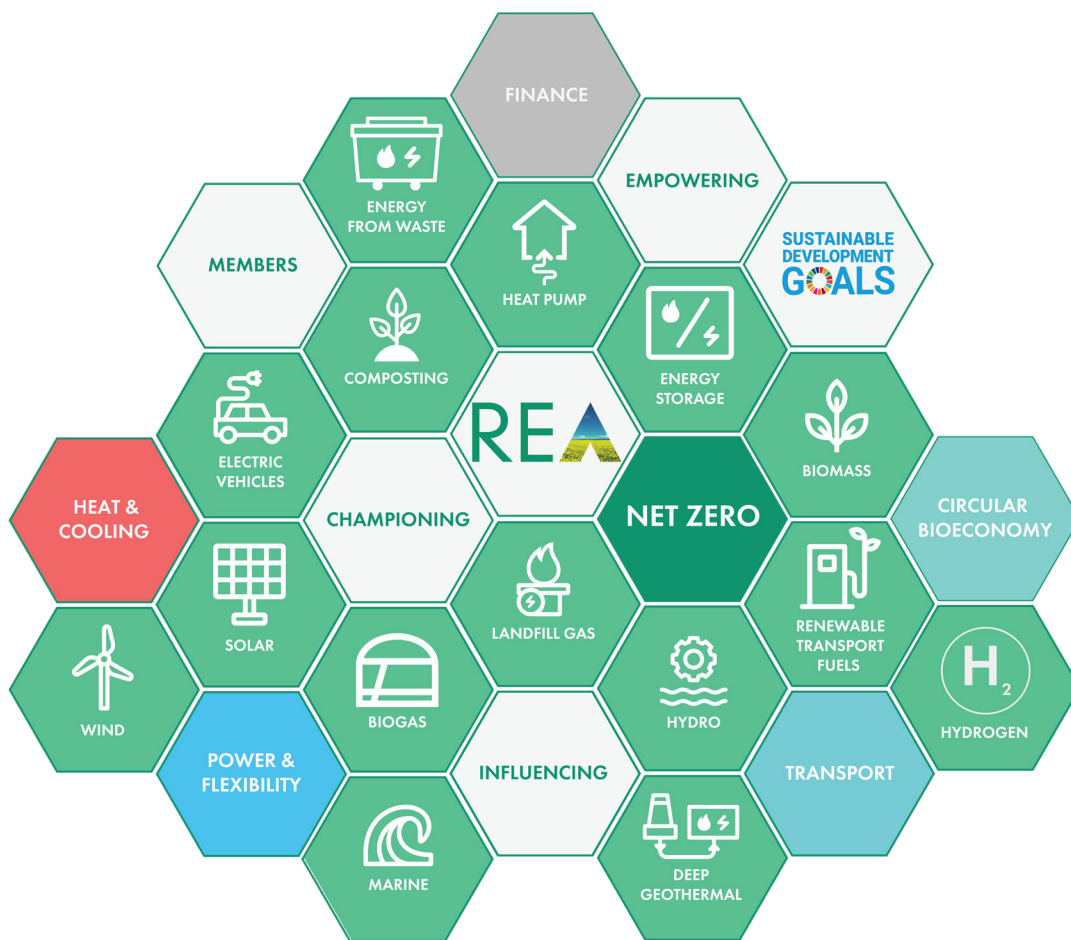


REVIEW23

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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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 . . .

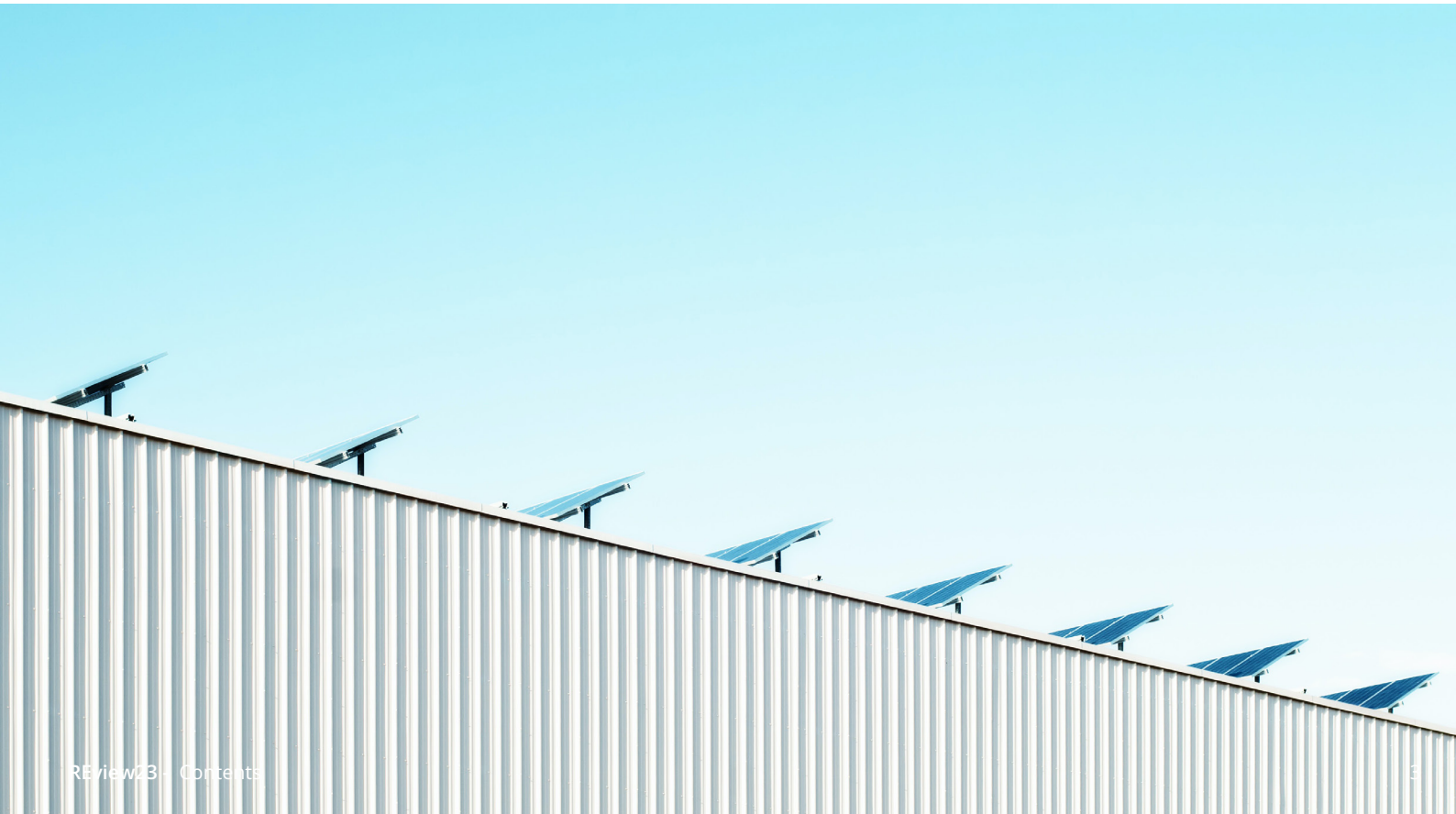
JOIN US and together, we will work towards a Net Zero future and a greener, more prosperous economy.



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Foreword

Time for Renewable Energy Action

2022 was an unprecedented year both for international upheaval and political turmoil here in the UK. Energy had rarely before been the focus of so much attention for almost every person and for so many different reasons.

While we continued to see the dynamic resilience of the renewable energy and clean technology sector through the energy crisis, as well as months of political and policy uncertainty, we are not immune to real world economic forces. Indeed, at times it can feel as if we are wading through treacle when repeatedly being challenged to make the economic case for net zero.

Even though it has been proven countless times that the energy transition is as much an economic opportunity as an environmental imperative, our sector still finds itself having to overcome naysayers time and time again.

It was hoped that 2023 would bring an end to this uphill and multi-front battle with the publication of The Rt Hon Chris Skidmore MP OBE net zero Review, 'Mission Zero,' which was hailed by the UK

Government itself to finally settle any political and economic debate as to why net zero is essential. Yet throughout 2023, counter arguments have continued to crop up, whether challenging the proposed date for the ban on the sale of new internal combustion engine (ICE) cars, to the recent rhetoric around Ultra Low Emission Zone (ULEZ) in the media. The latter is actually the case to be made to improve people's health and wellbeing, let alone net zero. How many 'Mission Zero' reports need to be published to dispel fears, suspicions, or downright denial that net zero will take a leading force in boosting the UK's economy and directly benefit everyone?

In REview23, we show further positive delivery of renewable power deployment, but policy uncertainty, planning delays, deep infrastructure concerns and lack of a route to market have all stymied the renewable energy and clean technology sector and remain to be addressed – particularly in heat, transport and the wider circular bioresource agenda. Action in all these areas must be accelerated. Renewable developers are hurting, and international investment is going elsewhere.

In 2022, the REA attended COP27 as Official Observers in Sharm El-Sheikh, Egypt, hosting an official side event at the conference which



facilitated fascinating discussions exploring how green technologies can help to reduce carbon emissions, mitigate climate change and deliver energy security for societies of both economically developing and developed nations. During our engagement with COP, the REA saw significant effort from industry to make this happen – governments need to move beyond vague promises and deliver on sometimes unfortunately tenuous-seeming commitments internationally.

There is a huge interest in renewable energy and clean technologies, from the finance sector and leading corporates in particular, though the REA advocates that we need their interests to expand beyond the most popular technologies and consider the smarter, more locally available renewable and clean technology solutions. The much-needed expansion in wind and solar at a large scale needs to go hand in hand with new technologies such as wave and tidal, and more on-site solutions for decarbonised homes and businesses. REview23 highlights again the plethora of approaches that can be used in smart ways to complement one another. As a ‘prosumer’ myself (generating renewable energy at my home), I am fortunate to have reaped the benefits of decarbonisation technologies in my home and as the REA we want to make sure all walks of life can benefit from them too.

For this year’s REview23, we estimate that the market value of the renewables industry is set to almost double to £46.5bn by 2035.

“ THE INDUSTRY IS CURRENTLY ON TRACK TO SUPPORT MORE THAN 210,000 JOBS. WITH THE RIGHT ENVIRONMENT, THE GOVERNMENT CAN ENSURE THAT THESE FIGURES ARE EXCEEDED, AND THE UK CAN BE A WORLD-LEADER. ”

I am delighted to read thought leadership pieces giving insight into the sector’s experiences over the past year, and what we need to see going forwards. Included is commentary from our brilliant REA policy leads - Mark Sommerfeld, Frank Gordon, Jenny Grant, Matthew Adams and Paul Thompson.

Going forward, with the passing of the Energy Bill, we hope for the unlocking and enablement of the next wave of renewable energy and clean technology to directly benefit all types of consumers, and the growing cadre of ‘prosumers’, as well as our economy as a whole. On behalf of the sector, we are working hard to make sure all political parties hear the key policy and regulatory

asks that will allow our sector to effectively play our part. REA members deliver and build the low carbon economy, and we stand ready to help the government go faster in doing so.

So, at this challenging time, the REA will continue to champion our members from all technologies and sectors to take immediate action and deliver net zero in the UK. We hope to see the Energy Bill rolled out at pace and are looking forward to continuing cross-sector collaboration so that we see a great leap forward of positive action from now until REview24.



N. M. Skorupska

Dr Nina M Skorupska CBE
Chief Executive, REA

Executive Summary

The 2023 report on the State of the Industry

The entire energy transition faces significant challenges which are currently delaying the roll out of low carbon technologies across all sectors. We can see the urgent need to unlock policy and investment blockages throughout this year's REview, which shows that in 2022, only 14% of the UK's total energy consumption came from renewable sources across heat, transport and power according to the Government's own statistics (DUKES, 2023).

Of the total renewable energy consumed, 60% is from renewable power generation, while only 8% is from heat - as was highlighted in last year's report, Government progress when it comes to heat decarbonisation in particular continues to leave much to be desired where major policy gaps are failing to enable the growth of potentially game-changing technologies. The continued lack of support for deep geothermal heat, for example, continues to be a missed opportunity for the UK and in cutting soaring costs for consumers. The technology can be locally deployed relatively quickly with a limited footprint, but at this stage requires commitments from the Government that still are yet to be made.

Decarbonising the transport sector still requires both a continued rapid increase in the uptake of electric vehicles (EVs) and the deployment of charging infrastructure. Continued growth is needed in the consumption of renewable transport fuels as they reduce emissions from existing internal combustion engines, as well as hard-to-treat sectors like aviation and shipping. The REA's strategy for energy sector decarbonisation highlighted that with decisive action, over half of UK transport demand could be decarbonised by 2035.

For the circular bioresources sector, some progress is being made, with both composting and anaerobic digestion seeing encouraging rises in the tonnages of waste feedstocks processed in 2021 (the most recently available full year of statistics) - 4.1% and 7%, respectively. However, household recycling rates actually fell from 44.3% in 2018 to 43.7% in 2021. This is still significantly below the 50% target in the UK's legacy EU Waste Framework Directive framework and underlines that there is much more work to do in this area. Several promising pieces of legislation are in the pipeline, but they must be quickly and effectively progressed, to be fundamental to furthering growth in the sector.

14%

UK'S TOTAL ENERGY CONSUMPTION
FROM RENEWABLE SOURCES IN 2022

This report includes projections for the market value of the industry in every nation and region in the UK. This is in addition to the estimated levels of full-time equivalent employment. Significant projects in the pipeline are also highlighted. Projections show an almost doubling of the market value of the sector from around £23bn today to £46.5bn in 2035 and reaching over 210,000 jobs including energy storage and flexibility services.

In last year's REview, we included our Strategy's recommendations for each 'REA pillar': power & flexibility, heat & cooling, circular bioresources, and transport and measured the Government's progress against these recommendations.

These recommendations were our key asks of Government, which we consider vital to ensuring a smooth, timely and efficient energy transition.

This year however, we have revised our key policy recommendations according to the REA's 'manifesto' in advance of the next General Election - which sets out transformational policy recommendations that will decarbonise the whole energy system. Within each 'pillar' chapter, we set out how the next Government can decarbonise power, heat, transport and support circular bioresources, in turn. First, we consider the pan-sectoral strategic areas for policy development which are essential to supporting the decarbonisation of several pillars, outlined below.

The entire energy transition faces significant universal challenges, which are currently delaying the roll out of low carbon technologies across all parts of the energy system. The next government must address these issues alongside the more sector specific recommendations made in the following chapters, as part of a comprehensive approach to stable energy policy development. The next government must;

- **With support of industry, develop and coordinate a comprehensive programme for green jobs training including re-skilling from existing industries, beyond the North Sea transition deal, which is in place and operational across multiple sectors by 2026 to ensure there are enough skilled staff available to**

rollout net zero technologies at scale in the UK. The REA have projected that jobs in renewable energy alone could reach 210,000, while its contribution to the UK economy could double to £46bn, by 2035.

- **Drive strong standards across all parts of the renewables and clean technology industry, from investments to the operation of assets, as part of policy development.** This includes:

- Establish a UK Green Taxonomy by the end of 2024 which will institute strong definitions for UK green financial activities. This will ensure a transparent definition for 'green' investments and activities as well as further UK global leadership in green financial products.
- Run 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. This will deliver high public confidence in the sector and address any existing technical deployment barriers.

- **Ensure sustainability is at the heart of policy development by:**

- Conducting 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.
- Aligning guidance to the UN Sustainable Development Goals and requiring sustainability to be built into all Government policy Impact Assessments.
- Establish an Office for Net Zero Deployment, as recommended within Chris Skidmore's Net zero Review, ensuring it has the ability to hold government to account against sustainability and net zero targets.



A message from our sponsors, Drax

Will Gardiner
CEO, Drax Group

Across the globe, countries and organisations are facing an era-defining challenge to hit net zero targets. Many, including the UK are also facing a tough balancing act between emissions cuts and energy security because of the ongoing war in Ukraine.

Throughout this turbulent period, Drax has continued to play a vital role in preserving the UK's energy security. Our power station in Selby, North Yorkshire provides 11% of the country's renewable power, the largest single source of renewable power in the UK. The introduction of Bioenergy with Carbon Capture and Storage (BECCS) at the power station, as well as the expansion of our Pumped Storage Hydro facility in Scotland, will further strengthen the UK's energy security. They will also help the country achieve its net zero ambitions in a balanced and affordable way.

Our BECCS project could remove 8Mt (million tonnes) of CO₂ from the atmosphere every year while simultaneously producing renewable and flexible power. BECCS is not simply a 'nice to have'; it's a net zero necessity, and organisations including the IPCC, the UK's Climate Change Committee (CCC), National Grid ESO, and the UK Government, all agree.

BECCS at Drax could contribute a significant amount to the UK economy. Not only could BECCS create and support 10,000 jobs and deliver £670m of economic benefit to the UK during peak construction, we're also aiming to source 80% of materials and services for the project from British businesses – a public ambition which shows significant opportunity for companies of all sizes across the UK.

And crucially, carbon removals will be especially important for sectors which will take longer to decarbonise, such as aviation, agriculture, and heavy industry. Alongside ongoing emissions reductions, carbon removals will help these sectors map out a journey to net zero.

The carbon removals market - a market projected to be worth \$1 trillion globally by 2050 - will help drive economic growth and opportunity while helping countries and organisations to reach net zero. Unsurprisingly, there is a global race for countries to lead in this emerging technology. The US, with the Inflation Reduction Act, has thrown

its support behind technologies including BECCS, with the EU progressing their own plans.

With a clear plan and support for BECCS, the UK can still take the lead and be a trailblazer in carbon removals internationally.

Our ambition doesn't stop with BECCS. We're also progressing with our planned £500m expansion of our Cruachan Pumped Storage Hydro station in Argyll and Bute, Scotland. This expansion will add 600MW to our current generation capacity, bringing it to over 1GW – enough to power over two million homes.

Through the expansion, almost 1,000 new jobs will be created and supported during development, bringing significant benefits to the local community.

We are delighted that the Scottish Government has backed the project, awarding planning consent for expansion in 2023. With the right support from the UK Government, we can get spades in the ground on these two vital projects, continue to deliver energy security for the UK and help the UK accelerate ahead as a leader in climate-saving technology.

“ IF GOVERNMENT MATCHES OUR AMBITION, WE WILL MOVE TOGETHER TOWARDS A FAIR, AND PROSPEROUS, NET ZERO FUTURE ACHIEVED AT THE LEAST COST. ”



REA Strategy

A Pathway to Enabling Net Zero

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

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.

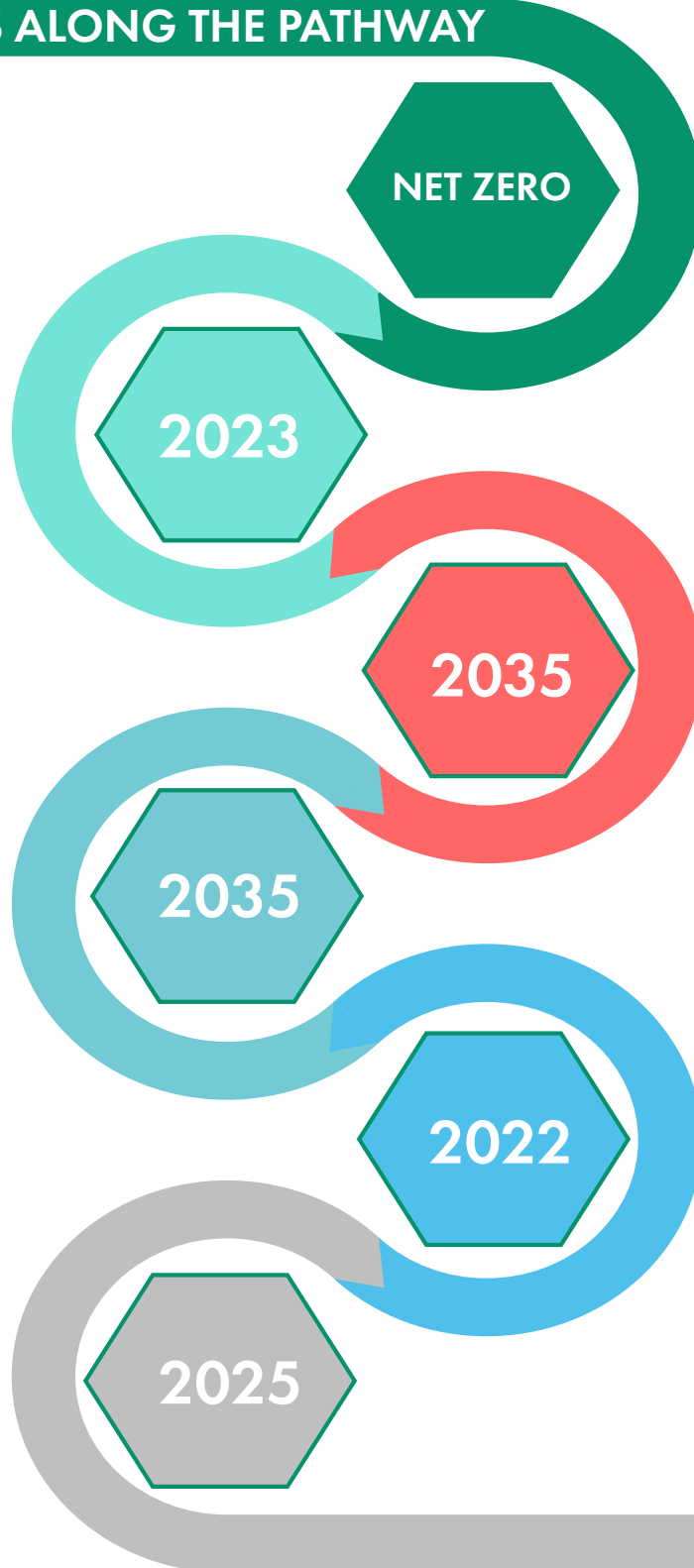
TRANSPORT

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.



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.

Deployment

Renewable Deployment Summary

In last year's REview22, we calculated that the UK's total energy consumption (across heat, transport and electricity) from renewable sources was 13.6% in 2021 and this year's report shows we are now at 14% from renewable sources in 2022.

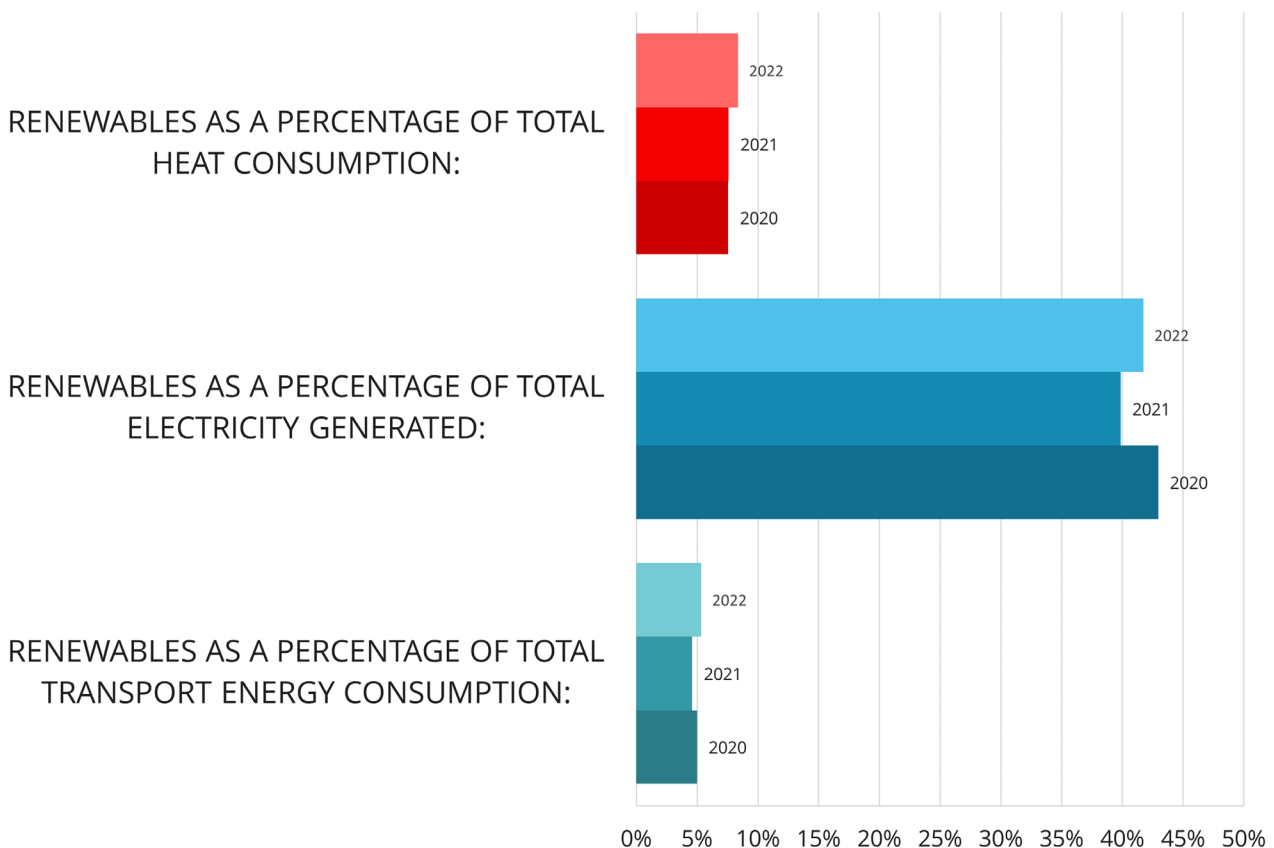
Overall progress is not as quick as required though there is a mixed picture. A positive recovery across some technologies from both weather and COVID-19 related dips saw overall renewable energy deployment increasing from 2021 but much of the UK's progress towards net zero continues to be driven by the power sector, with 41.7% of power generation now coming from renewable sources.

However, until supportive Government policy measures are forthcoming for heat and transport, it will continually be a challenge for the UK to meet its net zero commitments in the short, medium and long term. While this has major environmental consequences, the economic ramifications of such policy gaps are also significant and have become evident over the past year.

While we can see positive growth in both heat and transport sectors after the dip in 2021, there is still a long way to go, with 8.36% of the UK's total heat consumption and only 5.32% of the UK's total transport consumption generated by renewables in 2022. When these are compared to the REA's Decarbonisation Strategy target of renewables and clean technology solutions being the dominant form of energy for heating and transport by 2035, we can see there is a long way to go.

A full range of renewable and clean energy technologies are needed to decarbonise our energy system. Government must recognise that it is renewable energy and clean technology that is central to ending the current energy cost crisis and to the UK's overall future growth and prosperity, and act in accordance with that recognition. REview23 shows the potential economic benefits on offer. Yet, the predictions of tens of thousands of new jobs, and billions in additional market value will not come to pass without the right policy and regulatory conditions.

RENEWABLE ENERGY DEPLOYMENT BY REA PILLAR



Deployment: Power & Flexibility

Renewable Power Generation Summary

In 2022, the share of UK power generation coming from renewable sources reached 41.7%. This is a positive increase over just ten years, particularly when we compare this figure to 2011 when it had not yet reached 10%.

2022's figure is also a recovery from the previous year's fall in renewable generation that was 39.6% compared to 43.2% in 2020. This could be in part due to offshore wind weather conditions. The change from 2020 to 2021 also reflects the fall in overall electricity consumption during the height of the COVID-19 pandemic.

Wind remains the dominant renewable power generating technology - 59.5% of all renewable power generation comes from offshore and onshore wind, at 80,000 GWh.

41.7%

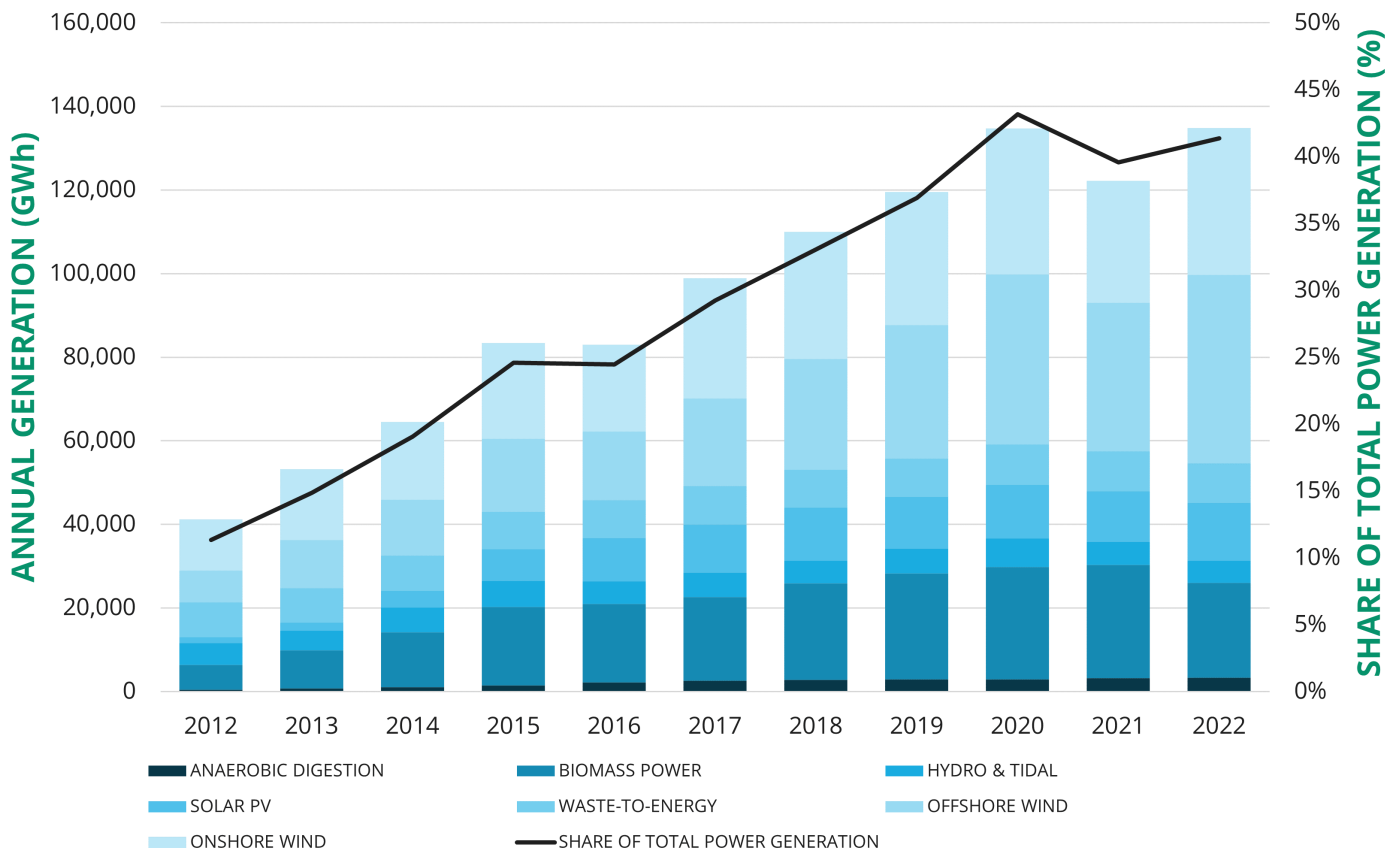
SHARE OF UK POWER GENERATION
COMING FROM RENEWABLE SOURCES

Biomass and solar also continue to be major contributors, providing 6.9% and 4.3% of all the UK's electricity needs, respectively.

While remaining relatively small contributors, anaerobic digestion and the technologies that make up the wider waste-to-energy sector have continued to grow consistently.



RENEWABLE POWER GENERATION BY TECHNOLOGY OVER TIME



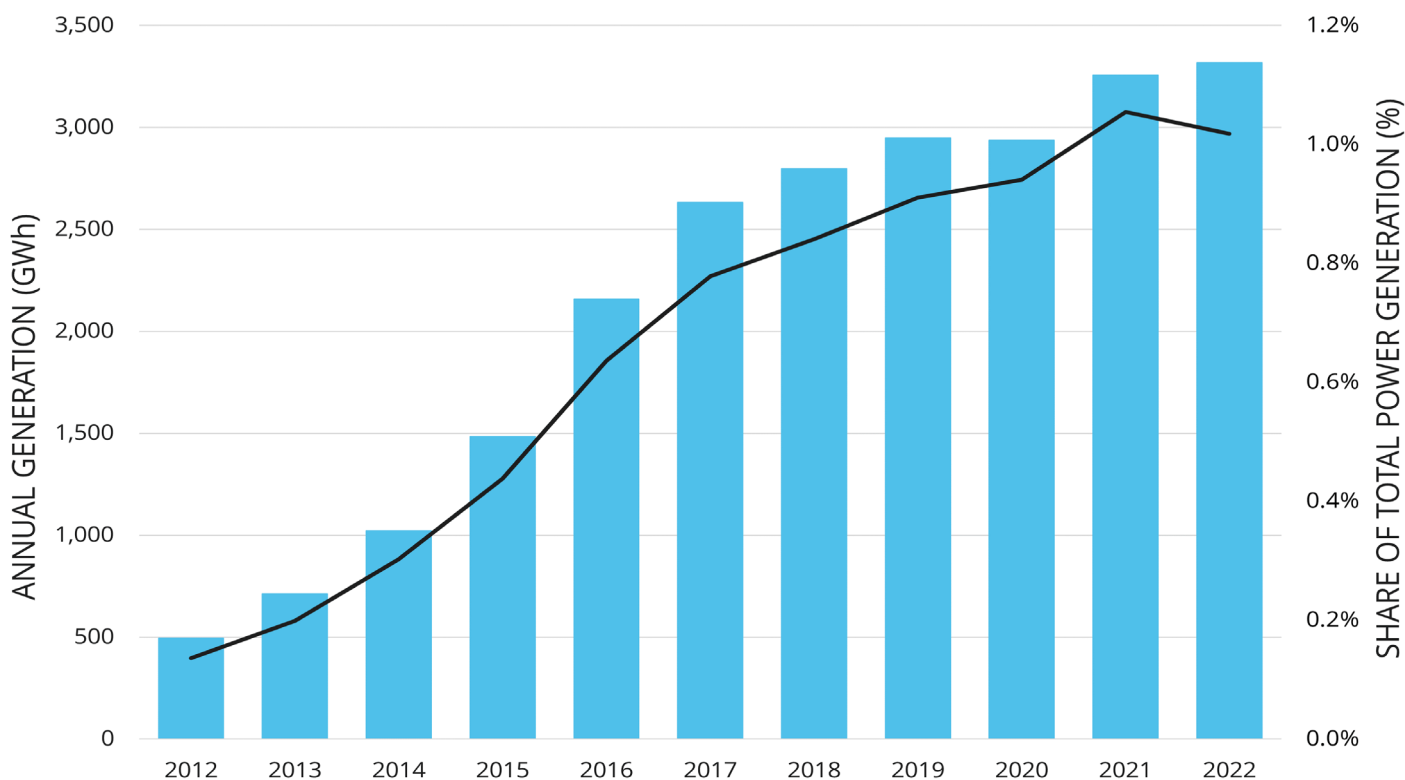
Deeper Insight: Anaerobic Digestion

Power generation through anaerobic digestion grew significantly in 2021 with more than 3,250 GWh being produced, and this growth continued into 2022 with 3,317 GWh being produced.

While 2022's 2% growth is indeed positive and continues the general trend of high increases over recent years, it is nowhere near the almost 11% rise in Anaerobic Digestion power generation in 2021 – the largest increase since 2017. 2021's increase was in part due to food waste volumes returning to pre-pandemic levels after lockdown throughout most of 2020, as well as biogas combustion projects which were delayed in 2020 eventually commissioning in 2021.

Anaerobic Digestion makes up just over a 1% share of 2022's total renewable power generation.

ANAEROBIC DIGESTION POWER GENERATION

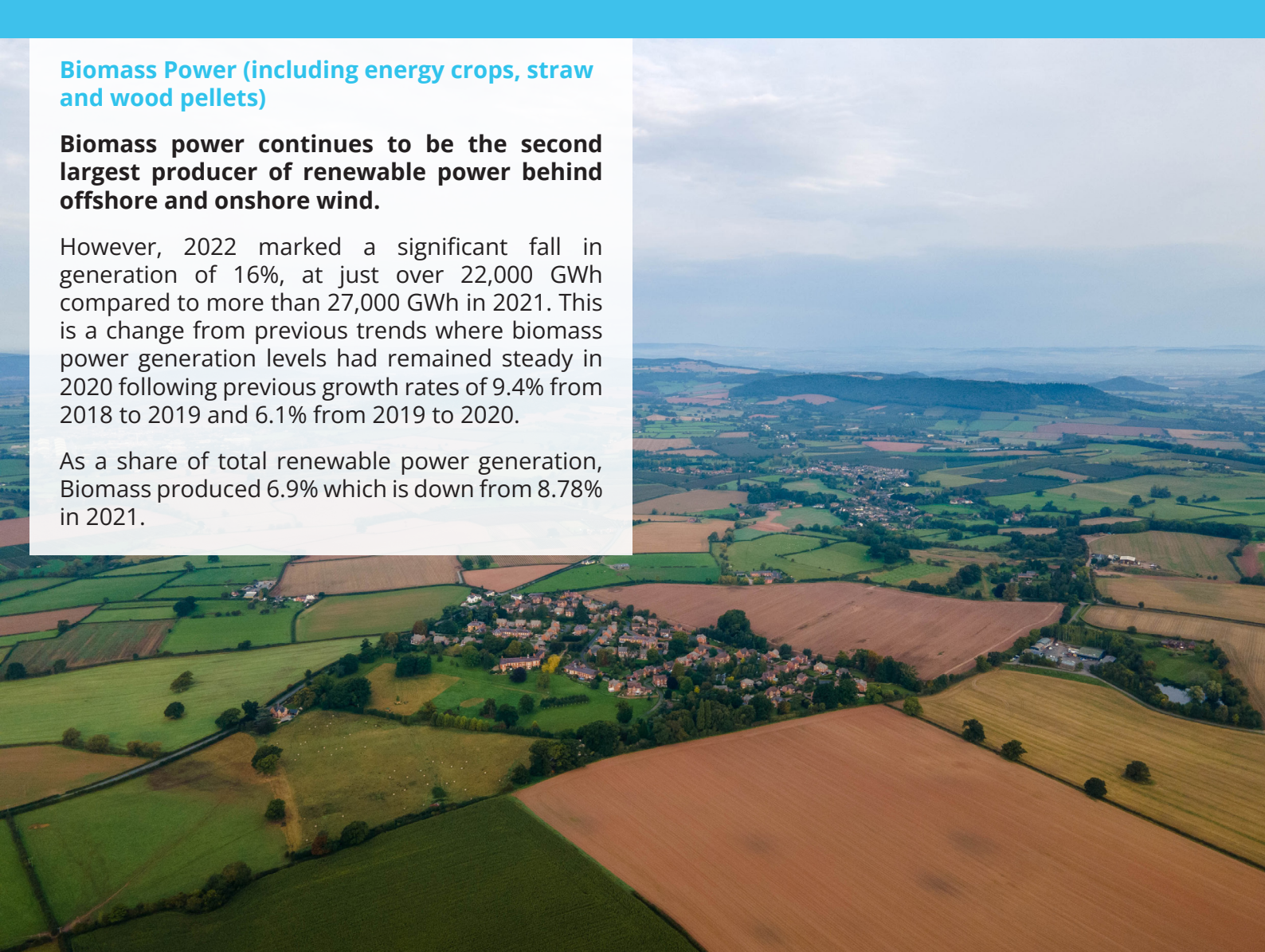


Biomass Power (including energy crops, straw and wood pellets)

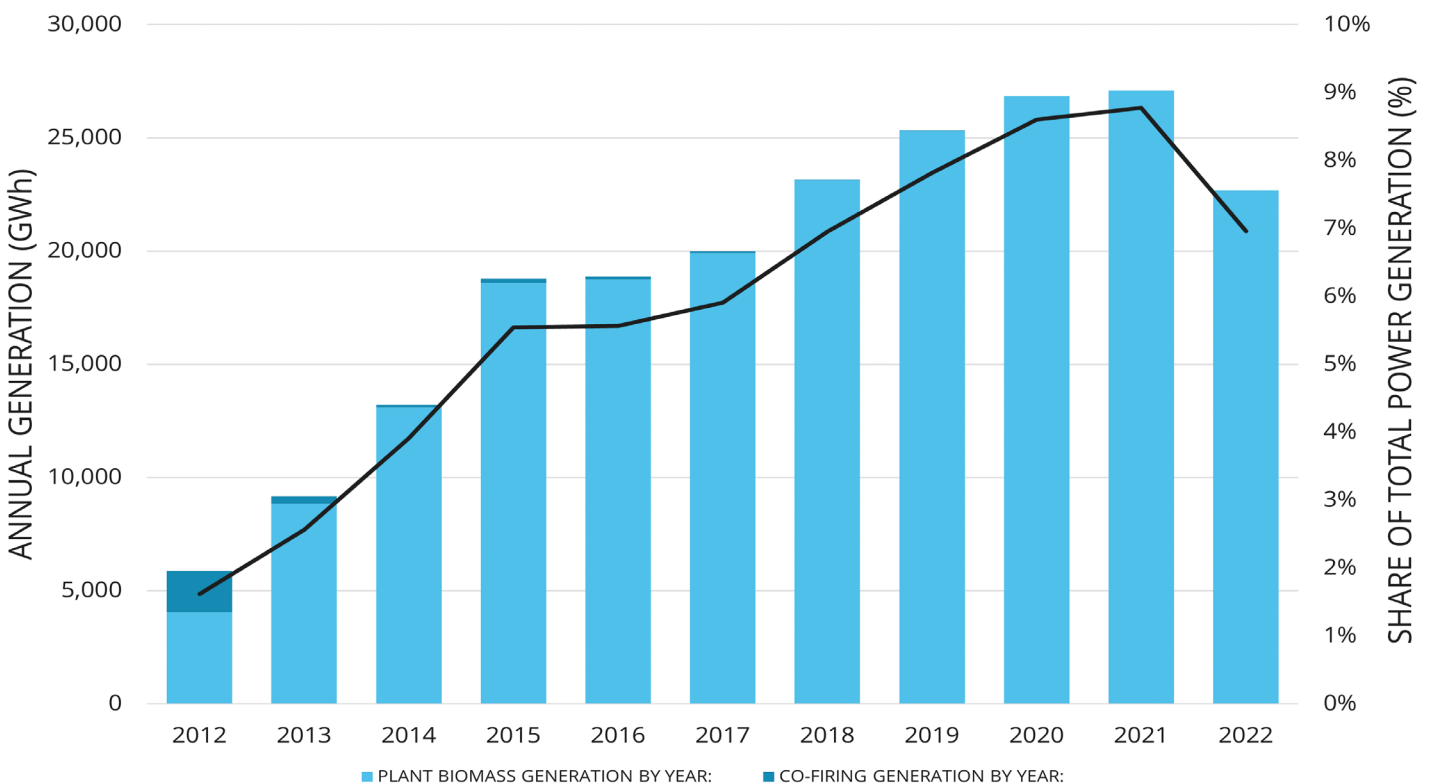
Biomass power continues to be the second largest producer of renewable power behind offshore and onshore wind.

However, 2022 marked a significant fall in generation of 16%, at just over 22,000 GWh compared to more than 27,000 GWh in 2021. This is a change from previous trends where biomass power generation levels had remained steady in 2020 following previous growth rates of 9.4% from 2018 to 2019 and 6.1% from 2019 to 2020.

As a share of total renewable power generation, Biomass produced 6.9% which is down from 8.78% in 2021.



BIOMASS POWER GENERATION



Hydro & Tidal

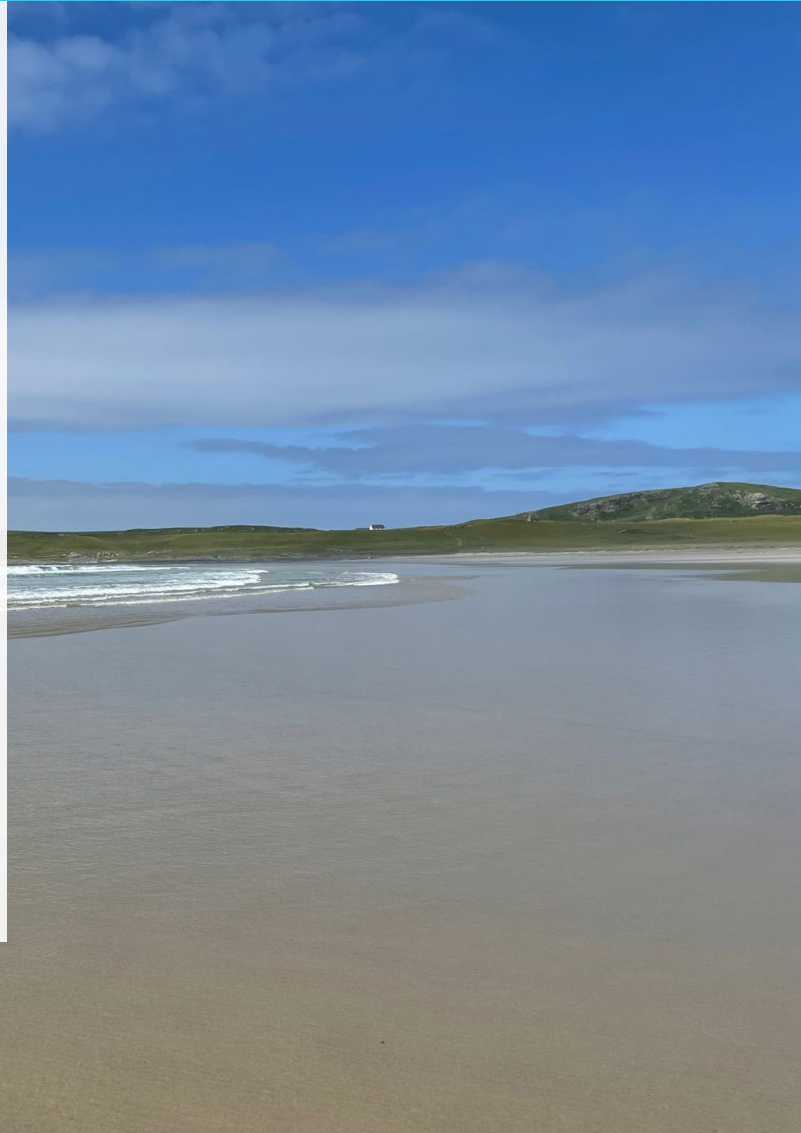
Hydro generation suffered a near 20% fall in 2021, and again declined in 2022 by 3% with just over 5,300 GWh of power being produced.

However, this is not out of the ordinary. As highlighted in REview22, hydro generation is broadly stable, fluctuating between 5,000 - 7,000 GWh per annum depending on levels of rainfall. 2020, for example, saw a record 6,865 GWh being produced, a 16% increase on the previous year.

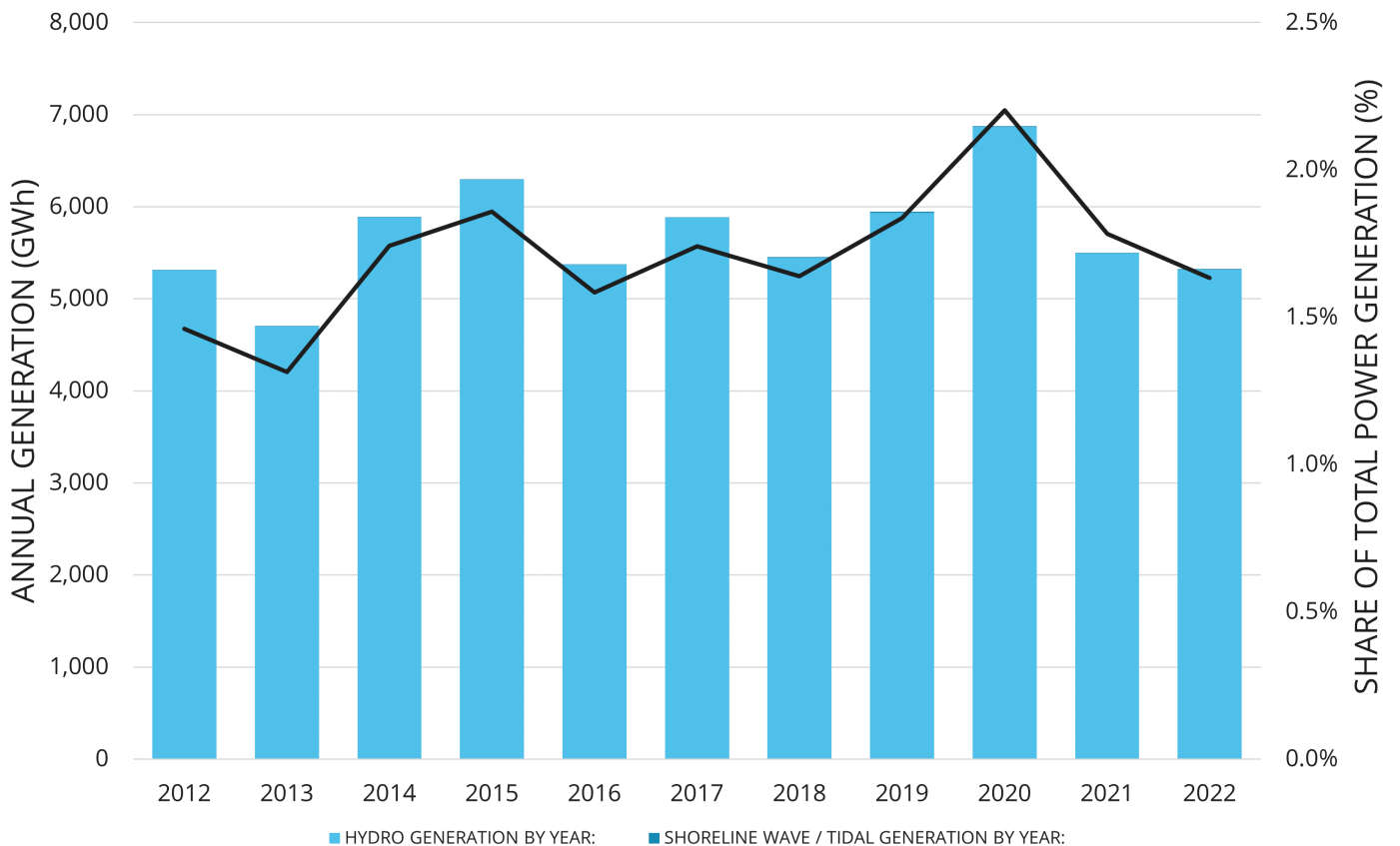
Unsurprisingly, shoreline wave and tidal generation continues to remain low, but did increase in 2022 to nearly 10 GWh after power from this source more than halved in 2021, with just 5.5 GWh being produced.

Recently awarded contracts for the deployment of four tidal stream projects by 2027 should mean further growth in the coming years.

There has been very limited new Hydro and Tidal power capacity. in recent years, and in 2022 this sector produced just over 1.6% of total renewable power generation.



HYDRO & TIDAL POWER GENERATION



Solar PV

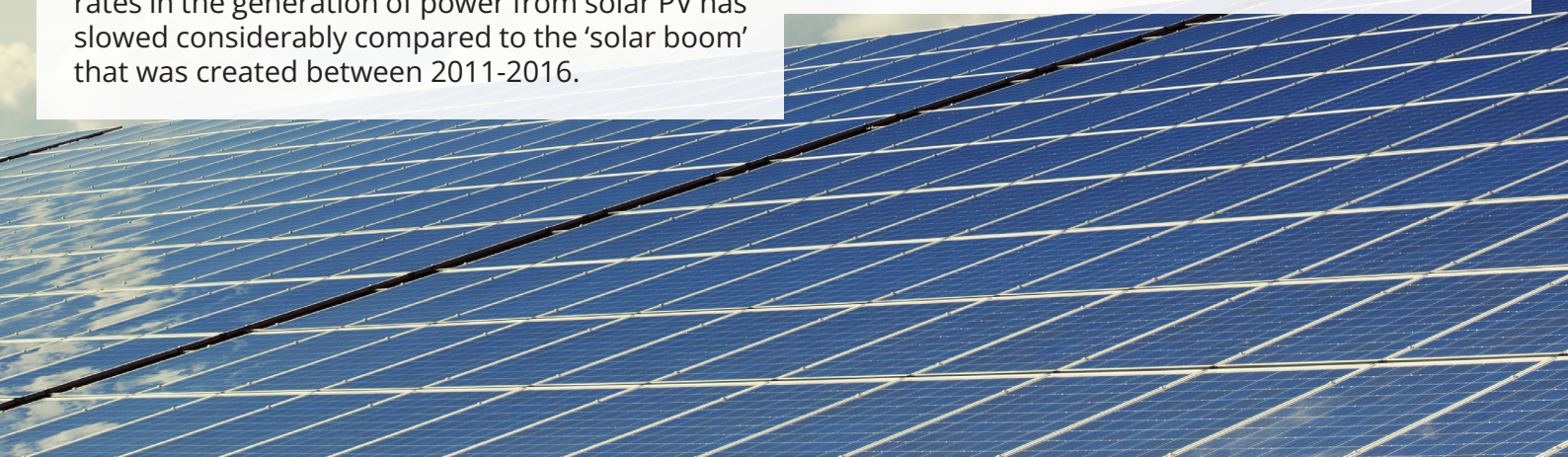
In last year's REview22, it was predicted that a significant amount of solar photovoltaics (PV) power would come online throughout 2022, and we are pleased to see this come to fruition, with a near 5% growth in capacity, which is the highest it has been in five years.

This is a good sign of growing uptake and has led to a near 15% increase in generation from 2021, after a 6% fall from 2020 to 2021. In 2022, 13,920 GWh was generated.

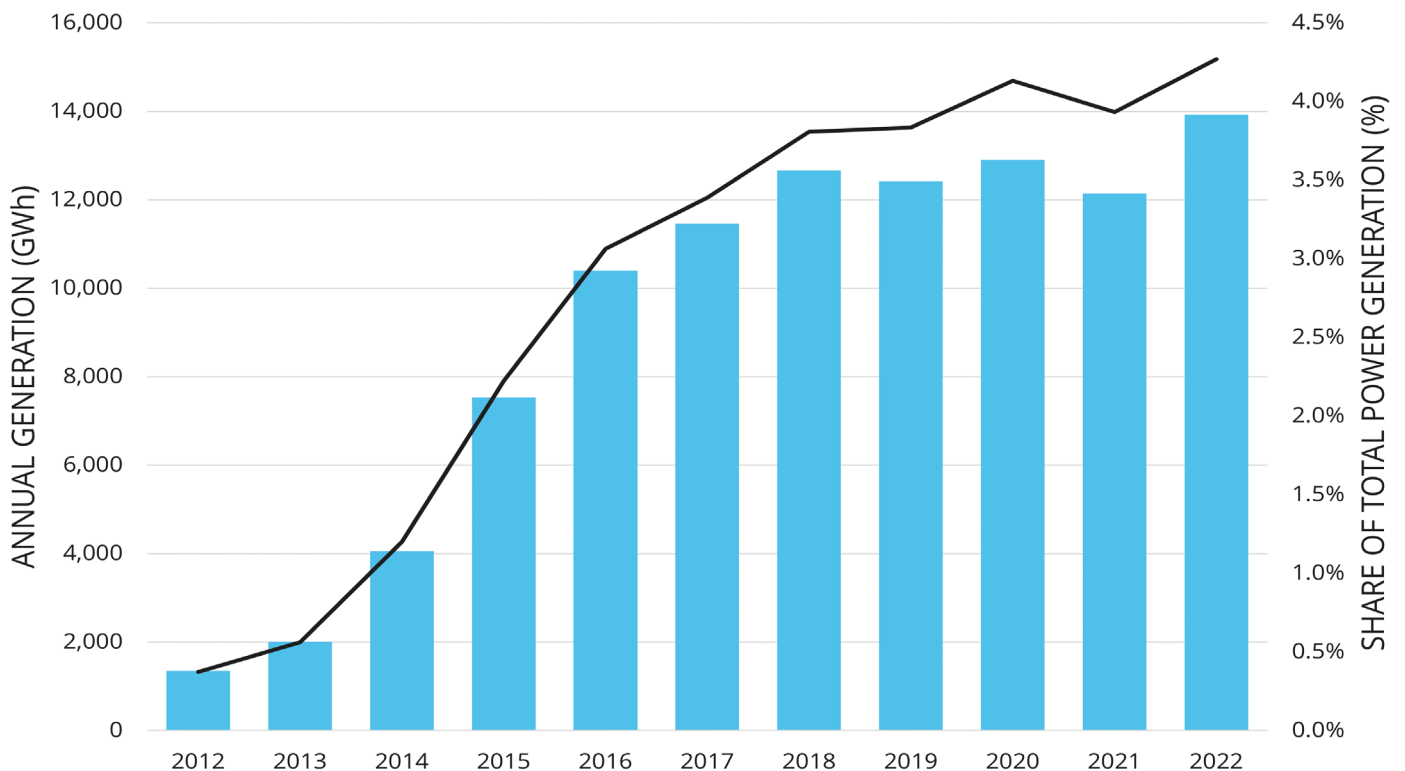
The fall in generation in 2021 was partly due to unfavourable weather conditions, but major factors also included on going lack of proactive Government support. This reiterates the sentiment that since the middle of the last decade, growth rates in the generation of power from solar PV has slowed considerably compared to the 'solar boom' that was created between 2011-2016.

Solar PV remains a crucial technology, producing 4.27% of all 2022's renewable power in the UK. It is also now one of the cheapest forms of generation, which in the context of current energy prices means that we are aware of a sizable pipeline of projects now being built. Solar also continues to be extremely popular: the BEIS Public Attitudes Tracking Survey in June 2022 shows 90% total support for solar and only 1% total in opposition, making solar the most popular renewable technology.

Recent REA work in solar is focused on establishing a route to market for solar at domestic, commercial, and standalone scales, amending building regulations, and supporting the emergence of a more flexible power sector where solar is deployed alongside a range of technologies.



SOLAR PV POWER GENERATION



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

In 2022, Waste-to-Energy accounted for almost 3% of total renewable power generation, at 9,445 total GWh. This is a further slight decrease (1%) in generation from 2021 which also saw a decrease of 0.2% from 2020. Overall waste-based generation grew nearly 5% by 2020, and it has decreased since then due to naturally declining landfill gas sources (being located at closed landfill sites therefore not receiving new feedstock) and a lack of new capacity in other parts of the sector.

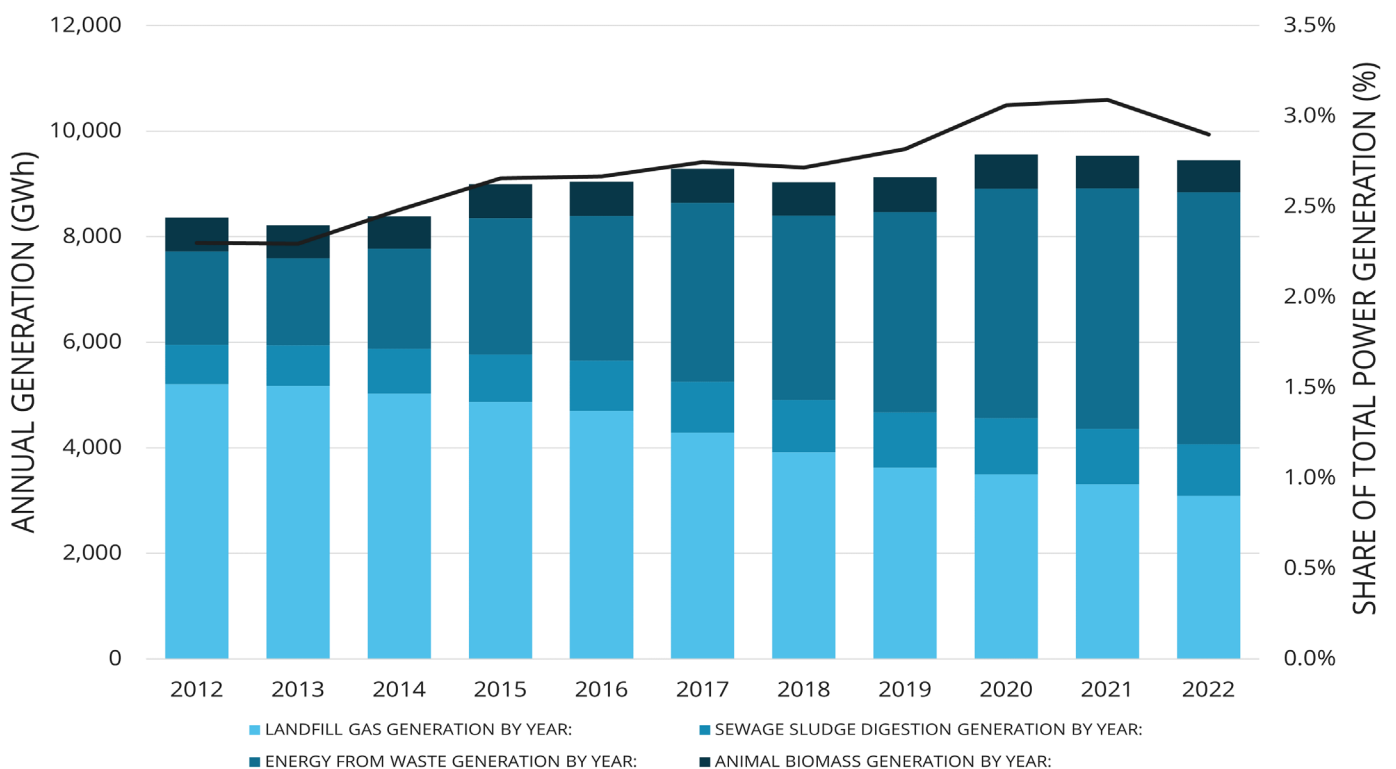
Energy from Waste by itself had another strong year, with generation growing again by just under 5%. It now contributes just over half of all waste-based generation, producing 4,775 GWh of the total 9,445 GWh.

Landfill gas is the next largest, generating 33% but decreasing over time, followed by sewage sludge digestion and animal biomass, at 10% and 6% respectively.

NB - Animal waste derived biomass includes: poultry litter, meat and bone. Energy from waste includes: waste (including waste wood), tyres and hospital waste. Waste-based does not include anaerobic digestion (AD) - this is treated separately.



WASTE-TO-ENERGY POWER GENERATION



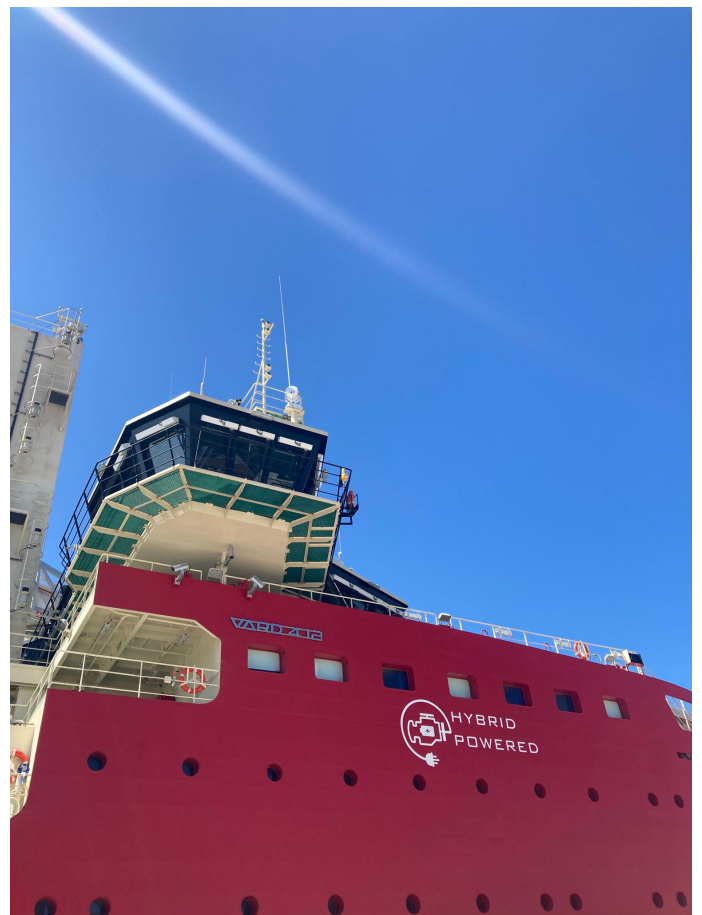
Wind (Onshore and Offshore)

Once again, wind is the largest producer of renewable power, with over 80,000 GWh being generated when aggregating offshore and onshore generation.

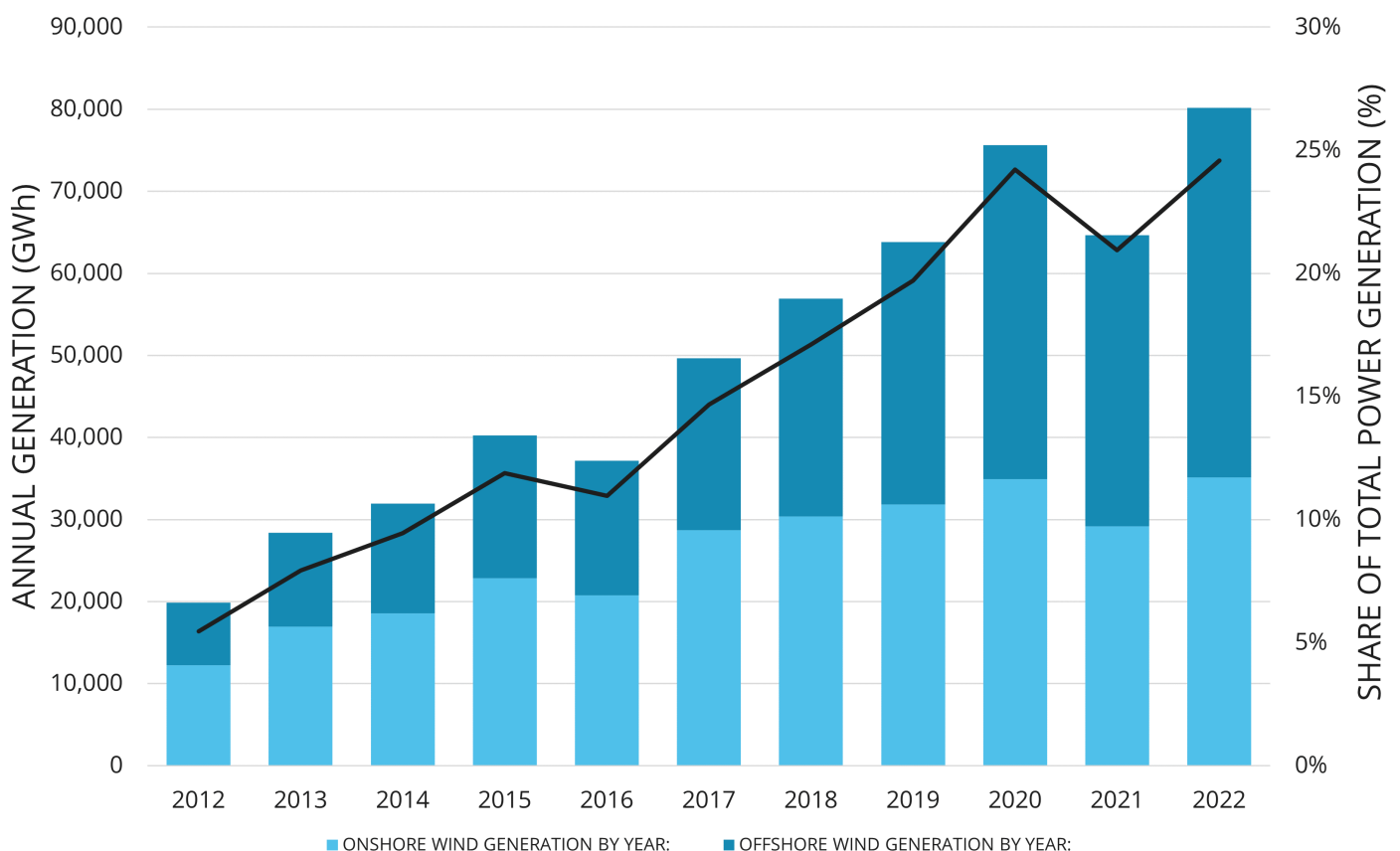
This is a huge 24% increase from 2021 at 65,000 GWh, which, as highlighted in last year's REview, was a year of predominantly less wind generation due to the weather. However, compared to 2020, generation in 2022 has still increased by 6% which is significant, and it is encouraging to see this overall growth.

In addition, aggregate capacity grew by more than 11%, showing significant investment. These capacity increases are being predominantly driven by offshore wind due to the ongoing difficulties in building new onshore wind farms.

In general, we have seen a continued trend of significant offshore wind growth, due to strong government support, with increases in the proportion of total UK electricity generation coming from this source, but stagnant onshore wind growth in generation since 2017. This is partly to do with the Government's de facto ban on new onshore wind projects.



WIND POWER GENERATION



The Need for Real Power in the Government's Energy Security Strategies

Mark Sommerfeld,
Head of Power and Flexibility, REA

In the last year, energy strategies and ambitions for decarbonising our power system have felt a bit like UK Prime Ministers. A new one seemed to come along every few months.

We started 2022 having just seen the publication of the 'Net Zero Strategy.' Within less than six months that had been accompanied by the publication of the 'British Energy Security Strategy', which was then itself superseded, within the space of a year, by the 'Powering-Up Britain: Energy Security Plan.' Meant as responses to the energy crisis, these documents reassuringly recognise that renewables are not only essential to decarbonisation but critical to delivering energy security and lowering generation costs for consumers. However, beyond these documents, actual firm policy development, and subsequent project deployment, have been more sedate. These plans have so far failed to address many of the real barriers to the decarbonisation of our power system.

On the face of it, there is much to applaud in the Government's current stated ambitions for power decarbonisation. Officially, government remain committed to a net zero power system by 2035. This includes ambitions for 50 GW of offshore wind by 2030 and 70 GW of solar by 2035, the latter being driven by a new Solar Taskforce that the REA is fully engaged with. We have also finally seen the establishment of annual Contract for Difference (CfD) auctions – a long standing ask of ours - commitments to a support mechanism for long-duration energy storage by 2024, and a new Biomass Strategy that recognises the long-term role of bioenergy carbon capture and storage in low carbon power generation.

However, elsewhere energy policy has been less positive, sending contradictory and confusing messages. Intentions to issue new oil and gas exploration licences for the North Sea and the introduction of the Electricity Generator Levy have hurt UK investor confidence. They have brought into question the government's commitment to net zero, or even whether there is a sensible pathway to energy security and lower costs.

Especially given the continued exposure to volatile international fossil fuel markets that any new oil and gas exploration would entail.

These announcements have also jarred when compared with the support now provided by the US Inflation Reduction Act and the legislated renewable targets in the EU's Green Deal. The attractiveness of the UK's low-carbon investment market has diminished, and the Government continues to risk seeing capital lost to other international markets.

However, as the REA has repeatedly stressed to Government, accelerating renewable generation and clean technology deployment does not mean getting into a 'subsidy war' with the US. More urgent is addressing the real market barriers and ensuring a wholesale market that properly values low carbon generation.

Chief amongst these barriers is getting to grips with our power grid infrastructure and planning systems. The REA continues to regularly hear of planning applications that take more than 12 months to be looked at and grid connection dates that are more than 10 years away. Such delays are simply untenable with a 2035 net zero power system target.

We note that there have been some hopeful developments on grid issues this summer. National Grid ESO and the Energy Networks Association (who represent the local distribution network operators) have both pushed ahead with implementing connection reform plans. It is hoped that these will bring connection offer dates forward. In addition, by the end of the year, we should finally have the establishment of the Future System Operator, who will act as an independent central body setting the priorities for the delivery of a grid system fit for the future. However, we will need to wait and see the results of these reforms, and political pressure will need to remain high to ensure our ageing power grid infrastructure issues are addressed.

Outside of physical infrastructure, we also need to ensure that our wholesale market can deliver meaningful price signals for low-carbon generation. The REA has been heavily engaged with the Review of Electricity Market Arrangements (REMA), currently being conducted by Government, and issued a report highlighting how amendments to the CfD could drive rewards for flexibility and firm generation, as well as maintain existing low carbon generation assets. Such reforms will sit at the heart of renewable and clean energy business models and their implementation must be forewarned and transparent.

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

The Government's long-awaited Biomass Strategy was published in August 2023, including a foreword from the Chief Scientific Advisor, Professor Paul Monks, that makes clear "Biomass can play a significant role in decarbonising nearly all sectors of the economy." It is little known, but bioenergy is the UK's largest source of renewable energy (across power, heat and transport), and the second-largest source of renewable power (after wind).

Unfortunately, in recent years the public debate on biomass has become increasingly polarised. Biomass is often presented in binary terms as either 'good' or 'bad' for the planet. The reality is more nuanced – biomass is an important climate solution, when done correctly. Furthermore, the UN's climate science body, the Intergovernmental Panel on Climate Change, the International Energy Agency, and the UK's Climate Change Committee are all in agreement – sustainable biomass is key to meeting our net zero targets.

Sustainability is absolutely mission-critical for any use of bioresources, and the new Biomass Strategy is correct to refer to it as its "top-priority." The UK has been at the forefront of developing stringent regulations that ensure that biomass is always sustainable, whether imported or grown in the

UK. The industry looks forward to working with the Government as they consult on the development of a new cross sectoral common sustainability framework that will ensure sustainability governance arrangements remain strong and aligned with the scientific evidence.

At a time when all eyes are on America's Inflation Reduction Act, new policy certainty on bioenergy will help to drive investment in the UK, creating jobs and maintaining the UK's leadership on biomass. It is critical that Ministers urgently provide workable routes to market for "negative emissions" through bioenergy with carbon capture and storage (BECCS). The Government must also act to further support the rapid scaling up of production of homegrown bioresources.

The UK has been a pioneer in the use of sustainable biomass to displace fossil fuels. We would otherwise not have been able to lead the world in leaving coal in the ground and close coal-fired power stations, for example. This is a genuine UK climate success story. We have the skills, supply chains, and infrastructure to deliver the next generation of bioenergy technologies, but we must build on this foundation if we are to fully realise the potential of the sector.



Power & Flexibility

To reach net zero we need stable policy that will facilitate a fully decarbonised, secure, and affordable electricity system. The REA Strategy has previously stated this can be achieved by 2032, but we will not realise this without urgent action from the next Government. 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 remove the UK's dependence on international fossil fuel imports. However, the next government must now ensure the infrastructure for such generation is in place to manage both decentralised generation and increased demand.

The next government must:

- **Ensure the Future System Operator (FSO) is operating by the end of 2024**, following its establishment via the 2023 Energy Security Bill. The next Government must ensure the FSO's independence and funding, as regulated by Ofgem, so that it can deliver a strategic and centrally coordinated plan for reinforcing the electricity grid and gas network by 2025. This will help address capacity constraints and ensure faster connection periods for all generation.
- Task the **National Infrastructure Commission to deliver an annual progress-report on efforts to speed up grid connection lead times**, monitored against the recommendations made by the Electricity Networks Commissioner this year, to be presented to Parliament and 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 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 2024 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.
- Provide **capital allowances** for investments in new low carbon generation technology, **within the new administration's first Spring Budget**, akin to those already available for oil and gas sectors.
- Implement a **cap and floor support mechanism for long duration energy storage** by the end of the first year in government, to support deployment of critical technologies needed to decarbonise and balance the power system.
- Finalise and allocate the **Power Bioenergy Carbon Capture and Storage (BECCS) Business Models** from 2024, supporting projects at all scales, ensuring the delivery of negative emissions in the power sector by 2030.
- Prioritise **completion of reforms to planning guidance** by 2025, to halve the time taken for planning decisions on new renewable assets.
- Reform the **Smart Export Guarantee (SEG)** and provide **interest free loans**, by 2025, for households and businesses to install onsite renewables and clean tech, helping them lower their bills. There must be renewed focus on improving buildings' energy efficiency.

Deployment: Heat & Cooling

Renewable Heat Deployment Summary

Despite a lack of cohesive government support after the closure of the Non-Domestic Renewable Heat Incentive (NDRHI), the UK's renewable heating industry continues to show growth in 2022 with a slight increase in annual generation from 2021.

However, only 8.36% of 2022's total heat consumption was generated by renewables – still an increase from 2021 but there is a long way to go. As fossil fuel prices continued to rise in 2022, renewable heating became more competitive with fossil heating, but Government are yet to close the policy gap on heat decarbonisation and bring long term relief for hard pressed households and businesses as well as cutting long-term emissions.

Responding to Ofgem's energy bill price cap rises in 2022, the REA called for immediate front-line support from Government, while stressing that delivering the renewable energy transition was the lonely long-term solution to the crisis. Indeed, the REA welcomed the Government's Energy Bill Relief Scheme and the Energy Price Guarantee while simultaneously reiterating throughout the year that the schemes would not protect

60%

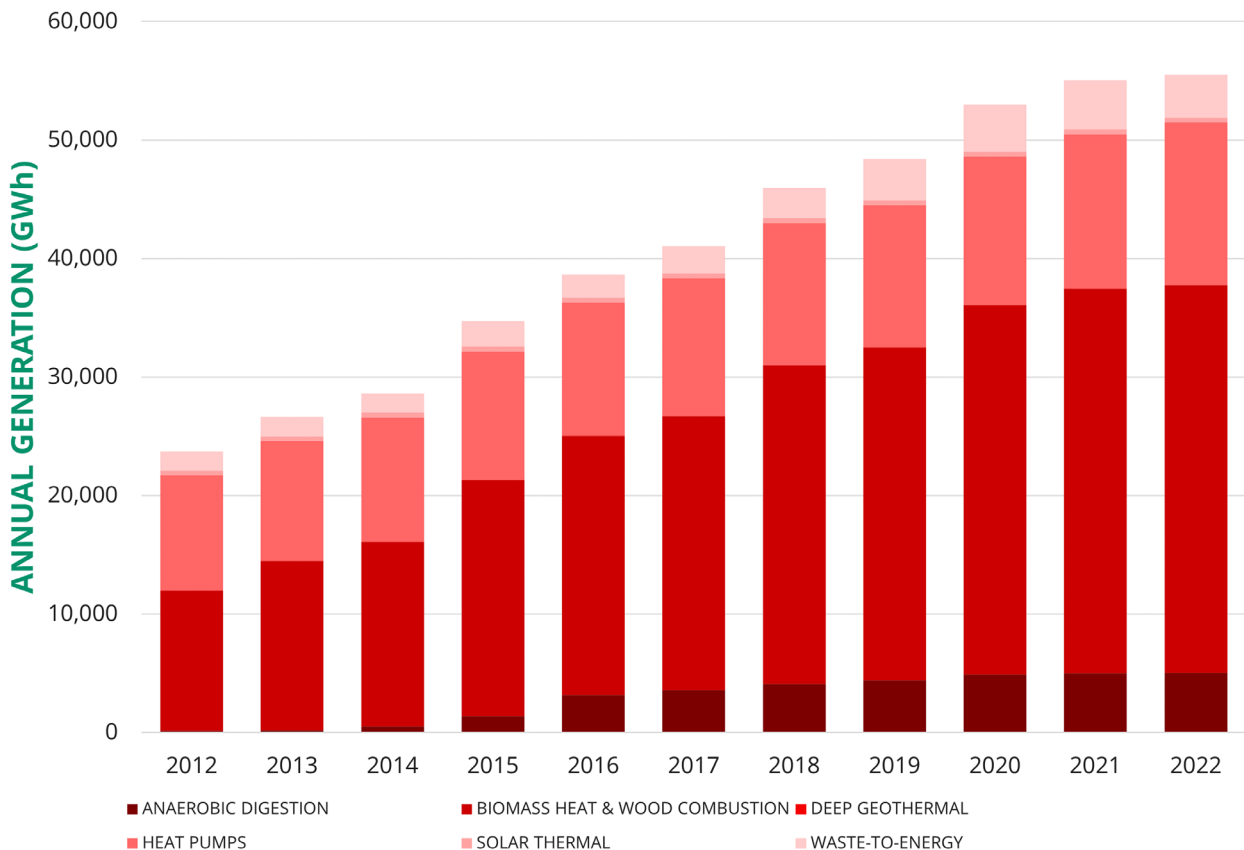
OF ALL RENEWABLE HEAT GENERATION
WAS PRODUCED BY BIOMASS IN 2022 -
32,000 GWh

consumers from the underlying energy crisis in the long term without a shift to renewables and energy efficiency.

The REA and the industry as a whole have continued discussions with Government to determine how the much cheaper costs of renewable generation can be better felt within the wholesale market and benefit both domestic and non-domestic energy users. We have all the solutions available to us to encourage the mass roll-out of low carbon heat technologies, including heat pumps, biomass boilers, hydrogen, thermal storage and other renewable technologies.

Policy mechanisms such as The Boiler Upgrade Scheme (BUS) - the largest subsidy for renewable heating since the closure of the Renewable Heat Incentive - have provided some small growth for the industry but are not ambitious enough to meet the decarbonisation challenge (nor the Government target of 600,000 heat pumps to be installed every year by 2028).

RENEWABLE HEAT GENERATION BY TECHNOLOGY OVER TIME



Deeper Insight:

Deep Geothermal

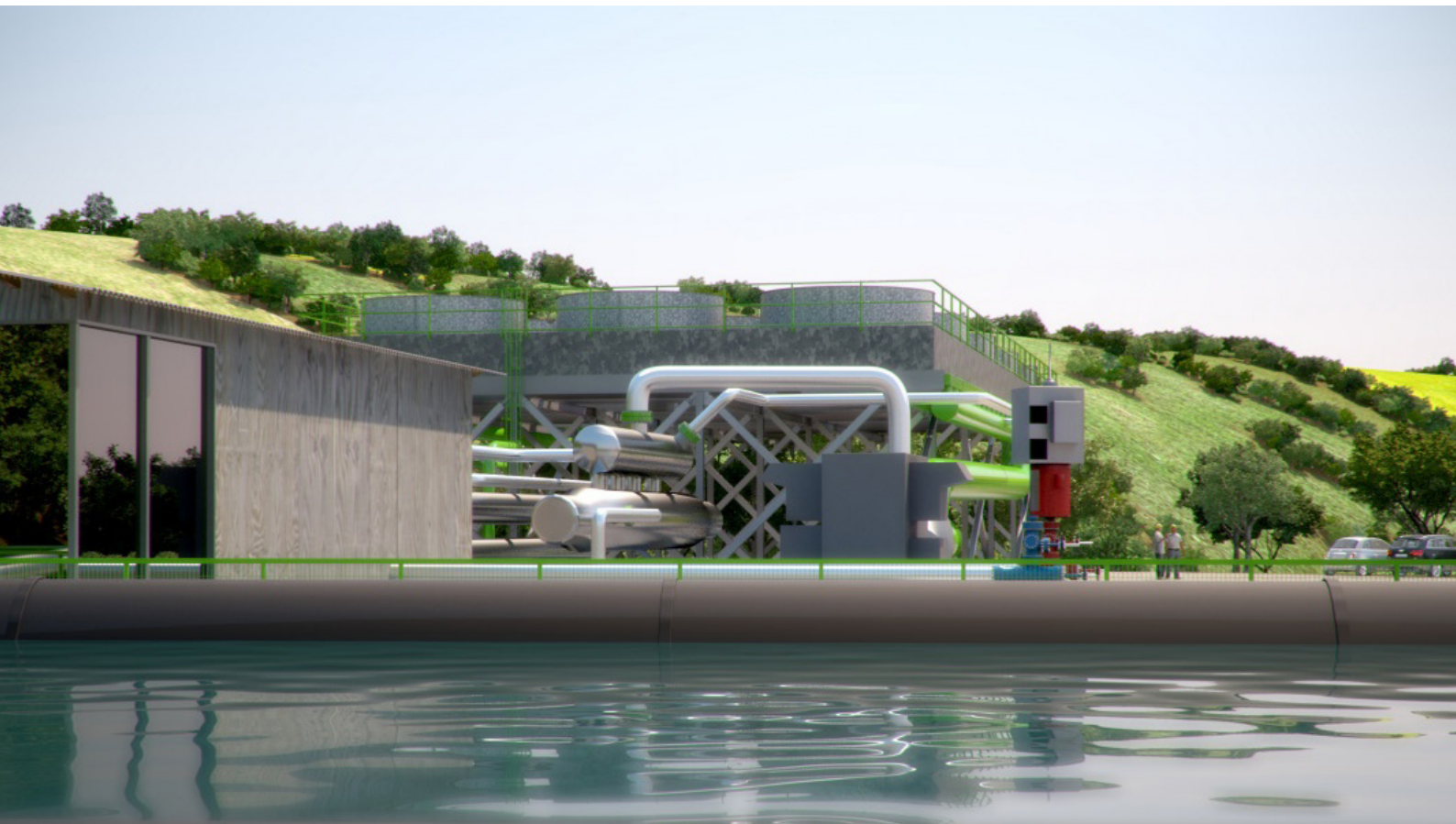
Due to a lack of Government support since the closure of the Non-Domestic Renewable Heat Incentive in March 2020, renewable heat generation from deep geothermal has remained negligible. This scheme closed before several projects were able to fully commission, meaning a number of projects are shovel ready, but require some additional support to reach completion.

There are many hot sedimentary aquifers and Deep Geothermal plants can be constructed to extract the heat from them and utilise the hot water in district heating schemes and process heat. 360 geothermal plants by 2050 could provide 15,000 GWh of annual heat and carbon savings of around 3 megatons annually. Geothermal is well placed to renewably heat large buildings such as hospitals and schools where other technologies may struggle.

The REA has continued to push for planning guidance to give extra weighting to deep geothermal, alongside the long-standing push for a Geothermal Development Incentive.

However, 2023 marked the publication of Dr Kieran Mullan MP's report for Prime Minister Rishi Sunak on the potential of deep geothermal in the UK. Titled 'Dig Deep: Opportunities to Level Up through Deep Geothermal Heat & Energy on the way to net zero,' the report demonstrates that geothermal energy can deliver jobs, investment and clean cheap energy to the parts of the UK that need it the most. Importantly, there is significant overlap between areas in need of levelling up and investment and the best geothermal locations.

Furthermore, the REA's work has been acknowledged in the report, particularly in reference to our very own report with ARUP titled 'Deep Geothermal Energy: Economic Decarbonisation Opportunities for the United Kingdom.'



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

Combined, biomass heat and wood combustion are the largest renewable heating source by a mile - they generated nearly 60% of total UK renewable heat in 2022. Second to this are heat pumps, at 25%.

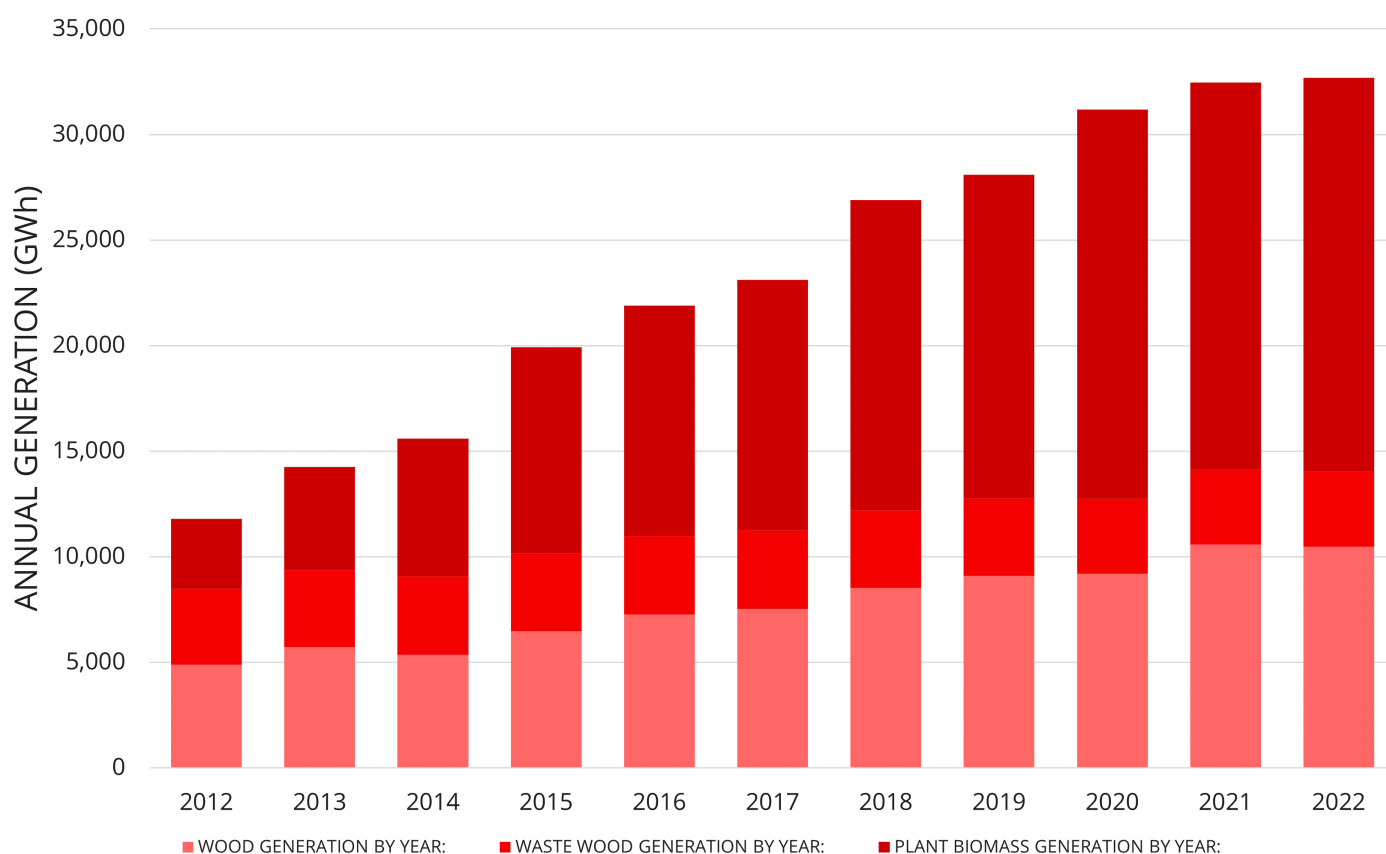
To break this down further, in 2022, 57% of this combination was plant biomass, 32% wood generation and 11% is waste wood generation.

Compared to previous years this increase is slowing, but we can still see steady growth over time. Waste wood generation has remained steady, with near 0 or negative growth in recent years. At a little over 3,500 GWh, this is broadly the same figure since 2011.

In last year's REview, we noted that wood heat generation (e.g., fireplaces and stoves) grew significantly with an increase of nearly 16%. Despite this, 2022 has seen an ever so slight decrease possibly due to different weather conditions and new, more stringent, regulations on domestic fuel.



BIOMASS HEAT & WOOD COMBUSTION HEAT GENERATION



Deeper Insight: Anaerobic Digestion (AD)

After a sharp increase from 2013 to 2016, AD growth has continued but at a slower pace since and this has continued in 2022, with a 0.64% increase from 2021 to 2022.

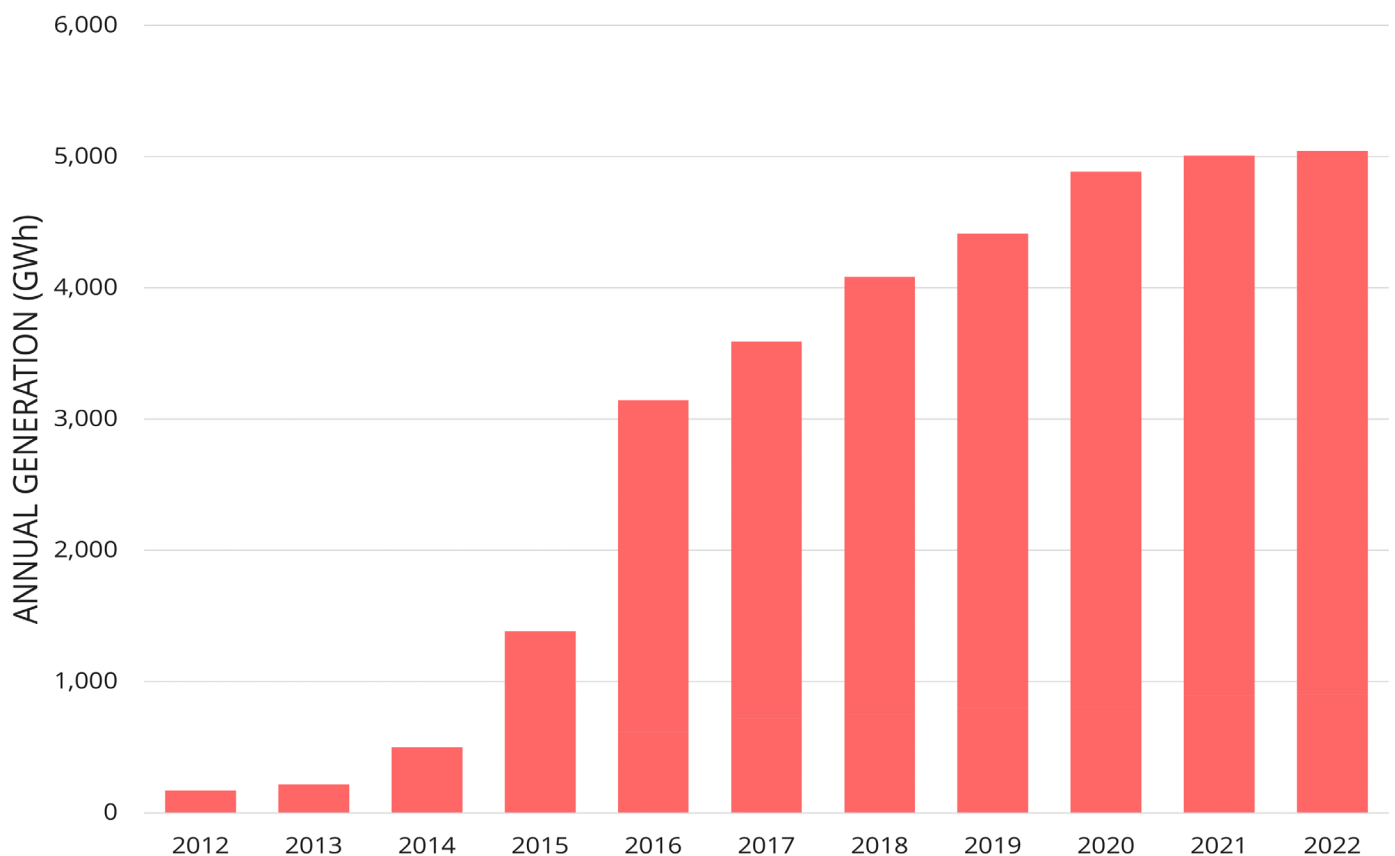
It is positive however to see continued yet modest growth, and in 2022, AD provided 9.1% of total renewable heat generation.

Indeed, growth had more than doubled in each of the years between 2014 and 2016. As noted in RReview22, while the sector is still expanding, the pace of growth is slowing. This slowdown in growth is in part due to project delays for new biomethane facilities during the pandemic, when project deadlines under support schemes were extended to 2022.

These figures include biomethane injected into the gas grid and assume that biogas is evenly mixed across the gas grid so that Government estimates of the proportion of gas consumption used for heating apply equally to biogas.



ANAEROBIC DIGESTION HEAT GENERATION





Deeper Insight: Heat Pumps (Air and Ground Source)

Heat pumps now supply 25% of renewable heat generation, but this share is actually a declining one over time. They supplied 50% of renewable heat generation in 2008, then sunk to the lowest level of 23.7% in 2020, with signs that the industry is now recovering. This shows the slow pace of progress in this area, particularly if we are to reach the current UK target of 600,000 heat pumps to be installed every year by 2028.

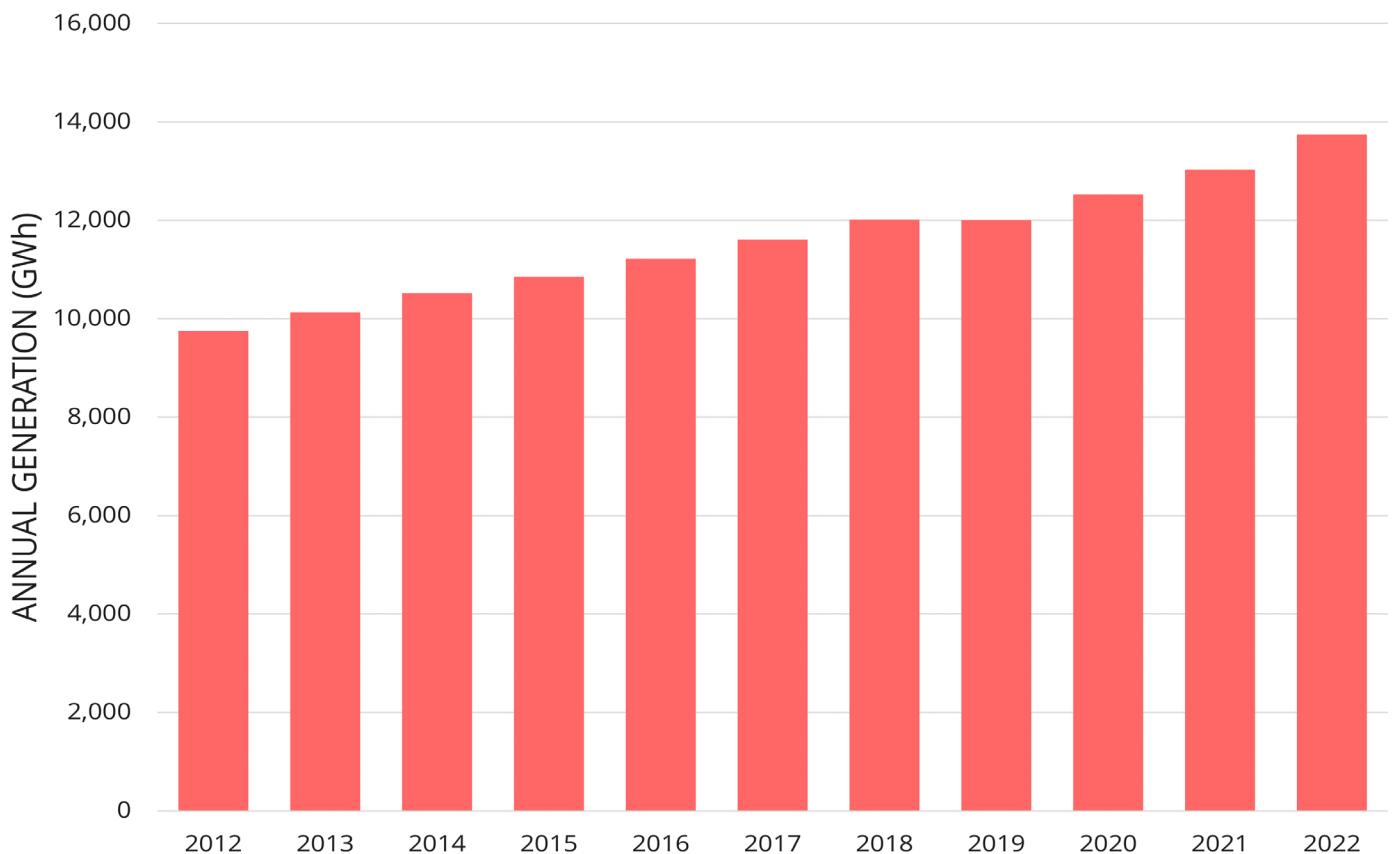
However, Government are beginning to lay the foundation for the future roll out of heat pumps and other technologies under the Clean Heat Market Mechanism, so we expect positive growth to come.

Solar Thermal

Solar thermal has continued its recent annual trend of relatively limited growth rates, showing a slow decline since 2017, with a positive increase above this in 2021.

Overall, solar thermal accounts for around 1% of all renewable heat generation.

HEAT PUMPS HEAT GENERATION

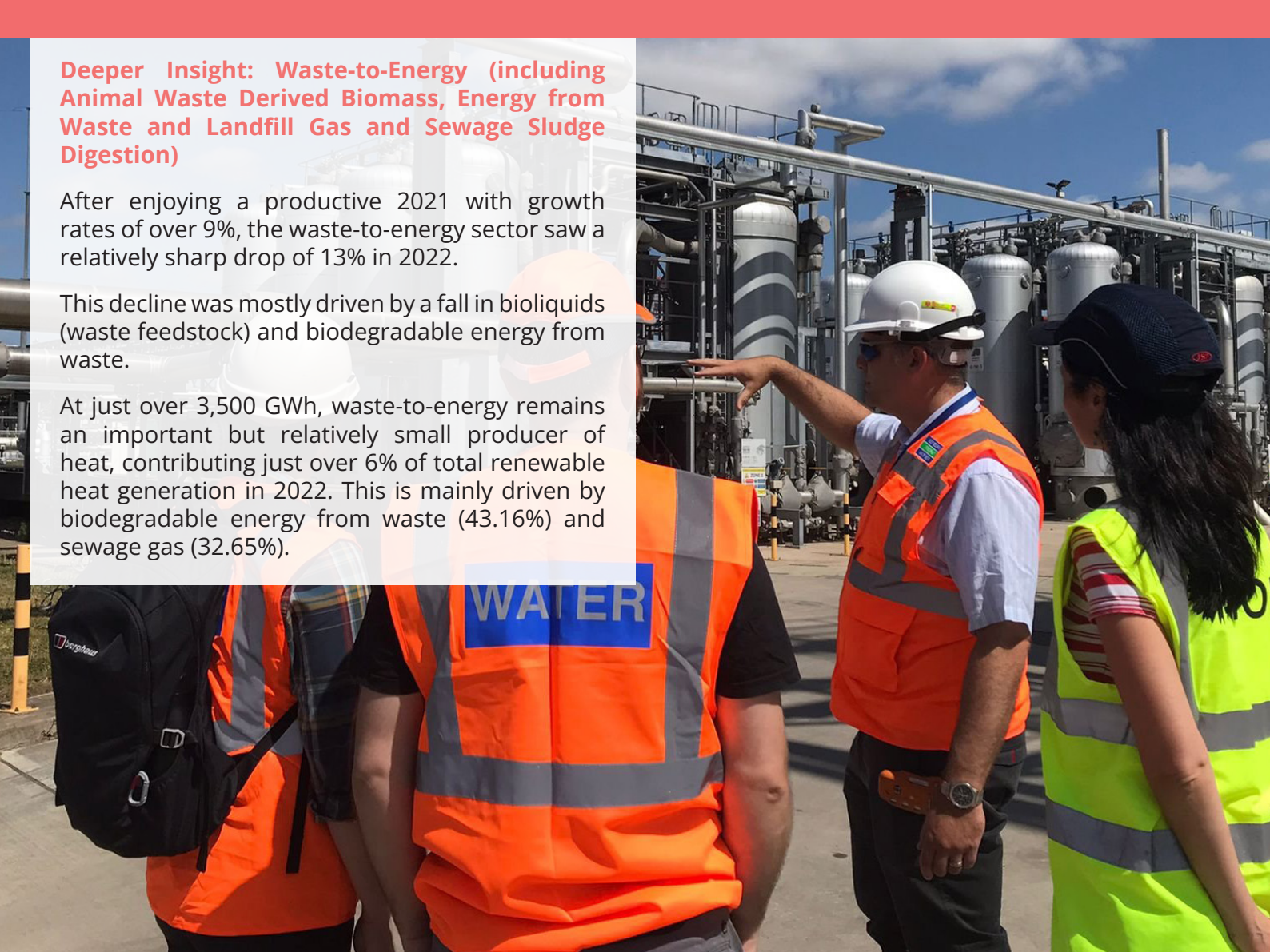


Deeper Insight: Waste-to-Energy (including Animal Waste Derived Biomass, Energy from Waste and Landfill Gas and Sewage Sludge Digestion)

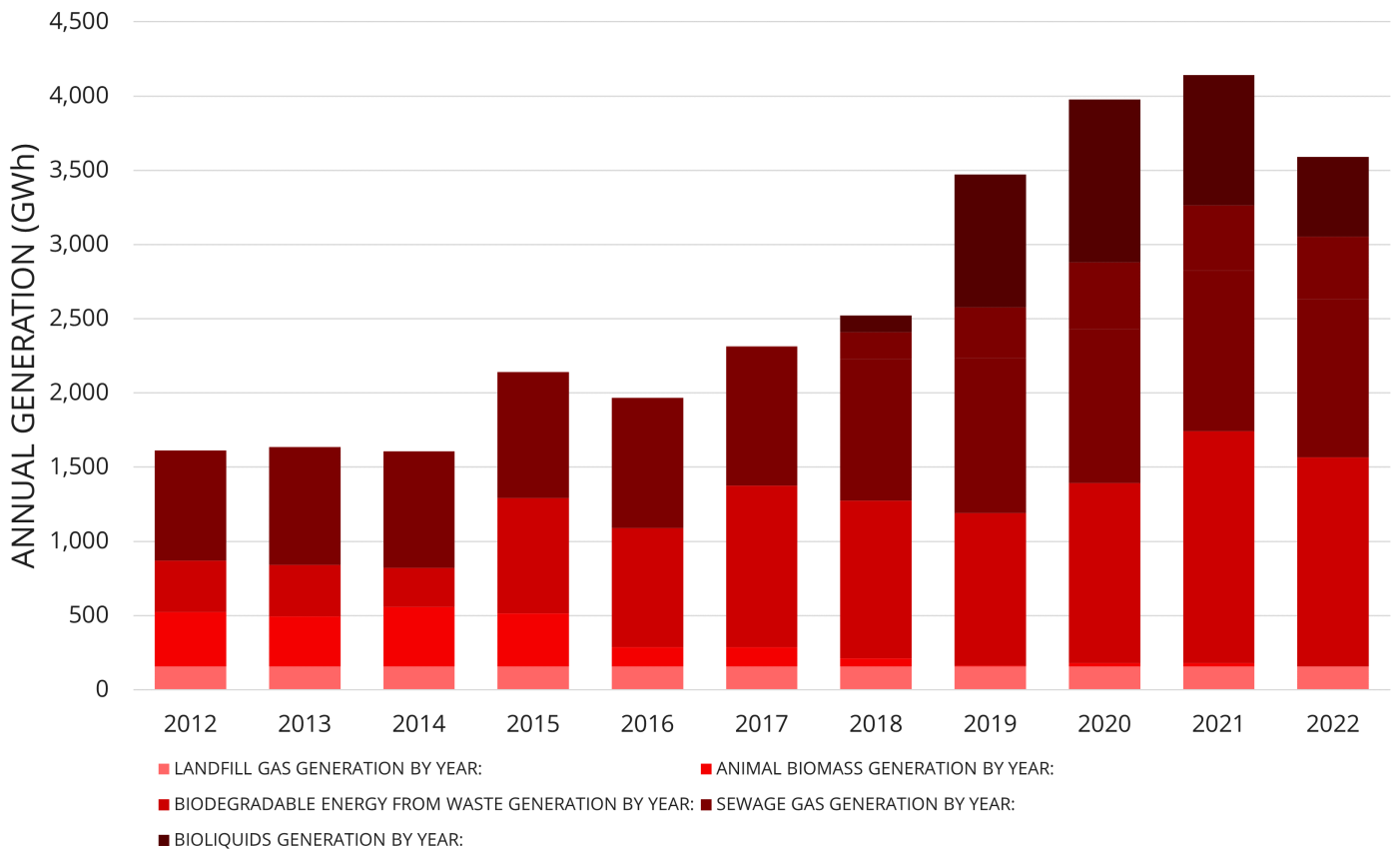
After enjoying a productive 2021 with growth rates of over 9%, the waste-to-energy sector saw a relatively sharp drop of 13% in 2022.

This decline was mostly driven by a fall in bioliquids (waste feedstock) and biodegradable energy from waste.

At just over 3,500 GWh, waste-to-energy remains an important but relatively small producer of heat, contributing just over 6% of total renewable heat generation in 2022. This is mainly driven by biodegradable energy from waste (43.16%) and sewage gas (32.65%).



WASTE-TO-ENERGY HEAT GENERATION



The time for action on heat is now

Frank Gordon
Director of Policy, REA

We have seen one of the most tumultuous periods in the recent UK and global energy landscape. Although we have seen some progress in policy development, the time to act on heat decarbonisation is now.

Energy costs were the number one political issue for long periods of the past year as our legacy reliance on imported fossil fuels in the face of geo-political turbulence has seen fossil prices soar and put untold strain on household and business finances. What is clear is that clean, homegrown energy supplies are the only viable long-term answer to this critical issue - and Government must take this moment to invest in renewables and energy efficiency. This is the only way to set us on a path whereby a major part of our business and living costs are never again determined by dubious international regimes' supply of, and global demand outside our control for, damaging, polluting and finite resources.

There is no doubt that the Government made some positive inroads on heat decarbonisation, but it is limited in scale and provides little immediate impact. Government have provided funding to support heat networks. They are also laying the foundation for the future roll out of heat pumps and other technologies under the Clean Heat Market Mechanism. The Future Homes Standard will end the installation of new gas boilers in new homes in two years' time. The Boiler Upgrade Scheme (BUS) is the largest subsidy for renewable heating since the closure of the Renewable Heat Incentive, but it is clear that the Boiler Upgrade Scheme is not ambitious enough to meet the target of 600,000 heat pumps to be installed every year by 2028.

We need a much bolder approach and new heat decarbonisation and energy efficiency support measures. For example, the entire BUS pot only has enough money to fund less than 100,000 installations, less than 15% of the target. It must also support other technologies such as Biomass boilers, to prevent over reliance on one technology. Every year around 1.5m boilers are installed in the UK, so even if we hit the Government's target of 600,000 heat pumps a year by 2028 there will still be 900,000 fossil boilers going in. We need to replace 26 million fossil boilers across the UK - and heat pumps cannot shoulder the burden of

decarbonising our homes alone.

Decarbonising our homes needs a nuanced, multi-technology approach if we are to meet the immense challenge before us - not just heat pumps, but geothermal, biomass boilers, heat networks, solar thermal, heat batteries and a range of other technologies.

Making homes and buildings more energy efficient is equally essential to cut carbon and lower bills. The lack of Government action on delivering energy efficiency across our leaking building stock is both baffling and concerning. There are interrelated areas in grid connections and planning that lead to bottlenecks too - showing how interconnected our energy system is becoming.

In terms of industrial and commercial heating, there is also an urgent need for action - while several grants and competitions to decarbonise industries are welcome, such as under the Net Zero Innovation Portfolio, Public Sector Decarbonisation Fund or the Industrial Energy Transformation Fund - these schemes only address initial capital expenditure and do little to cover operational costs. Hydrogen support is welcome and forthcoming, but may take a few years to be built out.

Government must urgently close the policy gap on heat decarbonisation and bring long-term relief for hard pressed households and businesses by introducing new policy support for the sector - this could include a funded CfD for industrial heat decarbonisation, or a fuel switching tariff. Now is the time for a revolution in our heating sector to cut long-term emissions, and importantly, lower bills.



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 the huge policy gap for non-domestic heat decarbonisation must be urgently addressed. If done correctly, more than half of UK heat demand could be decarbonised by 2035.

The next government must:

- Incentivise non-domestic heat for small and medium enterprises with a **fuel switching tariff**, to enable organisations to switch from fossil fuels to a range of low carbon alternatives including heat pumps, biomass, green gas and hydrogen. This should start by the end of 2024 and follow the end of the Green Gas Support Scheme in 2025. Support should depend on strong standards for maintenance and fuel quality.
- Incentivise large scale industrial heat decarbonisation projects through establishment of a **Heat Contracts for Difference** mechanism. Allocation should be open to all low carbon technologies and all industries, with the first allocation round in 2025.
- **Expand the Boiler Upgrade Scheme** by the end of 2024 and make it more flexible, to cover a wider range of project sizes. This should ensure all technologies are at least able to access the new higher grant level of £7500, including biomass, and support energy efficiency measures. This should be accompanied by a low interest government-backed loan to pay for the remainder of the installation. Reinstating

ambitious fossil fuel boiler phase out dates should also be reconsidered here.

- Work with the finance industry to **deliver low carbon heat financial products** that promote installations, such as green mortgages.
- 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.
- Urgently deliver **planning reforms** to enable Local Area Energy Planning for renewable heat projects such as green gas sites, as well as providing funding to local authorities to appropriately resource and speed up decision-making process, such as enabling heat network zoning.
- **Ensure the Future System Operator** delivers a strategic plan by the end of 2025 for gas grid development and map out the transitioning of different green gases and their role in a decarbonised grid.

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 next government must:

- **Ensure delivery of allocation rounds** for the Low Carbon Hydrogen Business Model in 2024, 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 covers the management of biodegradable wastes and materials. It includes composting, aerobic and anaerobic digestion, landspreading and other biological treatment techniques and the use of biologically treated materials for the enhancement of our natural capital.

The recycling rates of all wastes from UK households (excluding Incinerator bottom ash metals) have increased slightly from 43.6% in 2020 to 43.7% - indicating that this is starting now to recover from COVID-19 after a decrease from 2019 to 2020.

Biodegradable Municipal Waste (BMW) going to landfill has increased, with tonnages rising from 6.1 million tonnes in 2020 to 6.8MT in 2021. This could again be driven by changes to waste collections during COVID-19 and a slow recovery. In previous years we have seen slight fluctuations as tonnages fell 8% in 2019, another 8% in 2020, and then a rise to 10% in 2021. England is responsible for 79% of the UK's BMW to landfill. In May, Defra called for evidence on the near elimination of biodegradable waste to landfill from 2028 and we await further policy developments.

Wales continues to lead the way in 2022 with a 56% recycling rate, with Northern Ireland second at 48.4%. England and Scotland have slightly lower rates at 43.1% and 41.4% respectively. These figures represent all recycling, not just the materials covered by Circular Bioresources.

Apart from Wales, these rates remain below the 50% required by the (no longer applicable but

43.7%

THE UK'S WASTE RECYCLING RATE IN 2021 - THE TARGET FOR ENGLAND WAS 50%

only UK-wide target of recent years) EU Waste Framework Directive, and the individual targets set by the devolved Governments. Given the fairly static rates over the past few years and the slight drop in 2021, it leaves most of the UK with much more to do.

Despite the Environment Act 2021 mandating the separate collection of food and garden waste from households and separate food waste collections from businesses, we still await the secondary legislation to implement these requirements along with further details on timing.

The Scottish Government have published the Circular Economy (Scotland) Bill to make steps towards creating a circular economy in Scotland, which includes (amongst others): powers to set recycling targets; improved enforcement against fly-tipping and other waste crime; requirements for local authorities to comply with a code of practice on collection and recycling of household waste; and requiring public reporting of surplus food waste for business.

In Wales, the Net Zero Strategic Plan sets out a range of initiatives so that low carbon becomes the default choice. These include sustainable procurement, maintaining and enhancing the resilience of ecosystems and both qualitative and quantitative carbon reduction targets.

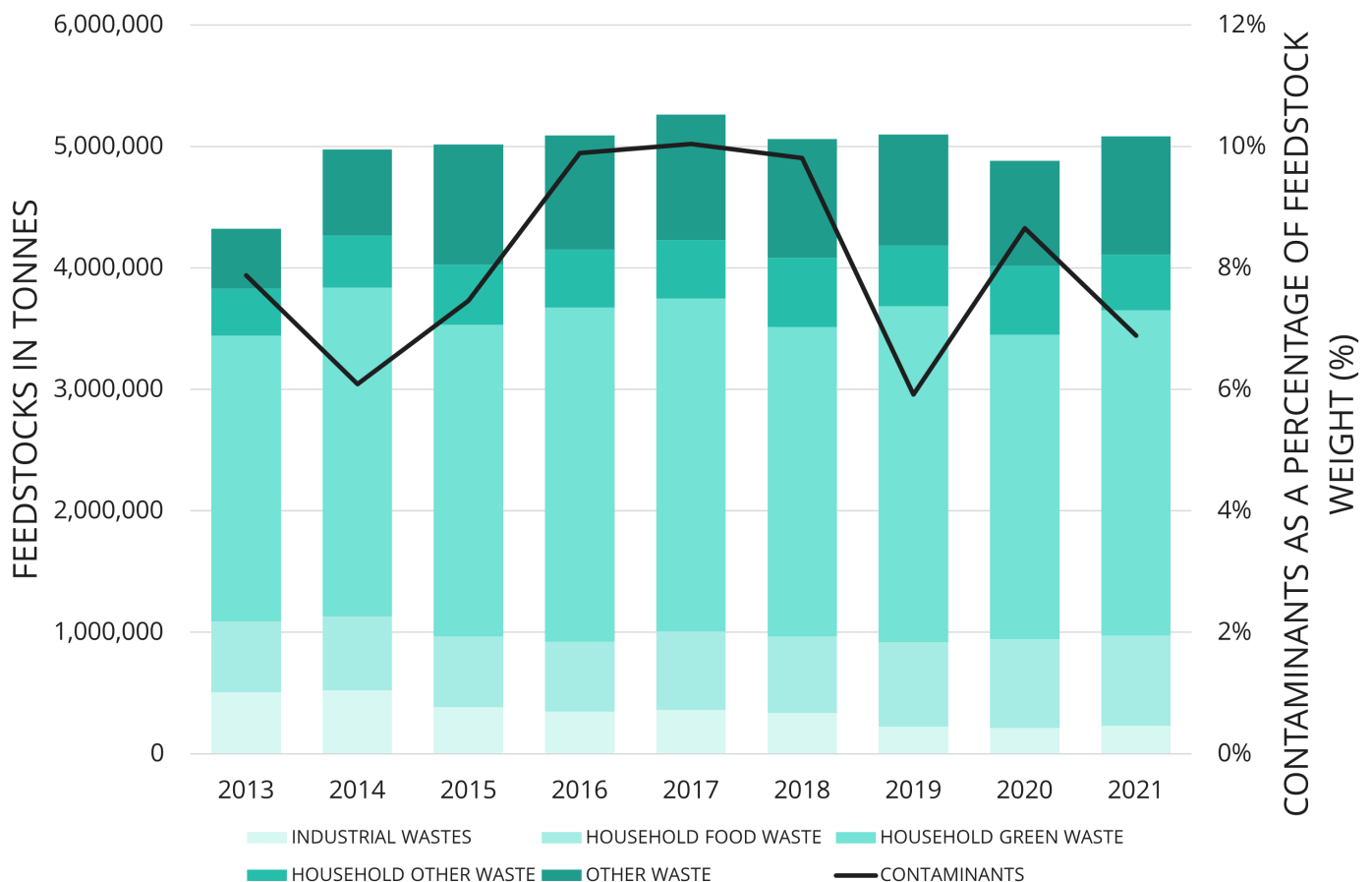
With regards to biodegradable waste received at composting facilities, 2021 represented a broadly successful year for composting with the tonnages received in England increasing slightly by 4.13% compared to 2020. The types of waste and the sources remain roughly the same.

In terms of the quality of feedstocks, physical contaminant and other waste tonnages also fell in 2021 to 6.89% which is an improvement on 8.65% in 2020, but still higher than in 2019 (5.91%).

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.



COMPOSTING FEEDSTOCKS RECEIVED IN ENGLAND, AND CONTAMINATION RATES



6.2m

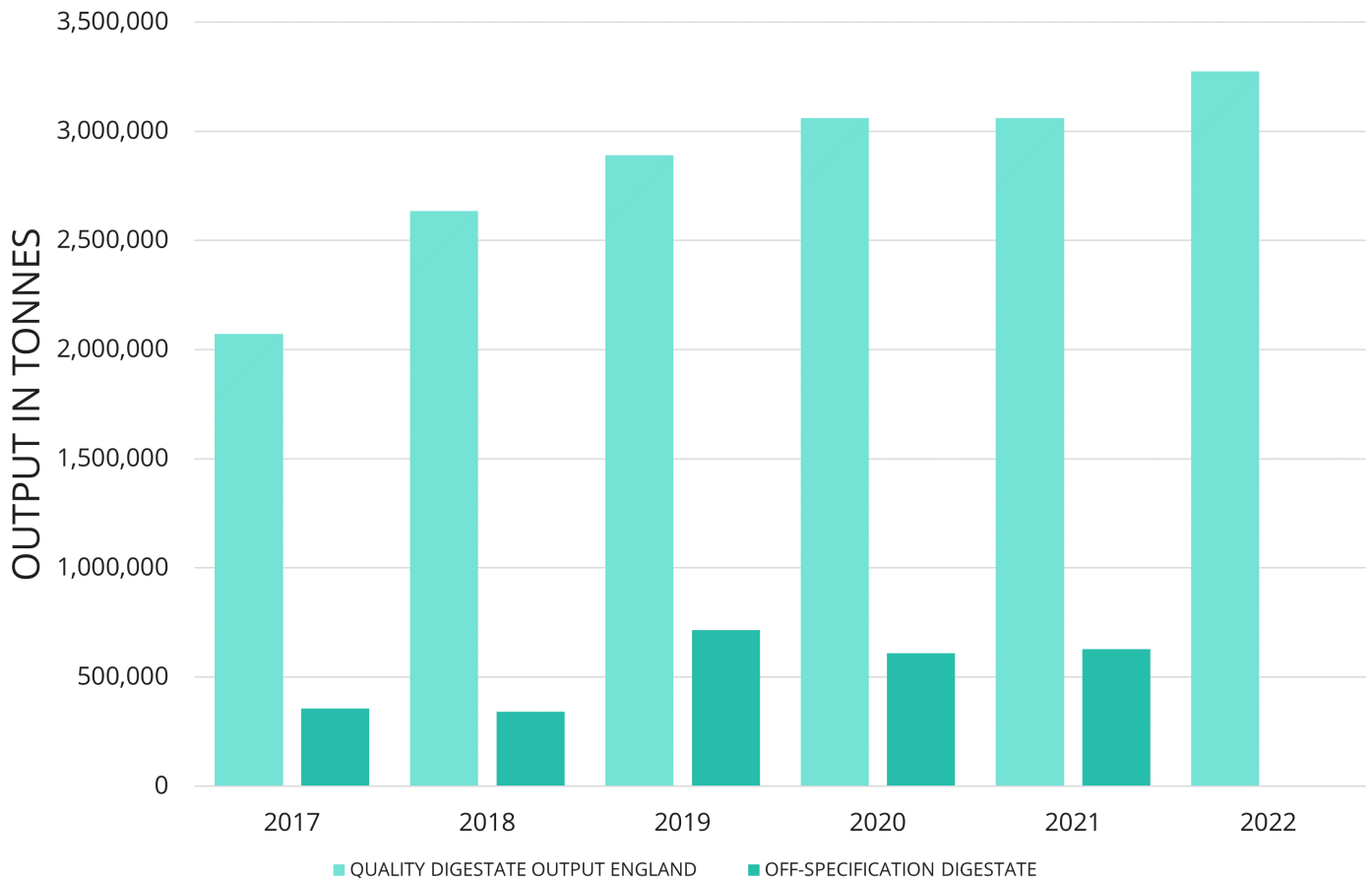
TONNES OF QUALITY COMPOSTS AND DIGESTATES PRODUCED

Composting feedstocks into Renewable Energy Assurance Ltd's Compost Certification Scheme certified sites fell in 2022 by 0.82%, from 4.138 million tonnes (MT) in 2021, to 4.109 MT in 2022; this is still a strong relative increase over time from 3.807 MT in 2018. The slight decrease could be down to climate factors and the delay in implementation of legislation. Notably, tonnages in England and Scotland fell from 2021 to 2022, while in Northern Ireland and Wales they rose.

Quality compost output for the UK has risen by 2.26% from 2021 to 2022; which given the reduced feedstocks is good news. However, quality compost outputs are still lower than they were in 2018 (2018 was 1.876MT and 2022 was 1.810 MT).



AMOUNT OF QUALITY AND OFF-SPECIFICATION DIGESTATE PRODUCED

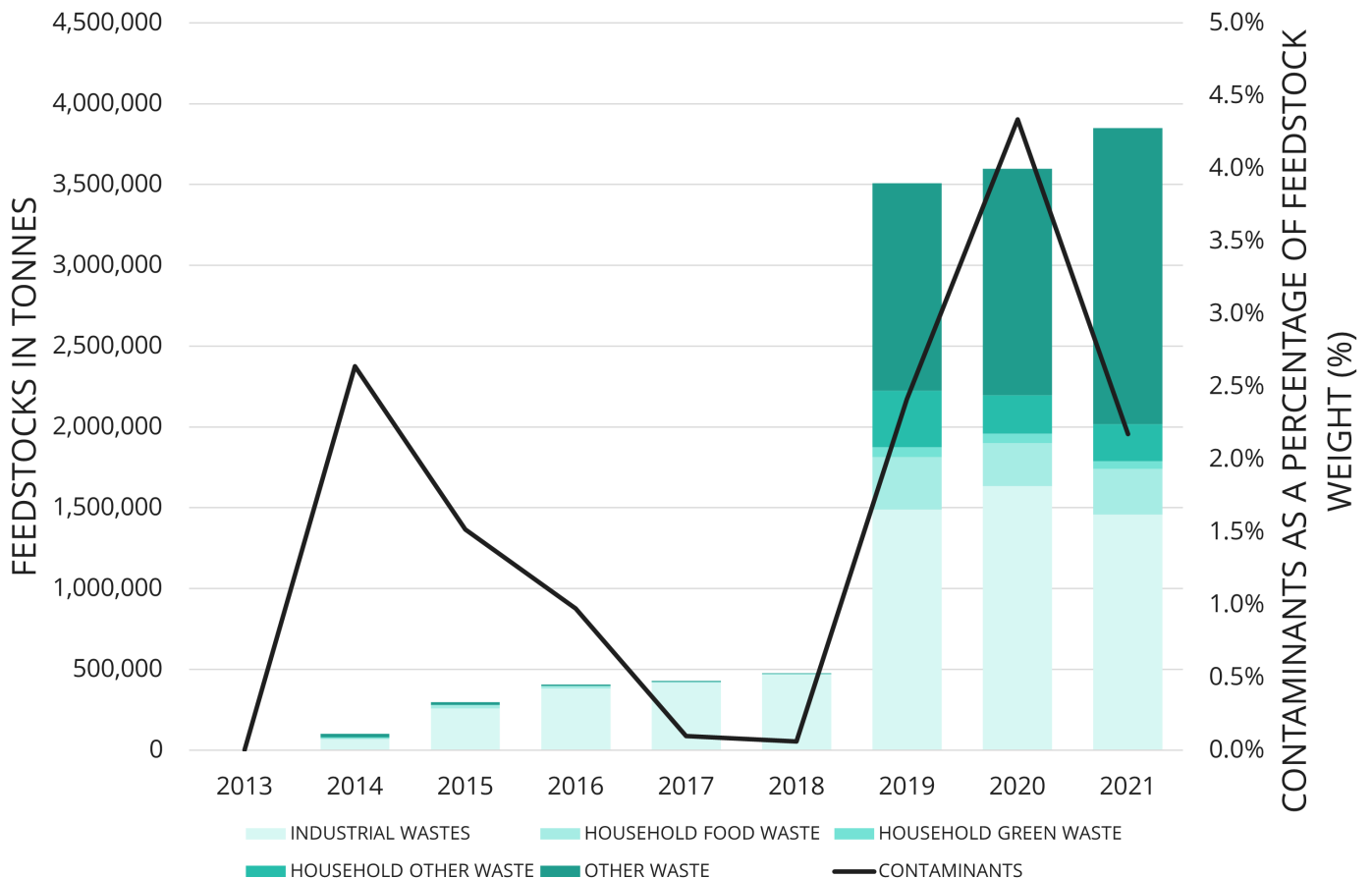




For AD, feedstock tonnages have still shown growth over time. Plants certified under Renewable Energy Assurance Ltd's Biofertiliser Certification Scheme are showing moderate growth of 3.35% from 2021 to 2022. This is from 5.188MT to 5.362MT. Only in Scotland did quantities fall, by 9% on the previous year.

With regards to quality of feedstocks received to AD, like compost, there was a decrease in contaminants (2.17%) compared to the previous year (4.34%). This was connected to an 85% spike in physical contaminants and other wastes rejected in 2020 which could be down to COVID-19 disrupted collection or a change in reporting. Overall, this represents a 1% fall in physical contamination and other wastes rejected from AD facilities in 2021 compared to 2019. A move in the right direction but still work to be done to improve the quality of material arriving at AD sites. It is extremely difficult to gauge what the consistent physical contamination and other waste reject rates have been so far.

ANAEROBIC DIGESTION FEEDSTOCKS RECEIVED IN ENGLAND, AND CONTAMINATION RATES

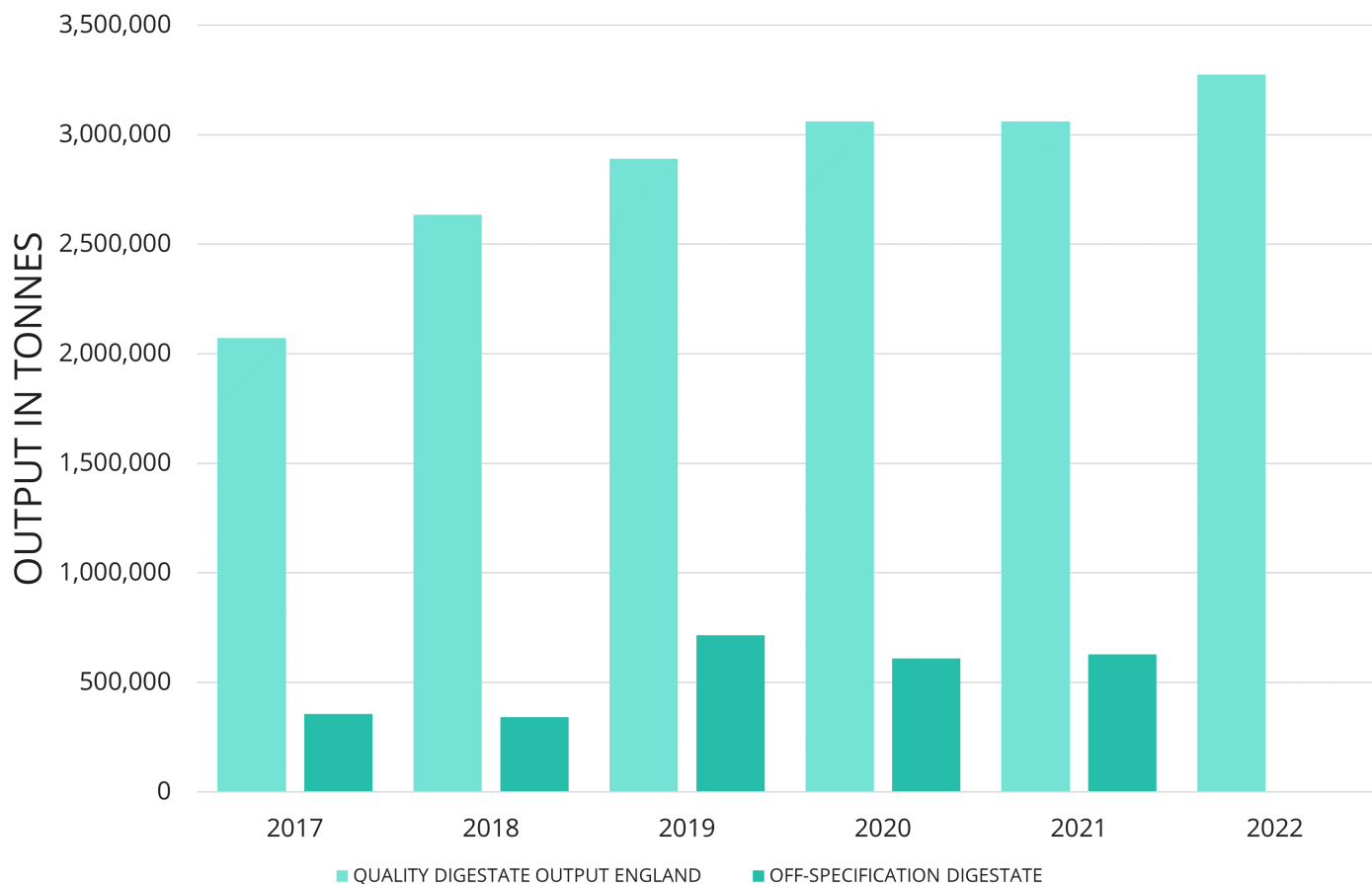


There was a corresponding increase in the amount of digestate produced, with a slight increase in the amount of certified digestate (certified under the Biofertiliser Certification Scheme) and a 3% rise in off specification digestate produced.

The total amount of quality compost and digestate produced in the UK was approximately 6.2 million tonnes of quality organic fertilisers and soil improvers that can be recycled to land with many environmental and agricultural benefits, replacing the need for fossil fuel derived fertilisers and improving soil quality and health, which in turn enables soil carbon sequestration and the production of food.

It should be noted that data on off-specification digestate for 2022 is still yet to be published.

AMOUNT OF QUALITY AND OFF-SPECIFICATION DIGESTATE PRODUCED



Ready and waiting to help reach net zero

Jenny Grant
Head of Organics and Natural Capital, REA

The organics industry is in a prime position to help the UK deliver on our net zero targets. It is disappointing that industry is not able to capitalise on the full potential as we are still waiting for the Government to implement their commitment to mandatory food and garden waste collections in England. This is essential to increase the amount of unavoidable food waste and garden waste collected and treated through composting or anaerobic digestion to turn into renewable energy, capture the carbon and enable the production of quality organics to return vital nutrients and organics matter back to our soils.

The recent announcement from Government delaying the full implementation of the Extended Producer Responsibility for packaging reforms from October 2024 to October 2025 will have an impact on the timing and Government have said that consistent collections for England's dry-recyclable, food and garden household wastes will come in after the implementation of EPR.

Whilst we welcome the forthcoming separate collections, it is essential that there is a focus on ensuring that these are high performing collections where the maximum amount of food and garden waste is captured, and that the quality of resources collected is high. There must be focus on and funding for education and communication campaigns so that householders (and businesses) are using the services correctly and putting the right materials in the right bins. We continue to work with WRAP and other stakeholders on the actions set out in the Organics Road Map to improve the quality of feedstocks and outputs. However, as every operational site knows, getting high-quality material at the start helps to reduce operational costs and facilitate higher quality outputs.

Scottish Government have published the Circular Economy (Scotland) Bill to make steps towards creating a circular economy in Scotland, and in Wales, the Net Zero Strategic Plan sets out a range of initiatives so that low carbon becomes the default choice. Northern Ireland is looking at options to limit biodegradable waste to landfill, and the REA are pleased to be part of their advisory group.

The news that the use of peat in retail horticulture will be banned from 2024 is very much welcome and there is an opportunity for our sector to provide high-quality consistent materials that could contribute as peat replacements in appropriate applications. We continue to emphasise the importance of protecting our soils and the vital role that compost and digestates can play. There are benefits in provision of valuable nutrients (reducing the need for fossil-derived fertilisers) and soil improvement benefits from the addition of organic matter.

With all the regulatory changes, one of our calls to Government this year has been for adequate resources for our environmental regulators. We need to ensure regulations are fairly implemented and enforced, we have a functioning permitting system and illegal operators are not allowed to undercut legitimate business.

Further policy and regulatory developments are expected over the next year. We've been involved in a regulation co-design group looking at tackling pollution from slurry and we expect consultations on covers for slurry and digestate stores and low emission spreading. There will also be an overhaul of the fragmented UK Fertilisers Regs which is likely to be a phased approach and will involve consultation.

We need certainty of policy and timescales so that the organics sector can contribute towards net zero and provide products that can improve soil quality, increase soil organic matter and enable food production for future generations.

We have no time to waste if the UK wants to achieve net zero. Organics recycling can play a valuable role not only in contributing towards net zero, but also in providing products that can improve soil quality, increase soil organic matter and enable food production for future generations.



Circular Bioresources

The delivery of a circular economy and the energy transition go hand in hand. Waste 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 next government will need to prioritise waste and resource policy while recognising its interaction with the wider energy transition.

The next 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.
- **Fully deliver high performing mandatory food waste collections** across the UK with the general 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 **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**.
- Commit to funding Local Authorities to deliver local **targeted communications for public behaviour change** for food and garden waste collections, as well as funding

centralised waste management campaigns run by DLUHC and DEFRA 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.
- Provide support for recycling end of life wastes that would otherwise be sent to landfill into new markets such as transport by chemical recycling.

Transport

Renewable Transport Summary

In 2020, the transport sector accounted for nearly a quarter of the UK's greenhouse gas emissions, continuing to be the largest emitting sector since 2016, following a sharp fall in emissions from the power sector.

2022 has seen a marginal increase in renewables as a percentage of the total transport energy consumption, at 5.3% compared to 4.6% in 2021, which is predominantly the result of gradual increases in Renewable Transport Fuel Obligation targets. We are most pleased to see the introduction of 'E10' (10% renewable fuels in conventional petrol) in September 2021 which will have contributed to this increase – a longstanding ask of the REA.

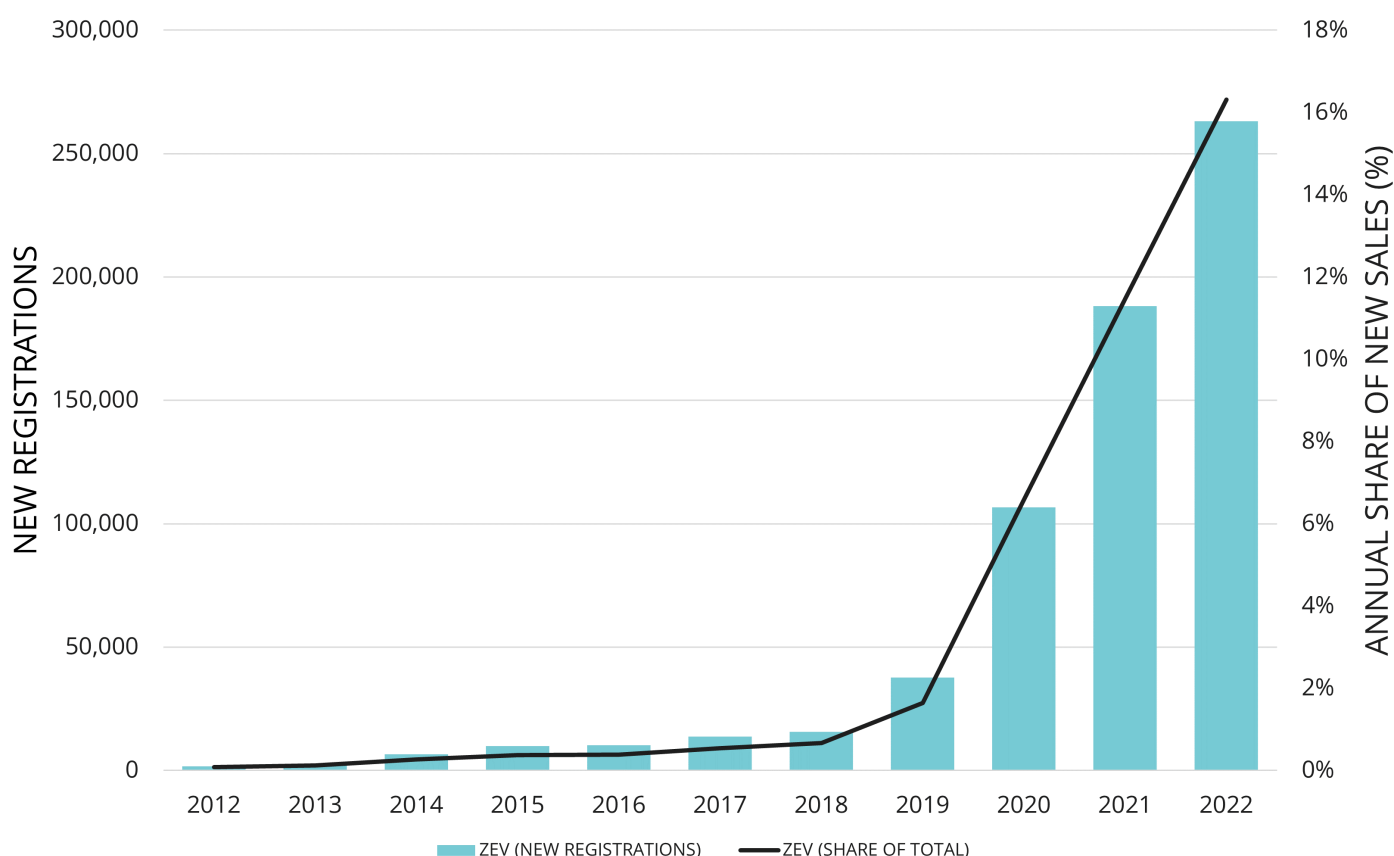
Throughout 2022, the REA saw several positive policy developments including the publication of the EV infrastructure Strategy – in particular the focus on improving customer experience. In March, the REA also welcomed the extension of the Plug-in Van Grant after joining an industry coalition joint letter urging the government to provide more support to the nascent electric van market.



Through Government's renewed commitment, the essential transition to electric vans was boosted.

Furthermore, 2022's Autumn Statement from the Chancellor offered several positive outcomes for the EV sector, including maintaining benefit-in-kind (BIK) incentives, a campaign that the REA participated in, and were delighted at the confirmation that they will increase by 1% per year.

REGISTRATIONS OF NEW ZERO EMISSION VEHICLES



Deeper Insight:

Electric Vehicles and EV Charging

It has been another year of extraordinary growth in new Zero Emission Vehicle (ZEV) registrations, and alongside our members, the REA has been working to ensure that chargepoints are on track to keep pace.

In 2022, 26,3205 new ZEVs were registered - an increase of 40%, building on the impressive increases in previous years, including a 183% increase from 2019-20, and 76% from 2020-21. 2022's new ZEV registrations represent a market share (percentage of new total road vehicle registrations that are ZEVs) of 16.3%, which, in contrast to less than 1% in 2018, is extremely positive. These encouraging advances underline the importance of ensuring that the country delivers a charging-network that keeps pace with demand, ensuring that rapid chargepoints are strategically deployed to future proof the transition to Electric Vehicles and their role in consumer transport across the entirety of the UK.

In this regard, progress is being made through steady growth in the overall volume of chargepoints (EVSE) that have now been established in the UK.

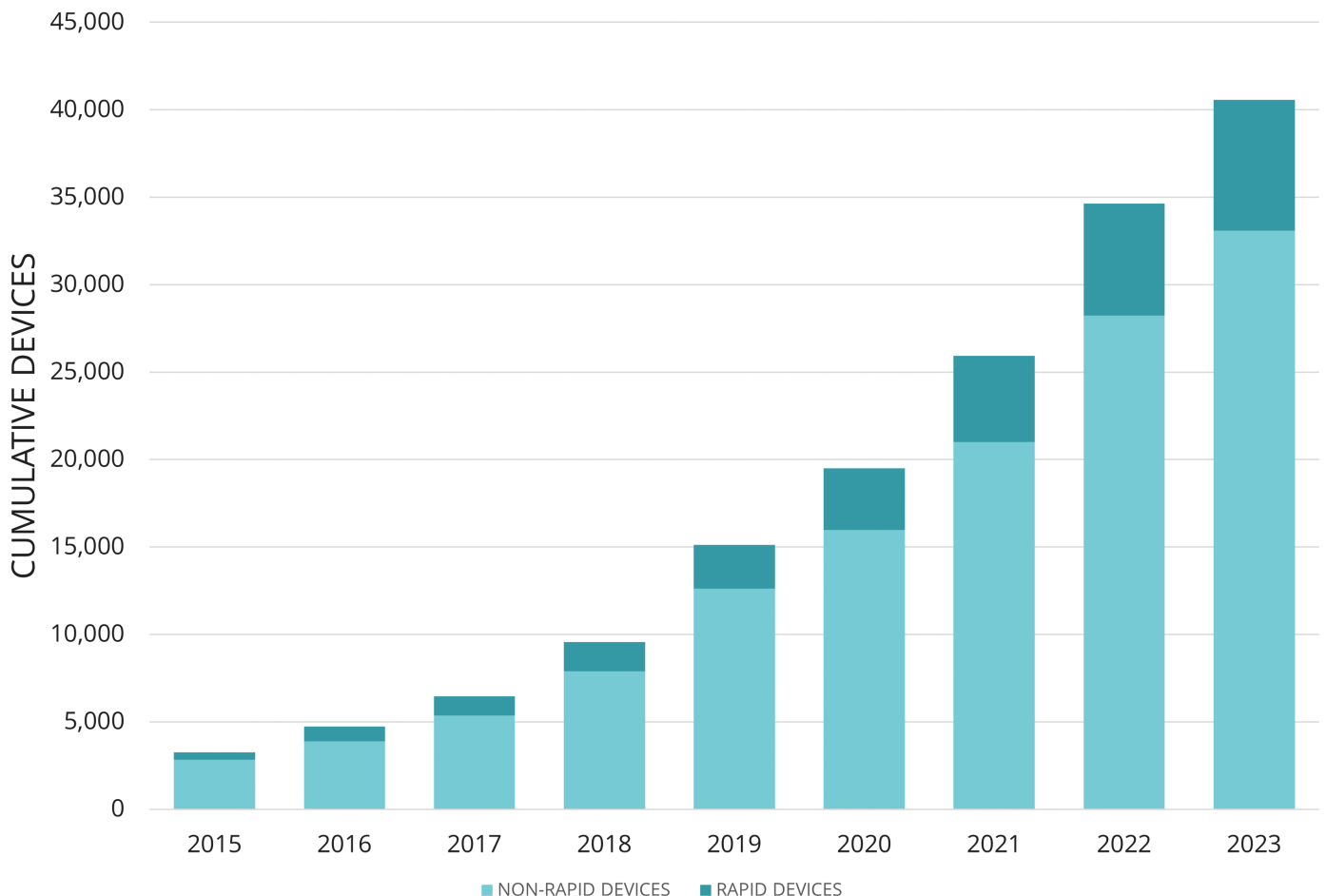
40%

INCREASE OF NEW ZEV REGISTRATIONS
BETWEEN 2021 AND 2022

In 2022 alone, over 8,700 chargepoints were added to the network, an increase in the cumulative number of chargepoints of 34% compared to 2021. This growth has been driven marginally more by non-rapid than rapid devices (37.43% for former, 32.89% for latter).

Furthermore, so far in 2023 (with data up to July) the overall volume of chargepoints has risen by another 9,383 and will continue to rise throughout the year. There are now almost 45,000 chargepoints across the UK with 8,461 classified as 'rapid' chargepoints. While there is still much more work to do, which you can read about in the opinion piece below written by Matthew Adams, Transport Policy Manager, the share of rapid EVSE has continued to increase over time.

NUMBER OF ELECTRIC VEHICLE CHARGING DEVICES



Deeper Insight:

Renewable Transport Fuels (RTFs)

Due to COVID-19 and the imposition of lockdowns, fewer journeys over 2020 and 2021 were made, leading to a decrease in fuel consumption. Since targets in the Renewable Transport Fuel Obligation (RTFO) are set as a share of total fuel, this means the volumes of renewable fuels also decreased. RTFO targets were increased in 2022, resulting in 2,698.67 million litres of biofuels being supplied over the year.

Under the RTFO, biodiesel and bioethanol 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.

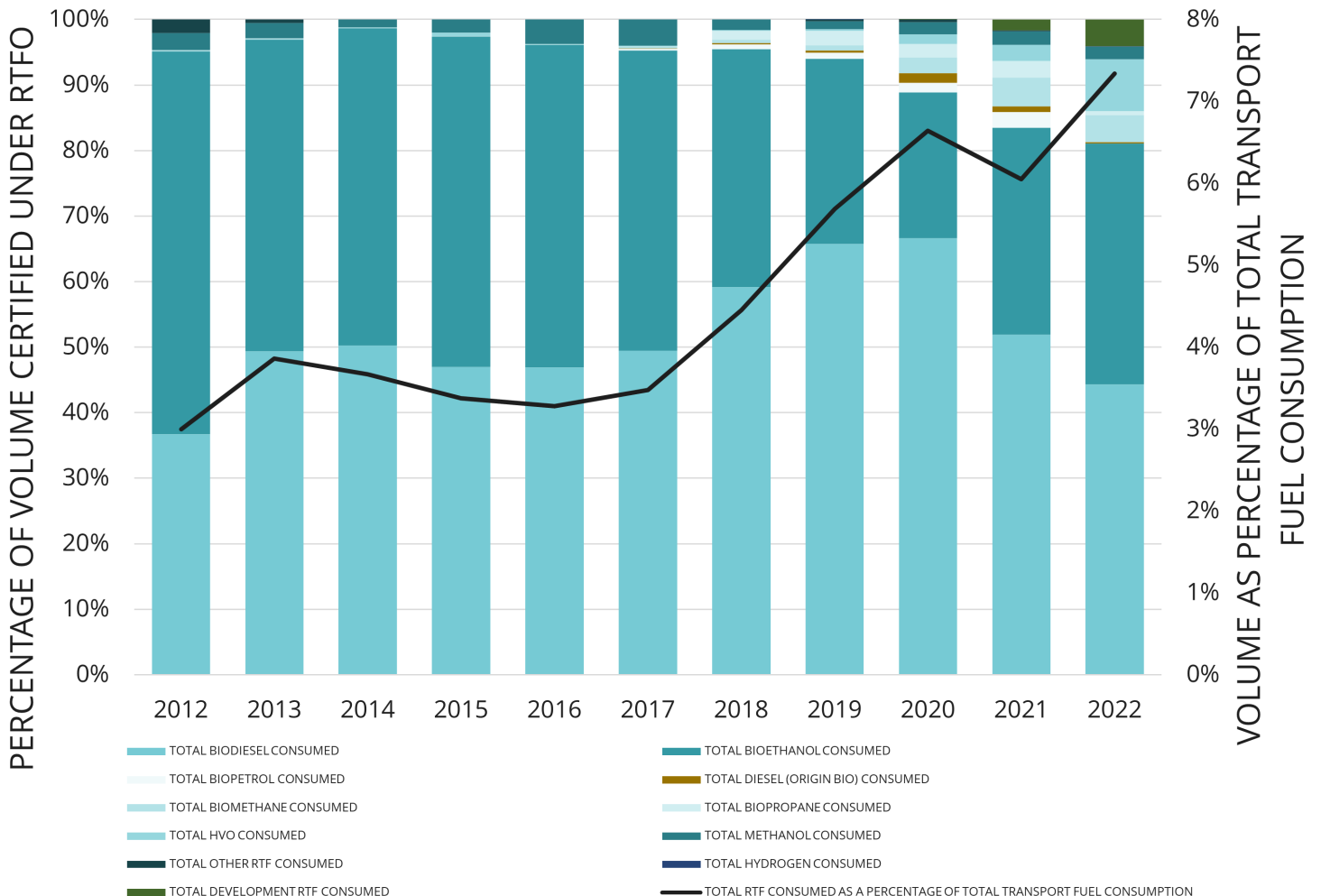
However, other renewable fuels have increased over time. Their share went from less than 5% in 2018 to nearly 20% in 2022. This is notably driven

323%

GROWTH IN HVO FUEL IN 2022. IT IS NOW 7.92% OF ALL RTFs.

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 grew 323% and is now 7.92% of all Renewable transport fuels. Biomethane also continues to grow in use.

RENEWABLE TRANSPORT FUEL CONSUMPTION UNDER RTFO



Combating net zero scepticism and resolving barriers to chargepoint rollout

Matt Adams
Transport Policy Manager, RECHARGE UK/REA

Due to the relaunch of the REA's EV forum as RECHARGE UK, this opinion piece is written to reflect further REA and policy developments in the Electric Vehicle sector into 2023. RECHARGE UK is quickly becoming one of the most influential voices in the EV sector following the launch of our report 'Charging Forward to 2030.'

The 'Charging Forward' report discusses what the likely public charging energy demand could be per postcode area in 2030, what the policy and regulatory barriers are to chargepoint deployment to meet that energy demand and the skills we need to deploy them. It also tackles how to ensure the infrastructure we deploy is effectively utilised and accessible for everyone, every time. Subsequently we have committed to work with OZEV (the Government Office for Zero Emission Vehicles) on barriers to chargepoint delivery and have been invited to talk to all the OZEV teams about the report.

There is a growing threat to achieving significant milestones in EV deployment. We currently see in the media on an almost daily basis scepticism around the ZEV mandate committing to end the sale of ICE vehicles in 2030 and hybrids in 2035 and the accompanying sales targets. We also have seen mixed messaging from our politicians regarding the importance of the mandate and also around low traffic neighbourhoods and ULEZ which are also adding to the concern the industry feels around the safety for investment in E-Mobility in the UK.

Despite this, we have seen significant growth in the used EV car market in Q4 2022 which saw a 37.5% increase on 2021 Q4 figures according to the SMMT who say there were over 70,000 second hand EV sales in 2022. This was despite an 8.5% decline in second hand vehicle sales overall in 2022 vs 2021, showing EV's are far outperforming petrol and diesel cars. We expect second hand EV growth to rise further still this year with clear and obvious growth in the supply of second hand EV's on the market as the first three-year lease EV fleet vehicles enter the market.

Significant criticism of the EV charging industry has also cropped up in the media regarding its capacity to deal with charging demand. However, what is always overlooked in these attacks is the large numbers of domestic charging points available - there are nearly 400,000 chargers installed under the EV Home Charge Scheme (formerly Domestic recharge scheme) alone since its inception in 2013. With such strong levels of domestic charging capability today, public charging infrastructure is more than capable of fulfilling current demand, indeed on average public chargepoints are utilised only 15% of the time so there is plenty of scope for growth.

Despite the sector's recent negative media coverage, RECHARGE UK and the REA are determined to progress policy in the UK. This is why we have set up three working groups - On Street Connected to home charging, HGV and Fleet and V2X - which all aim to deliver policy change to progress these significantly underdeveloped policy areas. This is in addition to our day-to-day activities delivering key opportunities for our members to influence and engage with a changing policy landscape.

There are still significant challenges ahead, looking at how we prioritise grid connections, ensure long-term planning to assist DNOs in meeting the growing number of connection requests, build in renewable energy generation and storage into our EV infrastructure and resolving the policy and regulatory barriers to installation for example. I am confident that with our members support all of this is possible.



Scope remains for far greater ambition on future targets

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

2022 saw the first increases in targets under the Renewable Transport Fuel Obligation for many years. The 2032 target will be 5% higher than it would otherwise have been, saving an additional 23.6m tonnes of CO₂eq over the period.

In part, this reflects the introduction of the 'E10' blend in Autumn 2021, which went smoothly despite the timing coinciding with panic buying at garage forecourts.

While this increase is welcome, there is scope for far greater ambition on future targets. We also only have current targets set up to 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 was published recently, setting a very wide framework for feedstock availability and priorities for use. The Department for Transport (DfT) has also been working on its own Low Carbon Fuels Strategy (since 2021). The latest is that this is hoped to be published by the end of the year and should give a clearer view on feedstocks, priority sector uses for renewable fuels, and how this interacts with electrification.

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

We continue to push for DfT and the Treasury to move to a duty regime of setting lower rates for high biocontent fuels – 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. It is great

“ THERE NEEDS TO BE FAR BETTER INTEGRATION BETWEEN THE ELECTRIFICATION AND RENEWABLE FUELS APPROACHES. THIS IS NOT AN EITHER/OR. WE NEED ELECTRIFICATION TO ADVANCE SWIFTLY, AND WE NEED WHATEVER FUELS WE CONTINUE TO BURN TO BE SUSTAINABLE AND AS LOW CARBON AS POSSIBLE. ”

to see that the Government has committed to many of the high-level decisions – the mandate is due to come into effect in 2025, will be set in greenhouse gas saving terms, and will be equivalent to 10% of aviation fuel in the UK in 2030. 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. However, many important details of implementation were reserved for a follow up consultation, and we expect the result of that by the end of the year. Government also need 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.

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 to the next election and beyond.

In particular, there needs to be far better integration between the electrification and renewable fuels approaches. This is not an either/or. We need electrification to advance swiftly, and we need whatever fuels we continue to burn to be sustainable and as low carbon as possible.



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 next government must:

- Immediately reinstate the initial 2030 Phase out date for sales of new petrol and diesel cars.
- **Introduce a national scrappage scheme by 2025**, financially compensating people with the most polluting cars and supporting them with interest free credit to buy an EV.
- Provide tax breaks for **rural EV infrastructure investment**, supported by finance from the UK Infrastructure Bank.
- Introduce a more ambitious **Renewable Transport Fuel Obligation targets**, increasing the obligation beyond 2032, with a clear trajectory out to 2050, which is reinforced by lower taxes at the fuel pump with higher blends of renewable fuels and make sure vehicles are suited to higher sustainable fuel use by bringing in support for e85 vehicles early, for example. A market mechanism for Recycled Carbon Fuels must also be secured as soon as possible.
- Immediately introduce an **EV Infrastructure Bill** to ensure effective, inclusive, and widespread infrastructure. This includes mandating industry standards for universal charging and requiring local authorities to have EV charging infrastructure plans.

- Agree to a match-funded industry deal to develop an **EV infrastructure apprenticeship scheme** that is led by charge point operators and delivered in conjunction with district network operators, changepoint manufacturers, energy suppliers and motor manufactures to create a pipeline of skilled workers.
- Ensure an ambitious **Sustainable Aviation Fuel Mandate** to start in 2025 and develop equivalent policy for sustainable marine fuels by 2030.

Finance

Employment: Renewable Energy and Clean Technology

In last year's RReview22, we were able to analyse the impact that the COVID-19 pandemic had on the UK's renewable energy and clean technology sectors from an economic perspective. This year, we have seen some growth as the economy recovers from the effects of the pandemic, though the sector has been hindered by the Russian invasion of Ukraine and the impact on natural gas and oil prices.

The energy crisis has led to previously unthinkable measures in the market, and in our view cemented renewables position as the economically preferable source of energy, as well as the environmentally preferable one. However, Government are yet to recognise this, and supply chain issues, unstable geopolitics and inflationary/cost of living pressures are likely to reduce the growth levels that would otherwise be expected moving forward.

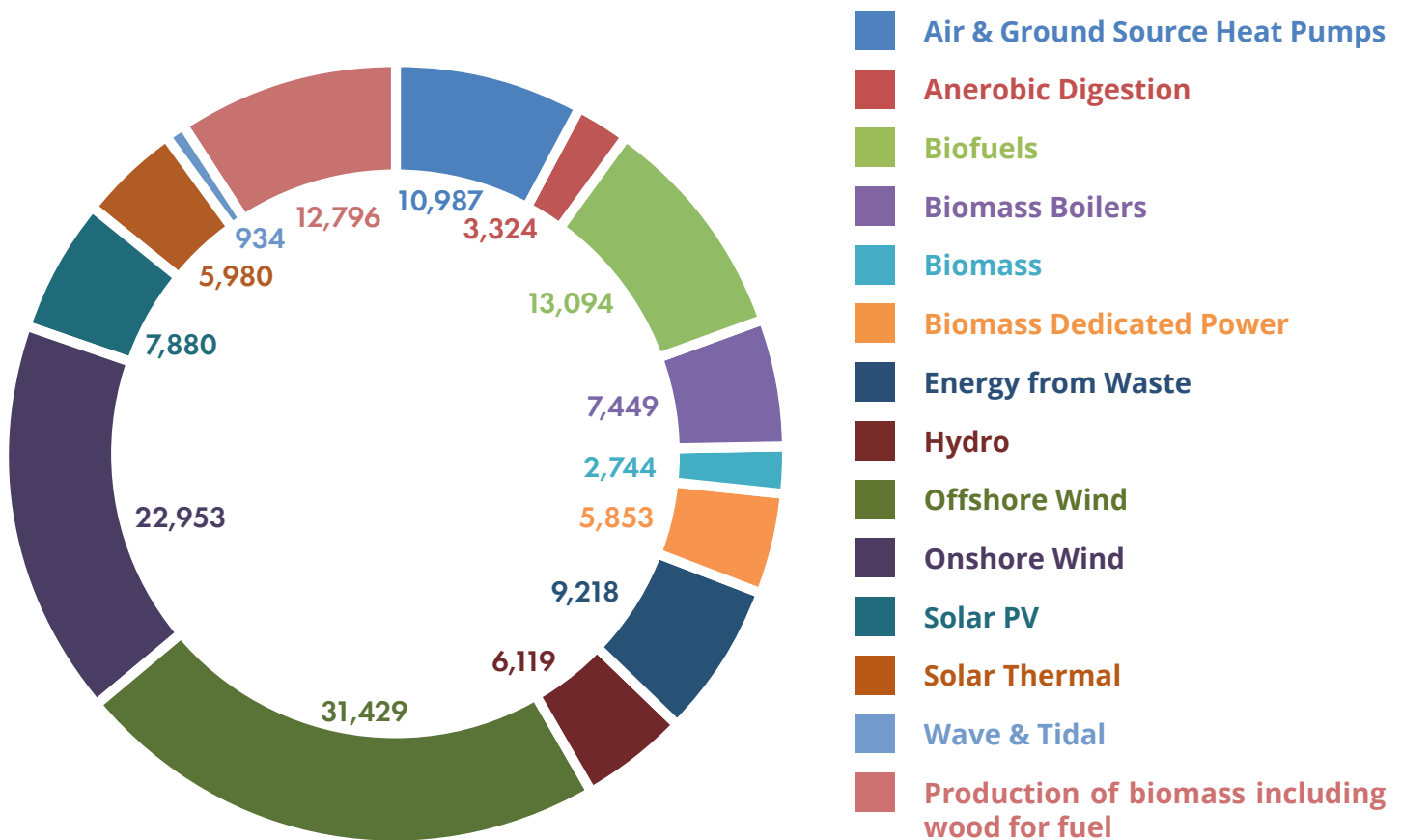
£23bn

MARKET VALUE OF THE RENEWABLE ENERGY SECTOR IN 2021-2022

This year's RReview23 includes a breakdown of both the current and projected full-time employment numbers for the renewable and clean technology sector for each nation and region of the UK.

Furthermore, our partners Innovas have built upon their existing technical modelling to better understand the future economic landscape for our sector. As well as the full-time employment data, there is the addition of the sector's market value for each area, as well as the inclusion of significant projects that are in the pipeline.

EMPLOYMENT IN 2021-2022 BY SECTOR



Over 140,700 people were employed in the renewable energy and clean tech sector in 2021/22, growing by 1.1% 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 will nearly double from around £23bn to £41bn in the same time period. It shows that, while the climate is uncertain for many industries, the renewable energy and clean technology sector's resilience, adaptability and innovation will continue to see it grow provided there is a supportive policy environment.



Looking Back

Analysing employment & investment in the UK renewable energy sector

The overall UK renewable energy sector in 2021-22 has seen a return to growth after the impacts of the COVID-19 pandemic with an increase in market value of 3.7% to £23 billion, and an increase in employment of 1.1% to about 140,760 fulltime equivalents (FTEs) from the previous year. These figures exclude energy storage and flexibility services.

There are about 6,740 companies directly and indirectly involved in this sector. This is a substantial sector and one that has seen growth from £18.8 billion to £23 billion and an additional 12,000 people employed in the last five years.

However, the impacts of the pandemic and less supportive policy can still be seen as the growth level of 3.7% is still not back to those in the three years prior to 2020-21 which were between 5% and 9.6%. As in the previous year the picture was mixed with offshore wind showing the highest level of economic growth with 13.9% and solar PV continuing its recovery with 11.3% market value growth.

Offshore wind grew faster than expected as deployment caught up with the backlog from 2020-21. Planned deployments could see continued strong growth for the foreseeable future if built. This was tempered by a small decrease in onshore wind market value of 3.1% where deployment has pretty much stalled after a lengthy period of declining growth rates since 2016-17. Current policies and plans will see the decline continue unless policies change, despite onshore wind being a cost-effective solution for generating electricity.

Solar PV is having a strong growth period as the cost of solar PV arrays continues to decrease, the flexibility brought by co-located battery storage decreases lost load, and high prices for electricity decrease payback periods. The UK now has a 70GW solar PV deployment target that could continue to drive growth.

Employment in heat pumps grew at 7.7%. Heat pump growth is supported by a focus in government policies while falling costs for heat pump systems, improvements in efficiencies, and better understanding of how best to use them are also supporting a higher level of growth which is expected to continue for the near future. Unfortunately, the Government's target of 600,000 installations per year is unlikely to be met in the next few years, due to skills gaps and a lack of

140,760

NUMBER OF PEOPLE EMPLOYED IN THE RENEWABLE ENERGY SECTOR IN 2021-2022

support and clear direction from government on heat decarbonisation. While this target is providing a focus and impetus to continued growth, uptake is far slower than it needs to be.

Transport fuels have seen limited jobs growth. Under current policies, targets for renewable transport fuels are set as a percentage of total road transport use. Thus, the absolute volume of renewable fuels supplied varies with total fuel demand. Government will need to adjust targets depending on the rate of transport electrification.

Government also needs to do more to support investment in new UK production facilities as current policies on their own are having little impact.

Solar Thermal continues its steady decline, partly due to other alternatives such as heat pumps being seen as more flexible and efficient as part of an integrated heating and hot water system. This is also due to the development of new hybrid solar thermal systems which use heat pump technology and will be classed as heat pumps in the future.

Biomass dedicated power saw a small market value decrease of 2.0% with limited deployment of new facilities and biomass fuel saw a large decrease of 13.2% as there were operational issues in some of the larger biomass power plants throughout 2021-22. Biomass fuel is expected to resume growth as the operational issues are solved, though the uncertain situation with regards to global supplies may have a negative impact.

Biomass boilers are showing a slowdown in growth as incentives are reduced. Biomass CHP, Energy from Waste, anaerobic digestion and hydro all showed steady if limited growth. Wave and tidal activity is still mainly at the research, development and proving stage with largescale deployment yet to occur.

The higher costs of gas and electricity in 2021-22 made renewable alternatives more attractive cost wise and renewables are now the cheapest forms of a number of energy sources.

Renewable Energy Sub Sectors	£'millions	Employment Numbers	Company Numbers
Air & Ground Source Heat Pumps	1,748	10,987	514
Anaerobic Digestion	449	3,324	160
Biofuels	2,466	13,094	643
Biomass Boilers	1,092	7,449	325
Biomass CHP	423	2,744	166
Biomass Dedicated Power	949	5,853	242
Energy from Waste	1,355	9,218	428
Hydro	752	6,119	304
Offshore Wind	6,614	31,429	1,116
Onshore Wind	3,764	22,953	1,028
Solar PV	879	7,880	769
Solar Thermal	557	5,980	323
Wave & Tidal	161	934	55
Production of biomass including wood for fuel	1,794	12,796	670
Totals	23,005	140,760	6,743

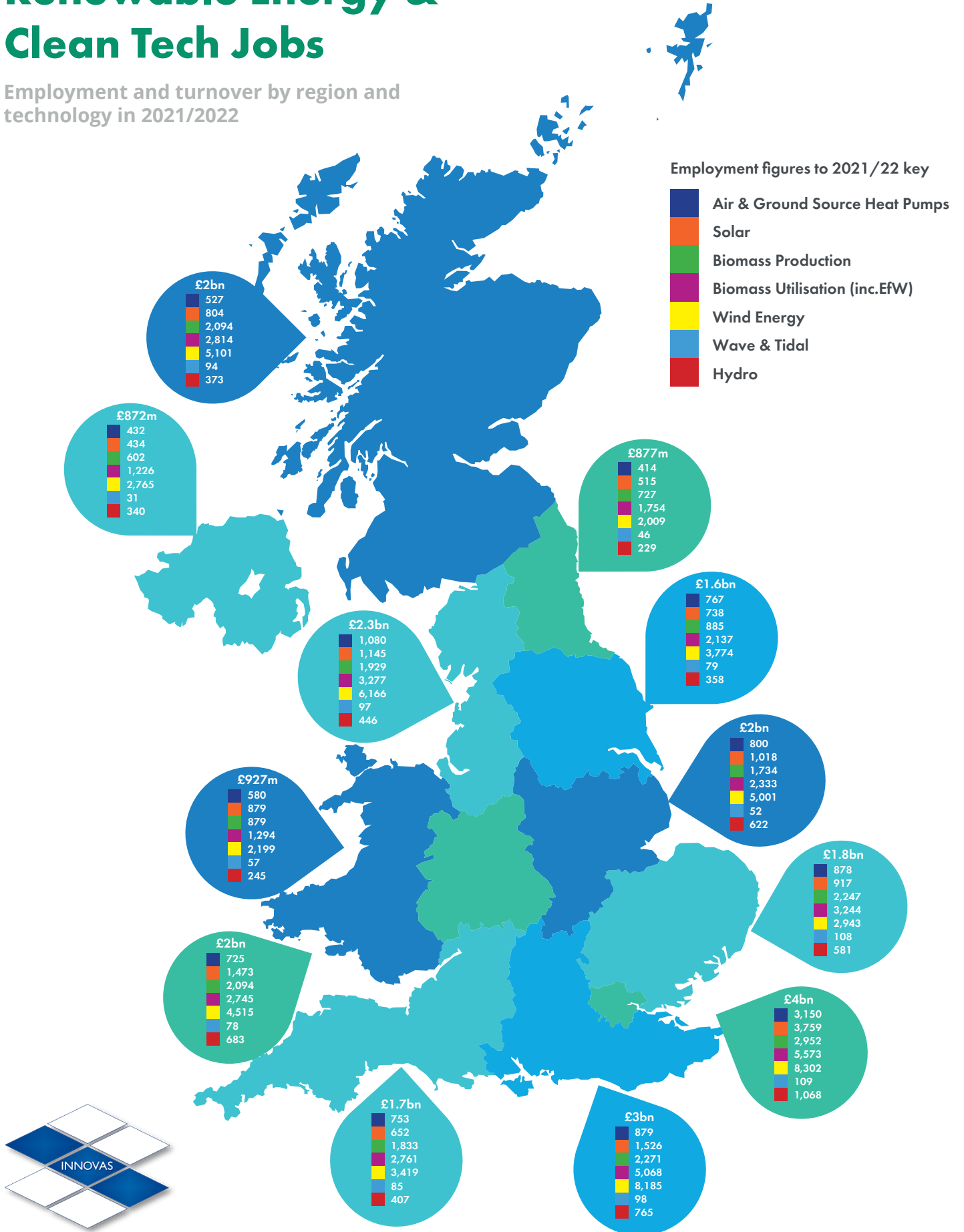


Made in Britain 2021/22



Renewable Energy & Clean Tech Jobs

Employment and turnover by region and technology in 2021/2022



Looking Forward

Employment and investment to 2035 –
Projections from Innovas Consulting

Overall, the Renewable Energy sector (excluding energy storage and flexibility services) is forecast to grow to £38 billion employing over 174,200 people by 2030 and by 2035 reach a peak of £41 billion employing over 183,000 people. This is an increase of about £15 billion and £18 billion and of 34,000 and 43,000 people respectively. The data below is from forecasts from our modelling partner Innovas based on current policy and market signals and not reflective of any 'values' given to a particular technology.

Air and ground source heat pumps are forecast to have a steady and prolonged growth as a result of government strategies and aims to move away from gas-fired heating and hot water supplies. The technology is fairly mature, and efficiencies are improving year on year. For new builds and more modern buildings with external space, heat pumps are a good technology solution but they are not the best option for every site - for example retrofitting older buildings and those without the necessary external space are reasons why other technologies are vital too and growth is expected to be steady rather than at higher levels. This will however still lead to growth from a value of £1.8 billion and employing about 10,980 people, to £2.7 billion employing about 13,900 by 2030, and £5.7 billion employing about 20,200 people by 2050.

Anaerobic Digestion is set to continue its growth trajectory with steady growth rates rather than a spectacular explosion. There is a large untapped potential in the UK with plenty of opportunity for growth especially with the current energy price situation and restriction in global natural gas supply.

Biofuels are forecast to continue a relatively high growth rate, increasing from £2.5 billion employing about 13,100 people to a peak of £6.3 billion employing about 20,400 people in 2030. It is forecast to remain fairly stable until 2035 when a gradual decline is forecast as the move to electric and fuel cell vehicles impacts on the use of petrol/diesel fuels.

Biomass Boilers are forecast to grow at a steady rate increasing from £1.1 billion employing about 7,450 people, to £1.4 billion employing about 8,400 people in 2030 as installations ramp up. They will have an important role to play in decarbonising off-grid household heat systems. Current energy



price increases may well see a short-term increase over and above the forecast levels.

Biomass CHP also sees a slow rate of growth to £550 million employing about 3,200 people in 2030 and stable from there on until a possible decline from 2040.

Dedicated Biomass Power sees a continued high growth rate until 2030 as planned large-scale facilities are built and come on stream. Increasing from £949 million and employing about 5,850 in 2022, to £1.5 billion employing about 7,640. It is then forecast to stay stable until 2050 as new facilities come on stream and older ones are replaced.

Energy from Waste is forecast to show steady growth to £1.9 billion employing about 11,000 people in 2035. Afterwards, a managed reduction is driven by less avoidable waste feedstock (as separate food and garden waste collections and higher recycling rates kick in) and their sustainable treatment moving up the waste hierarchy, and therefore the need for new facilities and operation of existing ones may reduce.

Hydro power is forecast to show steady consistent growth to 2050 as newer and more efficient micro-hydro systems are developed and commissioned.

Offshore Wind Energy is forecast to have the highest initial growth of the sub-sectors based on current and planned deployment in the North and Irish Seas. It is forecast to increase from £6.6 billion employing about 31,450 to £14.5 billion employing about 50,560 in 2035. Technology development on the turbines, cables and power connections along with the potential to store excess capacity to use it to generate green hydrogen will see deployment increase in the UK and internationally. The growing export market for offshore wind will

benefit UK companies who are now recognised as being amongst the world's leading suppliers and manufacturers of products and services.

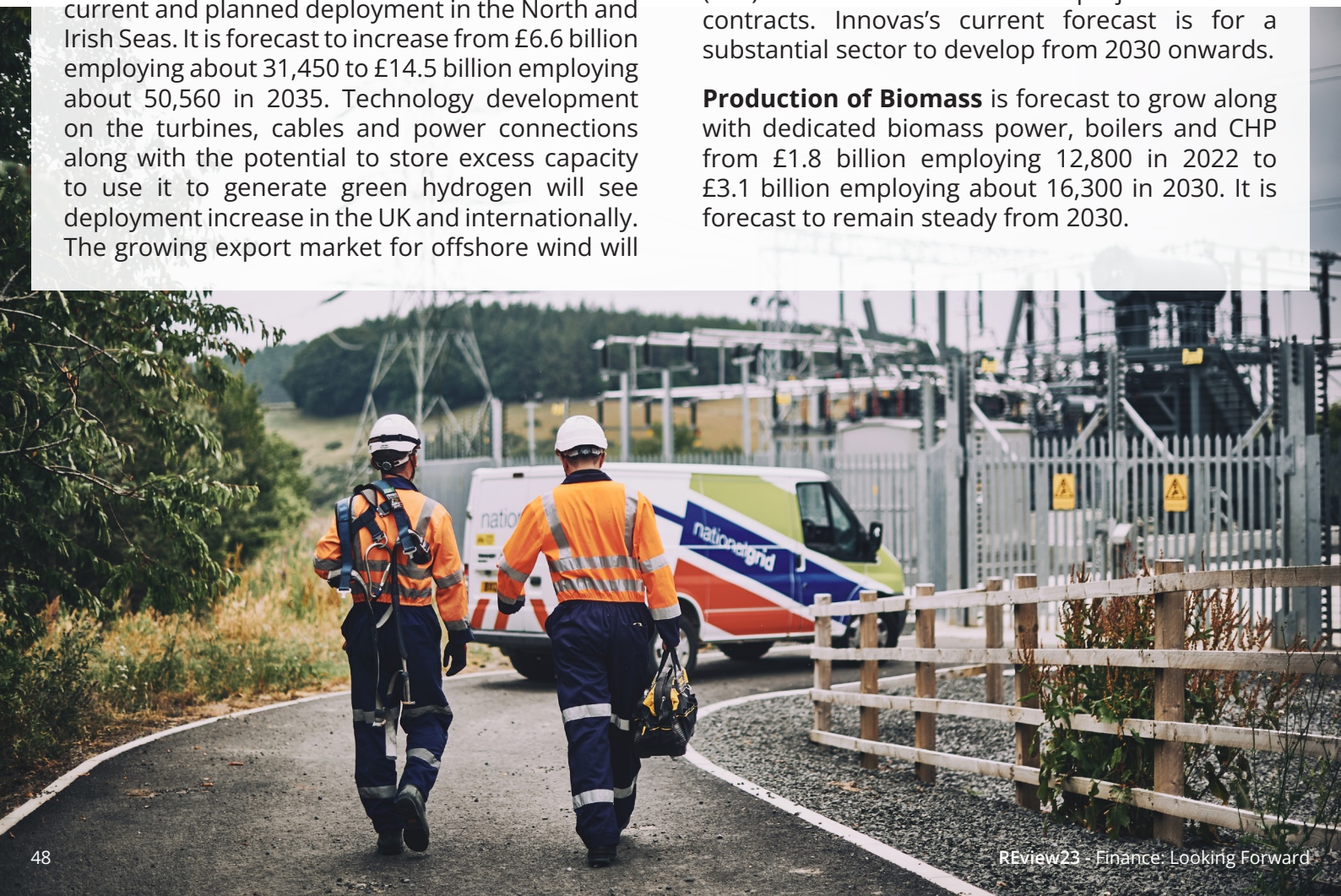
Onshore Wind is in a slow growth stage with current forecasts showing an increase from £3.7 billion employing about 22,950 to £4.5 billion employing 25,100 by 2030. Unless there is a major change in UK government policy the forecast is for no further growth after 2030, but also no decrease.

Solar PV is forecast to grow steadily until 2050 increasing from £879 million employing about 7,900, to £2 billion employing about 12,400 in 2050. There are an increasing number of mixed power generation/energy storage facilities planned or being considered which, along with large-scale deployments and increasing numbers of new build homes using solar PV, are all forecast to drive growth in this sub-sector.

Solar Thermal is forecast to steadily decline over the forecast period. Heat pump technology is developing and has greater support from Government. There are new solar thermal hybrid systems which use heat pump technology and will be counted in the heat pump sub-sector.

Wave and Tidal is forecast to grow and to increase quicker in the future once new technologies are deployed. There could be encouraging signs for the sector from recent renewable power (CfD) auctions where 53MW of projects received contracts. Innovas's current forecast is for a substantial sector to develop from 2030 onwards.

Production of Biomass is forecast to grow along with dedicated biomass power, boilers and CHP from £1.8 billion employing 12,800 in 2022 to £3.1 billion employing about 16,300 in 2030. It is forecast to remain steady from 2030.





This is the fourth time that the REA will survey energy industry experts to produce its Energy Transition Readiness Index (ETRI) report, which has been generously sponsored this year by EATON and Foresight Group.

The report detailing the first index was published in 2019, and subsequent editions have considered the impact that wider geopolitical trends have had on the investment landscape in the UK and a number of European markets – comparing countries attractiveness as investment destinations in renewables and clean tech. The second report in 2021 showed the effect of the COVID-19 pandemic, and the third report in 2022 encompassed the energy price hikes associated with Russia's invasion of Ukraine. This year, the report will consider the impact that the US Inflation Reduction Act and the EU's Green Deal Industrial Plan has had on the confidence of public and private investors.

All the reports have assessed the readiness of countries for the energy transition from the perspective of investors. Public and private investment in the flexibility technologies and services that support the deployment of renewable power and decarbonisation are critical to the success of the energy transition, and this is why the index is compiled from the point of view of the investor, or potential investor.

Like previous editions, the report will be based on an analysis of readily available published data, one-to-one interviews with relevant stakeholders across European countries, and a targeted survey of industry stakeholders who are expert in the following subject matter, in the country where they are based:

- Socio-political support for the energy transition in their country.
- Their country's capability to exploit new technologies and business models.
- The extent of open market access for flexibility services in their country.

The ETRI 2023 study will build on the previous versions of ETRI with the following key updates:

1. Quantifying distributed energy resources and flexibility markets, considering the recent rapid development of battery storage and other technology and policy enablers.
2. Highlighting a deep dive into selected markets, regulation, and policy characteristics to highlight best practices, offering an international comparison on key topics to stakeholders and policymakers and examining whether there are lessons other markets can learn.
3. Addressing the current energy crisis, looking forward to likely future developments and how the flexibility market is one of the key solutions for energy security.
4. Expanding the number of survey participants where possible. We aim to include experts from every segment of the supply chain and give a voice to newly developing, fast-growth market sub-sectors.
5. Comparing the new findings with results from past ETRI reports, and highlight the changes in policy and their effect over the past four years.

Without 'naming and shaming', the report will clearly compare and contrast examples of regulations and policies that appear to be curtailing the private investment needed to develop smart and flexible energy systems.

The overall goal will be to provide perspectives and guidance to help shape smart regulation and policy to match best practices, thus supporting the development of deep and vibrant flexibility markets in as many countries as possible.

The report will be launched on Wednesday 8th November 2023, from 10:00 – 11:00 at Foresight Group's London office, The Shard, 32 London Bridge St, London. You can register for the event by scanning the QR code on this page.

Rebuilding investor confidence after a year of perplexing market signals

Mark Sommerfeld
REA

Chris Tanner
Partner at Foresight Group
and Chair of the REA Finance Forum

Writing in the Telegraph in December 2022 during last winter's energy crisis, Dr Nina Skorupska, Chief Executive of the REA, set out how Government energy policies were putting low carbon investment at risk. Focusing on the poor design of the windfall tax now impacting low carbon generation (the Electricity Generator Levy), Nina challenged the Government to consider not only "how do we fund short-term support?" but also "how do we solve the energy crisis, permanently?"

As the REA have repeatedly highlighted, doing so requires an attractive investment market that allows for the creation of a secure, affordable and low-carbon energy system. However, sadly in 2023, REA Finance Forum members have continued to warn of a deterioration in investor confidence, seeing the essential low-carbon investment pipeline slow.

The causes of this decline have been many. This includes inflation, increased interest rates, policy uncertainty, continued planning and infrastructure issues and, perhaps most significantly, a failure of government to react to international competition. While some developers report as much as a 50% increase in development and supply chain costs in the UK, the US has implemented a generous support package through the Inflation Reduction Act (US IRA) and the European Union have placed strong expectations on member states via the Green Deal Industrial Plan.

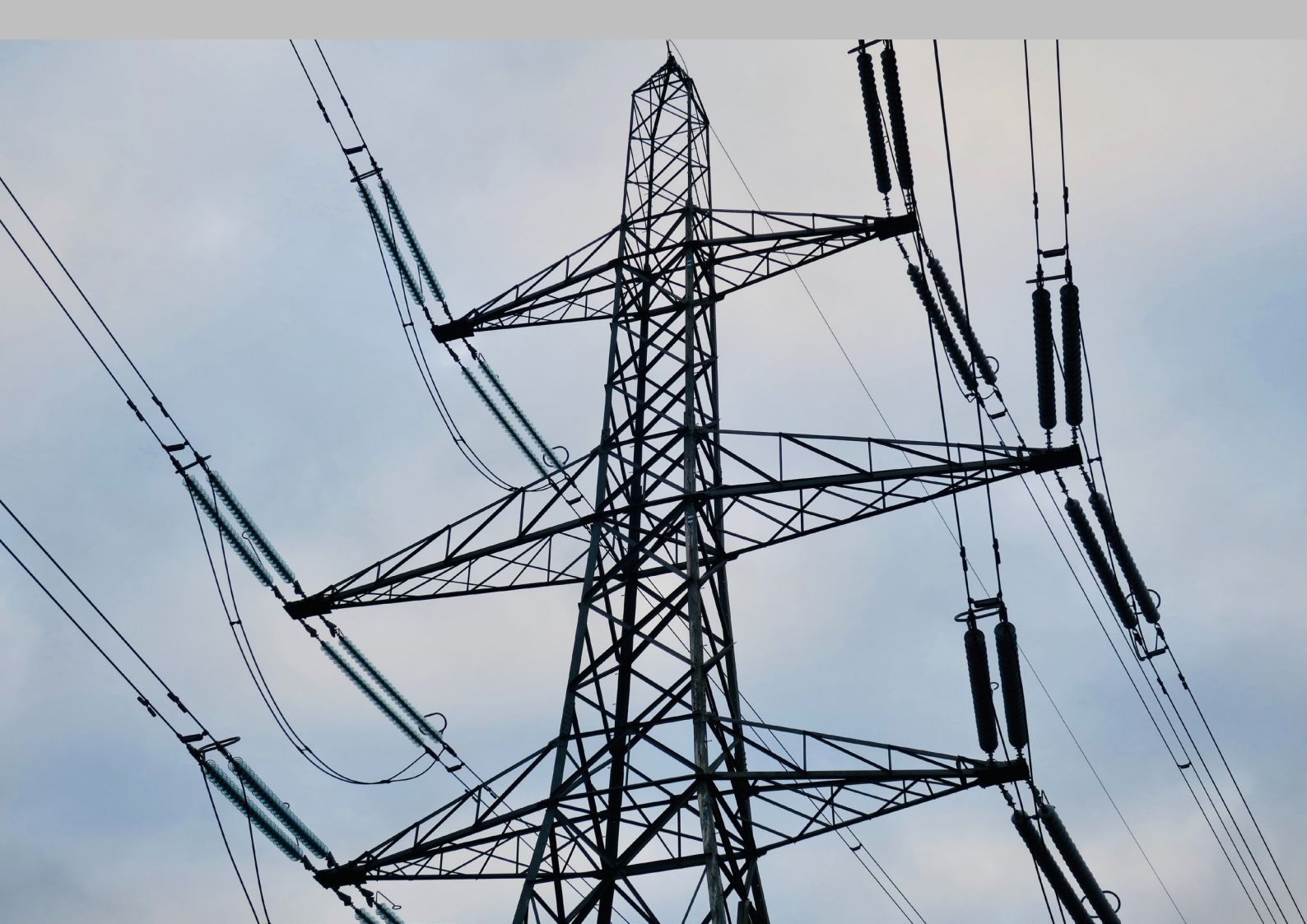
As such, while a level of investment activity does continue, it cannot be ignored that the UK is starting to lag behind. Research by the House of Commons Library indicated that investment in the energy transition fell by 10% in 2022, from \$31 billion to \$28 billion. Bloomberg New Energy Finance has also indicated this is happening while other nations are seeing investment numbers increase, causing the UK to fall down the energy transition league tables. The REA's own Energy Transition Readiness Index 2022 report, highlighted that,

despite strong long-term ambitions, the UK's actual current policy environment is lacking, meaning that the UK remains in the lower tier of investor attractiveness when compared against the other 12 European countries considered in the report.

Part of the issue remains that the Government has continued to focus on short-term policy actions, while at the same time putting in place long-term targets that, although welcome, are currently difficult to measure success against. In 2023, this has led to confused policy messages for the finance community. On the one hand, the Government's 'Powering Up Britain: Energy Security Plan', committed to a fully decarbonised power system by 2035, including ambitious solar and offshore wind targets. On the other hand, this summer, the Government issued new fossil oil and gas exploration licences for the North Sea and failed to take heed of industry warnings concerning project costs, meaning Allocation Round 5 of the Contracts for Difference Mechanism completely failed to secure a single new offshore wind project. The long-term strategy and visible Government actions currently do not align.

Where progress is being made on renewable energy policy, it is happening at a pace that is also making it hard for investors to remain committed to the UK. The current Energy Bill, nearing its final consideration in Parliament at the time of writing, has taken more than a year and a half to get through the parliamentary process. Included within it are important powers for the Secretary of State, a position itself that has had four office holders since the Bill was introduced. It will enable them to support the deployment of critical clean energy technologies, including hydrogen production, carbon capture and storage and heat networks. Investors who have been awaiting the Bill to become law before advancing projects are losing patience, especially when other markets are moving faster and attracting their attention.

Similarly, a major government Review Of Electricity Market Arrangements (REMA), has also now been underway for nearly two years. This is an important and valuable initiative, but it has also had the impact of increasing uncertainty concerning how to value both existing assets and future projects when it isn't clear what the fundamental market structure will be. More needs to be done to assure financiers that grandfathering of existing arrangements remains a key policy principle, avoiding retrospective changes. Once a country loses the confidence of the investment community, leading investors to question – and price – the risk of past commitments being reneged upon, it can take a long time for the cost of capital to return to a normalised level, as the experience of



Spain and Italy shows. At the same time, investors understand that subsidy schemes should change over time but expect transparency on the nature of future markets so that new projects can continue to build out.

However, despite the deterioration in investor confidence, it would be completely wrong to write off the UK's investment potential. As a country, it is right to highlight that we have previously led the world in clean energy development. The UK renewables market has continued to grow, albeit at a slower pace than some of our competitors. As such, the country has a strong basis on which to rebuild confidence.

It would not take much to reengage renewable and clean technology investors. The focus must now be on establishing a favourable investment market suitable to the UK's needs. This includes creating a favourable tax environment with dedicated renewable and clean technology investment allowances. It also requires a review of the Contracts for Difference scheme, to ensure a fair strike price can be achieved, aligned with current development costs. Similarly, strong signals need to be reasserted in the heat and transport sectors so that renewed financing of both infrastructure and low-carbon technologies are supported.

It has been a difficult twelve months for UK renewable and clean technology investors. However, we remain confident that this is a market that can be reinvigorated. This will require all political parties to work with industry to address the immediate concerns so that those longer-term and essential ambitions can be realised, no matter what the Government looks like in 2024.



Region by Region

Regional economic forecasts to 2035

As has been done over recent years, the REA's REview publication provides employment projections on a regional and technological basis. Furthermore, with our partners Innovas, we have added market value projections and highlighted some of the key projects that are in the pipeline in every nation and region of the UK. These projections include energy storage and flexibility services.



Over 140,000 people were employed in the renewable energy and clean technology sector in 2021/22 – the REA projects that this could increase to 183,244 by 2035 and including energy storage and flexibility services this grows further to 212,000. The market value of the sector will almost double from around £23bn to £46bn in the same time period. Significantly, due to the very nature of renewables whose location is often influenced by resource availability and centres for demand, these are jobs that are fully dispersed across the UK.

Headline figures show that the North East will see a 111% increase in market value by 2035, the North will support around 30,600 jobs with another 12,700 jobs held in Yorkshire and the Humber.

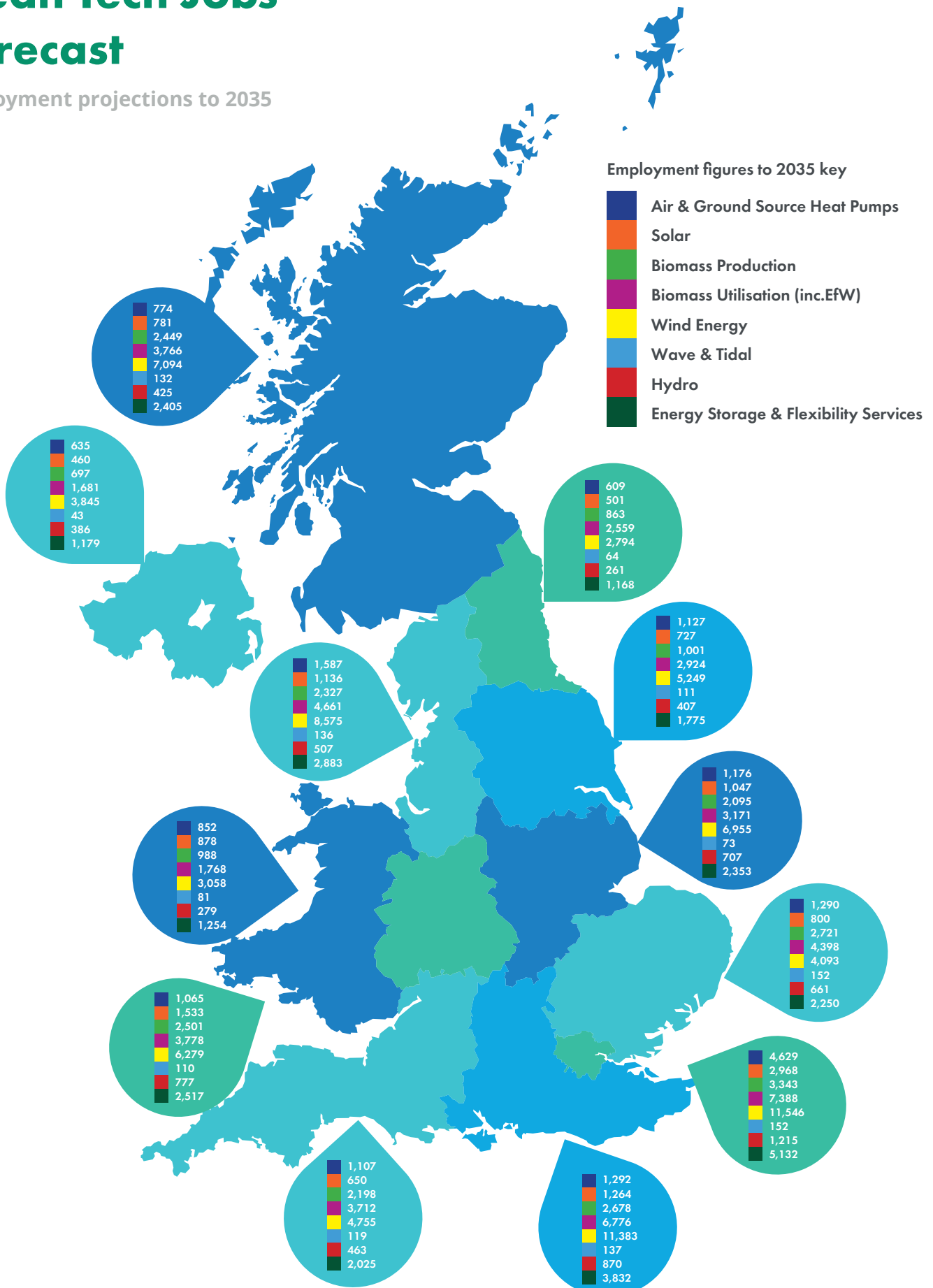
There are positive signs of growth in all regions and nations in the UK on current trajectories, and these numbers could all be surpassed with the right Government policy.

Made in Britain 2035

Renewable Energy & Clean Tech Jobs Forecast



Employment projections to 2035



NORTHERN IRELAND 2035

There is much scope for development in Northern Ireland, which currently has the second smallest level of total renewable jobs and smallest level of market value out of any region or nation in the UK - proportionally, just 4%. This is partly due to its relatively small size, however.

The wind industry and anaerobic digestion are relatively bigger sub-sectors, with wind making up half of Northern Ireland's total renewable energy market value.

However, with the right support, the rate of increase in Northern Ireland could be greater than other areas, and there could be an increase of over double the total investment by 2035.

£453M

WIND ENERGY CONTRIBUTES HALF OF THE RENEWABLE ENERGY MARKET VALUE IN NORTHERN IRELAND

1. Nomadic Offshore Wind - Floating wind turbines
2. Lisahally Power Station CHP, River Ridge MRF AD, Dunbeg/Dunmore wind farms
3. South Antrim Solar Park
4. Ulster University, NIBEC, Hydrogen, Centre for sustainable technologies
5. Queen University, QUILL, ISOALKYL, NISEP, CASE
6. Belfast Metropolitan College GENCOMM - hydrogen, Belfast Maritime consortium
7. Altamusklin, Slieve Divena - Wind and battery storage



Northern Ireland		2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs	FTEs	% change	£'millions	£'millions	% change	
Air & Ground Source Heat Pumps	432	635	47%	66	137	108%	
Anaerobic Digestion	108	143	32%	18	31	68%	
Biofuels	519	808	56%	92	235	157%	
Biomass Boilers	271	275	1%	28	31	12%	
Biomass CHP	80	94	17%	12	16	30%	
Biomass Dedicated Power	174	227	30%	26	42	64%	
Energy from Waste	344	409	19%	51	73	45%	
Hydro	340	386	14%	30	38	26%	
Offshore Wind	1,598	2,571	61%	289	635	120%	
Onshore Wind	1,167	1,274	9%	164	200	22%	
Solar PV	319	410	29%	31	50	59%	
Solar Thermal	115	50	-57%	13	6	-57%	
Wave & Tidal	31	43	40%	5	9	93%	
Production of biomass (inc wood)	332	423	27%	48	83	73%	
Energy Storage and flexibility services	140	1,180	602%	18	198	537%	
Total	5,969	8,928	50%	890	1,784	100%	

SCOTLAND 2035

The renewable energy industry's current market value in Scotland is significant and is one of only four regions and nations in the UK where it is greater than £2 billion.

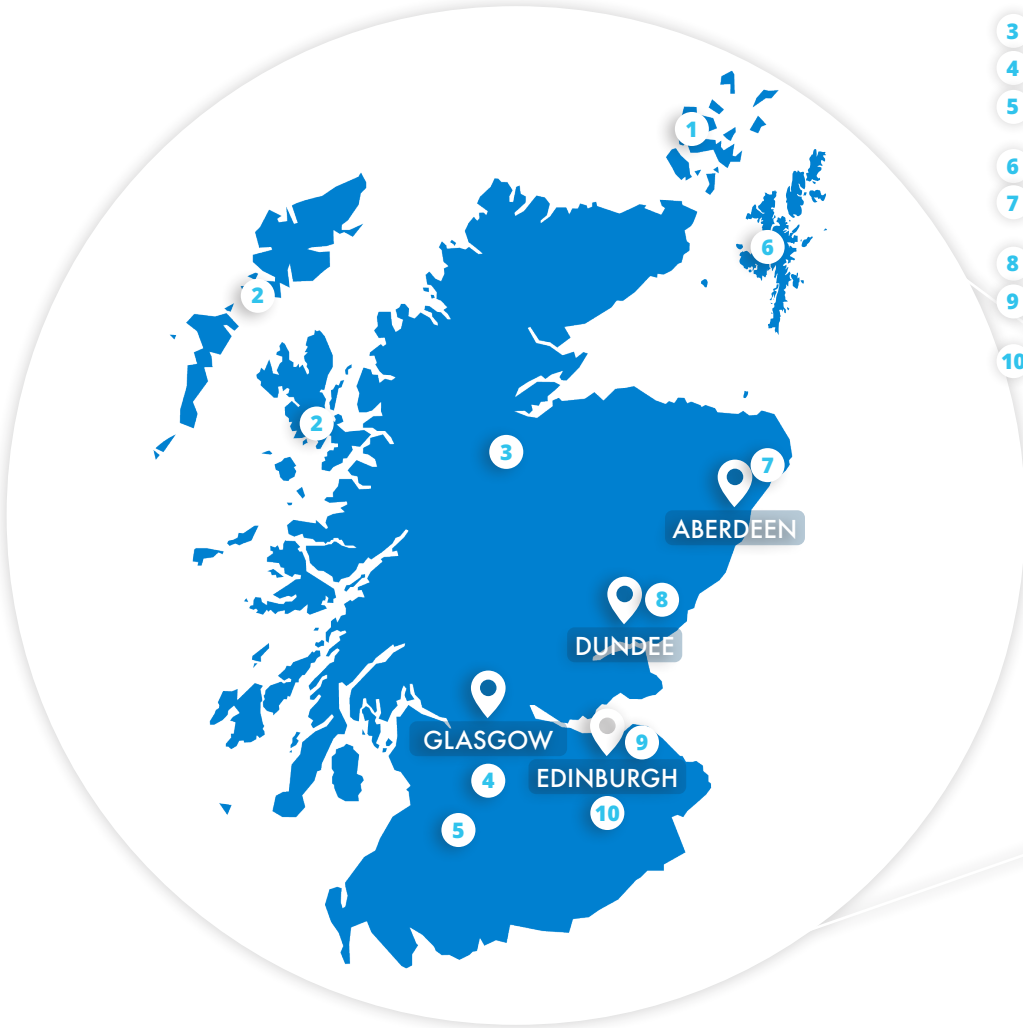
The wind industry is a prominent driver, supporting nearly 5,100 jobs and over £980 million in market value.

Biomass, wave and tidal are sub-sectors of real note, proportionally providing more than 10% of the UK's employment and market value in these areas.

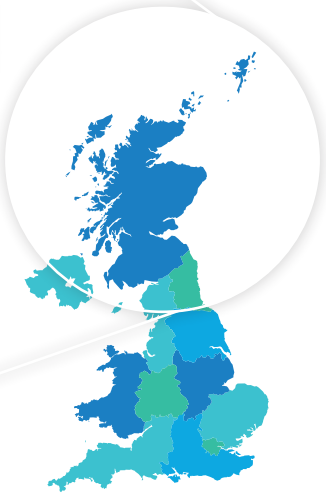
The wind industry is a prominent driver, supporting nearly 5,100 jobs and over £980 million in market value.

£2BN

THE MARKET VALUE OF THE RENEWABLE ENERGY INDUSTRY IN SCOTLAND.



- 1 European Marine Energy Centre green hydrogen, Community Energy Scotland
- 2 Western Isles Micro-turbines CREEL, OHLEH
- 3 University of Highlands & Islands
- 4 Strathclyde University
- 5 Glasgow & Glasgow Caledonian Universities SMART Tech Centre
- 6 Viking Wind Farm
- 7 Aberdeen University Offshore Wind Deployment Centre
- 8 Dundee University
- 9 Edinburgh University, UK CCUS, UK Biochar Research Centre
- 10 Edinburgh Napier and Heriot-Watt Universities, Biofuels Research Centre, REFLEX, IDRIC



Scotland	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs	FTEs	% change	£'millions	£'millions	% change
Air & Ground Source Heat Pumps	527	774	47%	95	197	108%
Anaerobic Digestion	171	226	32%	28	47	68%
Biofuels	887	1,381	56%	205	527	157%
Biomass Boilers	840	852	1%	146	163	12%
Biomass CHP	343	401	17%	51	67	30%
Biomass Dedicated Power	663	865	30%	113	186	64%
Energy from Waste	748	891	19%	94	136	45%
Hydro	373	425	14%	43	54	26%
Offshore Wind	2,948	4,743	61%	626	1,377	120%
Onshore Wind	2,153	2,351	9%	357	435	22%
Solar PV	506	652	29%	68	108	59%
Solar Thermal	298	129	-57%	23	10	-57%
Wave & Tidal	94	132	40%	17	34	93%
Production of biomass inc wood	1,253	1,597	27%	167	289	73%
Energy Storage and flexibility services	284	2,405	606%	42	466	544%
Total	12,091	17,826	47%	2,076	4,097	97%

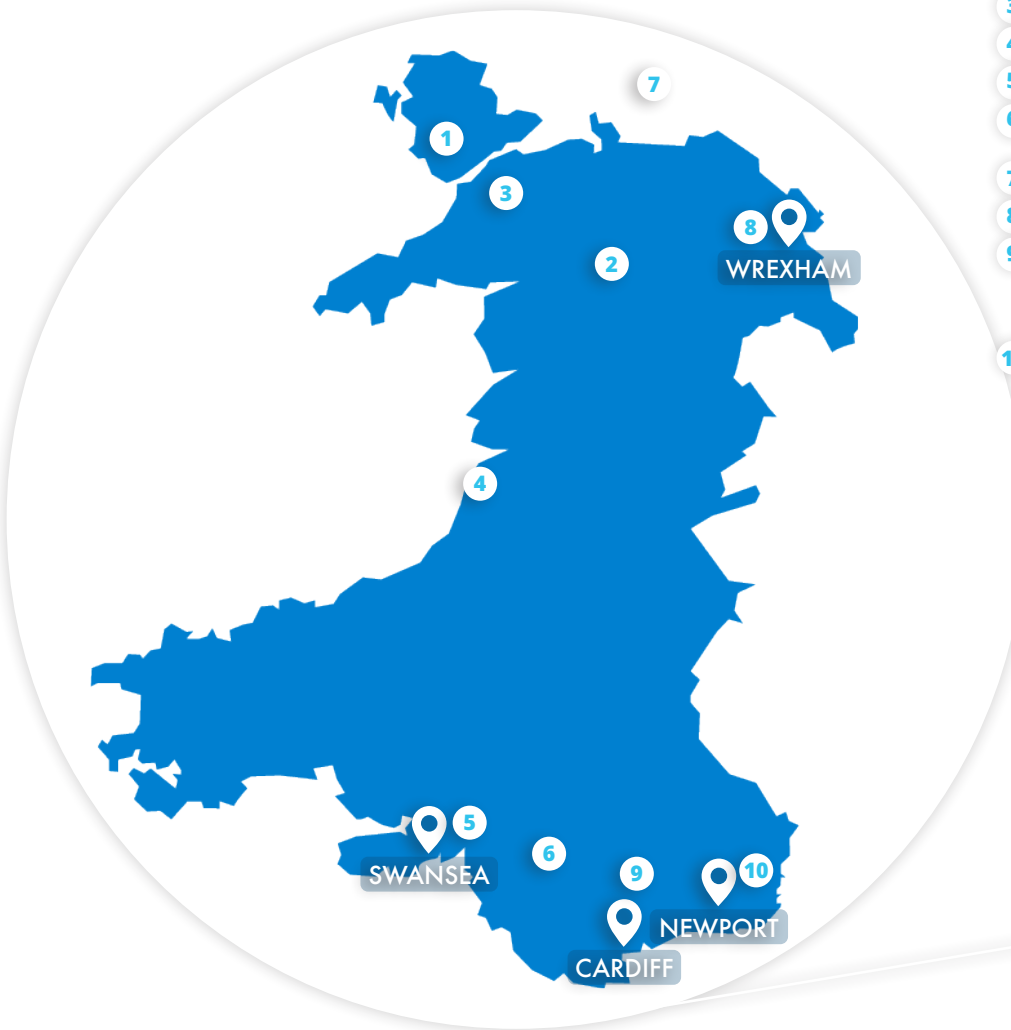
WALES 2035

Wales' renewable energy employment numbers and market value are lower in absolute terms than other parts of the UK but, as a smaller population this does not provide the whole picture.

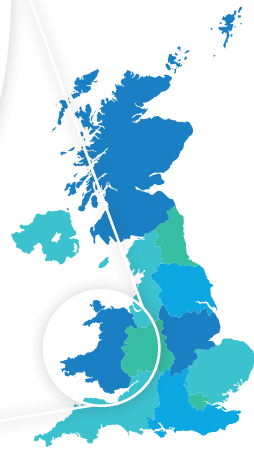
However, the future market value of the sector in Wales may be of greater concern. Although the current market value figure of £944m is set to rise to £1.8bn by 2035, the rate of increase will be smaller than every other region and nation outside Greater London. That means, proportionally, Wales' renewable energy market value national share will drop below 4%. This may reflect the area capturing less supply chain benefits than the rest of the country and deployment focussing on other parts of the UK – for example little onshore wind development and a still nascent offshore wind sector.

1,045

WALES WILL SUPPORT MORE THAN 1,000 JOBS IN ENERGY STORAGE BY 2035.



- 1 Anglesey Biomass Power Station
- 2 Llyn Celyn hydro
- 3 Bangor University
- 4 Aberystwyth University IBERS
- 5 Swansea University SPECIFIC
- 6 Margam biomass, Hirwaun, Trident Park EFW
- 7 Rhyl Flats, Gwynt y Mor - offshore wind
- 8 Wrexham Glyndwr University
- 9 Cardiff and Cardiff Metropolitan University Turbine testing and lightning labs BRE Centre for Sustainable Construction
- 10 Llanwrnog Solar / Battery Storage



Wales	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	580	852	47%	95	197	108%
Anaerobic Digestion	81	107	32%	8	14	68%
Biofuels	502	782	56%	84	216	157%
Biomass Boilers	508	515	1%	63	71	12%
Biomass CHP	150	176	17%	23	30	30%
Biomass Dedicated Power	321	419	30%	53	86	64%
Energy from Waste	239	285	19%	27	39	45%
Hydro	245	279	14%	24	31	26%
Offshore Wind	1,271	2,045	61%	246	541	120%
Onshore Wind	928	1,013	9%	140	171	22%
Solar PV	581	748	29%	57	90	59%
Solar Thermal	298	129	-57%	40	17	-57%
Wave & Tidal	57	81	40%	10	20	93%
Production of biomass inc wood	371	473	27%	56	97	73%
Energy Storage and flexibility services	128	1,254	716%	17	214	640%
Total	6,262	9,158	46%	944	1,834	94%

EAST MIDLANDS 2035

As with many other regions, the most significant contributor to the East Midlands' renewable energy employment numbers is wind.

Between offshore and onshore, the sector supports over 5,000 out of the total 11,560 jobs in the region. At £958 million, the wind industry accounts for almost half of the region's total renewable energy market value.

However, hydro in the East Midlands is also noteworthy, given it supports more than one in ten jobs in hydro power nationally.

48%

THE WIND INDUSTRY CONTRIBUTES
NEARLY HALF OF ALL RENEWABLE ENERGY
MARKET VALUE IN THE EAST MIDLANDS



1. Derby University Low Carbon Rail HYDEX – Fuels for Rail
2. Loughborough University, Nat Centre for Combustion & Aerothermal Tech, Rolls Royce UTC, Aviation fuels, Hydrogen vehicles, ViVID, Caterpillar Innovation & Research Centre
3. Leicester and De Montfort Universities, REEMAIN
4. Northampton University
5. Lincoln University, National Grid, Crop research, Scawby Brigg Battery Storage
6. Nottingham and Nottingham Trent Universities, Hydrogen Systems Test Bed, RAD Building, Integrated Water, Energy & Food Centre, District Heat Network, EMERGE (EFW), Trent Basin (ERA – battery storage)
7. Dudgeon East, Race Bank, Lynn, Inner Dowsing
8. Sleaford RE Plant Methering Heath AD



East Midlands	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	800	1,176	47%	126	261	108%
Anaerobic Digestion	185	245	32%	27	45	68%
Biofuels	889	1,384	56%	201	516	157%
Biomass Boilers	443	449	1%	88	99	12%
Biomass CHP	231	270	17%	33	42	30%
Biomass Dedicated Power	428	558	30%	74	121	64%
Energy from Waste	601	715	19%	90	131	45%
Hydro	622	707	14%	66	84	26%
Offshore Wind	2,890	4,650	61%	610	1,342	120%
Onshore Wind	2,111	2,305	9%	347	423	22%
Solar PV	709	913	29%	78	124	59%
Solar Thermal	309	134	-57%	30	13	-57%
Wave & Tidal	52	73	40%	8	15	93%
Production of biomass inc wood	1,291	1,646	27%	187	323	73%
Energy Storage and flexibility services	281	2,354	598%	40	452	554%
Total	11,841	17,577	48%	2,007	3,993	99%

EAST OF ENGLAND 2035

With more than 3,600 full time employees, the biomass sector accounts for nearly a third of all renewable jobs in the region. This equates to more than one in ten biomass jobs nationally.

However, in terms of overall market value, wind remains the largest sector, with a value of more than £610 million in 2022. The region also supports a nationally significant number of wave and tidal jobs too, employing more than one in ten people in this sub-sector, jointly the largest sub-sector employer.

With energy storage contributing the lowest market value in the region, it is positive to see projections that this will dramatically increase over the coming years, from £38 million to £243 million in 2035.

3,026

JOBS SUPPORTED BY BIOMASS - THE ONLY REGION WITH A SUB-SECTOR THAT EMPLOYS MORE PEOPLE THAN IN OFFSHORE AND ONSHORE WIND COMBINED

1. Peterborough Energy Park
2. Cambridge University Energy Sector Partnerships, Energy Institute, Ireton Way AD/CHP
3. Cranfield University. Millbrook Test Centre, Rookery South (EFW)
4. Hertfordshire University, ENESD
5. East Anglia & Anglia Ruskin Universities, Norwich Research Park, John Innes Centre, Lotus (EVs), IRENES
6. East of England Energy Group, Snetterton Park Biomass
7. Gunfleet Sands, Greater Gabbard, Galloper, East Anglia Array 1-3, Scroby Sands
8. University of Essex & Writtle University Crops, Agriculture and Bioeconomy, Ford Research Centre, Dollymans Battery Storage



East of England	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	878	1,290	47%	124	257	108%
Anaerobic Digestion	296	391	32%	44	74	68%
Biofuels	1,207	1,878	56%	238	611	157%
Biomass Boilers	547	554	1%	98	109	12%
Biomass CHP	249	291	17%	38	49	30%
Biomass Dedicated Power	530	692	30%	84	137	64%
Energy from Waste	962	1,146	19%	131	191	45%
Hydro	581	661	14%	74	94	26%
Offshore Wind	1,701	2,737	61%	390	856	120%
Onshore Wind	1,242	1,356	9%	222	270	22%
Solar PV	471	607	29%	53	85	59%
Solar Thermal	445	193	-57%	41	18	-57%
Wave & Tidal	108	152	40%	16	30	93%
Production of biomass inc wood	1,700	2,167	27%	220	380	73%
Energy Storage and flexibility services	269	2,249	597%	38	419	539%
Total	11,187	16,365	46%	1,811	3,582	98%

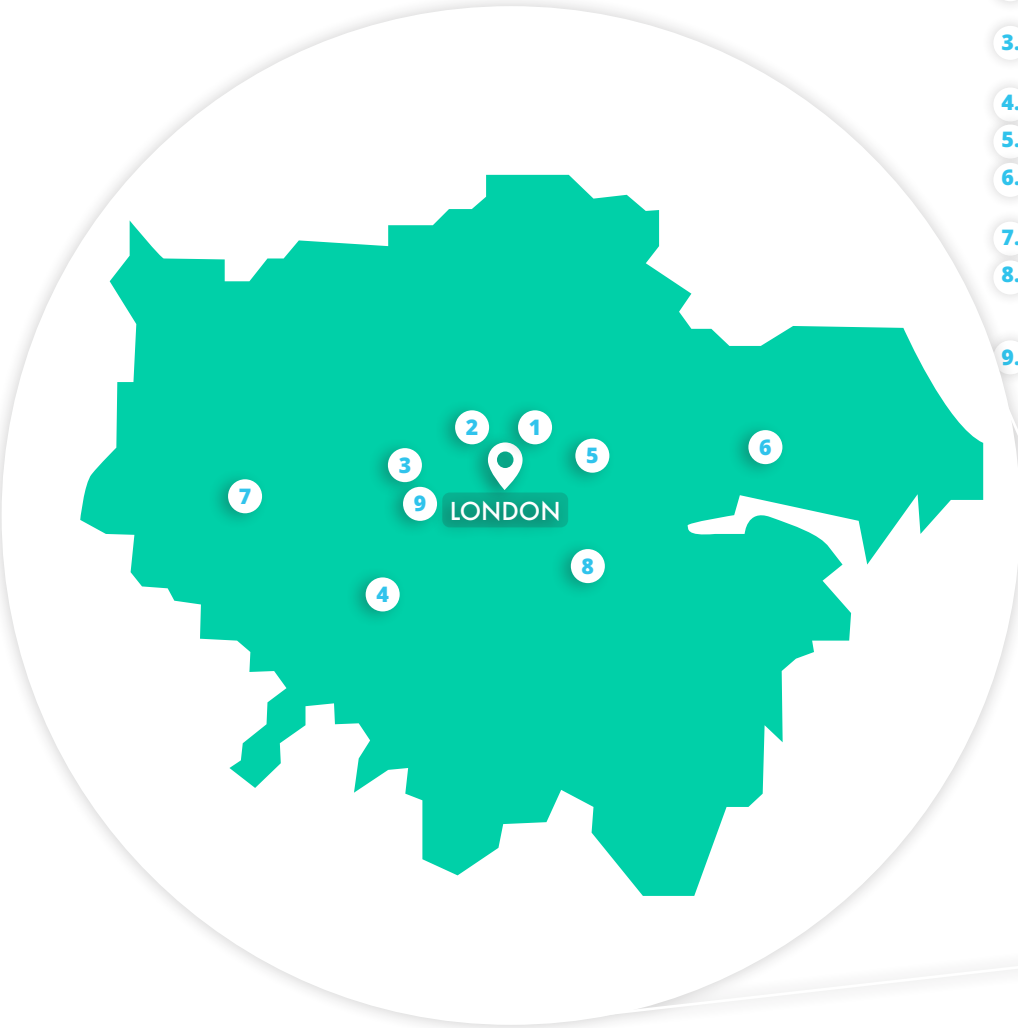
GREATER LONDON 2035

Greater London continues to lead the economic landscape when it comes to renewable energy. The area now supports more than 25,000 jobs and over £4 billion in market value, and this is predicted to increase to 36,000 and £7.8 billion, respectively, by 2035. This equates to around 17% of the UK's renewable economic activity.

The wind industry is particularly well-served, with more than 8,300 jobs and £1.6 billion worth of market value. Projections see wind technologies only increase farther in to 2035, with offshore jobs predicted to grow by 61% and onshore by 9%. Greater London also leads the way in current solar thermal jobs, accounting for over one-third of total solar thermal jobs across the UK.

17.4%

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



1. Kings College, Queen Mary's. Royal Holloway, Net zero Centre
2. London Metropolitan & Middlesex Universities
3. University College London City University
4. Kingston University, Beddington EFW
5. University of East London
6. Riverside Energy Park, Edmonton Eco Park, Beckton Biomass
7. Brunel University
8. Greenwich and South Bank Universities, BSIA net zero building centre
9. Imperial University Grantham Institute MAGIC - Air



Greater London	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	3,150	4,629	47%	532	1,106	108%
Anaerobic Digestion	815	1,077	32%	93	156	68%
Biofuels	1,451	2,258	56%	247	634	157%
Biomass Boilers	1,608	1,630	1%	186	208	12%
Biomass CHP	424	496	17%	76	99	30%
Biomass Dedicated Power	1,091	1,423	30%	163	266	64%
Energy from Waste	1,792	2,134	19%	294	427	45%
Hydro	1,068	1,215	14%	148	187	26%
Offshore Wind	4,798	7,719	61%	1,062	2,334	120%
Onshore Wind	3,504	3,827	9%	605	737	22%
Solar PV	1,565	2,015	29%	192	305	59%
Solar Thermal	2,194	953	-57%	188	82	-57%
Wave & Tidal	109	152	40%	21	40	93%
Production of biomass inc wood	1,344	1,713	27%	193	333	73%
Energy Storage and flexibility services	613	5,135	598%	82	917	548%
Total	25,526	36,373	42%	4,081	7,831	92%

NORTH EAST 2035

While job and investment figures are proportionally low in a national context in absolute terms, in contrast to just about every other region, the largest sub-sector in the North East is biofuels.

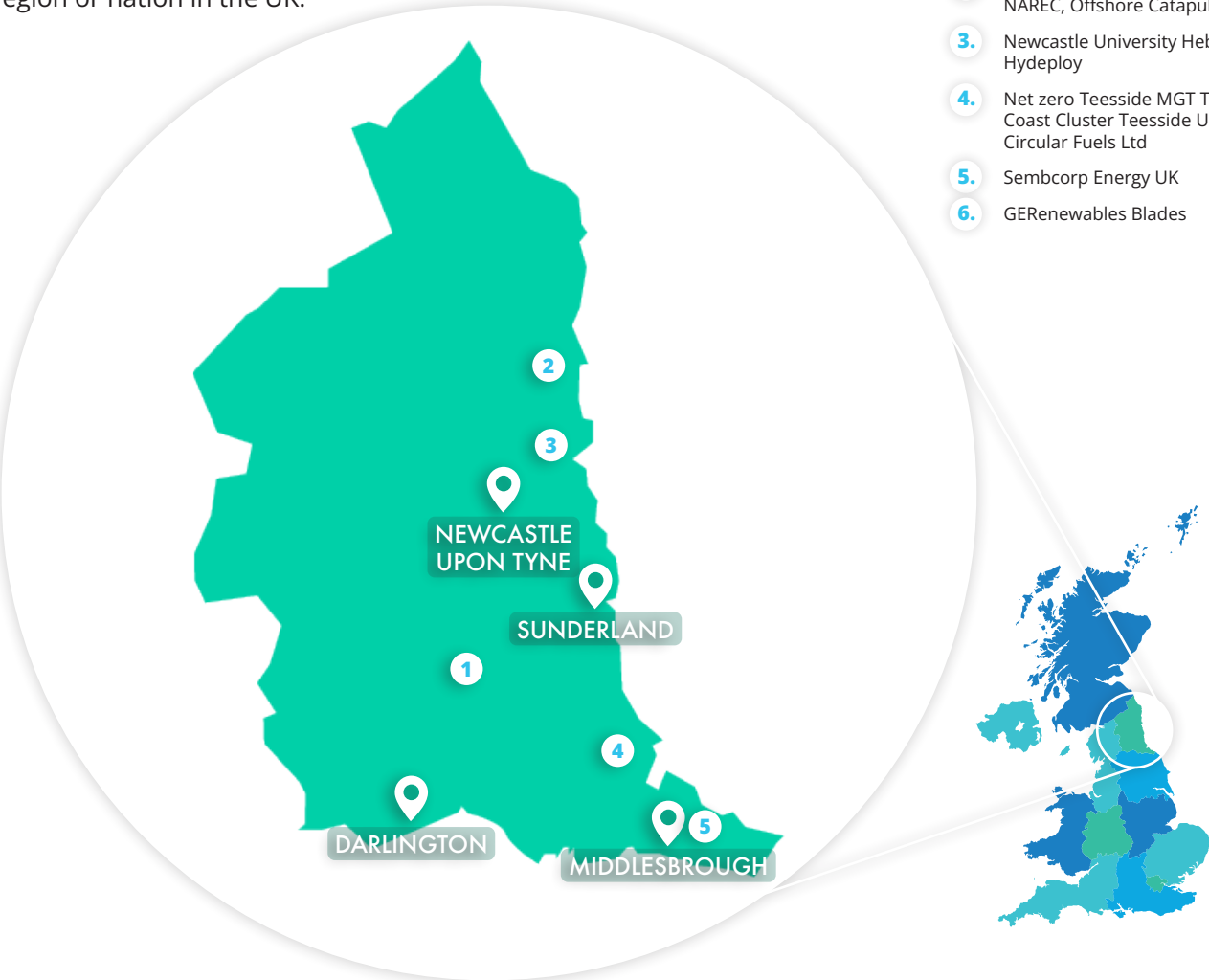
Despite having one of the smaller populations of the UK, the North East has a number of high intensity clusters of renewable energy activity, especially around the Teesside and Port Blyth areas where historically there have been large chemicals, refinery and power generation activity.

The North East has the ports and space for larger industrial facilities and onshore deployment that supports further expansion in the sector. The current market value of £895 million is projected to increase to £1.8 billion by 2035 - the largest predicted increase of any region or nation in the UK.

1,214

JOBS SUPPORTED BY BIOFUELS - THE LARGEST RENEWABLE SUB-SECTOR IN THE NORTH EAST

1. Durham University Lighthtrock Solar Banks Renewables
2. Britishvolt Port Blyth, Energi Coast NAREC, Offshore Catapult
3. Newcastle University Hebburn GSHP Hydeploy
4. Net zero Teesside MGT Teesside East Coast Cluster Teesside University Circular Fuels Ltd
5. Sembcorp Energy UK
6. GERenewables Blades



North East	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	414	609	47%	64	132	108%
Anaerobic Digestion	63	83	32%	9	16	68%
Biofuels	1,214	1,890	56%	214	550	157%
Biomass Boilers	244	248	1%	36	40	12%
Biomass CHP	93	109	17%	13	17	30%
Biomass Dedicated Power	175	228	30%	31	51	64%
Energy from Waste	208	248	19%	28	41	45%
Hydro	229	261	14%	22	28	26%
Offshore Wind	1,161	1,868	61%	207	455	120%
Onshore Wind	848	926	9%	118	144	22%
Solar PV	325	419	29%	37	59	59%
Solar Thermal	189	82	-57%	20	9	-57%
Wave & Tidal	46	64	40%	7	14	93%
Production of biomass inc wood	483	615	27%	70	122	73%
Energy Storage and flexibility services	140	1168	595%	18	210	577%
Total	5,833	8,818	51%	895	1,888	111%

NORTH WEST 2035

The North West has a balanced set of subsectors, with only biofuels well above the national average, and just anaerobic digestion and energy from waste well below. The region also has the highest level of market value in air and ground source heat pumps of any region or nation outside London.

The region is forecast to benefit from the expected growth of applied renewable energy technologies in urban areas, as well as the supply chain for wind energy, air and ground source heat pumps, and biofuels.

£151 M

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

1. Walney, Barrow, Duddon Sands 330MW onshore wind and biomass
2. Liverpool and John Moore Universities, Mersey Titak, Green Power Grid, Liverpool CR, Peel Ports Biomass Terminal, Burbo Bank
3. Chester University, Halton W2E, Protos Park, Sustainable Refuelling Hub
4. Manchester, Salford and Manchester Met Universities, net zero NW, District Heating Network
5. Ellesmere Port Hydrogen Village Thornton Science Park



North West	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	1,080	1,587	47%	151	313	108%
Anaerobic Digestion	225	297	32%	26	44	68%
Biofuels	1,859	2,894	56%	353	907	157%
Biomass Boilers	501	508	1%	88	99	12%
Biomass CHP	283	331	17%	39	51	30%
Biomass Dedicated Power	492	642	30%	94	154	64%
Energy from Waste	418	498	19%	76	111	45%
Hydro	446	507	14%	57	71	26%
Offshore Wind	3,563	5,732	61%	722	1,588	120%
Onshore Wind	2,603	2,843	9%	411	501	22%
Solar PV	748	964	29%	80	128	59%
Solar Thermal	396	172	-57%	44	19	-57%
Wave & Tidal	97	136	40%	16	32	93%
Production of biomass inc wood	1,428	1,819	27%	185	319	73%
Energy Storage and flexibility services	344	2,883	598%	49	545	544%
Total	14,484	21,813	51%	2,393	4,882	104%

SOUTH EAST 2035

The South East remains the largest region in terms of overall job numbers in absolute terms and market value outside of Greater London. Indeed, when it comes to employment in wind and bioenergy, the region matches Greater London, supporting around 8,100 and 4,900 jobs, respectively.

This comparison is reflected in the market value too. Wind contributes £1.4 billion in value out of a total £2.9 billion.

The South East also leads the way in Energy from Waste employment numbers at 1790, jointly with Greater London. Jobs in Energy from Waste make up almost 10% of the South East's total renewable energy and clean technology jobs in 2022.

£5.9BN
THE SOUTH EAST'S PROJECTED MARKET VALUE IN 2035

1. Oxford University, RELCON, JET Fusion Flywheel
2. Reading University
3. Southampton, Solent and Portsmouth University, AD/Marine/Biofuels test centre
4. Canterbury & Kent Universities Cleve Hill Solar Farm, Kemsley & Allington EFWs
5. Guildford University Cryohub - Institute of Refrigeration
6. Brighton University
7. Kentish Flats, Rampion, Thanet offshore wind farms



South East	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	879	1,292	47%	133	276	108%
Anaerobic Digestion	593	783	32%	87	146	68%
Biofuels	1,589	2,474	56%	312	801	157%
Biomass Boilers	829	841	1%	111	124	12%
Biomass CHP	309	361	17%	41	54	30%
Biomass Dedicated Power	787	1,027	30%	104	171	64%
Energy from Waste	1,790	2,131	19%	239	348	45%
Hydro	765	870	14%	106	134	26%
Offshore Wind	4,730	7,610	61%	909	1,998	120%
Onshore Wind	3,455	3,773	9%	517	630	22%
Solar PV	705	908	29%	74	119	59%
Solar Thermal	821	356	-57%	69	30	-57%
Wave & Tidal	98	137	40%	17	32	93%
Production of biomass inc wood	1,442	1,838	27%	213	367	73%
Energy Storage and flexibility services	456	3,831	600%	61	675	541%
Total	19,248	28,233	47%	2,993	5,904	97%

SOUTH WEST 2035

Although employment and market value is, overall, more modest than some other regions in the UK in absolute terms, the South West does have some subsectors of note.

In particular, the production of biomass, energy from waste and anaerobic digestion, all contribute more than one in ten jobs for their sub-sectors, nationally.

The wind industry remains crucial to the region, however, with just over a third of renewable energy jobs and market value in the South West supported by the sector.

10,153

NUMBER OF RENEWABLE ENERGY AND CLEAN TECHNOLOGY JOBS IN THE SOUTH WEST

1. Gloucestershire and Hartpury Universities
2. Plymouth University, Supergen, COAST. St Denis Battery Storage
3. Maritime UK SW, FABTest, Wave Hub
4. Bristol and West of England Universities, Bristol Bioenergy Centre - Fuel Cells, Severnside energy recovery centre
5. Dyson Institute, Melksham Solar Farm
6. Bath University
7. Exeter University, Marine Renewables business park, Camborne school of mines - geothermal, EUROWAC - seawater cooling



South West	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	753	1,107	47%	124	257	108%
Anaerobic Digestion	318	420	32%	53	88	68%
Biofuels	950	1,478	56%	152	391	157%
Biomass Boilers	531	538	1%	79	88	12%
Biomass CHP	223	261	17%	31	40	30%
Biomass Dedicated Power	354	462	30%	70	114	64%
Energy from Waste	915	1,090	19%	147	213	45%
Hydro	407	463	14%	46	58	26%
Offshore Wind	1,976	3,179	61%	424	932	120%
Onshore Wind	1,443	1,576	9%	241	294	22%
Solar PV	430	553	29%	50	80	59%
Solar Thermal	223	97	-57%	26	11	-57%
Wave & Tidal	85	119	40%	15	28	93%
Production of biomass inc wood	1,302	1,660	27%	213	367	73%
Energy Storage and flexibility services	242	2,025	597%	35	388	542%
Total	10,153	15,029	48%	1,705	3,350	97%

WEST MIDLANDS 2035

The West Midlands has a balanced mix of subsectors with comparative strengths in hydro, solar PV, and biomass production. This reflects the region's manufacturing and engineering strengths and large areas of rural land in counties such as Herefordshire, Shropshire and Worcestershire.

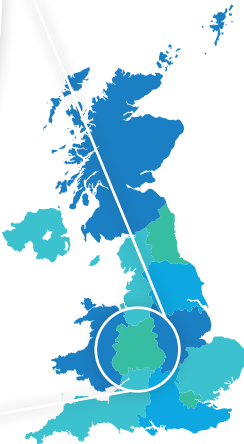
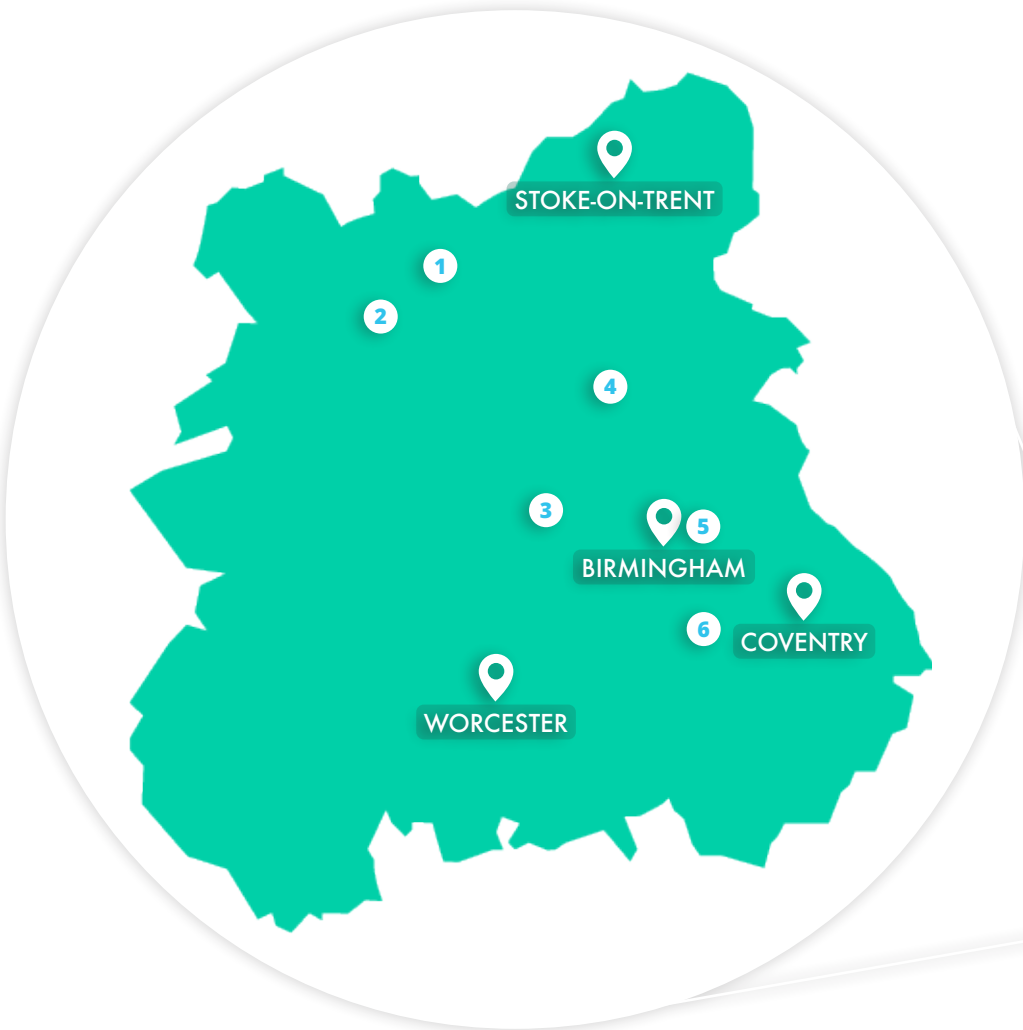
There are projects around hydrogen with Cadent and Northern Gas Networks working with Keele University to inject up to 20% hydrogen into the closed gas network at the university.

The West Midlands also has the largest number of jobs in Solar PV in the UK outside of London, at 1,047, with a high market value of £107 million – 12% of the UK's total Solar PV market value in 2022.

101%

INCREASE IN THE WEST MIDLAND'S RENEWABLE ENERGY AND CLEAN TECHNOLOGY MARKET VALUE BY 2035

1. Keele University, Hydeploy – Hydrogen, SIMULATE
2. Harper Adams University, Bioeconomy
3. Wolverhampton University, Sandwell Energy Storage, Energy Superhub, Kelvin Energy
4. Rugeley Zero Carbon, Canal heat pumps, Poplars AD
5. Birmingham, Aston & Birmingham City Universities, Tyseley Energy Park ATETA, Sustainability West Midlands
6. University of Warwick, Energy Superhub



West Midlands	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	725	1,065	47%	129	268	108%
Anaerobic Digestion	305	403	32%	34	57	68%
Biofuels	1,161	1,808	56%	204	524	157%
Biomass Boilers	643	652	1%	86	96	12%
Biomass CHP	173	202	17%	36	46	30%
Biomass Dedicated Power	430	561	30%	74	121	64%
Energy from Waste	676	805	19%	96	139	45%
Hydro	683	777	14%	89	112	26%
Offshore Wind	2,609	4,197	61%	596	1,311	120%
Onshore Wind	1,906	2,082	9%	339	413	22%
Solar PV	1,047	1,348	29%	107	170	59%
Solar Thermal	426	185	-57%	41	18	-57%
Wave & Tidal	78	110	40%	14	27	93%
Production of biomass inc wood	1,451	1,849	27%	177	305	73%
Energy Storage and flexibility services	301	2,517	597%	44	545	617%
Total	12,614	18,560	47%	2,065	4,151	101%

YORKSHIRE & THE HUMBER 2035

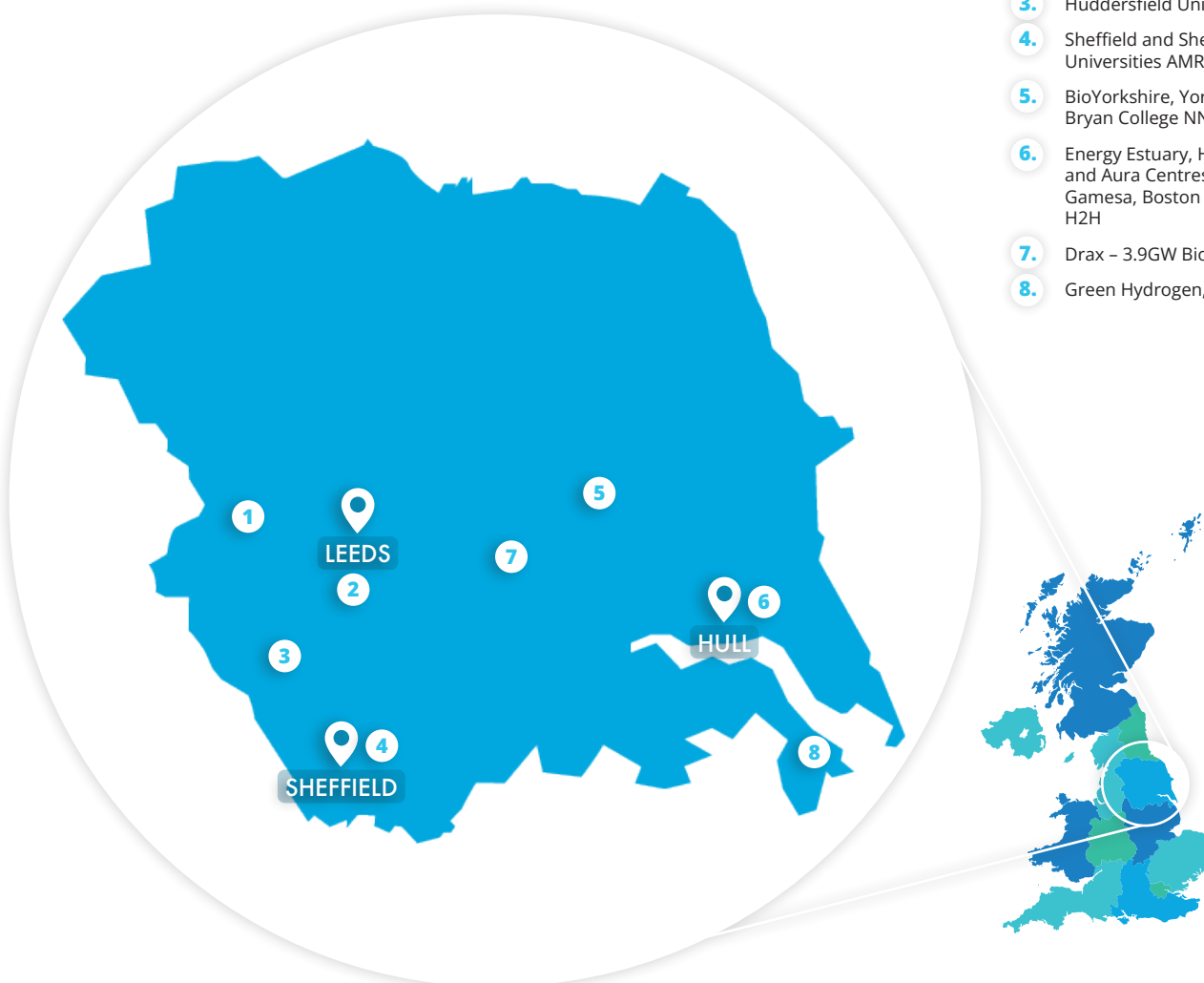
Yorkshire and the Humber has long been at the centre of fossil fuel power generation and the supply of natural gas for the UK. However, in the last decade it has become a UK centre for bioenergy, with biomass power generation being a major employer and delivering new low carbon jobs.

When it comes to jobs and market value in renewables, Yorkshire and the Humber support just under 9,000 jobs and £1.5 billion in market value. Proportionally, this equates to around 6%. Several potential projects could change this picture dramatically, however. Hydrogen and bioenergy with carbon capture and storage, for example, could add thousands of jobs and lead to hundreds of millions in new investment.

£3BN

LEVEL OF MARKET VALUE BY THE
RENEWABLE ENERGY AND CLEAN
TECHNOLOGY SECTOR BY 2035 IN
YORKSHIRE AND HUMBER

1. Bradford University Yorkshire Water
2. Leeds University, Leeds Beckett Uni, UTC Hydrogen, district heating
3. Huddersfield University, 3M centre
4. Sheffield and Sheffield Hallam Universities AMRC, ITM Power
5. BioYorkshire, York University, Askham Bryan College NNFC, Fera Science,
6. Energy Estuary, Hull University, ERGO and Aura Centres, HOTA, Siemens Gamesa, Boston Energy, Equinor H2H
7. Drax - 3.9GW Biomass, BECCs
8. Green Hydrogen, Orsted, Phillips66



Yorkshire & the Humber	2021-22	2035		2021-22	2035	
Renewable Energy Sub Sectors	FTEs (Jobs)	FTEs (Jobs)	% change	Value (£'millions)	Value (£'millions)	% change
Air & Ground Source Heat Pumps	767	1,127	47%	113	235	108%
Anaerobic Digestion	162	213	32%	21	36	68%
Biofuels	862	1,342	56%	161	414	157%
Biomass Boilers	486	492	1%	82	92	12%
Biomass CHP	185	216	17%	30	40	30%
Biomass Dedicated Power	407	532	30%	64	105	64%
Energy from Waste	522	621	19%	82	119	45%
Hydro	358	407	14%	46	58	26%
Offshore Wind	2,181	3,509	61%	534	1,173	120%
Onshore Wind	1,593	1,740	9%	304	370	22%
Solar PV	476	614	29%	51	81	59%
Solar Thermal	262	114	-57%	20	9	-57%
Wave & Tidal	79	111	40%	15	29	93%
Production of biomass inc wood	399	509	27%	64	111	73%
Energy Storage and flexibility services	211	1,775	601%	32	359	551%
Total	8,950	13,321	49%	1,620	3,230	99%

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 five sections - a summary section which tracks overall sectoral progress, four further sections explore deployment data for each constituent technology of the four REA 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 Business, Energy and Industrial Strategy (BEIS) - now DESNZ.

Heat & Cooling

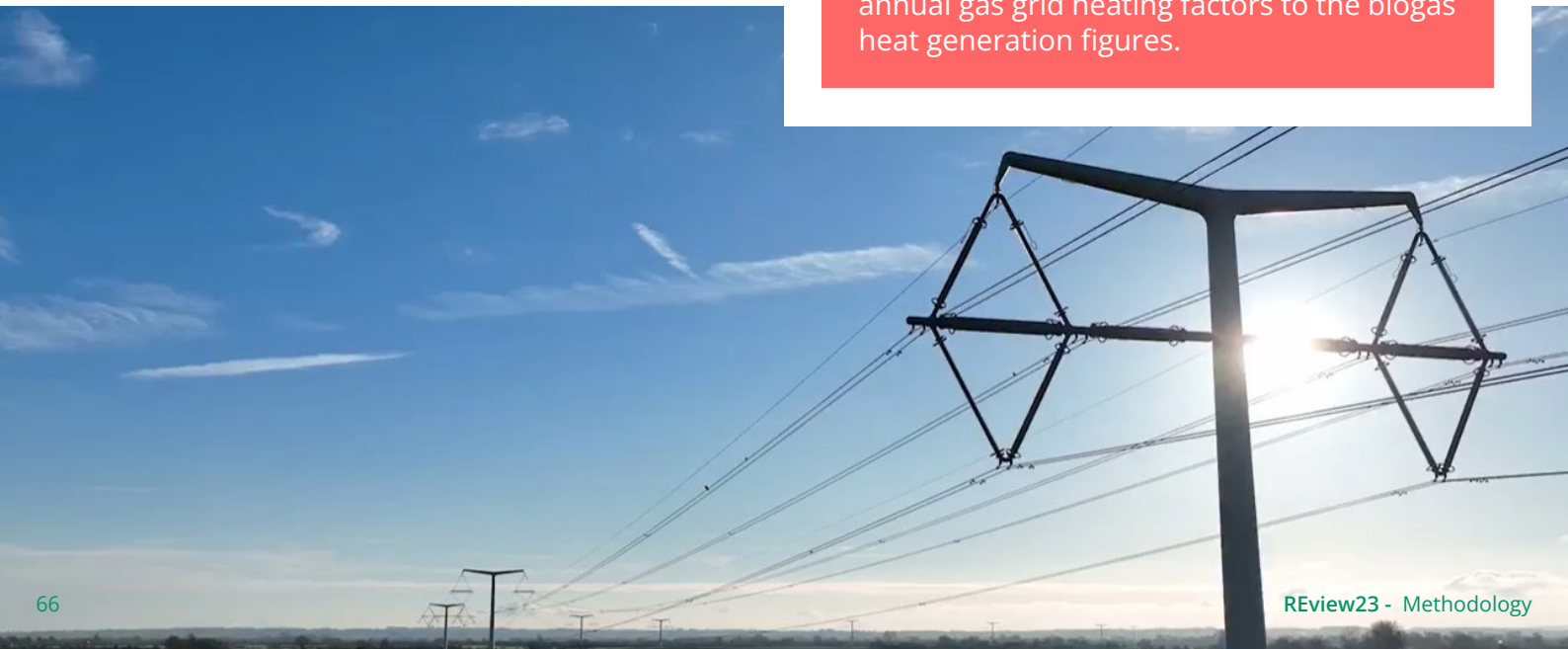
Heat & Cooling data focuses on renewable fuel used to generate heat and is sourced primarily from the Digest of UK Energy Statistics (DUKES) chapter 6, subsection 5, published by BEIS - now DESNZ. Most of the data is self-explanatory.

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 (FECV, 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 (2022) 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 42-51 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 52-65 are for all previously mentioned technologies as well as Energy Storage and Flexibility Services.

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Abbreviations

AD	Anaerobic Digestion	FTE	Full Time Equivalent (numbers of people employed)
BEIS	Department for Business, Energy and Industrial Strategy (now DESNZ)	GHG	Green Homes Grant
BEV	Battery Electric Vehicle	GWh	Gigawatt Hour
BMW	Biodegradable Municipal Waste	HBS	Heat and Buildings Strategy
BUS	Boiler Upgrade Scheme	HGV	Heavy Goods Vehicle
CBR	Circular Bioresources	IBA metals	Incinerator Bottom Ash metals
CCC	Climate Change Committee	KPI	Key Performance Indicator
CfD	Contract for Difference	MBT	Mechanical Biological Treatment
COP27	The 2022 United National Climate Change Conference, and the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change	MT	Metric Ton
DECC	Department for Energy and Climate Change (now Department for Business, Energy and Industrial Strategy)	MWh	Megawatt Hour
DEFRA	Department for Environment, Food and Rural Affairs	NDRHI	Non-Domestic Renewable Heat Incentive
DESNZ	Department for Energy Security and Net Zero	NHS	National Health Service
E5 / E10	5%/10% Bioethanol blend in standard petrol supplies	NREAP	National Renewable Energy Action Plan: a series of projections from the mid 2010s
ECO	Energy Company Obligations	Ofgem	Office of Gas and Electricity Markets
EfW	Energy from Waste, such plants generate energy using waste as a feedstock	R&D	Research and Development
EIS	Enterprise Investment Scheme	REA	Association for Renewable Energy and Clean Technology
ETRI	The Energy Transition Readiness Index	RED	EU Renewable Energy Directive, forming the UK's historic 2020 renewable energy targets when part of the EU
EU	European Union	REMA	Review of Electricity Market Arrangements
EV	Electric Vehicle, being an electric rather than Internal Combustion Engine, powered vehicle	RHI	Renewable Heat Incentive
EWP	Energy White Paper	RO	Renewables Obligation
FiT Scheme	Feed in Tariff Scheme	SAF	Sustainable Aviation Fuels
		Solar PV	Solar Photovoltaic
		ULEV	Ultra Low Emission Vehicle
		VAT	Value Added Tax
		WFD	Waste Framework Directive
		WRAP	Waste & Resources Action Programme

With thanks & gratitude to our Patrons:



Acknowledgements

Special thanks are due to those who lead on the delivery of REview23.

These include:

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Communications Executive & author of REview23

Stan Fielding

Policy Analyst

Frank Gordon

Director of Policy

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Thank you to all members of the REA team who also contributed to REview23, in particular Jenny Grant, Matt Adams and Paul Thomsson. Thank you also to our partners Drax and Foresight who contributed to the report.

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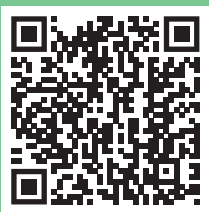
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