-powered heat networks are now widespread across Europe. REA reports estimate that by 2050, the UK could have 360 geothermal plants generating 15,000 GWh of heat annually, enough to supply over 2 million homes [1]. There are already shovel-ready projects that could be commissioned in the coming years, but policy must evolve to provide a clear route to market.

Another underestimated area is the decarbonisation of the gas grid, which remains the primary heat supplier for UK households. Despite its potential, biomethane is underutilised, and the extent of hydrogen's valuable role remains unresolved. The Green Gas Support Scheme (GGSS), designed to boost biomethane production, has underperformed, leaving a portion of its budget unspent due to poor scheme design and regulatory barriers. However, the UK Biomass Strategy has highlighted the need for between 30-40 TWh of biomethane production by 2050 to cost-effectively meet net zero goals.

Finally, one of the largest gaps in heat decarbonisation policy is a lack of focus on commercial and industrial heat. Since the closure of the Non-Domestic Renewable Heat Incentive (RHI), there has been little incentive for businesses or industrial processes to switch to low-carbon heating. While grant-based initiatives like the Public Sector Decarbonisation Scheme and Industrial Energy Transformation Fund (IETF) have offered limited support, their narrow scope means that only a small portion of the market can access them. The REA has proposed more comprehensive schemes, such as a commercial fuel-switching tariff and an industrial heat contract-for-difference (CfD), to decarbonise commercial and industrial heat at scale.

For the UK to fully decarbonise its heat sector, policy must create a level playing field for all low-carbon technologies, from heat pumps to bioenergy, biomethane, and geothermal. Households, businesses, and industries must be given both the incentive and the regulatory push

to adopt the best solutions for their needs, at an affordable price. Unfortunately, so far Labour has been light on the specifics of how it will address these pressing issues.

Now is the time for a step change in the UK's approach to heat decarbonisation. The challenges are significant, and so far, policy has lacked the focus to design and deliver a comprehensive strategy. But the stakes are high. A secure, decarbonised heat system would reduce emissions, stabilise energy prices, and lessen the UK's dependence on volatile international fossil gas markets. The potential benefits are substantial, and the UK must now redouble its efforts to move forward.

*Frank Gordon,
Director of Policy*



REA

Sector Recommendations

Heating and Cooling

UK domestic and business buildings remain the most energy inefficient buildings in Europe. Successfully decarbonising all UK heat demand is going to need a wide range of low carbon technologies, ensuring the right technology is used in the right situation and the decarbonisation of our gas network. Current domestic heat support schemes need to be more ambitious, while there remains a huge policy gap in relation to non-domestic heat decarbonisation that must be urgently addressed. If done correctly, more than half of UK heat demand could be decarbonised by 2035.

To achieve this, the Government must:

- Urgently deliver loans and grants for the installation of low carbon heating and energy efficient materials via the Warm Homes Plan. Consider the successes of previous policies, allowing salary sacrifice schemes where repayment is required. As part of this, the Government should also expand the Boiler Upgrade Scheme. This should ensure all technologies, including biomass and energy efficiency measures, are able to access the new higher grant level of £7,500.
- Deliver commercial and industrial decarbonisation through development of a fuel switching tariff and Heat Contract for Difference (CfD) mechanism. A fuel switching tariff will enable organisations to switch from fossil fuels to a range of low carbon alternatives including heat pumps, bioenergy fuels, hydrogen and geothermal. At the same time, incentivise large-scale

industrial heat decarbonisation projects through the establishment of a Heat Contracts for Difference (CfD) mechanism, open to all low carbon technologies and all large-scale industries. This would replicate the success of the power CfD in procuring affordable capacity.

- Deliver a Geothermal Development Incentive by the end of 2025, targeted at shovel ready geothermal heat projects, to get the sector established in the UK.
- Deliver market-based policies to realise the further decarbonisation potential for biogas. This includes driving up gate fees through separate food and garden waste collections; ensuring strong markets for AD digestate; establishing negative emission markets; and better recognition of biogas within the UK Emissions Trading Scheme (UK ETS).

Hydrogen

Hydrogen is likely to play a role in the decarbonisation of our power, heat and transport systems and can be exported. It is therefore important the next Government ensures an effective environment for hydrogen production, no matter its end use. Hydrogen production must be done in a net zero way in the UK as a key underlying principle.

The Government should:

- Ensure further delivery of allocation rounds for the Low Carbon Hydrogen Business Model in 2025, to continue to establish hydrogen production in the UK.
- Ensure this supports all possible hydrogen production pathways, aligned with the Low Carbon Hydrogen Standard, including bio-hydrogen pathways.

Circular Bioresources

Natural Resources & the Circular Bioeconomy

Circular Bioresources refers to the management of biodegradable wastes and materials. This includes composting, aerobic and anaerobic digestion, other biological treatment methods, landspreading, and the use of biologically treated materials to improve our natural resources.

Research from the Copper Sustainability Partnership⁽¹⁾ reveals that over half of government-published waste and recycling datasets have been phased out since 2010, due to funding cuts for environmental protection and changes in waste reporting following Brexit. As a result, the most recent available data only extends to 2022, though we have used more recent figures where possible. The REA is urging the new Government to reinstate key environmental reporting to support progress toward Circular Economy targets.

Wales continues to lead in recycling through the 2022/23 reporting period, achieving a 64.3% recycling rate for household waste and 76% for non-household waste, with an overall rate of 65.7%⁽²⁾. This ranks as the third highest recycling rate globally, surpassing the 64% target set in the 2021 Beyond Recycling Strategy⁽³⁾. Since devolution, the Welsh Government has invested £1 billion in municipal recycling, boosting rates from just 4.8% in 1998/99⁽⁴⁾. In 2023, Wales also reduced local authority municipal waste by 7.2%, now down to 1.4 million tonnes annually⁽²⁾. The Net Zero Wales Plan aims to further advance Wales toward a circular, low-carbon economy⁽⁵⁾.

In 2022, Scotland achieved a record-high recycling rate for waste from households, businesses and public services of 62.3%, while landfill usage dropped to a historic low of 23.2%⁽⁶⁾. That year, Scotland generated 10.16 million tonnes of waste. In August 2024, the Circular Economy (Scotland) Bill came into effect, requiring Scottish Ministers to implement measures that support a circular economy. These include setting waste reduction targets, increasing penalties for waste crime, improving waste monitoring, and ensuring proper waste disposal by households and businesses. The reforms aim to reduce waste generation and boost recycling rates across material types.⁽⁷⁾

44.1%

UK HOUSEHOLD WASTE RECYCLING RATE IN 2022

In 2022/23, 87.1% of the waste collected in Northern Ireland was household waste, and 50.7% of it was recycled. Household waste collection fell by 6.1% compared to 2021/22, and biodegradable waste sent to landfill decreased by 13.8%. The overall recycling rate for Northern Ireland stood at 49.7%⁽⁸⁾. In June 2023, the Department of Agriculture, Environment and Rural Affairs (DAERA) completed its consultation on 'Rethinking Our Resources: Measures for Climate Action and a Circular Economy in NI.' Actions stemming from this consultation could further boost recycling rates in the future.

England's household recycling rate dropped to 43.3% in 2022/23, down 0.8 percentage points from the previous year. Organic waste recycling fell 12% to 3.7 million tonnes, and dry recycling decreased by 5.9% to 5.5 million tonnes. Total household waste declined by 6.6% to 21.3 million tonnes⁽⁹⁾. Despite falling recycling rates, progress has been made with Simpler Recycling reforms, which mandate food and garden waste collections for households by March 2026 and food waste collections for businesses by March 2025 (with a two-year extension for micro-firms). The confirmation of these regulations gives the organics industry a clear timeline to prepare for increased feedstock volumes.

The overall UK recycling rate for waste from households (WfH) was 44.1% in 2022, a slight decrease from 44.6% in 2021⁽¹⁰⁾. These figures cover all recycling, not just Circular Bioresources materials. Both Northern Ireland and England's recycling rates remain below the 50% target set by the now non-binding EU Waste Framework Directive, which has been the only UK-wide benchmark in recent years.

¹ Copper Sustainability Partnership, 2024, <https://www.cusupuk.com/half-of-waste-datasets-phased-out-conservatives/>

² Welsh Government, 2023, <https://www.gov.wales/local-authority-municipal-waste-management-april-2022-march-2023>

³ Welsh Government, 2022, <https://www.gov.wales/new-stats-show-wales-remains-high-recycling-nation>

⁴ Welsh Government, 2022, <https://www.gov.wales/new-stats-show-wales-remains-high-recycling-nation>

⁵ Welsh Government, 2021 <https://www.gov.wales/net-zero-wales>

⁶ Scottish Environmental Protection Agency (SEPA), 2024, <https://beta.sepa.scot/news/2024/scotland-s-recycling-rate-hits-all-time-high>

⁷ Scottish Parliament, 2024, <https://www.parliament.scot/bills-and-laws/bills/s6/circular-economy-scotland-bill>

⁸ Northern Ireland Department for Agriculture, Environment and Rural Affairs (DAERA), 2023, <https://www.daera-ni.gov.uk/news/northern-ireland-local-authority-collected-municipal-waste-management-statistics-released-34>

⁹ Defra, 2023, <https://www.gov.uk/government/statistics/local-authority-collected-waste-management-annual-results/local-authority-collected-waste-management-annual-results-202223>

¹⁰ Defra, 2024, <https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste>

COMPOSTING IN THE UNITED KINGDOM

It should be noted that waste data, especially for biodegradable wastes, is extremely difficult to collect and significant changes in tonnages from one year to another could be due to changes in data collection methodologies or inaccuracies.

UK composters can certify their compost through the Renewable Energy Assurance Ltd's (REAL) Compost Certification Scheme (CCS). Certified compost meets the End of Waste rules and is considered a product. Therefore, it can be used without waste regulatory controls. In this publication, "quality compost" refers to compost certified under the CCS, while "off-specification" or "off-spec" compost refers to uncertified compost that remains classified as waste.

Data on the amount of quality compost produced is affected by the number of composting sites certified under CCS. According to the REAL Annual Report 2023 ⁽¹⁾, there were 165 CCS certified composting processors in the UK at the end of 2023. This includes 134 sites in England, 21 sites in Scotland, 13 sites in Wales, and 6 sites in Northern Ireland. In 2023, around 56% of all sites with permits for composting in the UK were certified under CCS.

In 2023, the UK produced 2,089,474 tonnes of quality compost.

2,089,474

TONNES OF QUALITY COMPOST PRODUCED IN THE UK IN 2023

This is a 15.44% increase from 2022. There is no UK data measuring off-spec compost production.

The chart above shows the production of quality and off-spec compost in England over time. In 2023, England produced 1,692,474 tonnes of quality compost. This is a 18.52% increase from 2022 and the most quality compost produced in England since data collection began in 2017. Off-spec compost production in England has decreased over time. The most recent data shows 337,381 tonnes of off-spec compost produced in England in 2022. This is a 12.05 % decrease from 2021.

In 2023, Scotland produced 173,000 tonnes of quality compost, a 10.19% increase from 2022. Northern Ireland produced 162,000 tonnes of quality compost, a 1.25% increase from 2022, and Wales produced 62,000 tonnes, a 4.62% decrease from 2022. There is no data on off-spec compost production for the devolved nations.



The chart above shows the production of quality and off-spec compost in England over time. In 2023, England produced 1,692,474 tonnes of quality compost.

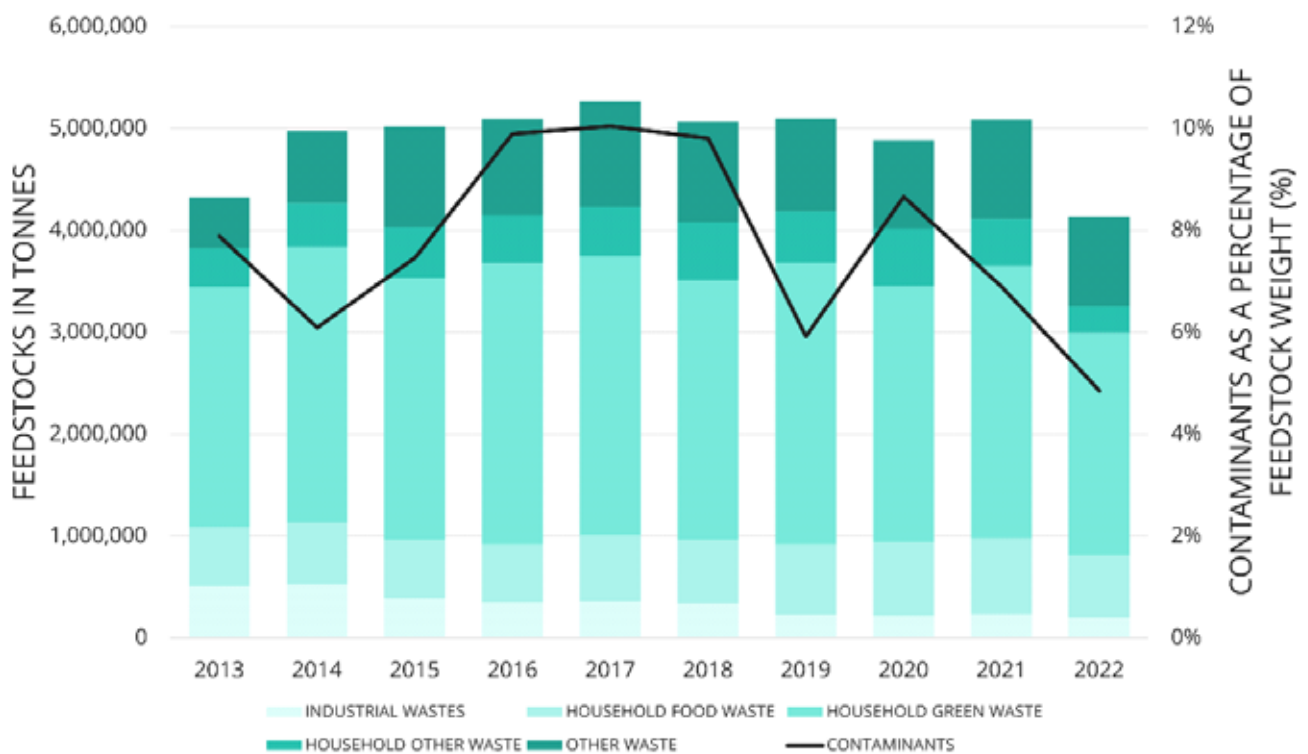
While there is no data available for overall feedstocks received for composting across the UK, the REAL Annual Report 2023 does provide data on feedstocks received for quality compost production across each of the devolved nations. According to their report, England received 3,294,000 tonnes of waste for quality compost production in 2023, down 1.02% from 2022. Wales received 395,000 tonnes of waste for quality compost production in 2023, up 203.85% from 2022. This is likely because 2 additional compost sites in Wales were certified under CCS between 2022 and 2023. Scotland received 316,000 tonnes of waste for quality compost production in 2023, up 4.64% from 2022, and Northern Ireland received 93,000 tonnes of waste, down 72.97% from 2022. Across the UK, CCS certified sites processed 4,098,000 tonnes of waste in 2023, down 0.15% from 2022.

4,098,000

TONNES OF WASTE PROCESSED BY UK CCS CERTIFIED COMPOSTING SITES

REAL, 2023, https://www.qualitycompost.org.uk/upload/annual_report_2023_final.pdf

COMPOSTING FEEDSTOCKS RECEIVED IN ENGLAND, AND CONTAMINATION RATES



The chart above shows the amount of feedstocks received for compost production in England over time, along with contamination (as a percentage of total feedstocks) during the same period. In 2022, England received 4,133,083 tonnes of waste for composting, a 18.73% decrease from 2021. Of this, 52.76% of feedstocks for composting in England came from household green waste, 21.28% from other waste, 14.9% from household food waste, 6.32% from other household wastes, and 4.74% from industrial wastes. Household green waste remains the dominant feedstock for composting in England. While contamination in compost feedstocks appears to be at an all-time low (4.85% of total feedstock weight in 2022), feedstock contamination is difficult to measure and therefore this data is highly variable.

BIOFERTILISER FROM ANAEROBIC DIGESTION IN THE UNITED KINGDOM

It should be noted that waste data, especially for biodegradable wastes, is extremely difficult to collect and significant changes in tonnages from one year to another could be due to changes in data collection methodologies or inaccuracies.

UK anaerobic digestion (AD) plants can certify their digestate through the Renewable Energy Assurance Ltd's (REAL) Biofertiliser Certification Scheme (BCS). Certified digestate meets the End of Waste rules and is considered a product. It can be used without waste regulatory controls. In this publication, "quality digestate" refers to digestate certified under the BCS, while "off-specification" or "off-spec" digestate refers to uncertified digestate that remains classified as waste.

Data on the amount of quality digestate produced is affected by the number of AD sites certified

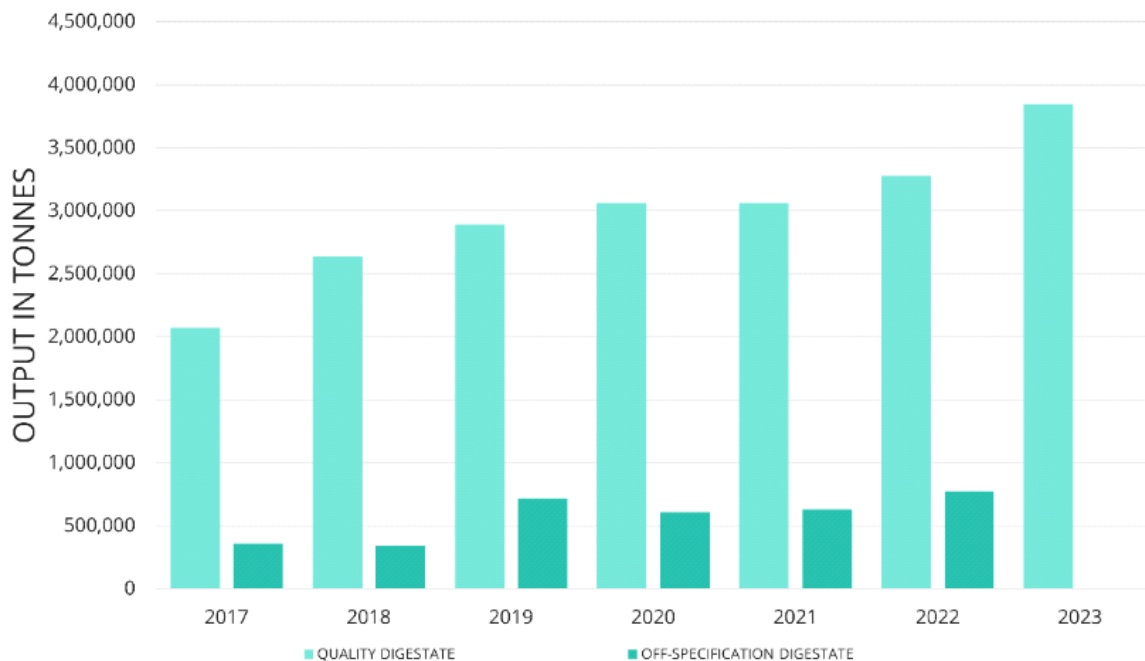
under BCS. According to the REAL Annual Report 2023 [1], there were 106 certified BCS processes in the UK at the end of 2023. This includes 78 sites in England, 13 sites in Scotland, 8 sites in Wales, and 7 sites in Northern Ireland. In 2023, around 30% of permitted AD or biogas sites in the UK were certified under BCS.

In 2023, the UK produced 4,943,451 tonnes of quality digestate. This is a 8.46% increase from 2022. There is no UK data measuring off-spec digestate production.

The production of quality and off-spec digestate in England was 3,846,469 tonnes of quality digestate in 2023. This is a 17.51% increase from 2022 and the most quality digestate produced in England since data collection began in 2017. The most recent data shows 770,327 tonnes of off-spec digestate produced in England in 2022. This is a 22.7% increase from 2021.

In 2023, Wales produced 238,811 tonnes of quality digestate, a 5.23% increase from 2022. Scotland produced 703,845 tonnes of quality digestate, a 17.36% decrease from 2022, and Northern Ireland produced 154,325 tonnes, a 24.98% decrease from 2022. There is no data on off-spec digestate production for the devolved nations.

**AMOUNT OF QUALITY AND OFF-SPECIFICATION DIGESTATE
PRODUCED IN ENGLAND**



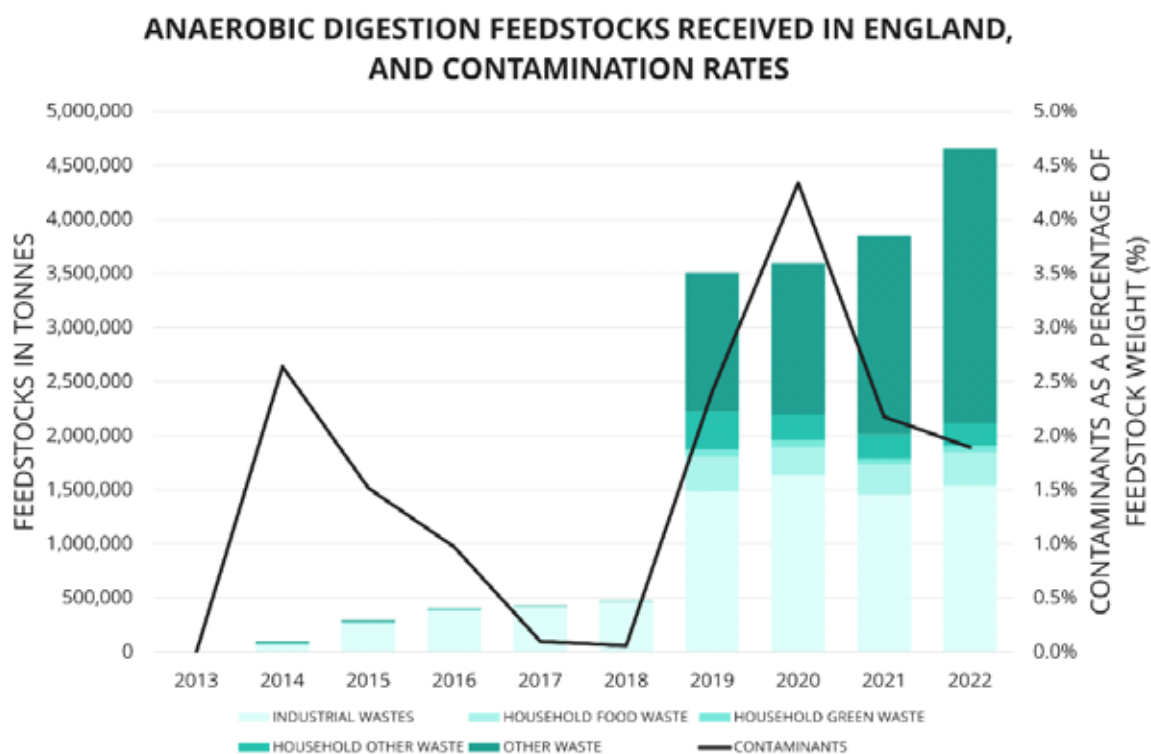
The chart above shows the production of quality and off-spec digestate in England over time. In 2023, England produced 3,846,469 tonnes of quality digestate.

In 2022, England received 4,656,913 tonnes of waste for AD, a 20.99% increase from 2021. Of this, 61.46% of feedstocks for AD in England came from other wastes, 37.25% from industrial wastes, 7.51% from household food waste, 5.05% from other household waste, and 1.4% from household green waste. 'Other wastes' has taken over 'industrial wastes' as the dominant feedstock for AD in England. However, incoming Simpler Recycling reforms are expected to significantly increase the amount of industrial food waste and household food waste sent to AD for recycling in England. While contamination in AD feedstocks appears to be decreasing (1.89% of total feedstock weight in 2022) from a peak in 2020, feedstock contamination is difficult to measure and therefore this data is highly variable.

While there is no data available for overall feedstocks received for AD across the UK, the REAL Annual Report 2023 does provide data on feedstocks received for quality digestate production across each of the devolved nations. According to their report, England received 4,130,156 tonnes of waste for quality digestate production in 2023, up 7.25% from 2022. Wales received 267,696 tonnes

of waste for quality digestate production in 2023, up 0.26% from 2022. Scotland received 1,230,928 tonnes of waste for quality digestate production in 2023, up 22.85% from 2022, and Northern Ireland received 240,000 tonnes of waste, down 0.83% from 2022. Across the UK, BCS certified AD sites processed 5,868,780 tonnes of waste in 2023, up 9.45% from 2022.

REAL Compost Certification Scheme (CCS) Annual Report, 2023. https://www.qualitycompost.org.uk/upload/annual_report_2023_final.pdf



The chart above shows the amount of feedstocks received for digestate production in England over time, along with contamination rates (as a percentage of total feedstocks) during the same period.

From Policy to Practice: How the REA is Leading UK Recycling & Circular Economy Reforms

Over the past year, we've seen progress across the waste and resources sector regulations in the UK. The REA has played a key role in pushing forward Simpler Recycling reforms, Quality Protocol revisions, and various other initiatives that emphasise the importance of organics, soil protection, and effective regulatory frameworks to support the transition to a circular economy.

England has made significant progress with the Simpler Recycling reforms, including mandatory food and garden waste collections from households (from March 2026) and food waste collections from businesses (from March 2025 with a two-year extension for micro-firms). These have long been advocated by the REA and are now enacted by the commencement regulations laid prior to the dissolution of Parliament. The commencement regulations provide clear timelines, allowing the organics industry to plan for the increased tonnages of feedstocks that are likely to result from the reforms.

The REA continues to engage with the Department for Environment, Food and Rural Affairs (Defra) on the associated statutory guidance which has been delayed due to the election and change of government. We are highlighting the need for sufficient funding for education and communication campaigns to maximise capture of unavoidable food and garden waste. Our goal is to ensure collections are not only high in volume, but also in quality. This will enable effective composting or anaerobic digestion and allow organic waste to produce renewable energy, enable carbon capture, and return vital nutrients back to our soils.

Good progress has also been made in revising

the Compost and Anaerobic Digestate Quality Protocols, with the REA actively involved in the task and finish group. The Environment Agency (EA) has agreed to publish interim revised Resource Frameworks (the new name for Quality Protocols) whilst additional risk assessment work is undertaken. The REA circulated the draft Resource Frameworks to members, hosted industry-wide discussions, and provided detailed feedback to the EA. We supported the introduction of tighter plastic limits for compost and digestate, as we want to protect soils, but have also called for more work to be done with waste producers to improve the quality of feedstocks. Once the risk assessments are complete, the Resource Frameworks will be reviewed and revised if necessary. Retaining End of Waste positions for compost and digestate is essential for industry and remains a high priority for the REA.

Representing our members' views in shaping policy reforms is an ongoing focus of our work. We publish briefings for members on important consultations, facilitate discussions, and canvas member views to inform the REA's responses.

Recently, the Scottish Government and the Scottish Environmental Protection Agency (SEPA) proposed changes to environmental authorisations, which has implications across the resources and waste sector. We held a member meeting, provided feedback on the initial consultations, and we await further details from SEPA on what environmental authorisations will look like so we can continue industry discussions.

The Scottish Government have also consulted on their Circular Economy and Waste Route Map to 2030, proposing various changes across the waste and resources sector to improve circularity

in Scotland. In Northern Ireland there are similar discussions ongoing via an associated consultation titled 'Rethinking our Resources: Measures for Climate Action and a Circular Economy in NI'. The REA responded to both consultations, incorporating members' views into these broader plans and highlighting the role our members play in achieving a fully circular economy. Globally, we were proud to be involved in landmark discussions for the adoption of compostable Price Look Up (PLU) stickers for fruit and vegetables.

In addition to responding to consultation responses, our team has been busy participating in task-and-finish and co-design groups across the regulatory landscape. We are working with Defra on agricultural reforms including co-design of regulations to tackle pollution from farming, particularly ammonia emissions. We continue to emphasise the importance of soil protection and the vital role compost and digestate play in providing nutrients and organic matter back to the soil.

With all the regulatory changes, one of our ongoing calls to Government has been for adequate resources for our environmental regulators. This is essential to ensure fair implementation and enforcement of regulations, maintaining a functioning permitting system, and preventing illegal operators from undercutting legitimate businesses.

You can read more detailed briefings on all the above on the Our Resources section of the REA website.

Jenny Grant
Head of Organics and Natural Capital, REA



REA

Sector Recommendations

Circular Bioresources

The delivery of a Circular Economy and the energy transition go hand in hand. Resources must be effectively reduced, collected, processed and used to ensure the UK can make the most of its valuable resources and deliver the best possible environmental outcomes. The new government needs to prioritise waste and resource policy while recognising its interaction with the wider energy transition.

The Government must:

- Ensure the **Environmental Regulators are adequately funded** immediately to address the considerable existing backlog of applications and issues, enabling regulations to be consistently enforced and drive out waste crime. In the longer term, the new Secretary of State must conduct a strategic review of how the environmental regulators function.
- Ensure Defra is adequately resourced to deliver the Resources and Waste Strategy reforms especially **fully deliver high performing mandatory food and garden waste collections** across the UK. Resulting in the public recycling 80% of their food

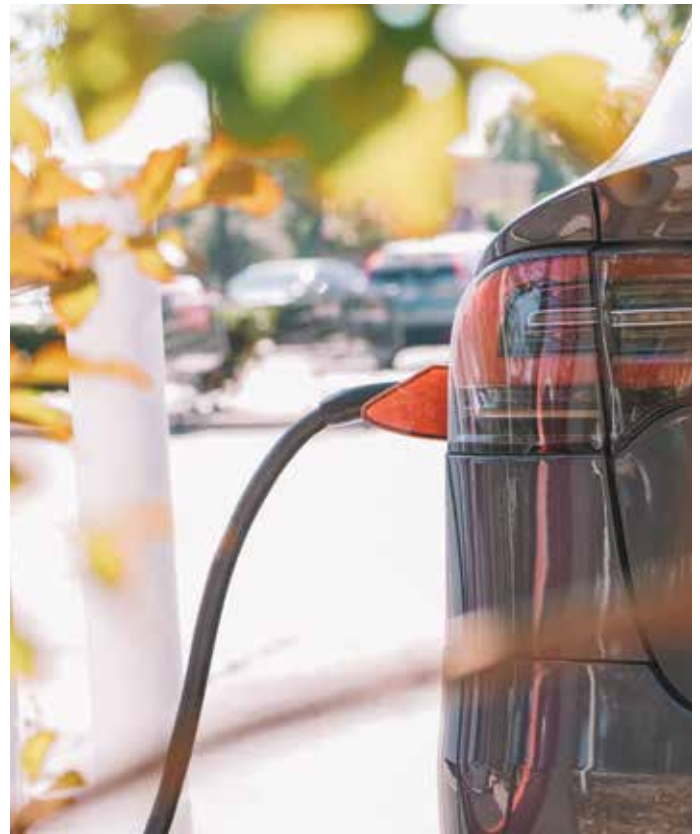
waste, and businesses recycling 90% of their food waste, as demonstrated by residual food waste reported to Government.

- Mandate that all bags and liners used for food waste, tea bags and fruit & veg stickers are independently **certified as at least industrially compostable**.
- Incentivise investment in waste facilities that can biodegrade a wide range of feedstocks so that **nothing goes to landfill in 2030**.
- Support quality organics recycling by committing to funding Local Authorities to deliver local **targeted communications for public behaviour change** for food and garden waste collections, as well as funding centralised campaigns run to deliver high performing collections.
- Prioritise **improving and maintaining the soil health** of agricultural land in the UK by acknowledging the benefits of compost and digestates, and mandating soil health metrics in the Environment Land Management Scheme.
- Preserve the biodiversity and carbon stores within peat bogs by **banning the sale and import of peat** to the amateur horticulture sector.

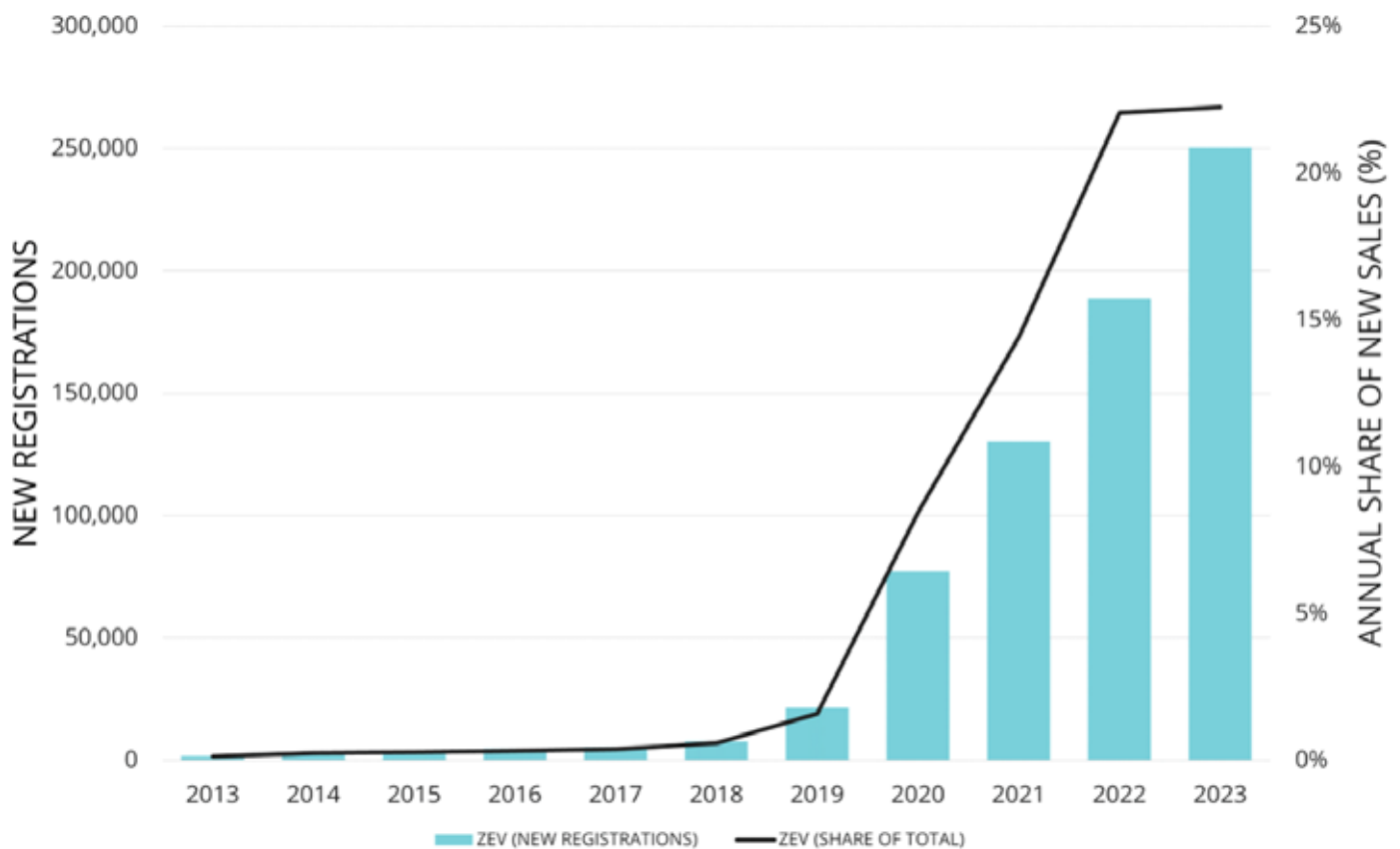
Transport

Renewable Transport Summary

There was steady progress in transport decarbonisation, though it still lacks other sectors such as power -a total of 6% of the UK's transport energy demand in 2023 was met from renewable sources, up from 5.3% in 2022. This is accounted for by the continued availability of E10 at the pump for petrol and diesel vehicles and continued growth of zero emissions vehicles (ZEVs) sales.



REGISTRATIONS OF NEW ZERO EMISSION VEHICLES



Total number and percentage share, of new Electric Vehicle registrations in the UK

Deeper Insight:

Electric Vehicles

In 2023, the UK saw over 250,000 new zero emissions vehicles (ZEV) registered in the country. The ZEV share meanwhile remained similar to levels seen in 2022. There were a number of contributing factors to this, including Brexit-related uncertainty causing concerns around the UK-EU Rules of Origin. The issue was resolved late in 2023, though may have led to supply chain disruption.

As well as misinformation in the media, the previous Government's decision to delay its ban of the sale of new internal combustion engine (ICE) vehicles from 2030 to 2035 stemmed greater uncertainty in the electric vehicle market. The annual share of new vehicle sales increased marginally, suggesting that the increasing popularity of hybrid vehicles could have impacted on the number of ZEV sales.

The SMMT suggest that, in 2023, all hybrid types increased as a proportion of total vehicle sales rising from 2022⁽¹⁾. Here we would attribute factors such as misinformation (particularly concerning the availability of public charging infrastructure) as significant contributing factors in the decision for consumers to purchase a hybrid rather than zero emissions vehicle. With the confirmation of ZEV mandate targets⁽²⁾ requiring that the annual share of ZEVs must rise to 22% for new car sales and 10% for new van sales from 2024, we would expect that the annual share of new vehicle sales to rise next year in line with the mandate.

To ensure that consumers have somewhere to charge, the REA's EV Forum (RECHARGE UK) has campaigned to accelerate chargepoint installation. In July 2023, we published Charging Forward to 2030⁽³⁾, a comprehensive report investigating barriers to chargepoint delivery. The report called for, among other areas, reforms to street works licensing, permitted development rights and grid connections. That same year, the Government published their Plan for Drivers⁽⁴⁾ and the Government subsequently published consultations on reforms to street works licensing and permitted development rights, as well as setting up a grid connections industry review group.

Accelerating chargepoint rollout across the UK to give consumers the confidence to go electric is crucial. This is why we are campaigning on accelerating cross-pavement solutions and other alternative ways to charge such as driveway sharing to be supported.

40%

INCREASE OF NEW ZEV REGISTRATIONS
BETWEEN 2022 AND 2023

Deeper Insight:

Renewable Transport Fuels (RTFs)

In 2023, renewable transport fuels (RTFs) made up 8% of total road fuels supplied, saving on average 82% on GHG emissions compared to the use of fossil fuels. Biodiesel and bioethanol form the largest components consumed, yet their share of the total is declining. This is against the backdrop of development fuels, chiefly hydrogenated vegetable oil (HVO), having grown significantly in recent years.

HVOs have seen increasing take up in the construction sector and a range of use cases, to replace traditional diesel, accelerated by the end of Government subsidies for Red Diesel in several sectors.

Elsewhere, the REA has continued to be closely involved in the development of the Sustainable Aviation Fuels (SAF) targets and accompanying Revenue Certainty Mechanism, confirmed in 2024.



¹ SMMT, 2024, December 2023 New Car Registrations, <https://media.smmt.co.uk/december-2023-new-car-registrations>

² DfT, 2023, Zero Emission Vehicle Mandate Consultation, <https://assets.publishing.service.gov.uk/media/6537c6821bf90d0013d8450b/zev-mandate-consultation-summary-of-responses-and-joint-government-response.pdf>

³ REA, Charging Forward to 2030, https://www.r-e-a.net/wp-content/uploads/2023/07/Charging_Foward_to_2030_Report_19th_July_2023-Hi-Res.pdf

⁴ DfT, 2023, The plan for drivers, <https://www.gov.uk/government/publications/plan-for-drivers/the-plan-for-drivers#transition-to-zero-emission-driving-1>

Deeper Insight:

Electric Vehicles and Electric Vehicle Charging

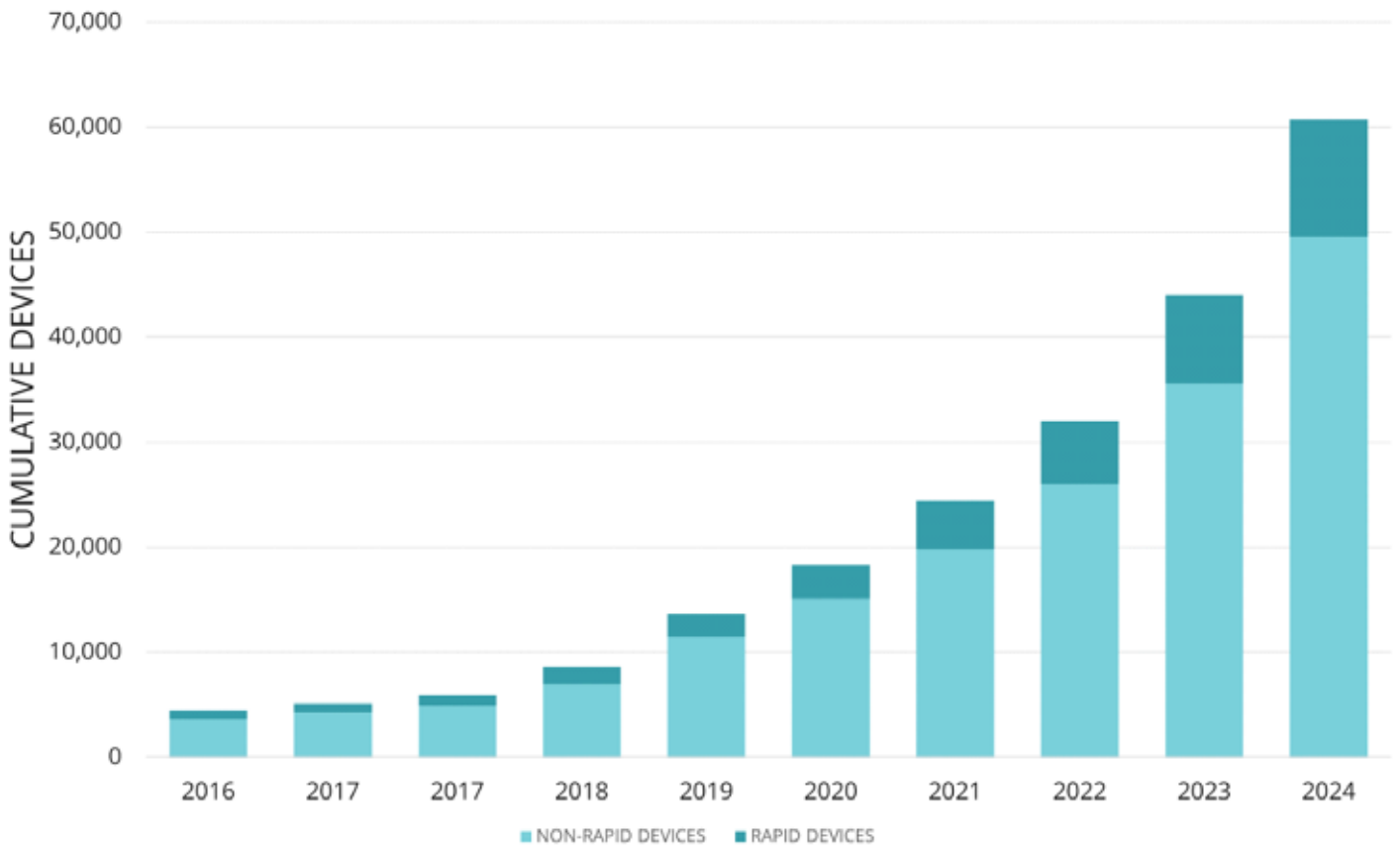
In June 2024, there were over 60,000 public chargepoints in the UK, up by over 15,000 from the same time the previous year. Although non rapid devices and rapid devices have both enjoyed growth the number of on street chargepoint installations is concerning. With procurement issues causing delays in Local Electric Vehicle Infrastructure fund (LEVI) rollout, the number of on street chargepoint installations have fallen from a growth in installations of below 8kW chargepoints of 36% 2022-23 to only 23% in 2023-24 according to ZapMap data⁽¹⁾. The decline in slow device installation speed suggests that recent procurement issues could have a big impact on the growth rate by the end of 2024.

11,176

NEW PUBLIC RAPID EV CHARGING DEVICES

1. Zapmap, 2024. <https://www.zap-map.com/ev-stats/how-many-charging-points>

NUMBER OF ELECTRIC VEHICLE CHARGING DEVICES



The chart shows the increase in electric vehicle charging devices over the past decade. In 2024, 49,549 non-rapid devices and 11,176 rapid devices were installed, a combined total of 60,726 devices. This is up from a combined total of 44,020 in 2023, an increase of 38%.

Data, confidence and EV chargepoint installation

This year there are a number of positive steps we have taken to highlight the thriving EV charging ecosystem beyond the chargepoint numbers. This piece reflects the work our members are doing behind the scenes to make the chargepoint rollout as fast as it can be.

We have seen from the above that chargepoint installations are rising, up by around 20% from last year. And the annual share of new car sales has risen from around 15% last year and must rise to 24% for cars in 2024 due to the Zero Emissions Vehicle Mandate legislated for in January 2024.

However, we are moving away from early adopters towards a more representative set of the population. What this means is that consumers, fleet operators, and others in the ecosystem will look to solutions that are easy to use, understand, be competitively priced and save money over a petrol or diesel equivalent.

In our recent publication *Electrifying the Fleet: A practical resource for fleet managers*⁽¹⁾ we detail the significant number of actors involved in the fleet electrification process. These range from software providers whose fleet analysis proves vital to understanding which routes and vehicles can be electrified, to fleet managers choosing an operator to install a chargepoint, and service providers to run the chargepoints efficiently. The potential of these providers to help fleet managers utilise their chargepoints and fleet vehicles efficiently through smart charging, allowing them to benefit from cheaper energy while being fully operation ready when they are needed, is a crucial part of this journey. Data provided by the Energy Saving Trust, who contributed to the resource, highlights that fuel savings can be as much as £3,500 a year and that's before considering factors like demand-side response programmes utilising smart EV charging.

This year we hosted the first landmark conference to highlight the value of data and information in the EV sector, which we hope will be the first of many. Our panellists highlighted how interconnected the EV sector is which many attendees found particularly insightful. It was a fantastic day of networking and insights for the sector which we hope to replicate in 2025.

We have also been busy creating a number of new working groups within RECHARGE UK for members to operate within, to develop their professional networks and contribute to thought leadership. These include Alternative Base Charging; Cyber Security; Cross Pavement; Interoperability; Vehicle to Grid; and the HGV and Commercial Fleet working groups, the latter of which produced the aforementioned fleet resource.

There are still significant challenges ahead, looking at how we prioritise grid connections, ensure long-term planning to assist Distribution Network Operators in meeting the growing number of connection requests, build in renewable energy generation and storage into our EV infrastructure, as well as resolving the policy and regulatory barriers to installation. However, we are aware of the opportunities a new Government brings and with our members' support we will move the dial.

Matt Adams
Transport Policy Manager, RECHARGE UK/REA



1. REA, 2024, <https://www.r-e-a.net/resources/rea-fleet-electrification/>

Deeper Insight:

Renewable Transport Fuels

Deployment of renewable transport fuels in the UK is almost entirely driven by the Renewable Transport Fuel Obligation (RTFO), which has been in place since 2008.

The RTFO sets rising targets on suppliers of fossil fuel to UK road transport to displace fossil fuels with renewables. The scheme issues certificates to renewable fuel that meets sustainability criteria on greenhouse gas (GHG) savings and environmental protections. Fossil suppliers can meet their obligations by either supplying the renewable fuels themselves or buying certificates from other suppliers.

On the 2023 data currently available, renewable fuels made up 8% of total road fuels supplied, saving on average 82% on GHG emissions compared to the use of fossil fuel.

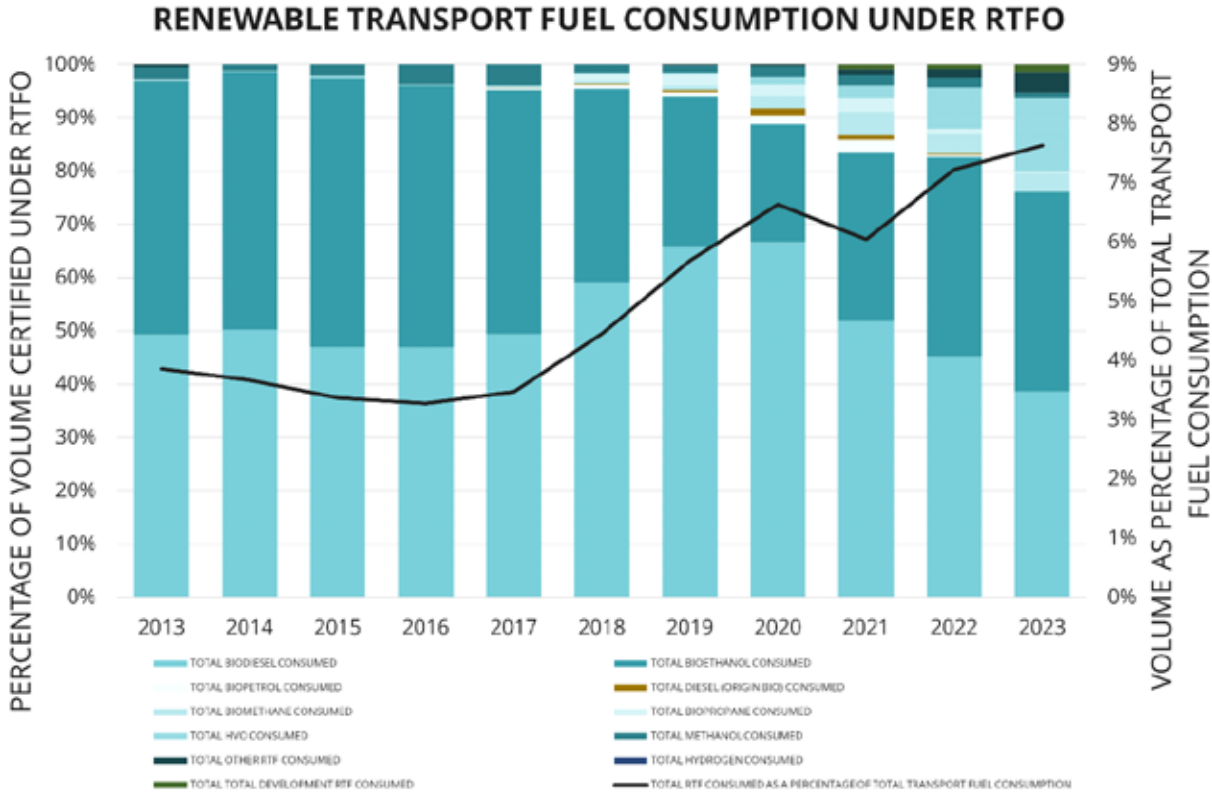
Under the RTFO, biodiesel and bioethanol

14%

HVO CONSUMED AS A PERCENTAGE OF TOTAL CONSUMPTION

constitute the types of fuel with the largest volume of certified fuel. These can be blended into conventional diesel (up to 7%) and petrol (up to 10%) respectively.

However, other renewable fuels have increased over time. Their share has gone from less than 5% in 2018 to 24% in 2023. This is notably driven by the rise in “development fuels”, which have their own dedicated sub-target within the RTFO - including aviation fuel, and ‘drop in fuels’ such as development diesel, petrol and hydrogenated vegetable oil (HVO). The latter has grown spectacularly in recent years. The 2023 volume is twice that seen in 2022 and ten times that reported in 2021.



The chart shows the evolving mix of renewable transport fuels consumption over the past decade. Biodiesel as a percentage of RTF consumption peaked at 67% in 2020 and has declined since then, to 39% in 2023 (2022: 45%). Bioethanol’s share has remained steady at 37% of RTF consumption, the same as 2022. The share of hydrogenated vegetable oil was 14% in 2023, up from 8% in 2022. Altogether, RTF consumption represented 8% of all transport fuel, up from 7.2% in 2022.

Deployment of renewable transport fuels continue to increase steadily, driven by increases in the Renewable Transport Fuel Obligation (RTFO).

Renewable Transport Fuel Obligation (RTFO) targets are set to continue increasing steadily until 2032. While the Government has been at pains to emphasise that this does not mean the policy will end at that point, there is only limited reassurance we can take from this until they set out what they actually do want to happen.

The Biomass Strategy sets a very wide framework for feedstock availability and priorities for use. For the implications for the transport sector, we are still awaiting the publication of a Low Carbon (Transport) Fuels Strategy, the development of which was announced in 2021. We engaged closely with the department as the strategy was developed. Since 2032 is fast approaching, the government urgently needs to develop a much more ambitious strategy.

Even on the most positive outlook for electrification, we will continue to be burning fuels in vehicles for many years to come. We cannot allow those fuels to be predominantly business as usual petrol and diesel and be content for only incremental increases in the use of renewable fuels. The Government's approach in this area should be to ensure that as much as possible of the fuels we will continue to need are renewable - and by that, we also mean delivering maximum greenhouse gas (GHG) savings and continuing to meet stringent wider sustainability criteria.

There is a danger that the Government's approach to electrification and fuels policy will be siloed into an either/or approach. With the REA's strong membership in both areas, we are well-placed to push for the importance of addressing the challenge of decarbonising transport using all the

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THERE IS A DANGER THAT THE GOVERNMENT'S APPROACH TO ELECTRIFICATION AND FUELS POLICY WILL BE SILOED INTO AN EITHER/OR APPROACH. WITH THE REA'S STRONG MEMBERSHIP IN BOTH AREAS, WE ARE WELL-PLACED TO PUSH FOR THE IMPORTANCE OF ADDRESSING THE CHALLENGE OF DECARBONISING TRANSPORT USING ALL THE TOOLS AVAILABLE TO US.

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tools available to us.

As cars and light vehicles will lead the way in electrification, it makes sense to prioritise those uses that are more challenging to electrify. Heavy Goods Vehicles (HGVs) are the most obvious example here. Use of biomethane in HGVs has grown in recent years, backed up by a lower rate of duty.

We continue to push for the Department for Transport and the Treasury to move to a duty regime of setting lower rates for high biocontent fuels and there were some signs before the election that the Government was prepared to look at this - which would include biomethane and high blends of renewable liquid fuels into petrol and diesel. This would do a huge amount to unlock use of these fuels. If the consumer sees that the fuel is significantly cheaper, they will be much more willing to try something different.

Overall, the biggest new area of activity in renewable transport fuels has been the development of a mandate for Sustainable Aviation Fuels (SAF). Our Forum has been fully involved in the development of this policy, through responding to multiple consultations, and engaging proactively on issues, both individually and within the stakeholder forums such as participation in the Jet Zero

Council. The final policy decisions are significantly improved on the original proposals as a result. The mandate is expected to come into effect as planned on 1 January 2025.

The policy is looking to the majority of fuels coming from advanced conversion processes, including those where some or all of the energy comes from 'recycled carbon fuels' – where the fuel is made from fossil residual waste. Government also needs to do more to ensure that the mandate leads to investment in UK production, rather than just hoping to be able to import the fuels we need. Prior to the election, the government consulted on its approach, which looks likely to be some form of Contracts for Difference mechanism. Although the results of that consultation are not yet published, the new government committed in the King's Speech in July to introduce primary legislation that would enable this mechanism, once the policy details are decided upon.

By contrast, there has been very little progress in developing an equivalent approach in the marine sector. The case for developing a policy is similar to that for aviation, and the difference is best explained by a very high level of interest in aviation at senior political level.

We continue to engage both at official and political levels to support the progress that has already been made and to push for greater and faster progress over the next five years and beyond.

Paul Thompson
Head of Renewable Transport Fuels and Landfill Gas, REA



REA

Sector Recommendations

Transport

Decarbonising the transport sector requires both a rapid increase in electric vehicles (EV) and charging infrastructure - especially for road transport - and renewable transport fuels increasingly decarbonising existing internal combustion engines, as well as hard-to-treat sectors like Heavy Goods Vehicles, off-road transport, aviation and shipping. The REA strategy demonstrated that with decisive action over half of UK transport energy demand could be decarbonised by 2035.

The Government must:

- Immediately reinstate the initial 2030 phase-out date for sales of new petrol and diesel cars.
- Reduce the VAT rate at public EV charging points from 20% to 5%, aligning it with the VAT rate applied to domestic EV charging.
- Create a fund for connecting fleet depots to the grid, like that of the rapid charging fund, with money awarded used for the cost of grid reinforcement where it is required. This should be complemented by extending the Plug in Van Grant to meet the Zero Emission Vehicle mandate.

- Create a maintenance fund for public chargepoints as chargepoint operators become more established. A maintenance fund for all publicly funded charging sites will help to ensure a reliable public service.
- Ramp up the Renewable Transport Fuel Obligation (RTFO) targets. Commit to the introduction of more ambitious RTFO targets to ensure existing vehicles on UK roads have as low greenhouse gas emissions as possible. The new targets should extend the RTFO beyond 2032 with a clear trajectory out to 2050.
- Create a duty differential for renewable liquid fuels that meet sustainability criteria to incentivise their use in hard to decarbonise sectors like heavy goods vehicles.
- Agree to a match-funded industry deal to develop an EV infrastructure apprenticeship scheme that is led by chargepoint operators and delivered in conjunction with distribution network operators, chargepoint manufacturers, energy suppliers and motor manufacturers to create a pipeline of skilled workers.

Finance

Employment: Renewable Energy and Clean Technology

The renewable energy and clean technology sector has seen a resurgence in the past year, as the impacts of the COVID pandemic, and the energy crisis caused by Russia's invasion of Ukraine, begin to decline.

The energy crisis, ongoing volatility in global energy markets (predominantly oil and gas), and wider supply chain issues have provided a strong incentive for Government to shift policy towards clean domestic energy and the investment necessary to make it happen.

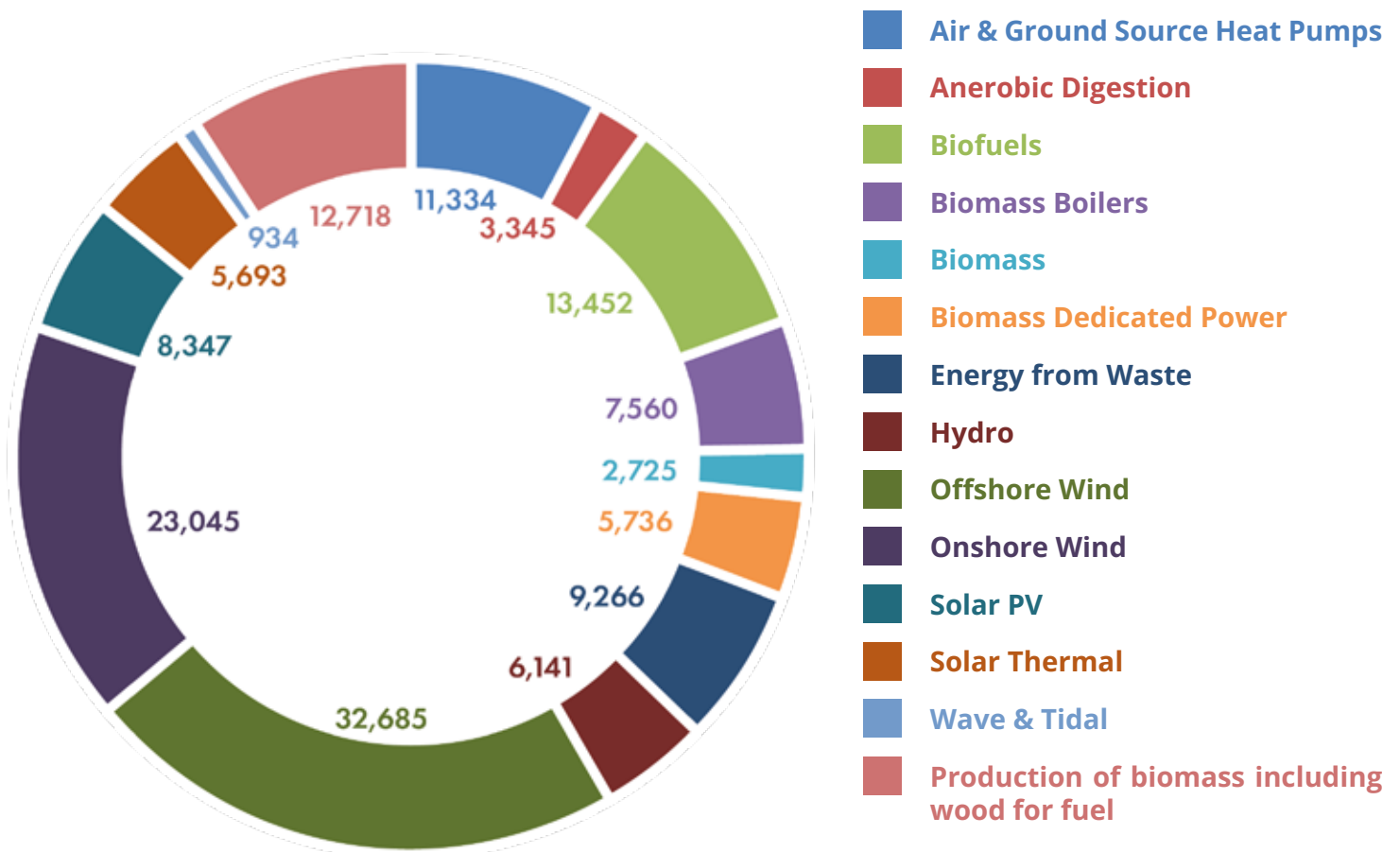
As in previous years, this year's REview provides an overview of estimates of full-time employment, and the market value, of 14 sub-sectors across every nation and region of the UK.

£24.4bn

MARKET VALUE OF THE RENEWABLE ENERGY SECTOR IN 2022-2023

The remainder of this section provides an overview for each sub-sector over the past few years, forward projections up to 2035, and concludes with thoughts on the wider finance and investment landscape for the sector in the UK.

EMPLOYMENT IN 2022-2023 BY SECTOR



We estimate nearly 143,000 people were employed in the renewable energy and clean technology sector in 2022/23, growing by 1.6% compared to the previous year – the REA projects that this could increase to 183,000 by 2035 excluding energy storage and flexibility services. The market value of the sector is projected to increase by 68% from £24.4bn to £41.1bn over the same period. This shows that, with a supportive policy environment in place, the renewable energy and clean technology sector will continue to be an important contributor to the country's economic health, while also helping the UK reach net zero.



Looking Back

Analysing employment & investment in the UK renewable energy sector – from our partner, Innovas

In 2022-23, the UK renewable energy sector experienced continued growth with an increase in market value of 6.0% and an increase in employment of 1.6% to £24.4bn and about 142,981 full-time equivalent employees respectively. The energy crisis and a return to a degree of normality in travel after the COVID-19 pandemic has supported a higher-than-expected level of growth.

There are about 6,832 companies involved in this sector directly and indirectly as part of the supply chain. This is a substantial sector and one that has seen growth from £18.8bn to £24.4bn in the last 6 years with an additional 14,000 people employed.

The market value increase of 6.0% is a return to the levels of growth seen in the 3 years prior to 2020-21 which were between 5% and 9.6%. As in the previous year the picture was mixed with solar PV showing the highest level of growth at 24.5% and biofuels showing a recovery with 18% growth after 2 challenging years due to travel restrictions.

Offshore wind continues to show good employment and value growth at 8.4% and with supportive government policy, both offshore and onshore wind are likely to grow further. Planning reforms, the establishment of GB Energy, the Crown Estate Bill, and increases to Contracts for Difference (CfD) budgets should have a positive impact on the further deployment of wind generation in the UK. While onshore wind grew more slowly than offshore, government policy announcements should see that increase more significantly from 2025 onwards.

Solar PV is having a strong growth period as the cost of solar PV arrays continues to decrease and the energy cost increases seen in 2022-23 make solar PV an attractive and cost-effective solution. The flexibility brought by battery storage improves efficiencies and the high cost of electricity makes payback periods shorter and therefore more attractive. The positive aspects for solar PV to those installing panels on their properties remain, with electricity costs unlikely to decrease to pre-2022 levels anytime soon.

The global situation remains unstable in relation to global energy supplies, with biomass fuels showing a decrease over the last 2 years as a result of transportation issues during and immediately post-pandemic, and supply problems as a result of

142,981

NUMBER OF PEOPLE EMPLOYED IN THE RENEWABLE ENERGY SECTOR IN 2022-2023

Russia's invasion of Ukraine.

Air source heat pumps grew by 8.2%. This market growth has been boosted by more supportive government heat pump policy. Improving costs for heat pump systems, improvements in efficiencies and a better understanding of how best to use them are also supporting a higher level of growth, expected to continue for the near future. However, the previous Government's target of 600,000 installations per year is unlikely to be met in the next few years as current figures are at about 65,000 units per year.

The biofuels sub-sector showed an increase of 18.0% FTEs and is almost back to 2019-20 peak levels. Post pandemic, most people have shifted away from home working, returning to workplaces either in a hybrid pattern or fully onsite. This has resulted in an increase in the use of private vehicles and in turn, biofuels. However, 'new' ways of working and an increase in the sale of electric vehicles will further reduce the number of fossil-powered vehicles and use of biofuels in the coming years.

Solar Thermal continues to decline, partly as other alternatives such as heat pumps are increasingly seen as more flexible and efficient. The development of new hybrid solar thermal systems which use heat pump technology and will be classed as heat pumps in the future is also playing a role. The closure of the Renewable Heat Initiative (RHI) has also resulted in a decline, while heat pumps continue to receive support under the boiler upgrade scheme.

Biomass (dedicated power sources) saw a decrease of 4.0% with limited deployment of new facilities and biomass fuel saw a smaller decrease this year of 3.9% owing to wider market issues in 2022-23. Biomass is expected to remain stable as many operators look to transition to Bioenergy Carbon Capture and Storage (BECCS).

Biomass Combined Heat & Power, energy from waste, anaerobic digestion and hydro showed limited growth or minor decreases. Wave and tidal activity are still mainly at the research and development and proving stage, with largescale deployment yet to occur.

The higher costs of gas and electricity in 2022-23 continued to make renewable alternatives more attractive. This trend is likely to continue as the

UK Government seeks to deliver its clean power mission by 2030, prioritising domestic, renewable energy and sending positive signals for investors and clean power developers.

Renewable Energy Sub Sectors	Market Value (£m)	Employment (FTEs)
Air & Ground Source Heat Pumps	1,896	11,334
Anaerobic Digestion	454	3,345
Biofuels	2,909	13,452
Biomass Boilers	1,125	7,560
Biomass CHP	422	2,725
Biomass Dedicated Power	911	5,736
Energy from Waste	1,382	9,266
Hydro	763	6,141
Offshore Wind	7,168	32,685
Onshore Wind	3,867	23,045
Solar PV	1,095	8,347
Solar Thermal	502	5,693
Wave & Tidal	161	934
Production of biomass including wood for fuel	1,725	12,718
Total	24,380	142,981



Looking Forward

Future Market Value & Employment Projections for UK Renewable Energy Technologies to 2035

The UK's renewable energy sector is on a trajectory for substantial growth by 2035, supported by both technological advancements and policy frameworks. We have assessed the projected market value and employment figures across various renewable energy technologies, providing a comprehensive analysis of each. These technologies are critical to achieving the UK's net zero targets and will play important roles in the energy transition.

Note: these projections are provided by our report partner Innovas and do not necessarily reflect REA's views on each technology's future pathways and development.

Air and ground source heat pumps are expected to grow by 141% in market value, increasing from £1,748 million in 2022-23 to £4,215 million by 2035. Employment is also projected to rise from 11,334 full-time equivalents (FTEs) to 16,147 FTEs, representing a 42.4% increase. The rapid expansion is driven by government incentives and policy focus on decarbonising heat. While the Government's target of 600,000 heat pump installations per year is unlikely to be met, ongoing support under the boiler upgrade scheme and requirements for new build homes and buildings to install low carbon heating will further boost the number of heat pump installations each year.

Anaerobic Digestion technology, used for generating energy from organic waste, is projected to grow moderately. Market value is expected to increase from £437 million to £753 million by 2035, reflecting a 72.3% increase while employment is expected to rise from 3,324 to 3,400 FTEs, a 2.3% increase. While AD remains an important part of the circular economy and vital waste management solution, its growth rate is slower compared to other technologies because of its limited scalability.

The **Biofuels** sector, which saw a significant recovery post-Covid, will experience slower growth moving forward, as the electrification of transport increases. Market value will rise from £2,496 million to £4,042 million by 2035, an increase of 61.9%, but employment is expected to rise only slightly from 14,581 FTEs to 14,933 FTEs. The transition to electric vehicles will likely limit the growth of biofuels, especially in road transport, although biofuels will continue to play an important role in decarbonising sectors like aviation and shipping.



Biomass Boilers, which provide heating using organic material as fuel, will see steady growth, with market value expected to rise by 59.1%, from £1,175 million to £1,870 million by 2035. Employment will rise from 7,726 to 8,351 FTEs, an 8.1% increase. Biomass boilers will continue to play an important role in providing an alternative to fossil fuels for heating, particularly in off-grid locations. However, changes in policy support, for example in the devolved nations (Scotland's Heat in Buildings Bill), could hamper further growth.

Biomass Combined Heat and Power (CHP) is expected to see modest growth, with its market value increasing from £924 million to £1,308 million by 2035, a 41.5% rise. Employment will increase by 6.5%, from 5,726 to 6,101 FTEs. While CHP systems remain efficient for producing both heat and power, their future growth may be constrained by wider supply chain constraints.

The market value of **dedicated biomass power** will increase by 58.2%, rising from £911 million in 2022-23 to £1,441 million by 2035. Employment will increase marginally from 5,726 to 5,946 FTEs. However it is likely that there will be significant market growth and increased employment provided as biomass power generators transition to Bioenergy Carbon Capture and Storage (BECCS).

Energy from Waste (EfW) is another key technology for waste management and energy production. Its market value will increase from £1,355 million to £1,966 million by 2035, a 45.1% rise. Employment will see moderate growth, from 5,253 FTEs to 5,943 FTEs, representing a 13.1% increase. EfW will remain an important part of the waste sector and could see further growth via the retrofitting and deployment of carbon capture and storage technologies, like BECCS, on sites.

Hydro power is one of the more mature technologies in the UK's renewable energy mix and is expected to see steady but modest growth. The market value will increase by 19.7%, from £763 million to £915 million by 2035, while employment will rise from 6,119 FTEs to 6,306 FTEs, a 3.1% increase. Hydropower's growth is constrained by geographical limitations and the relatively high cost of new developments, but it remains a reliable and consistent source of renewable energy.

Offshore Wind Energy is projected to remain a major contributor to the renewable energy sector, with market value rising from £7,598 million in 2022-23 to £12,835 million by 2035, an increase of 68.9%. Employment in offshore wind is expected to grow significantly, from 32,685 FTEs to 50,564 FTEs, a 54.8% increase. A supportive policy landscape, coupled with, ongoing technological

advancement and reduced costs make it one of the fastest-growing sectors.

Onshore Wind, like offshore wind, is likely to see further growth because of renewed, supportive Government policy. Market value will increase by 41.8%, from £3,867 million to £5,482 million by 2035. Employment will rise by 25.7%, from 22,953 FTEs to 28,853 FTEs.

Solar PV technology is set for substantial growth, with market value rising from £1,177 million to £2,100 million by 2035, an increase of 78.4%. Employment is expected to rise from 9,880 FTEs to 18,374 FTEs, a 85.9% increase. The decreasing cost of solar PV systems, combined with supportive Government policy, has made solar PV an attractive investment, particularly when paired with battery storage.

Solar Thermal is expected to grow modestly. Market value will increase by 6.2%, from £502 million to £533 million by 2035. Employment will increase slightly from 5,593 FTEs to 6,358 FTEs by 2035, a 13.7% rise. The closure of the Renewable Heat Incentive (RHI) and move towards heat pumps is likely to limit significant growth in solar thermal deployment.

Wave and Tidal are still to be deployed widely, but show good potential for future growth. By 2035, the market value could be expected to rise by 53.4%, from £161 million to £311 million, while employment is projected to grow from 934 FTEs to 1,159 FTEs, a 24.1% increase. Large-scale deployment has yet to occur, but advances in technology and investment in R&D could see wave and tidal play a larger role post-2035.

Production of Biomass, including wood for fuel, is expected to grow from £1,725 million to £3,098 million by 2035, an increase of 79.5%. Employment is forecast to rise from 12,718 FTEs to 16,309 FTEs, representing a 28.3% increase. The Government's support for Carbon Capture and Storage technologies like BECCS is likely to lead to a further demand for biomass production.

Conclusion:

By 2035, the UK renewable energy sector will see significant growth, with offshore wind, solar PV, and air source heat pumps leading the way in terms of market value and employment creation. More established technologies, such as hydropower, biomass boilers, and energy from waste (subject to policy decisions), will likely continue to grow but at a slower pace. Overall, the sector will play a vital role in the UK's transition to a low carbon economy, enhancing energy security, providing jobs, and increasing investment in the UK.

Building Renewed Investor Confidence in the Energy Transition

When examining global targets, fast-approaching net zero deadlines, and the harsh reality of increasingly warming temperatures, it's often too easy to slip into pessimism about the current state of climate action. The backdrop of geopolitical tensions, policy uncertainties both at home and abroad, and a myriad of other challenges faced by the market such as import tariffs, grid bottlenecks, planning restrictions and supply chain disruptions, only add to this sense of foreboding.

But all is not lost, for there are many reasons to celebrate our progress. For the first time, 2023 saw more than 40% of the world's electricity being generated from zero-carbon sources, and almost 91% of global net power capacity additions come from new solar and wind developments, compared to just 6% from fossil fuels. The first half of 2024 alone saw \$313 billion in new global investments in renewable energy technologies - a true testament to the momentum we're building ⁽¹⁾.

At home, the latest Contracts for Difference (CfD) round, Allocation Round 6 (AR6), was the 'biggest round ever', with the overall budget exceeding £1.5 billion and 131 projects awarded state backed generation contracts. These projects have the potential to power around 11 million homes, and a capacity of 9.6GW. This trend, despite a backdrop of challenging economic conditions, indicates the resilience, competitiveness and appetite for clean energy technologies.

As we acknowledge these achievements, it's imperative to recognise that the pace of this change must accelerate. The renewable energy sector, and the industries lending, advising, investing and underwriting these projects, whilst growing rapidly, still face a multitude of challenges that need urgent attention if we are to stay on track. Government and industry must work together to acknowledge both the current barriers to their deployment and financial closure, as well as potential barriers that may arise in future.

Many of the challenges that have impacted investor confidence in the last twelve months remain pertinent. International competition continues to be significant, especially in the form of the Inflation Reduction Act in the US and the European

Green Deal. Difficult planning regulations and lead times, grid connection constraints, and supply chain issues all represent significant parts of the risk profile currently faced by investors. However, industry and Government should not lose sight of the larger picture, or, for that matter, the positive overall direction to decarbonisation that continues to enjoy cross-party support (at least at the time of writing).

There is also an ongoing need for there to be an honest and transparent public debate about the costs and benefits of transitioning to renewable energy, led by both Government and industry. While the shift may involve significant investments in infrastructure and technology in the short term, this is the only sustainable path to energy security and driving down energy prices in the long term. It is essential to emphasise these returns and ensure the public enjoys the benefits.

With nature degradation alone projected to cause a 12% reduction in the UK's GDP ⁽²⁾ in the coming decades - surpassing the economic damage of both the 2008 financial crisis and the COVID-19 pandemic - climate scepticism, public hesitancy, and political point-scoring cannot be considered valid reasons for inaction.

There is also a potentially important role for public finance in catalysing private investment. The UK's new Labour government is establishing Great British Energy, a publicly owned energy company, a move which provides direct investment into the sector and sends strong signals to the private sector about the Government's commitment to the transition. However, if this is to have positive impact and not crowd out private finance, it is essential that public funds are focused on higher risk but strategically important sectors, which private finance currently struggles to enter. This includes sectors like marine renewables, hydrogen, carbon capture and storage, and longer duration energy storage.

Yet the UK's energy transition requires not just public sector leadership but also a clear, supportive policy environment that encourages private sector investment. Year on year industry stresses the importance of this certainty which includes stable and predictable policy frameworks, incentives for innovation, and support for the development of new and emerging technologies. These policies do not need to be groundbreaking or even costly. As set out in the REA's Autumn Budget 2024 representation, market transparency could be provided by implementing a rolling timetable and budget for the next three CfD allocation rounds. Equally, confidence in repowering existing assets could be secured by announcing clear support for existing assets coming to the end of their



Renewable Obligation (RO) contracts from 2027 onwards.

It is also important to look ahead to future challenges on the horizon. Competition for capital will grow. While clean energy technologies are making significant strides, they are now competing with artificial intelligence (AI) for venture capital, amongst other technological advances. Equity raised by climate-tech firms only made up 12% of the total global venture financing in the first half of 2024, down from 16% in the same period in 2023, with many favouring the higher returns and quicker paybacks often associated with AI ventures ⁽³⁾. What's more, this rapid growth of AI technologies is being followed by an expansion of power-hungry data centres.

To secure the UK's energy security, and to hit our net zero targets, we must compete with global powers such as the US and China for investors. Almost 60% of the climate-tech venture deals completed in the US in the first half of 2024 were cross-border, wherein companies attracted investors from outside the region - mostly due to the multiplier effect of the country's Inflation Reduction Act ⁽³⁾.

It is only through continual action, greater policy certainty and wider public support that we will continue to de-risk the renewable sector,

positioning the UK as a leader in the green economy of tomorrow.

*Francesca Cullaney,
REA Green Finance Analyst*



¹ Bloomberg New Energy Finance, 2024, <https://about.bnef.com/blog/clean-electricity-breaks-new-records-renewables-on-track-for-another-strong-year-bloombergnef/>

² Green Finance Institute, 2024, <https://www.greenfinanceinstitute.com/insights/assessing-the-materiality-of-nature-related-financial-risks-for-the-uk/>

³ Bloomberg New Energy Finance, 2024, <https://about.bnef.com/blog/us-is-top-climate-tech-financier-in-2024-china-led-last-year/>



Region by Region

Regional economic forecasts to 2035

With our partners Innovas, RReview 24 provides employment and market value projections by region and sub sector. These projections include energy storage and flexibility services. Furthermore, we have highlighted some of the key sites, activities and projects that are in the pipeline in every nation and region of the UK.

Nearly 143,000 people were estimated to be employed in the renewable energy and clean technology sector in 2022/23 – an increase of over 2,000, or 1.6%, since 2021/22. UK total market value was estimated to be £24.38bn in 2022/23, up 6% from £23bn in 2021/22.

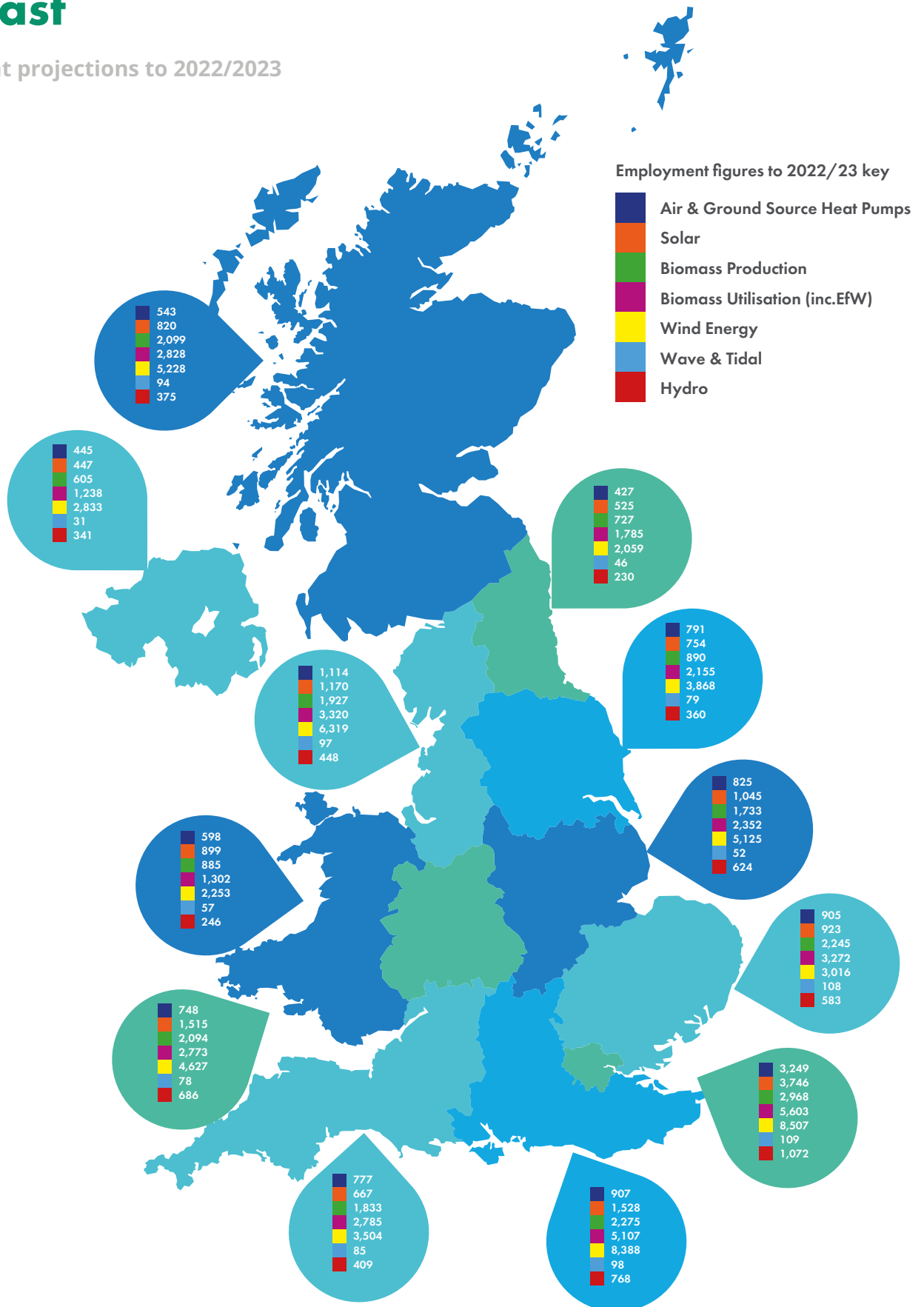
Significantly, due to the very nature of renewables whose location is often influenced by resource availability and centres for demand, these are jobs and revenues that are fully dispersed across the UK.

There are positive signs of growth in all regions and nations in the UK on current trajectories, and these numbers could all be surpassed with the right Government policy.

Made in Britain 2023 Renewable Energy & Clean Tech Jobs Forecast



Employment projections to 2022/2023

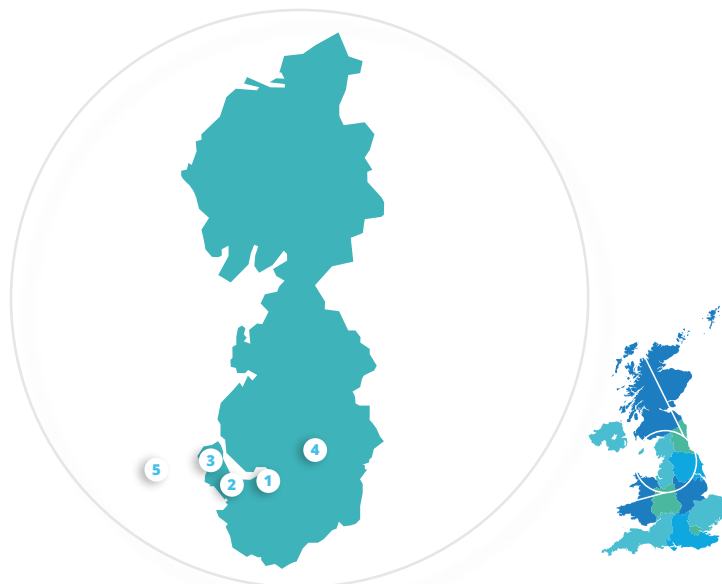


NORTH WEST 2023

Two major population centres and access to the coast have allowed a diverse range of climate-positive industries to develop in the North West.

The region is strong on biofuels, as we estimate it is home to 14% of biofuels jobs (1,911) and a 14% share of the market value (£417m) across the UK. It also performs well across the biomass sector, with Evero's Ince Biomass Power Plant set to become the first biomass waste to energy facility to incorporate carbon capture. Wind energy also plays a large role, with an estimated £1.2bn of market value.

The HyNet North West cluster is an important project in the region, drawing together existing industrial assets, local technical skill, and geological storage for CO2 to develop a hydrogen, CCUS and industrial decarbonisation consortium. HyNet is expected to reduce CO2 emissions by 10 million tonnes per year and deliver 75% of the UK's hydrogen targets by 2030, attracting billions of funding into the region with significant job creation.



- 1. HyNet cluster** – an industrial decarbonisation network project for hydrogen production and carbon capture and storage.
- 2. Ince Biomass Plant** – run by Evero, this 21.5MW plant processing 113,459 tonnes of waste wood a year is set to become the first biomass waste gasification facility to adopt BECCS technology.
- 3. AMP Clean Energy centre** – this on-site energy centre with partners Simpsons Malt showcases a flexible grid solution decarbonising the whisky sector. A high-voltage electric boiler will utilise otherwise-wasted excess wind energy, with a biomass boiler as backup.
- 4. GMCA Waste and Recycling Committee** – approved the development of the first dry AD plants in England as part of its Biowaste Management Strategy.
- 5. Burbo Bank Offshore Wind Farm** – 348 MW offshore wind farm located in Liverpool Bay.

£163M

THE NORTH WEST HAS THE HIGHEST LEVEL OF MARKET VALUE IN AIR AND GROUND SOURCE HEAT PUMPS OF ANY REGION OR NATION OUTSIDE LONDON

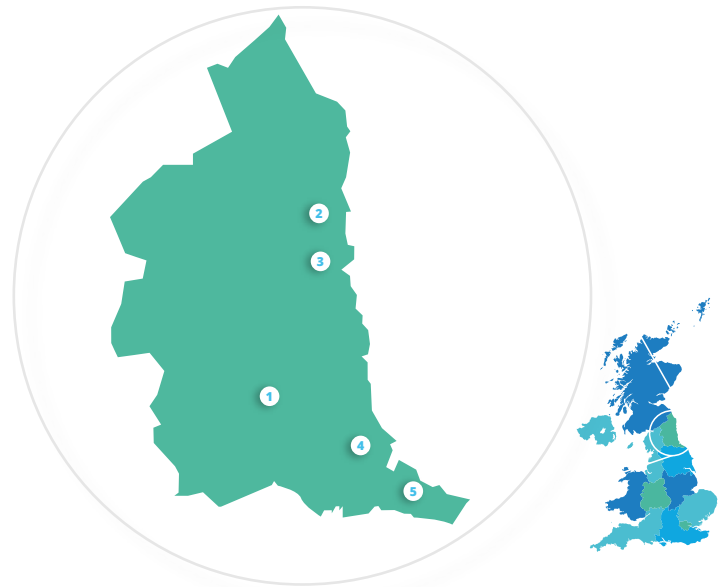
North West 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	1114	9.8%	163	8.6%
Anaerobic Digestion	226	6.8%	26	5.8%
Biofuels	1911	14.2%	417	14.3%
Biomass Boilers	509	6.7%	91	8.1%
Biomass CHP	281	10.3%	39	9.3%
Biomass Dedicated Power	482	8.4%	90	9.9%
Energy from Waste	120	4.5%	78	5.6%
Hydro	448	7.3%	57	7.5%
Wind Energy	6319	11.3%	1205	10.9%
Solar PV	793	9.5%	100	9.1%
Solar Thermal	377	6.6%	40	8.0%
Wave & Tidal	97	10.4%	16	10.2%
Production of biomass inc wood	1419	11.2%	178	10.3%
Total	14396	6.2%	2502	10.3%

NORTH EAST 2023

The North East benefits from large-scale renewable energy generation both onshore and offshore, allowing it to punch above its weight in contributing to energy decarbonisation.

The region is home to the largest offshore wind farm in the world, Hornsea Two, and the currently-in-development Dogger Bank which is set to take the title from Hornsea Two in 2026 with almost triple the capacity. Unsurprisingly, wind is estimated to be the largest sub-sector both by employment (2,059 FTEs) and by market value (£346m).

Relative to the rest of the country, the North East is particularly strong in biofuels, with an estimated 9% of the country's employment in this sub-sector and 8.7% of market value. Teesside will also make up part of the East Coast Cluster, one of the first two carbon capture, usage and storage clusters to be taken forward by the UK government.



- 1. East Coast Cluster** – a CCUS cluster comprising two industrial regions of the UK – Teesside and the Humber – which could capture and store up to 27 million tonnes of CO2 annually by the mid-2030s.
- 2. Dogger Bank Wind Farm** – an offshore wind farm being developed in three phases – Dogger Bank A, B and C – collectively becoming the world's largest offshore wind farm, capable of powering 6 million homes (3,600 MW).
- 3. Hornsea 2** – the largest offshore wind farm in the world, 1,320 MW capacity.
- 4. Gateshead minewater heat network** – largest mine water heat network in Great Britain and one of the largest in Europe.
- 5. Lynemouth biomass plant** – This 420 MW plant was the first UK coal-fired power station to convert to biomass electricity production. It is now the second-largest biomass plant in the UK, generating enough power for 450,000 homes.

1,248

JOBS SUPPORTED BY BIOFUELS

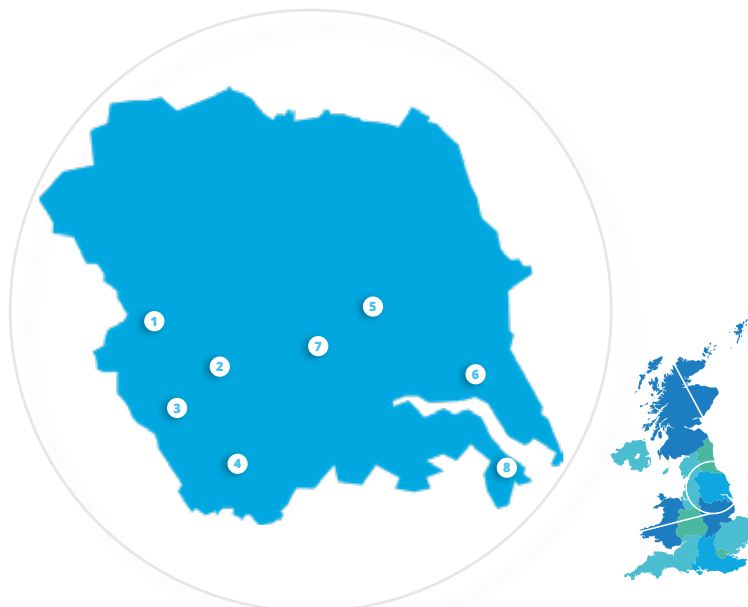
North East England 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	427	2.8%	69	3.6%
Anaerobic Digestion	64	1.9%	9	2.1%
Biofuels	1248	9.3%	253	8.7%
Biomass Boilers	248	3.3%	37	3.3%
Biomass CHP	92	3.4%	13	3.1%
Biomass Dedicated Power	172	3.0%	30	3.3%
Energy from Waste	209	2.3%	29	2.1%
Hydro	230	3.7%	22	2.9%
Wind Energy	2059	3.8%	346	3.1%
Solar PV	345	4.1%	46	4.2%
Solar Thermal	180	3.2%	18	3.5%
Wave & Tidal	46	4.9%	7	4.7%
Production of biomass inc wood	480	3.8%	68	3.9%
Total	5799	4.1%	947	3.9%

YORKSHIRE & THE HUMBER 2023

Yorkshire & The Humber has historically been associated with industrial activity and fossil fuel combustion but is now quickly becoming an exciting hub for renewable energy and clean technology.

The region is home to established projects like the country's largest biomass power station, Drax, and Europe's largest battery energy storage system, Cottingham Battery Storage. The Humber also forms the second industrial area comprising the East Coast Cluster, a carbon capture and low carbon power generation consortium that will significantly contribute to the UK's industrial decarbonisation.

We estimate the region punches above its weight in the tidal sector, with 79 jobs and 9.3% of the country's market share (£15m).



- 1. Phillips 66 Humber** – the first UK refinery to make sustainable aviation fuel (SAF) at scale.
- 2. Enfinium energy from waste sites** – Ferrybridge 1 and 2 are two of the UK's most efficient waste-to-energy facilities, each generating up to 85 MW electricity and will be CCUS ready by 2030.
- 3. Drax power station** – largest biomass plant in the UK generating 4% of UK power.
- 4. Leeds district heating system** – utilising waste heat from incinerating waste (EfW) and heating almost 2,000 buildings.
- 5. Cottingham Battery Storage, Hull** – thought to be Europe's biggest battery energy storage system
- 6. East Coast Cluster** – a CCUS cluster comprising two industrial regions of the UK – Teesside and the Humber – which could capture and store up to 27 million tonnes of CO2 annually by the mid-2030s.

£1.69bn

LEVEL OF MARKET VALUE OF YORKSHIRE AND HUMBER

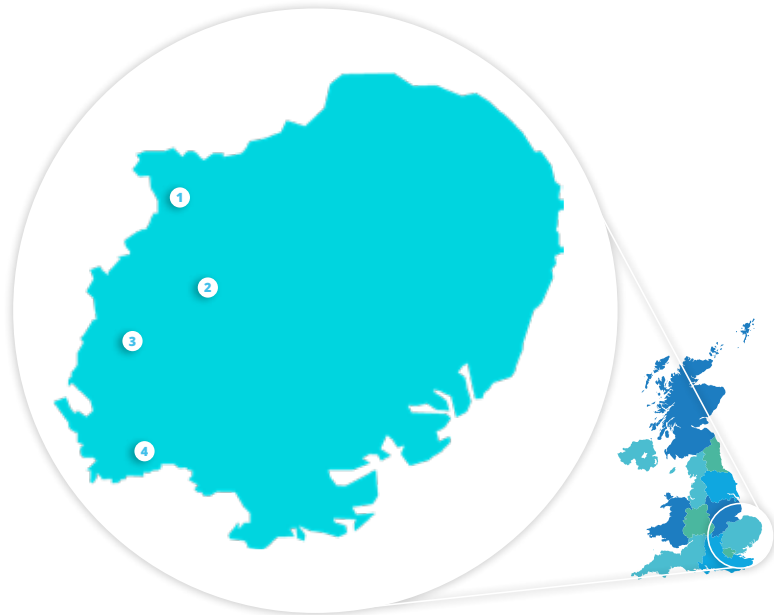
Yorkshire and the Humber 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	791	7.0%	123	6.5%
Anaerobic Digestion	163	4.9%	22	4.8%
Biofuels	886	6.6%	190	6.5%
Biomass Boilers	493	6.5%	84	7.5%
Biomass CHP	183	6.7%	30	7.2%
Biomass Dedicated Power	399	7.0%	61	6.7%
Energy from Waste	542	5.7%	83	6.0%
Hydro	360	5.9%	47	6.1%
Wind Energy	3868	6.9%	890	8.1%
Solar PV	505	6.0%	63	5.8%
Solar Thermal	249	4.4%	18	3.7%
Wave & Tidal	79	8.4%	15	9.3%
Production of biomass inc wood	397	3.1%	62	3.6%
Total	8897	6.2%	1689	6.9%

EAST OF ENGLAND 2023

A large amount of land and coastline have allowed the East of England to develop an array of important projects across East Anglia.

We estimate the region punches above its weight in biomass production, being home to 1,690 employees with a UK market share of 12% (£212m). Almost all sub-sectors are well-represented in the region, with only wind energy lagging slightly. However, this should change with the development of the East Anglia Hub offshore wind complex by Iberdrola.

The importance of the region is set to increase with the proposed Norwich to Tilbury upgrade of the power grid; required to handle all the new electricity generation set to come online in the coming years.



- 1. East Anglia Hub** – this offshore wind complex is being developed by Iberdrola and is expected to be the company's largest offshore wind project worldwide. The project comprises three wind farms: East Anglia ONE North, East Anglia TWO, and East Anglia THREE.
- 2. Sunnica, Gate Burton, and Mallard Pass** – these solar farms are expected to provide about two-thirds of the solar energy capacity in the East of England.
- 3. Envar Cambridgeshire IVC** – this flagship site is one of the biggest in-vessel and windrow composting facilities in the UK. Envar's processes include recycling coffee grounds, producing biomass fuels, and capturing carbon.
- 4. Freeport East** – this project in Felixstowe and Harwich will create a green hydrogen hub and an offshore wind hub. It will also collaborate with research institutions and organizations to drive innovation in the UK's technology and telecommunications sectors.

3,012

JOBS SUPPORTED BY BIOMASS

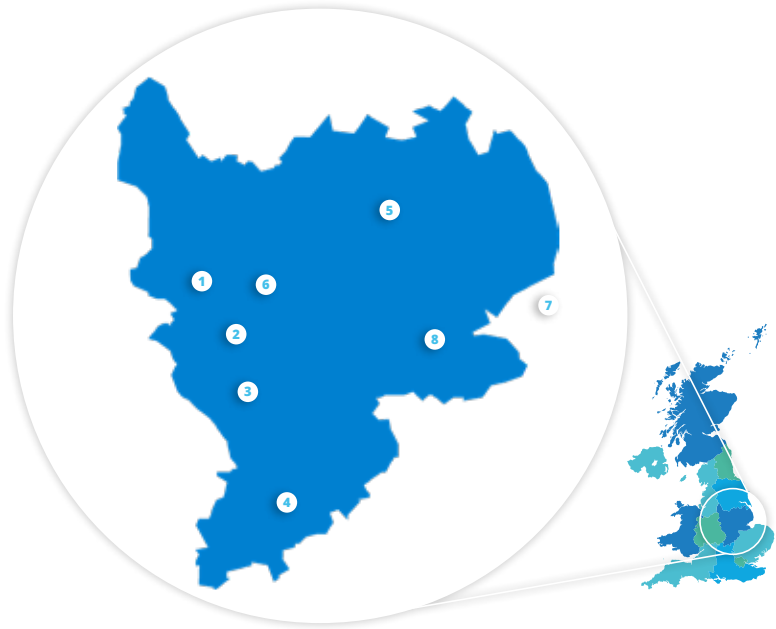
East of England 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	905	8.0%	134	7.1%
Anaerobic Digestion	293	8.9%	45	9.9%
Biofuels	1240	9.2%	281	9.7%
Biomass Boilers	555	7.3%	101	8.9%
Biomass CHP	247	9.1%	38	8.9%
Biomass Dedicated Power	520	9.1%	81	8.8%
Energy from Waste	967	10.4%	134	9.7%
Hydro	583	9.5%	75	9.9%
Wind Energy	3016	5.4%	650	5.9%
Solar PV	499	6.0%	67	6.1%
Solar Thermal	424	7.5%	37	7.4%
Wave & Tidal	108	11.6%	16	9.8%
Production of biomass inc wood	1690	13.3%	212	12.3%
Total	11053	7.7%	1869	7.7%

EAST MIDLANDS 2023

The East Midlands benefits from a history of energy-related industries and is now home to a range of innovative projects in the renewable energy space.

We estimate the region to be a leader in the hydro sub-sector, being home to over 10% of the employment in the sector across the country with 624 full-time equivalent jobs. Biomass production is also a major sub-sector, with the East Midlands accounting for over 10% of employment as well as 10% of UK market value.

The closure of Ratcliffe-on-Soar Power Station, the last of the UK's coal-fired power stations, marks the end of an era. Exciting projects being developed at the site of the plant symbolise the opportunities present for the energy transition as a whole.



- 1. EMERGE Centre** – an Energy Recovery Facility (ERF) that will use waste from recycling to generate electricity and heat. The facility will be located on part of the Ratcliffe-on-Soar power station site.
- 2. International Centre for Zero Carbon** – a project to transform the Ratcliffe-on-Soar power station into a centre for zero carbon technology development. The project is supported by the region's universities and could create 20,000 jobs.
- 3. East Midlands Hydrogen** – the UK's largest inland hydrogen cluster.
- 4. Hardwick Hall and Lyme Park** – Reheat has delivered 100% heat decarbonisation Hardwick Hall, a historic National Trust property, and 87% distribution efficiency for Lyme Park.
- 5. Cranfield University Soil Institute** – the largest group of soil scientists in the UK, with expertise spanning basic soil physics, chemistry and biology; to soil management and conservation; to soil informatics and resource evaluation.

49%

WIND CONTRIBUTED AROUND HALF OF ALL RENEWABLE ENERGY MARKET VALUE IN THE EAST MIDLANDS

East Midlands 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	825	7.3%	136	7.2%
Anaerobic Digestion	187	5.6%	27	6.0%
Biofuels	913	6.8%	237	8.2%
Biomass Boilers	449	5.9%	91	8.1%
Biomass CHP	229	8.4%	33	7.7%
Biomass Dedicated Power	419	7.3%	71	7.8%
Energy from Waste	604	6.5%	92	6.7%
Hydro	624	10.2%	67	8.8%
Wind Energy	5125	9.2%	1019	9.2%
Solar PV	751	9.0%	97	8.9%
Solar Thermal	294	5.2%	27	5.5%
Wave & Tidal	52	5.6%	8	5.0%
Production of biomass inc wood	1283	10.1%	180	10.4%
Total	11759	8.2%	2086	8.6%

WEST MIDLANDS 2023

The West Midlands enjoys a prime location as well as a history of heavy industry. It has developed a diverse range of projects, in particular contributing to transport and industrial decarbonisation.

We estimate solar PV is the sub-sector in which the region is strongest, with 1,109 jobs representing 13% of the sector's employment in the country. Similarly, solar PV represents over 12% of the sector's market value, at £133m.



- 1. Tyseley Refuelling Hub, Birmingham** – the UK's first multi-fuel, open access, low and zero carbon fuel refuelling station is now open.
- 2. Tyseley and Birmingham Energy Innovation Zone** – a project that optimizes the city's waste for energy and heating and creates a distributed heating grid.
- 3. Clean Futures** – a project exploring the market for second life batteries, which are used electric vehicle batteries converted to store energy for small industrial applications.
- 4. Peak Cluster** – an innovative collaboration to capture, transport and permanently store CO2 emissions from neighbouring industries and across Derbyshire, Staffordshire and Cheshire.
- 5. Biffa's Cannock Chase, Staffordshire AD Site** – completed in 2011, this is the largest AD plant in the UK, which can process up to 120,000 tonnes of food waste per year. The plant produces enough energy to power 6,000 homes.

£2.15bn

LEVEL OF MARKET VALUE OF THE WEST MIDLANDS

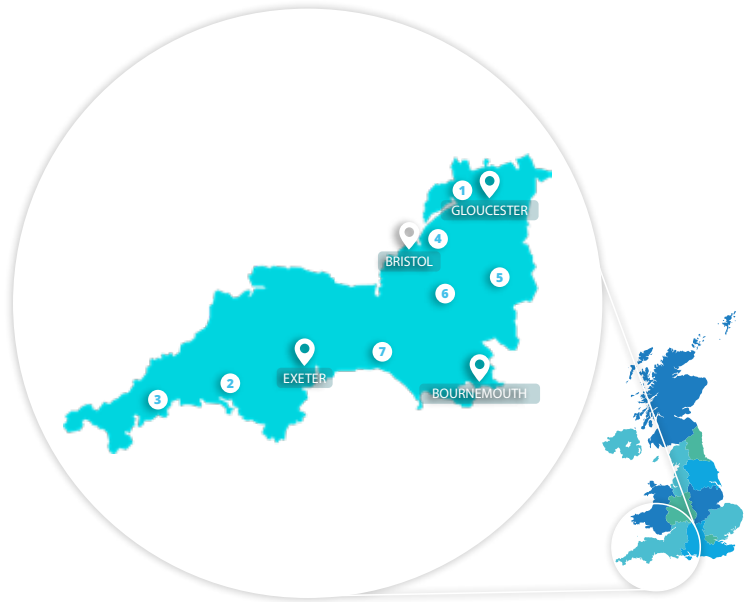
West Midlands 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	748	6.6%	140	7.4%
Anaerobic Digestion	307	9.2%	34	7.5%
Biofuels	1193	8.9%	241	8.3%
Biomass Boilers	653	8.6%	89	7.9%
Biomass CHP	171	6.3%	35	8.4%
Biomass Dedicated Power	421	7.3%	71	7.8%
Energy from Waste	680	7.3%	98	7.1%
Hydro	686	11.2%	90	11.8%
Wind Energy	4627	8.3%	994	9.0%
Solar PV	1109	13.3%	133	12.1%
Solar Thermal	406	7.1%	37	7.4%
Wave & Tidal	78	8.4%	14	8.6%
Production of biomass inc wood	1442	11.3%	170	9.8%
Total	12520	8.8%	2146	8.8%

SOUTH WEST 2023

The South West's unique geography allows it to pioneer in certain sectors, leading the way for the rest of the country.

Cornwall is home to pioneering geothermal projects including the Eden Project's deep geothermal heating system, with further geothermal projects in the pipeline. The region is also home to one of the largest battery storage facilities in Europe, Minety, and ABSL's world-first household waste to grid-quality biomethane facility.

We estimate the production of biomass is the region's strongest sub sector, with 1,295 employees representing 10% of the country's employment in the sub sector, and nearly 12% of market share (£205m).



- 1. Eden Geothermal** – completed in 2023, represents the first operational deep geothermal system in the UK for 37 years.
- 2. Geothermal heating network** – set to be the first deep geothermal district heating network in the UK, expected to be connected by 2027 by GEL at Langarth Garden Village, Cornwall.
- 3. Cornwall energy recovery centre** – operated by Suez, this site processes 240,000 tonnes of waste with enough energy to power 21,000 homes.
- 4. ABSL Swindon plant** – the first facility in the world to convert household waste into grid-quality biomethane using RadGas technology (gasification).
- 5. CNG Fuel Station, Avonmouth** – thought to be the world's largest public-access biomethane refuelling station, capable of refuelling 80 HGVs per hour from 14 high-speed dispensers to support low-carbon deliveries.

10,060

RENEWABLE ENERGY AND CLEAN TECHNOLOGY SECTOR JOBS IN THE SOUTH WEST

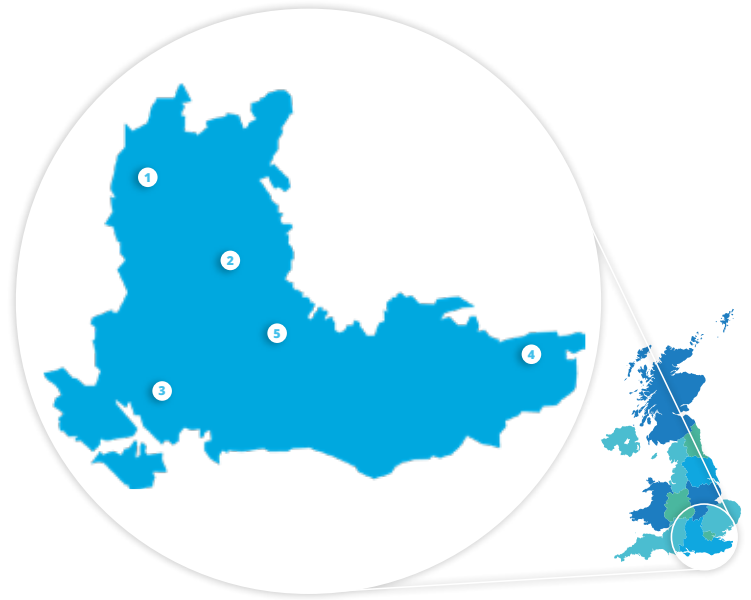
South West 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	777	6.9%	134	7.1%
Anaerobic Digestion	320	9.6%	53	11.7%
Biofuels	976	7.3%	180	6.2%
Biomass Boilers	538	7.1%	81	7.2%
Biomass CHP	222	8.1%	61	7.3%
Biomass Dedicated Power	347	6.0%	67	7.4%
Energy from Waste	920	9.9%	150	10.8%
Hydro	409	6.7%	47	6.1%
Wind Energy	3504	6.3%	707	6.4%
Solar PV	455	5.5%	63	5.7%
Solar Thermal	212	3.7%	24	4.7%
Wave & Tidal	85	9.1%	15	9.1%
Production of biomass inc wood	1295	10.2%	205	11.9%
Total	10060	7.0%	1755	7.2%

SOUTH EAST 2023

Enjoying easy access to Greater London and with a large population to serve, the South East has become a national leader across many sub-sectors.

We estimate the South East has nearly 18% of the country's jobs in anaerobic digestion. For the same sub-sector, the region is home to about £88m, or 19% of the UK's market value.

As the map shows, there are further exciting projects cementing the South East's position as a national leader. This includes the 350 MW Project Fortress facility, a 350 MW solar farm and battery storage site.



- 1. Project Fortress** – a 350MW solar power generation and battery storage facility under development on the north Kent coast.
- 2. London Array** – the second largest offshore windfarm in the UK (630 MW), located 20 km off the coast of Kent.
- 3. Kemsley** - this Combined Heat and Power (CHP) facility run by enfinium processes up to 657,000 tonnes of residual waste, providing power to more than 160,000 UK homes and businesses. Southampton, Solent and Portsmouth University, AD/Marine/Biofuels test centre
- 4. EFDA JET Fusion Flywheel Energy Storage System** – the second largest such site in UK, with a capacity of 400 MW.
- 5. Woodlands In-Vessel Compost Site** – processes 60,000 tonnes of biodegradable waste from the South Downs region each year, run by Veolia.

£3.1 BN

LEVEL OF MARKET VALUE OF THE SOUTH EAST

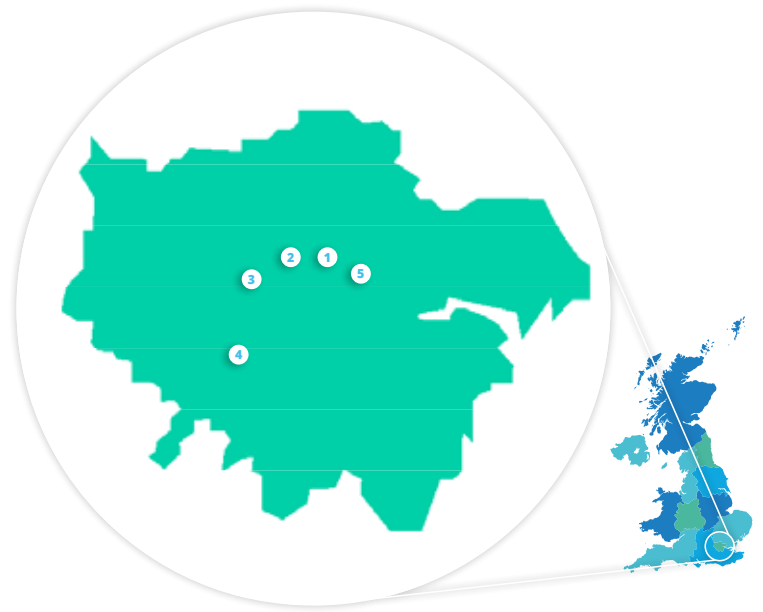
South East 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	907	8.0	144	7.6
Anaerobic Digestion	597	17.8	88	19.4
Biofuels	1633	12.1	368	12.7
Biomass Boilers	842	11.1	114	10.1
Biomass CHP	307	11.3	41	9.7
Biomass Dedicated Power	771	13.4	100	11.0
Energy from Waste	1799	19.4	244	17.7
Hydro	768	12.5	108	14.1
Wind Energy	8388	15.1	1516	13.7
Solar PV	746	8.9	93	8.5
Solar Thermal	782	13.7	62	12.3
Wave & Tidal	98	10.5	17	10.4
Production of biomass inc wood	1433	11.3	204	11.9
Total	19070	13.3%	3099	12.7%

GREATER LONDON 2023

Population density and extensive internal & external transport links have led to an interesting mix of renewable energy and clean technology projects being implemented in the Greater London region.

According to our estimates, wind continues to be the largest industry by employment numbers (8,507 FTEs) and market value (£1.8bn) - this is likely to be largely in supply chains, academia, services and finance rather than operational roles given the constraints of deploying wind power in built up areas.

Relative to the rest of the country, London leads in heat pumps and solar thermal. London holds a 30% market share for the heat pump industry, with the equivalent estimate for solar thermal sitting at 34%.



- 1. Blackfriars bridge** – the world’s largest solar bridge, where 4,400 photovoltaic panels cover an area of 6,000 square metres.
- 2. Bunhill 2 Energy Centre** – a district heat network using waste heat from the tube (a world first) to heat 1,350 homes, a school and two leisure centres in Islington.
- 3. Westminster Council** – the UK’s largest electric waste collection fleet, operated by Veolia. The fleet is also powered by recovered energy from the collected waste.
- 4. REA HQ** – the UK’s largest renewable energy trade association.
- 5. London Southend Airport** – where Syzygy operates the largest ‘on-site’ solar PV project in Europe, contributing to the airport running on 25% renewables.

17.3%

GREATER LONDON SUPPORTS 17.4% OF THE UK’S RENEWABLE MARKET VALUE

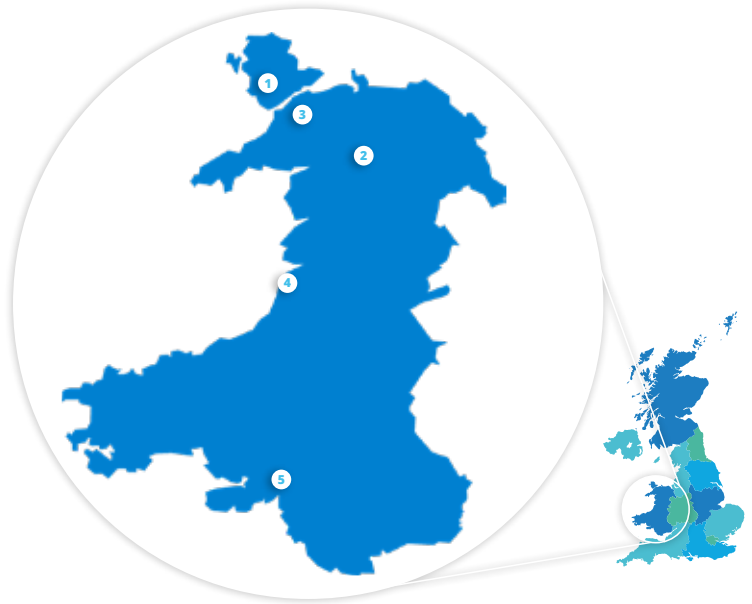
Greater London 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	3249	28.7	577	30.4
Anaerobic Digestion	821	24.5	94	20.7
Biofuels	1491	11.1	291	10.0
Biomass Boilers	1632	21.6	192	17.1
Biomass CHP	421	15.5	76	18.0
Biomass Dedicated Power	1069	18.6	156	17.1
Energy from Waste	1802	19.5	300	21.7
Hydro	1072	17.5	151	19.7
Wind Energy	8507	15.3	1772	16.1
Solar PV	1657	19.9	238	21.8
Solar Thermal	2089	36.7	170	33.8
Wave & Tidal	109	11.6	21	12.9
Production of biomass inc wood	1336	10.5	185	10.7
Total	25255	13.3%	4222	17.3%

WALES 2023

Wales' relatively smaller population contributes to figures that belie its present and potential contribution to the energy transition.

The strongest sub-sector is solar PV, with an estimated 615 jobs which represent 7.4% of the country's employment for the sub-sector. In terms of market value, solar thermal is where Wales performs best, with £36m market value and 7.2% of the UK's market share.

It is in the Circular Economy where Wales really outshines the rest of the country. It has the third highest rate globally for recycling, reflecting its leadership in sustainability through continuous improvements in recycling rates, innovative waste management initiatives, and new workplace recycling regulations.



1. **Llanwern Farm Solar Park** – the largest solar farm in Wales, commissioned in 2021, and the fifth largest renewable energy project in the country.
2. **Morlais Tidal Energy Project** – a project in Pembrokeshire that aims to establish one of the largest tidal energy demonstration zones in the UK with the potential to generate up to 240MW of low carbon clean electricity.
3. **Global Centre in Clean Energy (CLEETS)** – a £10 million project at Cardiff University that will develop sustainable transportation strategies.
4. **Wales Centre of Excellence for Anaerobic Digestion** – based in the University of South Wales, focuses on industry-led research to develop and optimize biological processes that enhance renewable energy, waste treatment, and material efficiency while reducing environmental impacts.
5. **Dinorwig power station** – also known as Electric Mountain, this hydroelectric facility is the largest pumped-storage plant of its kind in Europe, able to produce 1,728 MW to stabilise National Grid demand.

6,241

RENEWABLE ENERGY AND CLEAN TECHNOLOGY SECTOR JOBS IN WALES

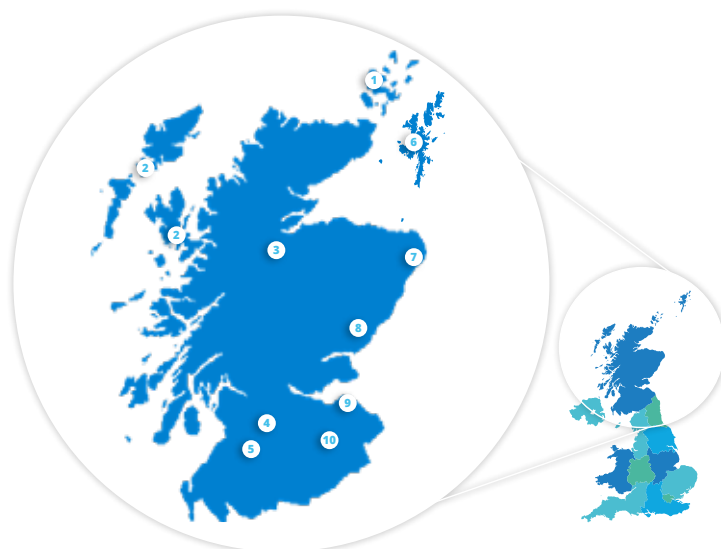
Wales 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	598	5.3%	103	5.4%
Anaerobic Digestion	81	2.4%	8	1.8%
Biofuels	516	3.8%	99	3.4%
Biomass Boilers	516	6.8%	65	5.8%
Biomass CHP	149	5.5%	23	5.4%
Biomass Dedicated Power	315	5.5%	51	5.6%
Energy from Waste	240	2.6%	28	2.0%
Hydro	246	4.0%	25	3.3%
Wind Energy	2253	4.0%	410	3.7%
Solar PV	615	7.4%	70	6.4%
Solar Thermal	284	5.0%	36	7.2%
Wave & Tidal	57	6.2%	10	6.4%
Production of biomass inc wood	369	2.9%	54	3.1%
Total	6241	4.4%	983	4.0%

SCOTLAND 2023

Scotland's relatively vast amount of space and history of energy-based industries and academic research have led to a range of different renewable energy projects being deployed in the nation. Drawing on world-leading engineering expertise, Great British Energy will be headquartered in Aberdeen, with 2 smaller sites in Edinburgh and Glasgow

The biomass sectors are where Scotland particularly leads, with an estimated 341 jobs in the biomass Combined Heat and Power sub-sector alone, representing 12.5% of the sector's employment across the country. The biomass boiler sub-sector, at an estimated £151m, holds over 13% of the UK's market value for that sub-sector in Scotland.

Unsurprisingly, wind plays an important role in Scotland, and this is reflected in an estimated 5,228 jobs and over £1bn in market value.



- 1 **Cruachan Power Station** – 'The Hollow Mountain' is one of four pumped storage hydro stations in the UK, with enough capacity to power 1.4 million homes (440 MW).
- 2 **H100 Fife** – the world's first green hydrogen-to-homes gas network, which will use a nearby offshore wind turbine to generate green hydrogen.
- 3 **Project Beacon** – innovative mechanical and chemical recycling project creating a world-first Advanced Plastics Reprocessing facility at Binn Eco Park.
- 4 **Seagreen Offshore Wind Farm** – Scotland's largest offshore wind farm, located around 27km from the coast of Angus in the North Sea, has enough generating capacity to power two-thirds of all Scottish homes (1,075MW).
- 5 **Gravitricity Demonstrator** – a gravity-based energy storage system built in 2021 at the Port of Leith in Edinburgh. Gravitricity is also developing underground hydrogen storage technology.
- 6 **Great British Energy HQ** – Headquarters of the country's new state-owned energy company.

£2.15BN

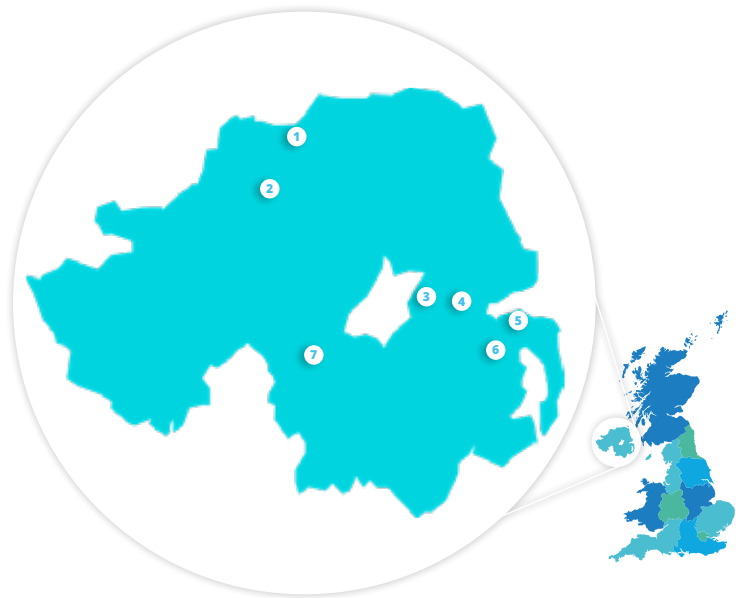
THE MARKET VALUE OF THE RENEWABLE ENERGY INDUSTRY IN SCOTLAND.

Scotland 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	543	4.8	103	5.4
Anaerobic Digestion	173	5.2	28	6.2
Biofuels	912	6.8	242	8.3
Biomass Boilers	853	11.3	151	13.4
Biomass CHP	341	12.5	51	12.1
Biomass Dedicated Power	650	11.3	109	12.0
Energy from Waste	752	8.1	95	6.9
Hydro	375	6.1	43	5.7
Wind Energy	5228	9.4	1045	9.5
Solar PV	536	6.1	85	7.7
Solar Thermal	284	5.0	21	4.2
Wave & Tidal	94	10.0	17	10.8
Production of biomass inc wood	1246	9.8	161	9.3
Total	11986	8.4%	2152	8.8%

NORTHERN IRELAND 2023

Partly due to its smaller population, Northern Ireland has lower estimates for renewable jobs and market value compared to most other UK regions. Renewables policy is also less developed due to the political impasse of recent years. However, there are still plentiful significant projects in operation in this part of the UK, as the map shows.

Hydro and wind energy are the leading sub-sectors in Northern Ireland, contributing an estimated £30m and £482m respectively. Wind remains the largest employer, with an estimated 2,833 full-time equivalent jobs.



- 1. BioCapital Granville Eco Park** – the first AD plant in NI to inject biomethane into the grid, and the largest facility of its kind in NI.
- 2. GeoEnergy NI, Unearthing the Heat Beneath Our Feet** – state-backed research project to show the untapped potential of geothermal energy in NI.
- 3. Strangford Lough Tidal Turbine** – the world’s first commercial-scale tidal energy project, commissioned in 2008 by a subsidiary of Siemens.
- 4. Bann Road solar farm** – the largest solar farm in NI, this 45.7 MW project in Antrim County generates enough energy to power almost 20,000 homes.
- 5. SSE Renewables battery storage project** – a 100MW/200MWh battery system expected to be operational by the end of 2026. It will help make the grid more resilient and maximize the use of surplus renewable energy.

12%

BIOFUELS CONTRIBUTION TO RENEWABLE ENERGY MARKET VALUE IN NORTHERN IRELAND

Northern Ireland 2023				
Renewable Energy Sub Sectors	Employment (FTEs)	Employment (Share of UK)	Market Value (£m)	Market Value (Share of UK)
Air & Ground Source Heat Pumps	445	3.9	71	3.8
Anaerobic Digestion	109	3.3	18	4.1
Biofuels	533	4.0	108	3.7
Biomass Boilers	275	3.6	29	2.5
Biomass CHP	80	2.9	12	2.9
Biomass Dedicated Power	171	3.0	25	2.7
Energy from Waste	345	3.7	52	3.7
Hydro	341	5.6	30	4.0
Wind Energy	2833	5.1	482	4.4
Solar PV	337	4.0	39	3.6
Solar Thermal	109	1.9	12	2.3
Wave & Tidal	31	3.3	5	3.0
Production of biomass inc wood	330	2.6	46	2.7
Total	5940	4.2%	929	3.8%

Methodology

Deployment (Data & Growth Projections)

The intention of this report is to present the latest data from authoritative sources on renewable energy generation, renewable transport usage, and organic waste recycling, accompanied by qualitative analysis of trends, driving market and policy factors, and progress against targets for the UK renewable energy and clean technology as set out in the REA Strategy.

The Deployment section is divided into sections – an initial summary that tracks overall sectoral progress, and four further sections that explore deployment data for each constituent technology of the REA’s strategic priorities ‘pillars’ (Power & Flexibility, Heat & Cooling, Transport, and Circular Bioresources). Unless otherwise stated, all data is annual and at the UK level.

Summary:

The summary section measures progress against the REA Strategy targets. A detailed description of the targets and a brief description of the methodology by which they are calculated and justified, can be found in the REA Strategy Executive Summary document.

- All summary data is sourced from the Digest of UK Energy Statistics (DUKES) chapter 6, subsection 5.
- Power & Flexibility progress is based on the percentage of electricity generated from renewable energy sources.
- Heat & Cooling progress is based on the percentage of heat generated from renewable energy sources.
- Transport progress is based on the percentage of energy consumed for transport usage sources from renewable energy.

Power & Flexibility

Power & Flexibility data focuses on renewable electricity generation, and is sourced from Energy Trends (ET), chapter 6, subsection 1. ET is a quarterly report on the supply and demand of all major energy sources in the UK, published by the Department for Energy Security and Net Zero.

Heat & Cooling

Heat & Cooling data focuses on renewable fuel used to generate heat and is sourced primarily from the Digest of UK Energy Statistics (DUKES) chapter 6, subsection 5, published by DESNZ. Most of the data is self-explanatory.

The exception concerns grid-injected gasses, specifically biogas from anaerobic digestion and sewage gas. Once these biogases are injected into the grid, they are blended with other gases, including conventional natural gas.

As a result, it is impossible to accurately confirm the proportion of grid-injected biogas used for heat generation as opposed to electricity generation.

This figure is significant, as the only heat generation from biogas otherwise included in DUKES would be on-site generation.

REview uses annual factors from DUKES chapter 4, subsection 2, on the fraction of the gas grid used for heating, thereby assuming that biogas is evenly mixed across the entirety of the gas grid and sums the product of grid-injected biogas and the annual gas grid heating factors to the biogas heat generation figures.

Transport

The transport section covers three considerably different technologies: zero emission vehicles (ZEVs), Electric Vehicle (EV) chargepoints, and renewable transport fuels (RTFs).

ZEV data considers the number of new registrations per year of Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEV, Hydrogen). Market shares are the sum of new registrations as a percentage of total new road vehicle registrations. Data is sourced from VEH 1153, a vehicle registration dataset published by the Department for Transport (DfT).

EV chargepoint data considers the total number of devices active in the UK, and the total number of rapid devices active in the UK. Data is sourced from EV charging device statistics, recompiled quarterly by DfT, in turn sourced from Zap-Map. The overall trends are based on summed totals from all local authorities, on the last publication of each calendar year (October).

RTF data comes from two sources. The first, covering just the two largest biofuels by volume (bioethanol and biodiesel), is sourced from ET chapter 6, subsection 2, published by DfT, and covers the annual consumption of biofuels in million litres.

The second is data published under the Renewable Transport Fuels Obligation (RTFO). RTFO data is published in five provisional reports and one final report over the course of the calendar year.

This means that in the latest data published, the fourth provisional report, in this case for 2022, the total volume of fuels certified under the RTFO have not been reported.

This is why REview looks at all RTFs as a percentage of total RTF volumes certified under the RTFO each year. By assuming that there is no bias between fuel types for when in the calendar year they report their volumes, the latest data (2023) can be considered in the report. RTFs considered individually are those which constitute at least 1% of total certified RTFs; the remaining RTFs are grouped together.

Circular Bioresources

Data on Circular Bioresources comes from a number of sources: ENV23, a dataset published annually by the Department for Environment, Food, and Rural Affairs (DEFRA); publicly available data published in the Compost Certification Scheme (CCS) and Biofertiliser Certification Scheme (BCS) annual report, published by Renewable Energy Assurance Ltd. (REAL); and the Waste Data Interrogator (WDI), published by the Environment Agency (EA). Figures from ENV23 are unchanged.

Figures from the CCS & BCS Annual Report are aggregated across the four regions of the UK. It is assumed, based on a figure from a BCS report, that the volume of digestate output by certified anaerobic digestate sites is equal to 85% of the volume of throughput processed by sites.

Figures from the WDI are for England only. Figures are from 2021 because it is published annually later in the year than other data sources. The REA has summed volumes of wastes received by specified permitted sites, grouped according to either composting or anaerobic digestion, and by the type of wastes received.

The same process is repeated for wastes removed from the list of permitted sites, focusing on identifying the volumes of off-specification compost and digestate removed, and the volumes of contaminants removed.

Contamination rates are measured as the volume of contaminants for each technology divided by the total feedstocks received.

The different groupings of wastes received, and wastes removed are groups of European Waste Catalogue (EWC) codes, the groups being defined by the REA.

While a full table of EWC codes under each grouping can be provided upon request, it is worth noting that "other" wastes are defined as all waste codes not otherwise included in another group; and that contaminants includes wastes other than plastic, such as certain types of glass, metals, hazardous substances, oils, and healthcare waste.

Innovas Solutions Ltd – Methodology for Forecasting and Renewable Energy Soft Market Intelligence

Forecasting - The standard forecasting is based on a combination of:

- Historical trend analysis of actual figures with previous forecasts to assess accuracy from the data sources;
- Confirmed planned deployments of renewable energy technologies;
- Planned and speculative deployments of renewable energy technologies;
- Government policies and environmental targets;
- Analysis of future global markets based on environmental targets;
- Technology assessment i.e. solar thermal being partially replaced by heat pump technology.

Forecasting against Bloomberg's scenarios is easier as there are historical figures and case studies for the construction, manufacturing, installation, servicing and maintenance of the various technology areas.

This is augmented by sense checking with current specialists in the various technology areas. These can be used to accurately forecast the cost and employment levels of specific technologies against specific deployment levels with a high degree of accuracy. Employment forecasts don't take into account displacement from other industry sectors.

The list of planned and potential renewable energy deployments and research/academic strengths in a region was augmented from various sources including trade associations, UK government/regional strategy documents, regional net zero carbon support programmes, online renewable energy focused websites that collate information, UK government and general internet searches.

Statistics referring to total or total regional employment and market value on pages 47-54 are for technologies including: Air & Ground Source Heat Pumps, Anaerobic Digestion, Biofuels,

Biomass Boilers, Biomass CHP, Biomass Dedicated Power, Energy from Waste, Hydro, Offshore Wind, Onshore Wind, Solar PV, Solar Thermal, Wave & Tidal, and Production of Biomass Including Wood. Statistics referring to total or total regional employment on market value on pages 55-68 are for all previously mentioned technologies as well as Energy Storage and Flexibility Services.

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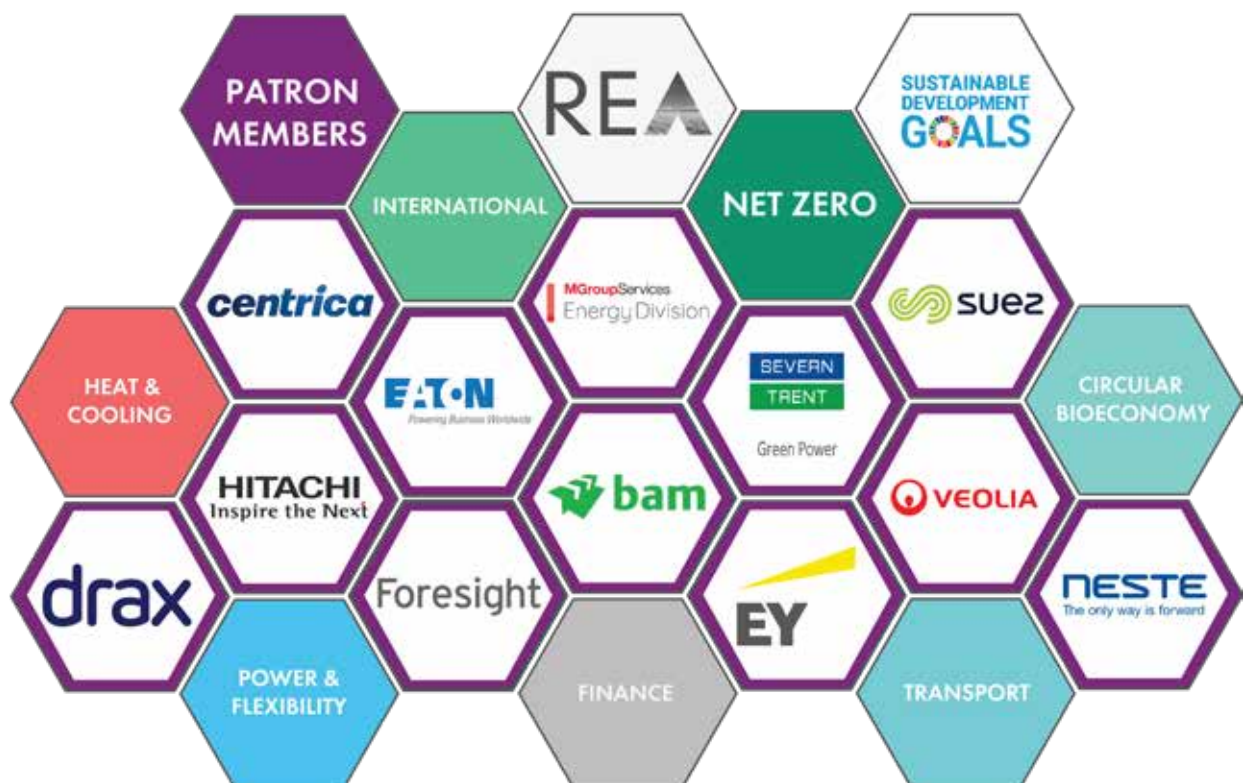
Abbreviations

AD	Anaerobic Digestion	IBA	Incinerator Bottom Ash metals
BCS	Biofertiliser Certification Scheme (administered by REAL)	KPI	Key Performance Indicator
BEV	Battery Electric Vehicle	MBT	Mechanical Biological Treatment
BMW	Biodegradable Municipal Waste	MT	Metric Ton
BECCS	Bioenergy Carbon Capture & Storage	MWh	Megawatt Hour
BUS	Boiler Upgrade Scheme	NDRHI	Non-Domestic Renewable Heat Incentive
CBR	Circular Bioresources	NRW	Natural Resources Wales
CCC	Climate Change Committee	Ofgem	Office and Gas and Electricity Markets
CCS	Compost Certification Scheme (administered by REAL)	R&D	Research and Development
CCUS	Carbon Capture Usage and Storage	REA	The Association for Renewable Energy and Clean Technology
CfD	Contract for Difference	REAL	Renewable Energy Assurance Ltd
COP 28/29	28th and 29th Conference of the Parties to the United Nations Framework Convention on Climate Change	REMA	Review of Electricity Market Arrangements
DESNZ	Department for Energy Security and Net Zero	RHI	Renewable Heat Incentive
DEFRA	Department for Environment, Food and Rural Affairs	RO	Renewables Obligation
E5 / E10	5%/10% Bioethanol blend in standard petrol supplies	RTF	Renewable Transport Fuel
EA	Environment Agency	RTFO	Renewable Transport Fuels Obligation
ECO	Energy Company Obligation	SAF	Sustainable Aviation Fuels
EfW	Energy from Waste	SEPA	Scottish Environmental Protection Agency
ETRI	Energy Transition Readiness Index (REA report)	Solar PV	Solar Photovoltaic
EU	European Union	ULEV	Ultra Low Emission Vehicle
EV	Electric Vehicle	VAT	Value Added Tax
FiT	Feed-in-Tariff scheme	WFD	Waste Framework Directive
FTE	Full-time equivalent (number of people employed)	WRAP	Waste & Resources Action Programme (waste NGO)
GWh	Gigawatt Hour	WDI	Waste Data Interrogator
HBS	Heat and Buildings Strategy	WtE	Waste to Energy
HGV	Heavy Goods Vehicle		

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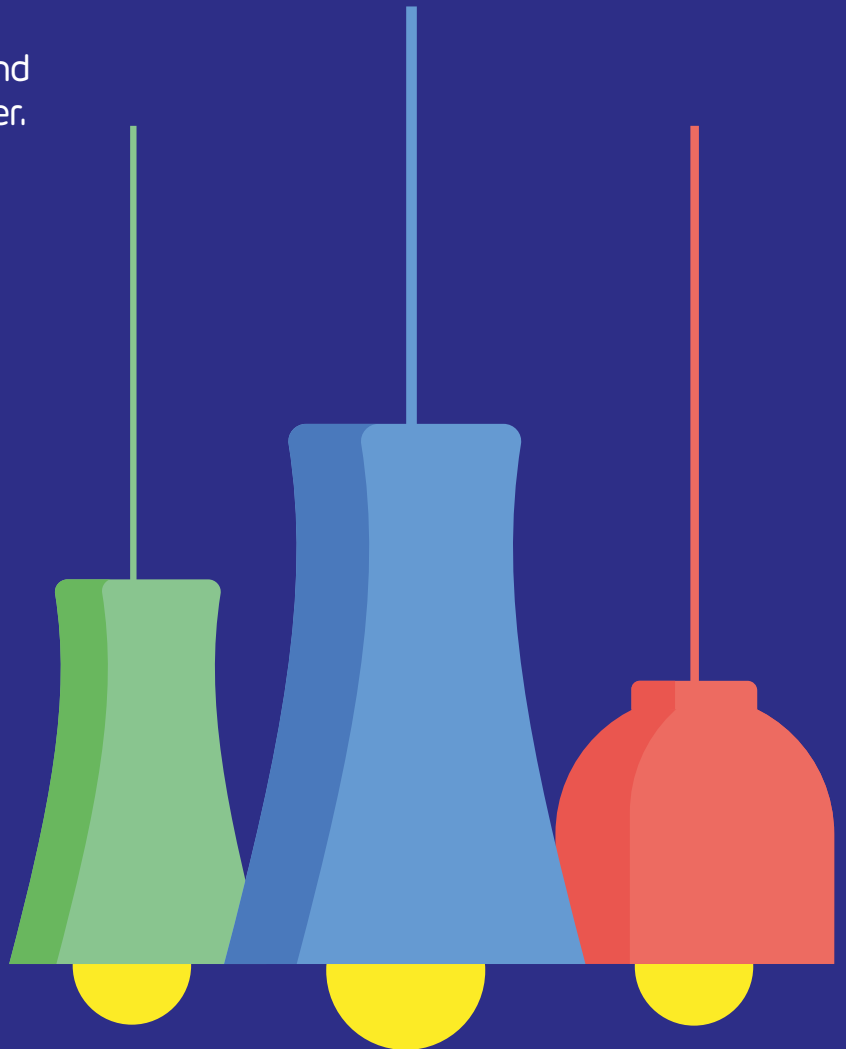
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