REVIEW21

RENEWABLE ENERGY VIEW

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

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A FUTURE BUILT ON RENEWABLE ENERGY AND CLEAN TECHNOLOGY

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About Us

2021 is the year we celebrate our 20th anniversary, but while the world around us has changed dramatically since we started out, our goal has always been the same: championing our members and promoting a future built on renewable energy and clean technology.

We do this by developing informed policy and advocating on behalf of all 500 of our members to Government. We are a coalition built to be the voice for renewable energy and clean technology in the UK. We are the largest renewable energy and associated clean technology body in the UK representing every type of renewable energy.

We empower our member companies to build commercially and environmentally sustainable businesses, by providing the latest information on policy updates, sector-specific insights, topical briefings and industry-leading training and events.

Together, we are working towards a Net Zero future and a greener, more prosperous economy.

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Foreword

Onward to Net Zero – a future built on Renewable Energy and Clean Technologies

I want to welcome you all to REview21. The publication of this year's report marks an important milestone in REA's history. It is now 20 years since we, in our previous guise as the *Renewable Power Association*, were founded.

I am proud to be the Chief Executive of the REA, of my colleagues at the Association, our many industry partnerships and our member organisations. We continue to support the sector's growth for a future built on renewable energy and clean technology and I know that the industry in 2021 is standing on the shoulders of the early energy disruptors – our sector's own giants.

Notwithstanding our own anniversary, this year should also have been the year when the UK Government would have been reporting for the last time on whether the UK had met its "legally binding" Renewable Energy Directive (RED) target to deliver 15% renewable energy by the end of 2020. This commitment was agreed with the UK's European partners when a member of the EU. While Brexit has removed that requirement, REview21 measures progress against this target.

With the stated focus now turned to delivering Net Zero by 2050, the REA confirmed its ambition with, and for, its members and the UK. We looked at Net Zero through the lens of the vital role renewables and clean technologies play across all sectors in the context of decarbonisation, as framed by the Climate Change Committee (CCC). Our REA Strategy, published in January this year, is the guiding framework we use to comment on the priorities for the pathway to Net Zero. We discuss the status of the array of technologies we can count on now to decarbonise **Power and Flexibility**, **Heating and Cooling**, **Transport** and deliver an effective **Circular Bioresource** economy.

Since the last publication of this report in January 2020 so much has happened to our society. Whilst we could anticipate that, following years of Brexit negotiations, there would be a slowdown of the energy transition legislative timetable and that the UK's relationship with Europe would alter, no one anticipated the world-stopping pandemic of COVID-19. Everyone's lives changed. Our sector's thoughts turned to supporting vulnerable people and our magnificent NHS through this pandemic. Priorities focused on energy security and fast-tracking recognition of ALL workers in the energy and waste sectors (large and small, fossil or renewable) as essential. We needed to ensure the nation could concentrate on beating the pandemic and not worry about keeping the lights on to keep vital services operational.

I am particularly proud of the part the REA played, working with members and colleagues across the sector. It would be wrong not to recognise the remarkable leadership from many departments of Government in working through those first months of lockdown. We must not forget how difficult those times were for the people in those high-pressure positions, with so many unknowns and much uncertainty. It was vitally important that the REA helped to make sense of the immense challenges facing our sector (and its people) and offer solutions. This included deciphering the emerging detail behind the remarkable furlough scheme and ensuring that other financial support being offered helped the sector.

> "IT IS TIME FOR THE WARM WORDS AND RHETORIC AROUND NET ZERO TO BE REPLACED WITH DECISIVE ACTION AND LEADERSHIP"

In all of this, the UK's commitment to achieve Net Zero greenhouse gas emissions by 2050 became a clarion call. The then Minister, Kwasi Kwarteng MP, invited our sector to come forward last summer with ideas of concrete actions that the Government could take to create jobs and stimulate green growth.

On behalf of our members, we eagerly submitted our recommendations on measures that would help deliver a 'green' economic recovery.

Since that time the furlough scheme has been extended as successive waves of COVID-19 swept through our nation. There was a widely welcomed Green Homes Grant launched that offered the extraordinary promise of green jobs. People's homes would benefit from energy efficiency grants and see the re-launching of the heat pump revolution. Other historic climate promises were made towards the end of 2020 including the Prime Minister's own Ten-Point Plan which was an important statement of ambition. The long-awaited Energy White paper (EWP) followed shortly afterwards and, while there were high hopes that the EWP would describe more detail around the specific energy-related measures, the reality was a long-term strategic vision for the energy system.

Whilst sparse in detail, it did confirm "the goal of

a decisive shift from fossil fuels to clean energy, in power, buildings and industry whilst creating jobs, growing the economy and keeping energy bills down", a gargantuan task needing Government, industry and society as a whole to enact this energy transition.

The pressure, though, is now on the Government. The postponed COP26 takes place in November, making this the defining year for the UK's climate credentials. We are now halfway through 2021, yet the roll-out of new, detailed climate plans, such as the Heat and Building Strategy, have been marred by delays and uncertainty. Those that have emerged have too often missed the mark – the cancellation of the Green Homes Grant after just six months is a case in point. Every month of inaction makes it harder for the UK to remain credible to meet its Net Zero ambitions.

I believe that there is still a window to make comprehensive plans and demonstrate leadership at home and to a global audience. The Net Zero Strategy, due for release in the autumn, will be crucial in achieving that. I hope it comes with clear policy plans, backed fully by the Treasury. It must.

Notwithstanding these delays, the appetite for action on climate change and the adoption of clean energy has grown exponentially. Financial institutions and corporations are moving forwards to address the climate emergency imperative. They are recognising that there are technical solutions that are cost effective now and that market models and jobs need to be aligned in pursuit of Net Zero. With clear public support and more businesses and communities taking action, it feels like a watershed moment.

This report serves as a baseline for the REA too. By describing where progress has been made with deployment levels in a pre-pandemic world, it will act as the best measurement for progress in the years to come. We are reporting where money has been invested, the job numbers linked to this deployment and where they have been created. These areas form the focus of the REA's strategic direction and we, as the leading trade association for our sector, will be monitoring them closely. The priorities you can read in the report are there because they are important to our members who are actually the organisations delivering Net Zero solutions and creating the jobs that grow the economy.

Never before has it been more appropriate to focus on jobs. I agree with the UK Government that it is by growing green jobs that Britain can 'Build Back Better'. To that end I am pleased we have not only repeated our work with Innovas, looking at jobs and skills development in the UK in 2019 and 2020, but have developed our reporting, with a new focus on regional development across the UK. We wish to shine a light on the opportunities for people to enjoy a career in our sectors - no matter where they live - as part of our work to ensure no one is left behind in the energy transition.

I hope that you will see progress on our priorities in future reports of REview from this year's baseline. We will certainly be working hard for this to happen. You can count on the REA to champion the work of the people and businesses in our industry who are forging ahead, despite the challenges facing them.

I urge the Government and other key stakeholders to accelerate the changes necessary to create the market structures and regulation needed. We want to be able to report that the UK is the leading destination for energy investment, and we want to shout about growing deployment on our journey to Net Zero.

Whilst we are seeing further progress, the question still remains, is it transparent and fast enough? The honest answer, I am afraid, is no. It is not too late to turn this around, but it is time for the warm words and rhetoric around Net Zero to be replaced with decisive action and leadership.

Dr Nina M Skorupska CBE
Chief Executive, REA

Executive Summary

A watershed moment

The theme of REview21 is one of progress, but frustration too. Clearly the renewable energy and clean technology sector is resilient, offering steady growth in the pursuit of Net Zero and opportunity in the forms of jobs and investment. However, the sector's true potential is being stifled by a lack of consistent, proactive and long-term support from the Government.

The UK's pre-Brexit renewables objective, in line with the EU's 'RED' targets, was to source 15% of its total energy consumption from renewable sources by 2020. In 2019, 12.3% of the UK's energy consumption came from renewable sources, but while this exceeds the interim target set for this period, it is unlikely that the UK will meet the 15% target in 2020.

The share of power generation coming from renewable sources in 2019 increased to nearly 35%. While onshore wind remained the largest overall contributor to renewable power generation in 2019, it is expected that it will be overtaken by a rapidly expanding offshore wind sector in 2020. Bioenergy accounts for around a third of all renewable power generation.

While other renewable technologies grew in terms of power generation in 2019, bioenergy has a major share, and wind is also responsible for 53% of all renewable power generation.

More broadly, however, it is clear that growth of power generation has slowed after large rises in the middle of the last decade. Anaerobic Digestion power generation, for example, is now unlikely to meet BEIS's projections (the UEP 2020 projections we have used as our benchmark for the past few years), with generation standing at 92% of the desired target.

However, it is worth noting that solar PV has long surpassed its forecast growth despite significant cuts to policy support.

Similarly to power, the renewable heat sector saw an increase in generation, albeit with slowing growth rates. Bioenergy sources continue to lead the way in this area, accounting for nearly 80% of total heat generation, underlining their importance to the UK's heat decarbonisation efforts.

Nonetheless, the diminishing growth rates since the mid-2010s are a cause for concern. Changes to the tariff rates under the Renewable Heat Incentive (RHI) have clearly had an impact, as has the large and prolonged gaps in heat decarbonisation policy. Deep geothermal is an obvious example of a technology that has been neglected by the Government. At the time of writing, the sector is still waiting for support that would provide a catalyst to the industry, and it is unlikely to be until 2024 at the earliest that the UK will be producing deep geothermal heat. You can read our report on this technology, produced with our partners, ARUP - 'Deep Geothermal Energy: Economic Decarbonisation Opportunities for the United Kingdom' *www.r-e-a.net/government-urged-to-help-deliver-a-world-leading-deep-geothermal-sector-to-secure-the-uks-green-recovery/*

In our newly named Circular Bioresources chapter, we focus on the composting and anaerobic digestion industries. The AD industry in England processed a gross estimated 1.5 million tonnes of feedstock in 2012, rising to 2.1 million tonnes in 2013, and 8 million tonnes in 2018. The composting industry has grown slowly, with the processing of 4.9 million tonnes of feedstock in 2012 rising to 5.1 million tonnes in 2018.

Over the course of the decade, the recycling rate of all wastes from households (excluding IBA metals) increased from 40.4% in 2010 to 44.3% in 2018. However, despite the semblance of progress, this growth was largely achieved between 2010 and 2012. Since then, the figures have plateaued and indeed fell between 2017 and 2018. Given EU targets requiring a rate of 50%, and continued Government ambitions to recycle, much work needs to be done in this area.'

When it comes to transport, there have been some gains in recent years. This has been achieved by a significant growth in the consumption of biofuels (even before the implementation of E10 petrol later this year) and there has been a dramatic increase in the number of new car registrations of EVs and hybrids for EVs and hybrid cars (from 3.17% to 10.56% between 2019 and 2020).

While more needs to be done to equip the UK with a strategic rapid EV charging network and more home and destination chargers, the ban on sales of new petrol and diesel cars and light vans from 2030, increased consumer awareness and investment in public EV charging infrastructure sets the path for increased uptake in future years.

In terms of employment, 138,264 people were employed in the renewable energy sector in 2019/20, an increase of 4,287, or 3.2%, from the

year before. The market value of the sector has, comparatively, increased by a greater rate, with the sector now worth £22.4 billion, an increase of 8.7%. However, it must be underlined that these figures represent the period before major policy changes in 2020 and the economic shock caused by the COVID-19 pandemic.

The offshore wind sector is the largest subsector of the industry, employing 28,300 people and having a market value of £5.4 billion. The biofuels sector saw the highest employment growth rates - 15.9% between 2018/19 and 2019/20 - but solar PV and solar thermal were the only technologies which saw a fall in employment, again due to policy changes in this period.

In terms of the breakdown by region and country, every region and devolved nation has a significant number of jobs. London is significantly higher than the rest of the country when it comes to market value and employment, with the South East in second position overall. More investment in developments like the ones in offshore wind manufacturing which will deliver 1,000 new jobs across the Humber and North-East are needed and are possible with the right framework in place.

For the first time, in this report we have sought to offer projections of future employment in each region and country of the UK. We are clear that, although some regions and countries will be more suitable for the deployment of certain technologies than others, every corner of the UK has the potential to economically benefit from the clean energy transition.

We estimate that there could be nearly 200,000 additional jobs in renewable energy and clean technology by 2035, bringing the total up to 333,000 across the UK. This figure could increase if the Government properly backs the sector and puts the industry at the heart of the UK's economic recovery. By the same token, neither are these job projections guaranteed. If the sector continues to receive patchy and short-term support from the Government then we could fall well short of our sector's, and indeed our country's economic potential.

REA Strategy

A Pathway to Enabling Net Zero

The UK transitions to 100% renewable energy and clean technology by 2050 delivering Net Zero CO_2 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.

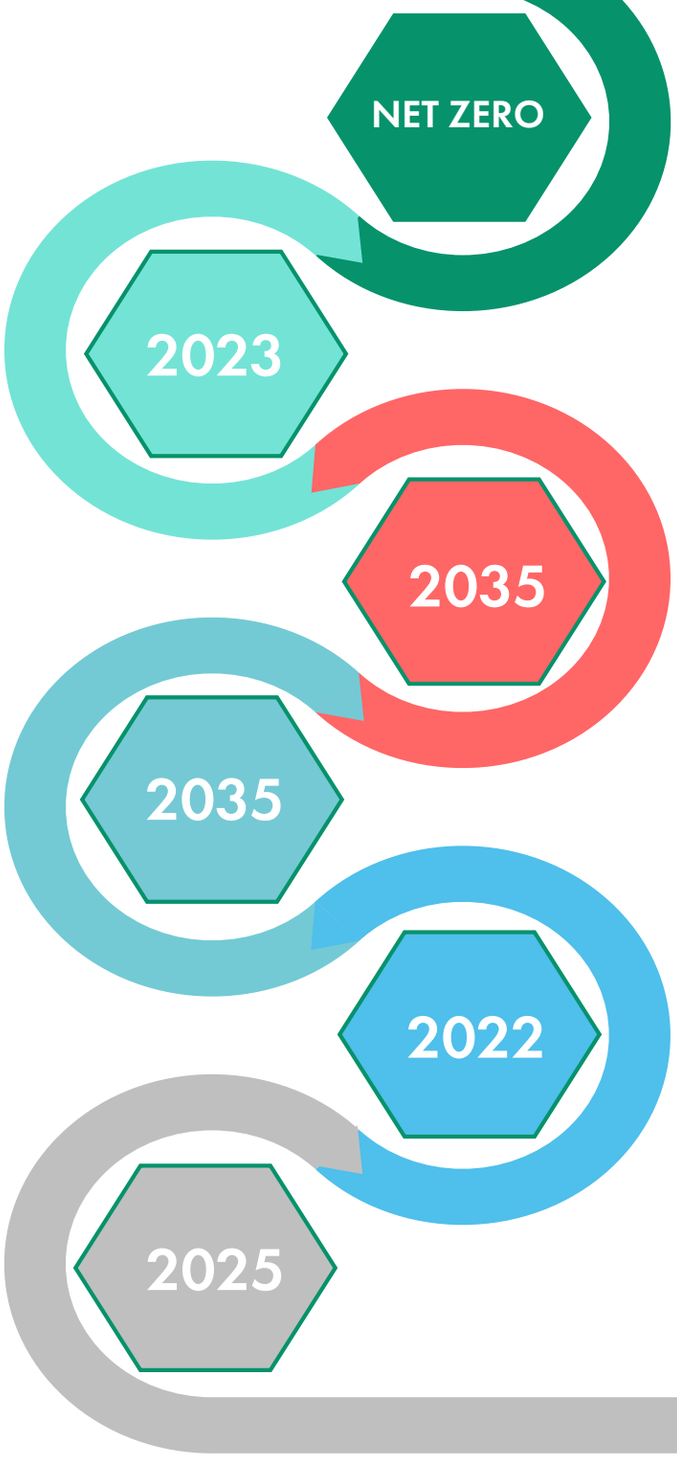
TRANSPORT

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

The UK Government's Net Zero ambitions are laudable, but slowing renewable generation shows that reality is yet to match the rhetoric.

REview21 covers generation and consumption data in 2019, the most recent full year for which data is available. The exception is data surrounding Electric Vehicles (EVs), for which we have data from 2020, and EV charging infrastructure, for which we have data from 2020 and 2021.

The Association for Renewable Energy and Clean Technology (REA) have measured the UK's progress of renewable energy deployment against targets set by the European Union (EU) through the Renewable Energy Directive (RED) in 2009.

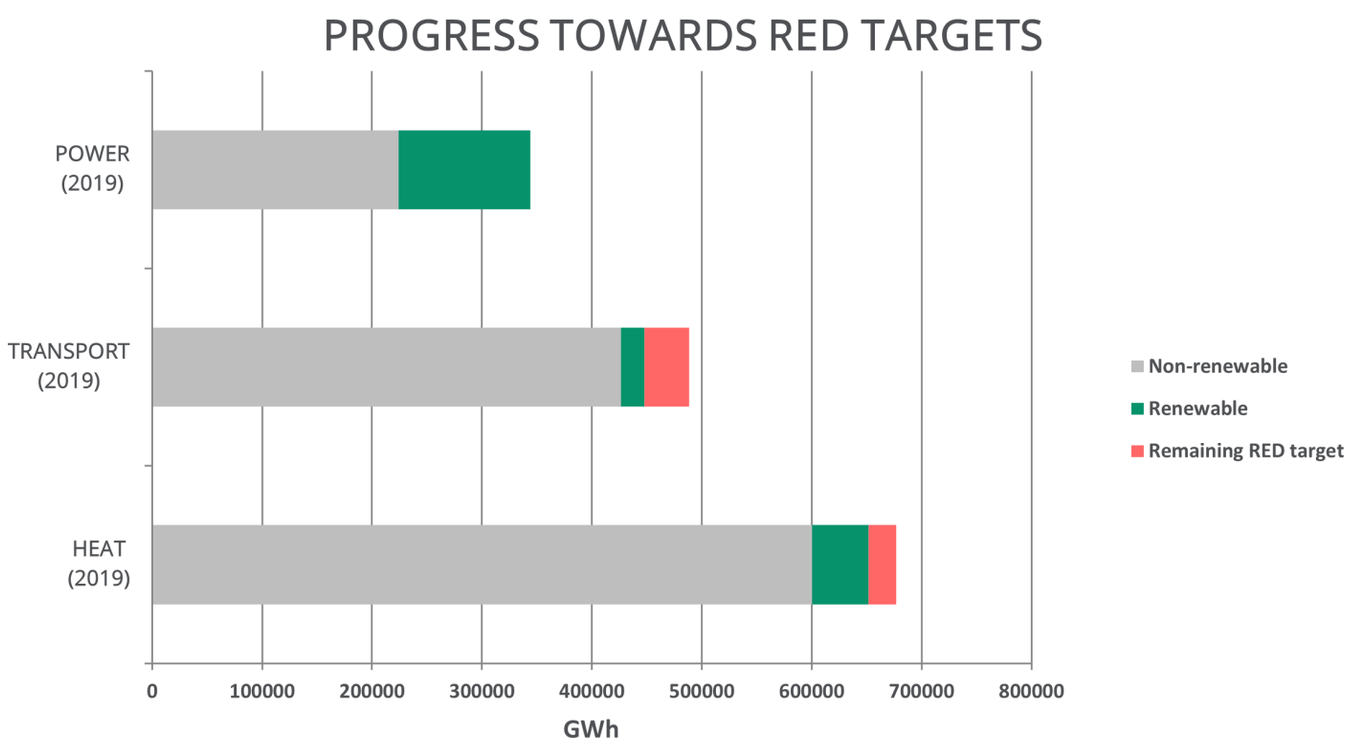
The UK's objective, in line with RED targets, was to source 15% of its total energy consumption from renewable sources by 2020. In 2019, 12.3% of the UK's energy consumption came from renewable sources, but while this exceeds the interim target set for this period, it is unlikely that the UK will meet the 15% target in 2020 based on recent growth rates.

Progress towards the UK's RED deployment target for 2020 continues to be driven by the power sector. In 2019, the power sector saw 34.85% of its energy come from renewable sources, up from 31.07% in 2018.

While the transport sector remains the greatest source of carbon dioxide emissions - accounting for 34% of UK carbon emissions in 2019 - it has seen a relatively significant increase in renewable fuels, from 2.39% in 2018 to 3.41% in 2019; this translates to a year-on-year growth rate of 42.67%. Similarly, while the heat sector has seen further growth, it has been sluggish, with just 8.08% of the sector's energy coming from renewable sources in 2019. This represents only a marginal increase since 2018 when this figure was 7.27%.

In short, while the UK's power sector has met and exceeded its RED deployment targets, slow progress in the transport and heat sectors is holding the UK back from reaching its 15% renewable energy consumption target by 2020.

The UK's RED Target is 15% of all energy consumption coming from renewable sources by 2020. However, with only 12.3% of energy consumption coming from renewable sources in 2019, and a lack of new policy measures, it will be a challenge for the UK to meet this ambition.



Deployment: Power & Flexibility

Renewable Power Generation Summary

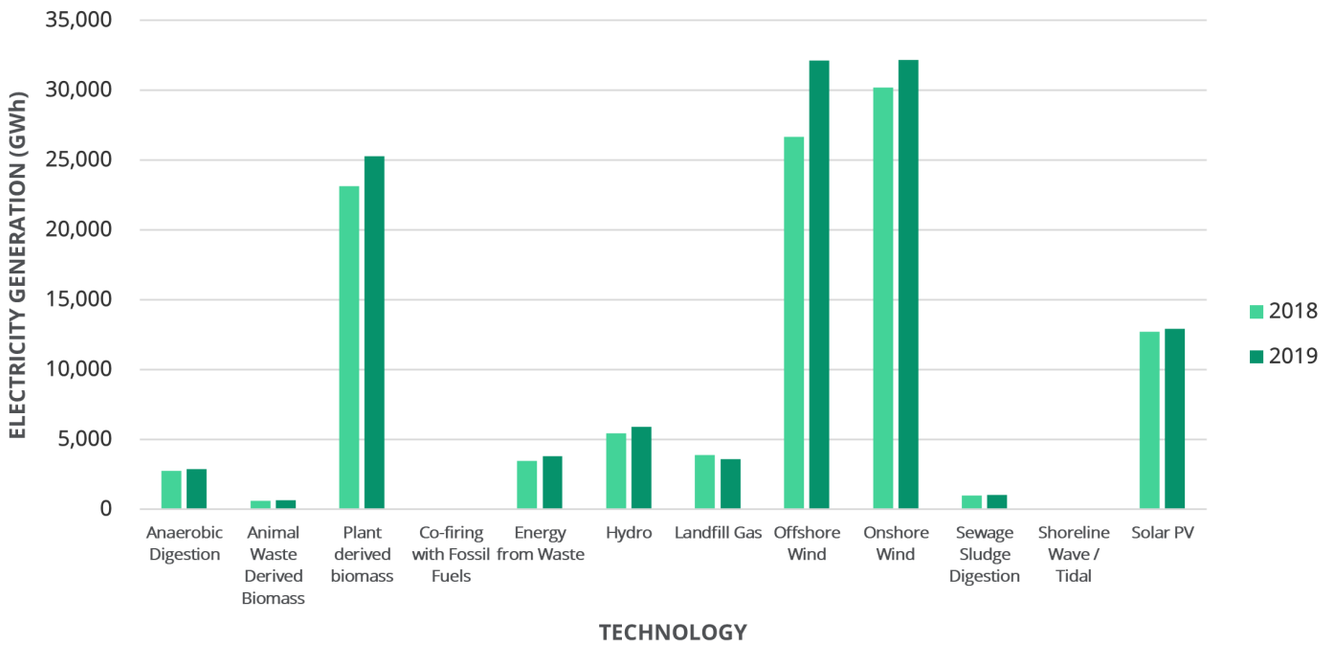
The share of power generation coming from renewable sources in 2019 increased to 34.87%.

Offshore wind continued to drive growth in renewable power, with an unparalleled increase of 20%. While onshore wind did not experience the same levels of growth, it remained the largest contributor. Overall, offshore and onshore wind accounted for more than half of all renewable power generation in the UK.

Biomass power generation also remained strong, as the second largest source of renewable power behind wind with a growth rate of 9%. Similar rates of growth were also seen in the energy from waste and hydro sectors.

Power generation from co-firing with fossil fuels and tidal remained negligible (2 and 14 GWh, respectively), while landfill gas generation decreased by 7.4% between 2018-19.

POWER GENERATION BY TECHNOLOGY, 2018 VS 2019



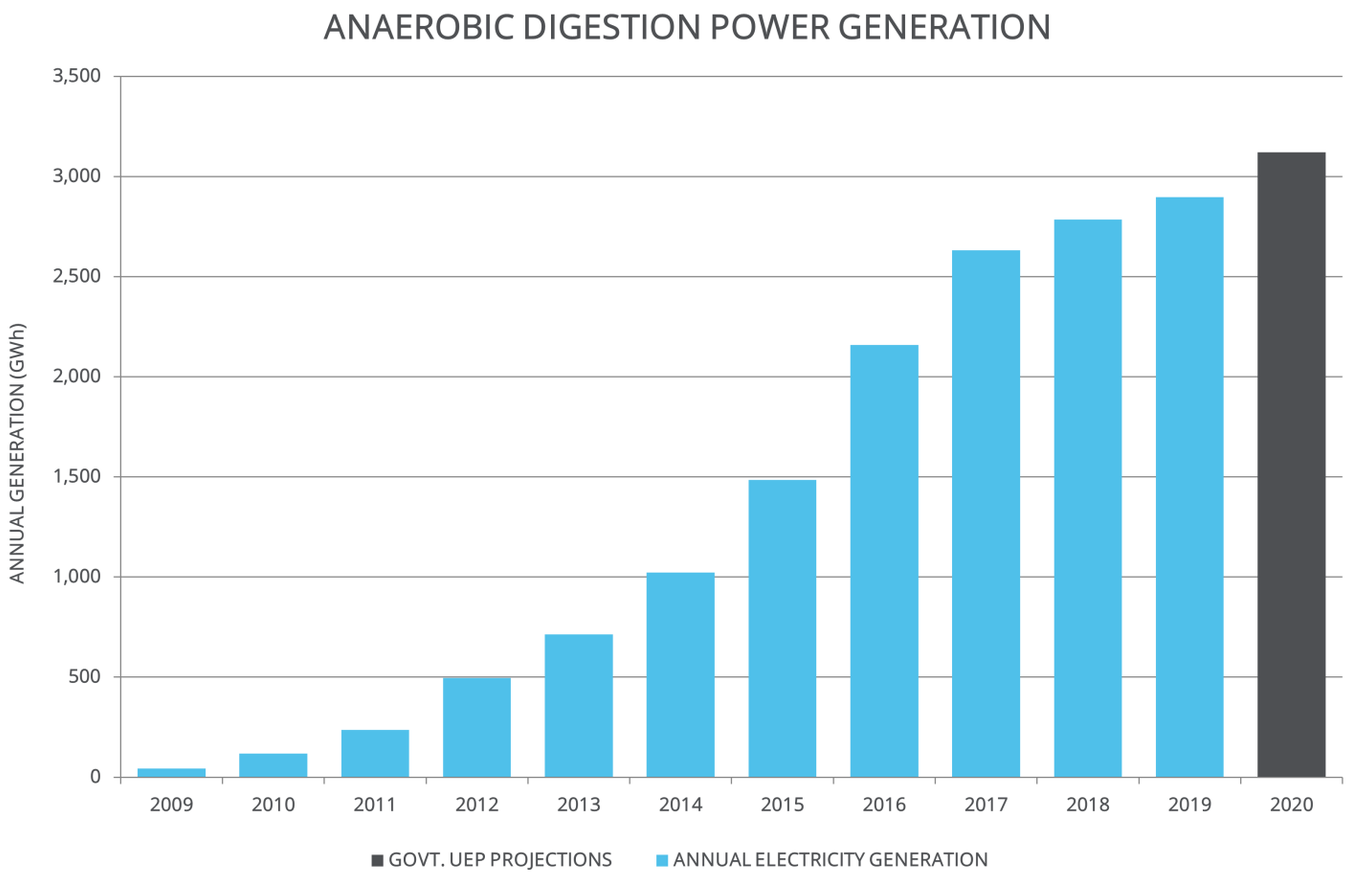
Deeper Insight: Power & Flexibility

Anaerobic Digestion

Power generation through anaerobic digestion (AD) has continued to see steady growth, with a rise of 4% between 2018 and 2019.

Growth rates have been relatively consistent for the last three years, and it is expected that annual generation will surpass 3,000 GWh in 2020.

However, with generation only at 92% of BEIS's UEP 2020 projections, there is likely to be a gap between the UEP projections and actual generation in 2020.

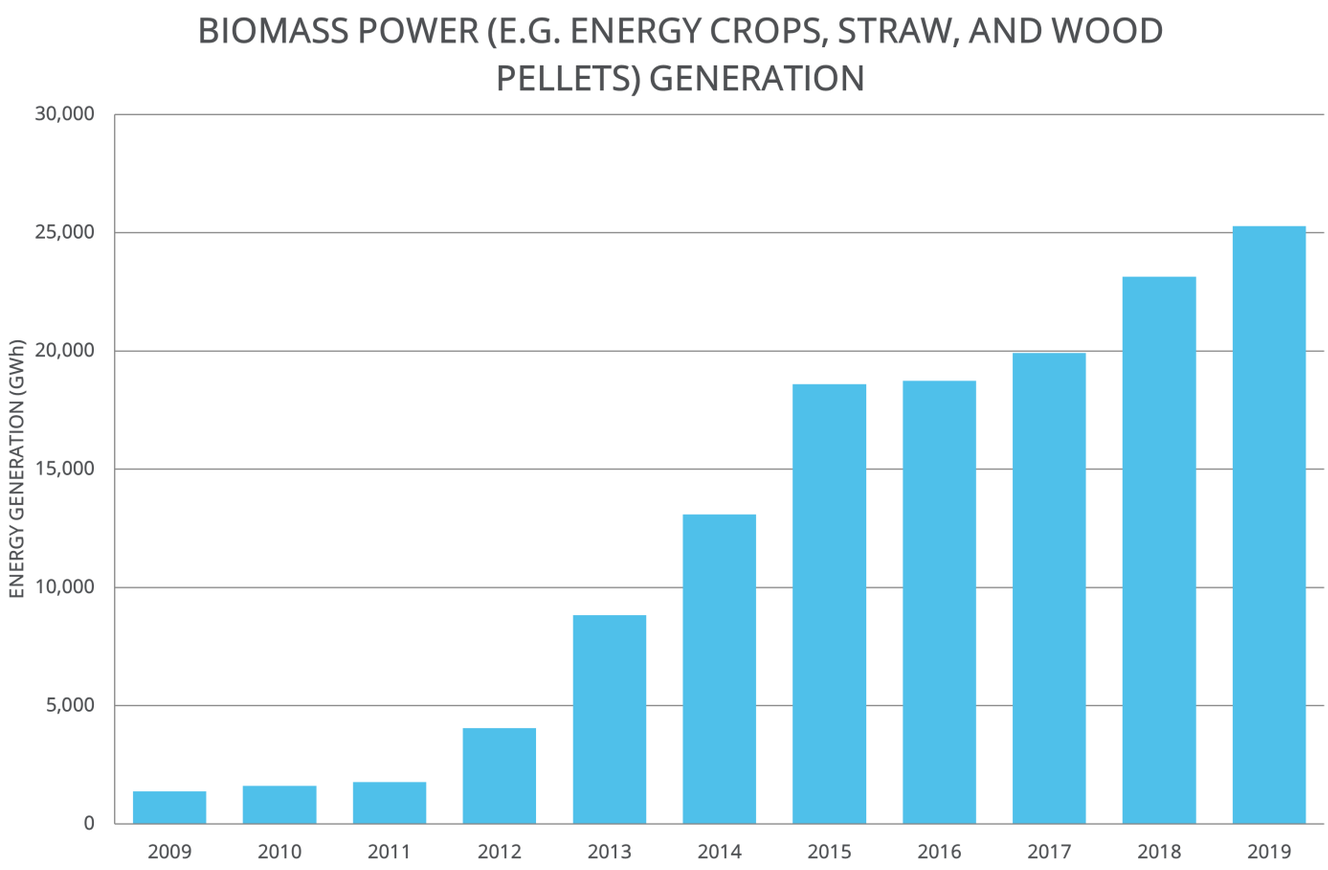


Biomass Power (e.g. energy crops, straw and wood pellets)

Biomass power remains the largest producer of renewable power behind offshore and onshore wind.

More than 25,000 GWh of power was generated in 2019, a 9.2% increase on the previous year and nearly double the figure produced in 2014.

Although growth has slowed in comparison to the period between 2011-15, biomass continued to represent one of the most important, and fastest growing renewable power generating technologies.



Co-firing with fossil fuels

Power generation from co-firing with fossil fuels is now negligible, with just 2 GWh of power generated from this source.

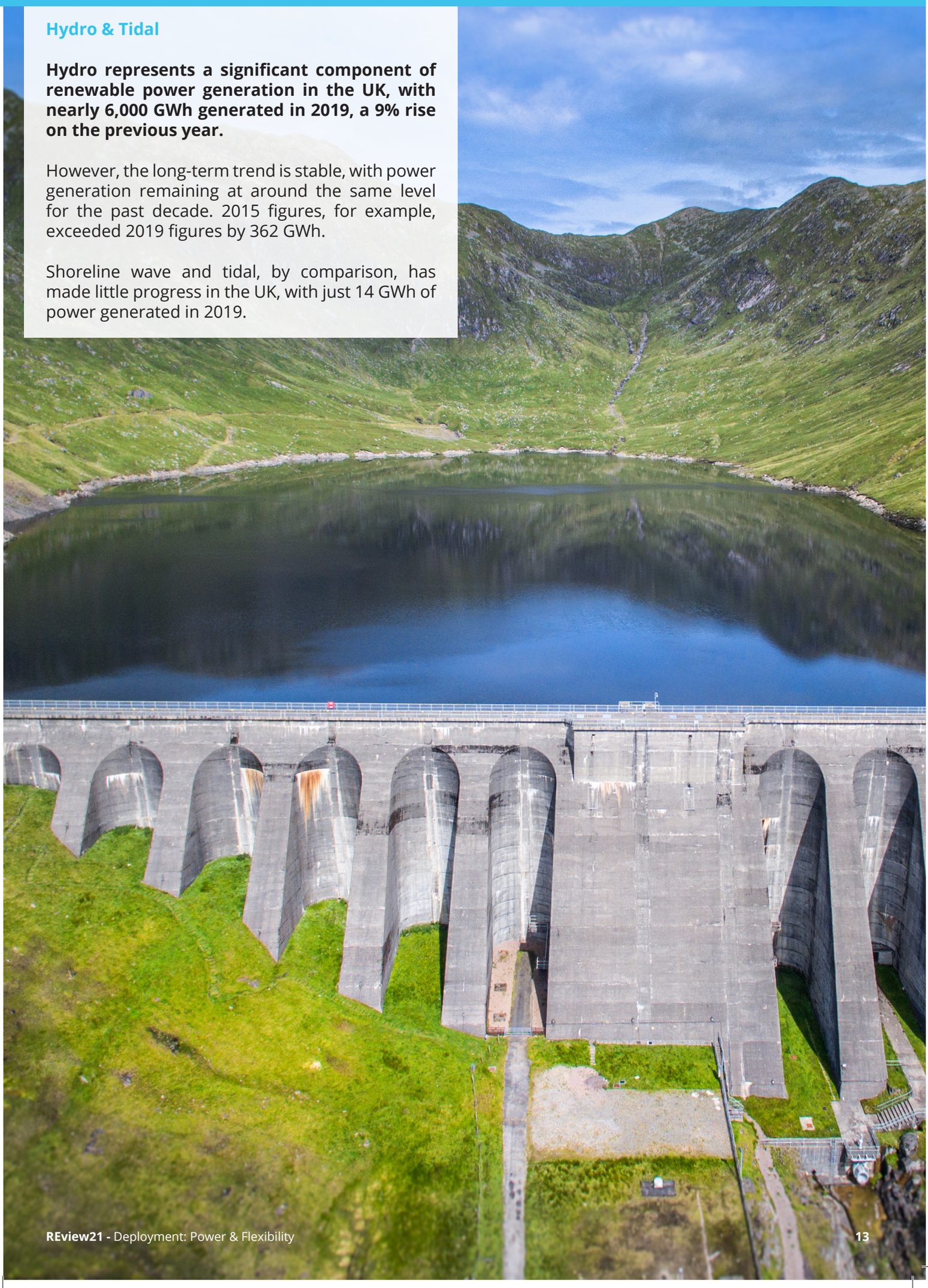
It is a far cry from 2011, when over 3,000 GWh of power was produced in this way. This reflects the conversion of a small number of large plants running exclusively on biomass power.

Hydro & Tidal

Hydro represents a significant component of renewable power generation in the UK, with nearly 6,000 GWh generated in 2019, a 9% rise on the previous year.

However, the long-term trend is stable, with power generation remaining at around the same level for the past decade. 2015 figures, for example, exceeded 2019 figures by 362 GWh.

Shoreline wave and tidal, by comparison, has made little progress in the UK, with just 14 GWh of power generated in 2019.

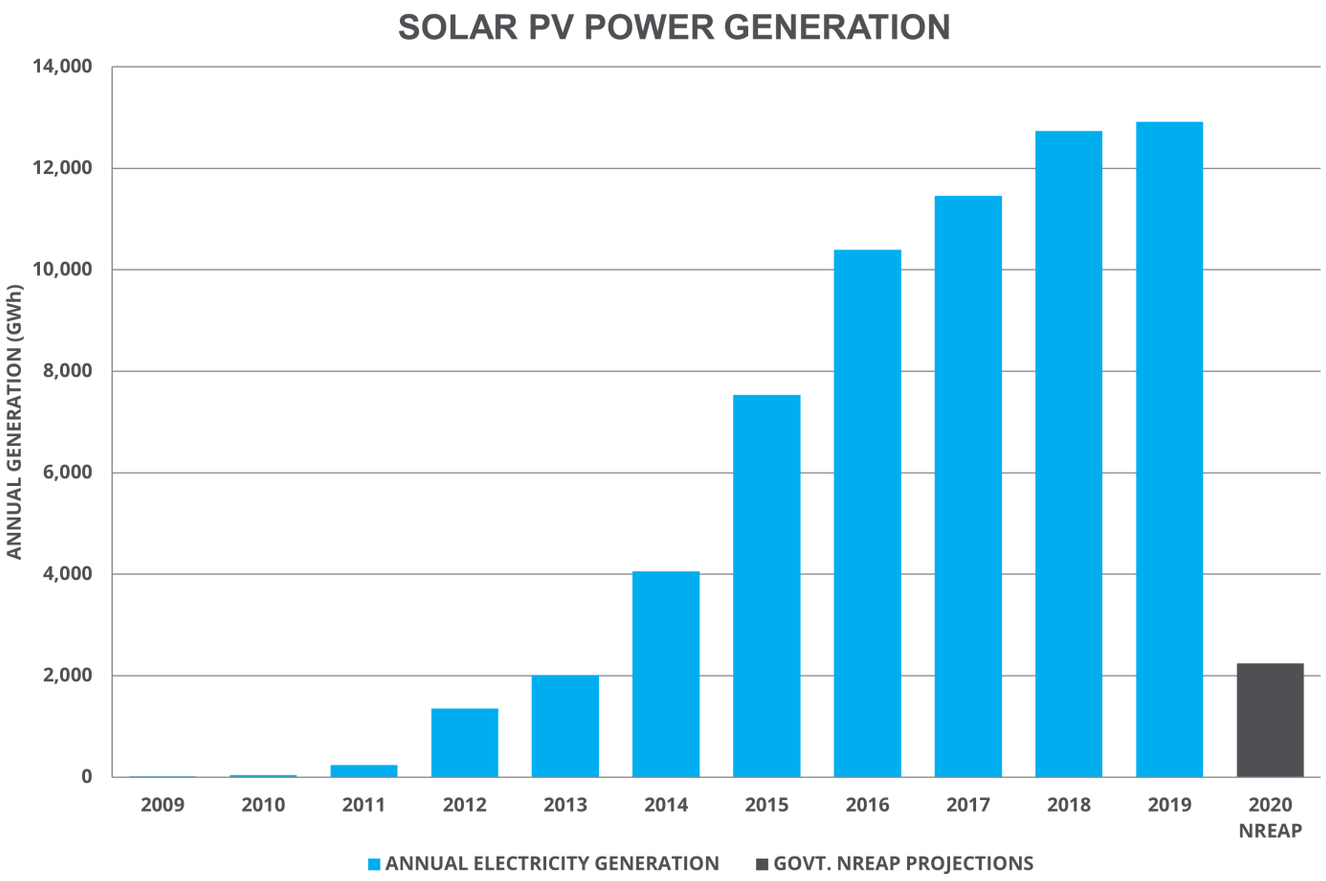


Solar PV

Solar PV power generation grew by 2% between 2018-2019, down from 2.45% the previous year.

This reflects a general trend from 2016, where growth rates have slowed considerably compared to 2010-2016 due to significant cuts in policy support (the closure of the RO and then FiT scheme to new plants).

However, solar PV power generation was around five times greater than the NREAP 2020 projection and continued to play a significant role in this area, producing more than 10% of all power in the UK.



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

From 2015, waste-to-energy growth in power generation slowed, with a 1.2% increase between 2018 and 2019.

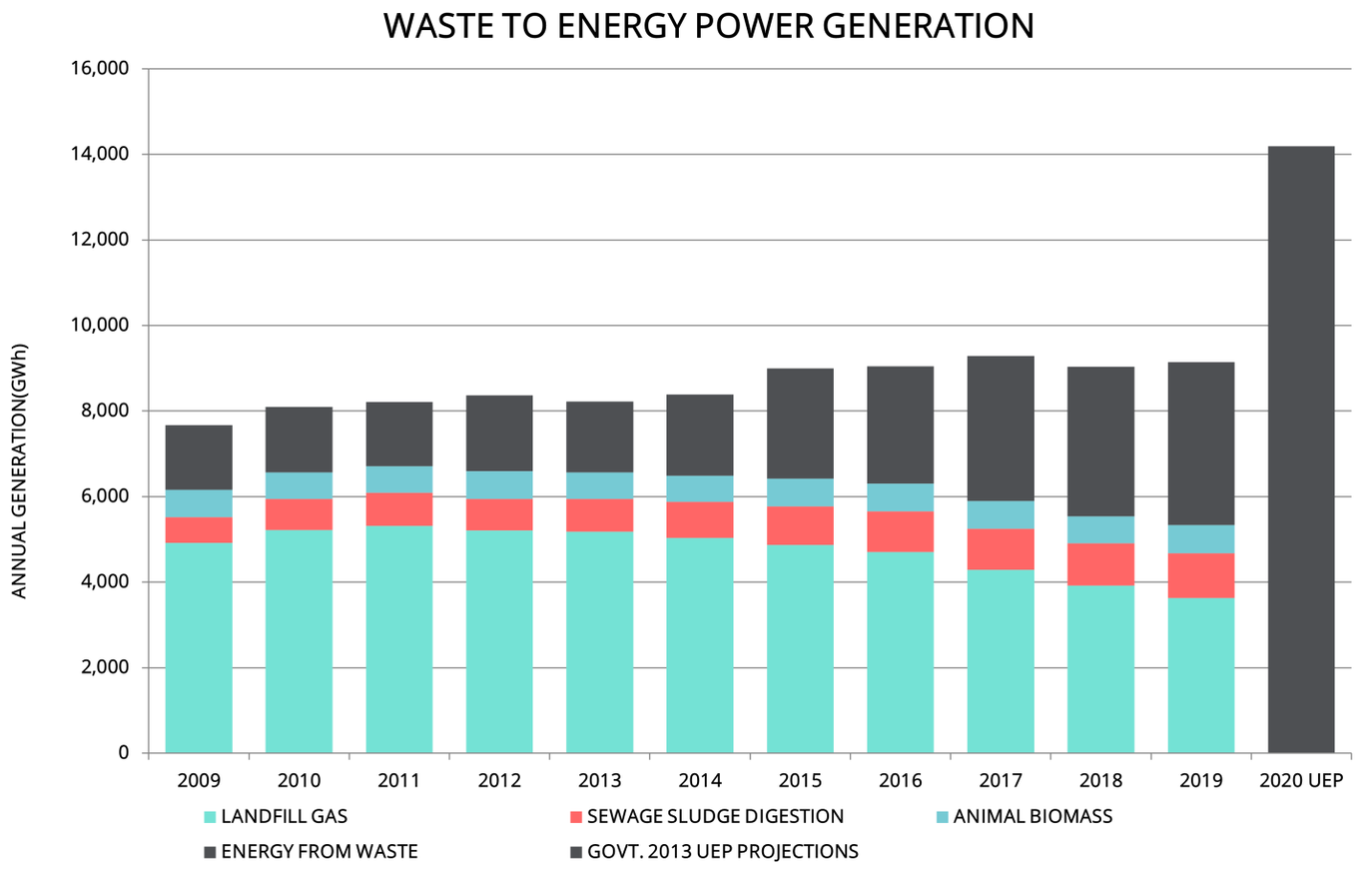
The falling dependency on landfill gas continued, with a reduction of 7.4% last year as expected as many sites are closed, receiving no new feedstocks.

However, while animal waste derived biomass, energy from waste and sewage sludge digestion have achieved growth rates of 4.2%, 5.7% and 9.1%, respectively, power generation from the waste-to-energy sector as a whole is lower than modelled a decade ago. Indeed, the sector is generating at just 64.4% of BEIS's 2020 UEP projections.

NB - Animal waste derived biomass includes: poultry litter, meat and bone.

Energy from waste includes: waste (including waste wood), tyres and hospital waste.

Waste-to-energy does not include anaerobic digestion (AD) - this is treated separately on p13.



Wind

Wind continued to be the largest producer of renewable power, with offshore and onshore wind accounting for more than half of all renewable power generation in the UK.

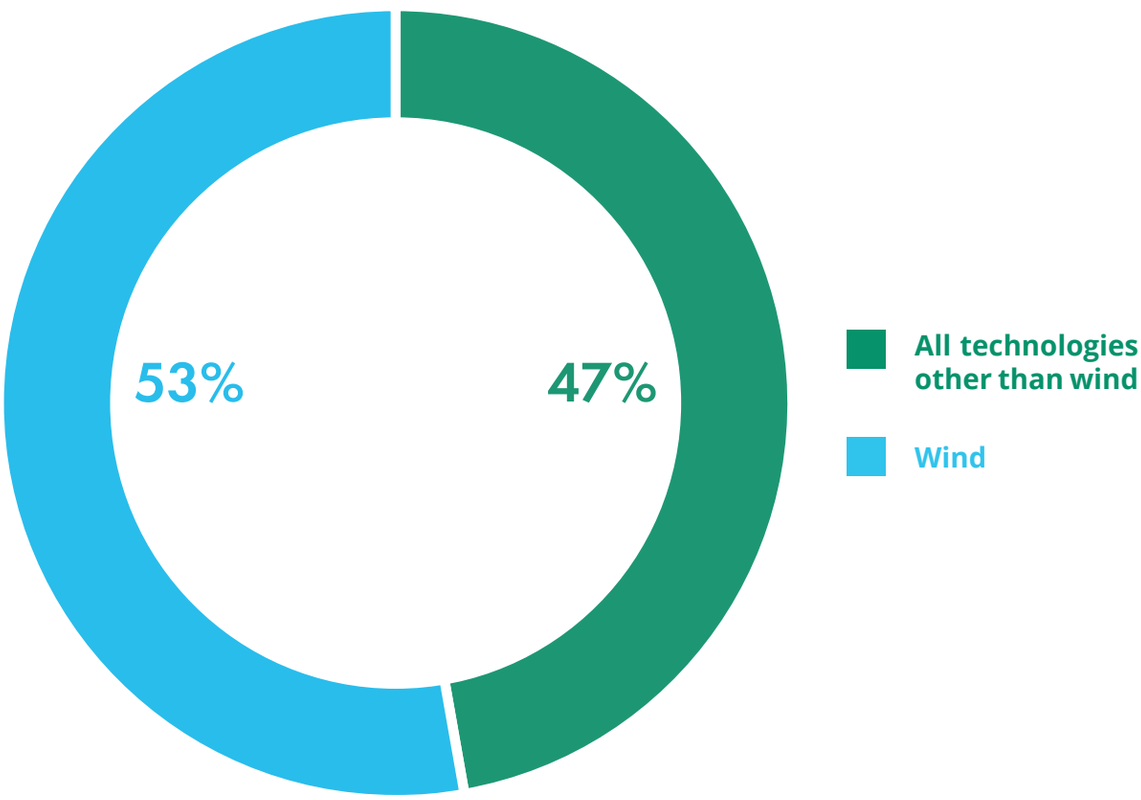
Between 2018 and 2019, offshore wind saw the largest growth rate in the sector, with the increase of 20.5% driving the overall increase in renewable power generation.

53%

OFFSHORE AND ONSHORE WIND ACCOUNTS FOR 53% OF ALL RENEWABLE POWER GENERATION.

While onshore wind did not experience the same level of growth, a rise of 6.5% ensured that it remained the largest contributor, largely due to more favourable wind speeds rather than new capacity. However, it is expected that offshore wind will surpass onshore wind in this regard in 2020.

WIND'S SHARE OF RENEWABLE POWER GENERATION



REA Strategy 'pillar' recommendations: Power & Flexibility

• ENSURE A ROUTE TO MARKET:
Six monthly CfD auctions with clear rolling timetable and sufficient budget with more technologies benefitting; new support for small scale projects and removal of VAT from domestic installations.

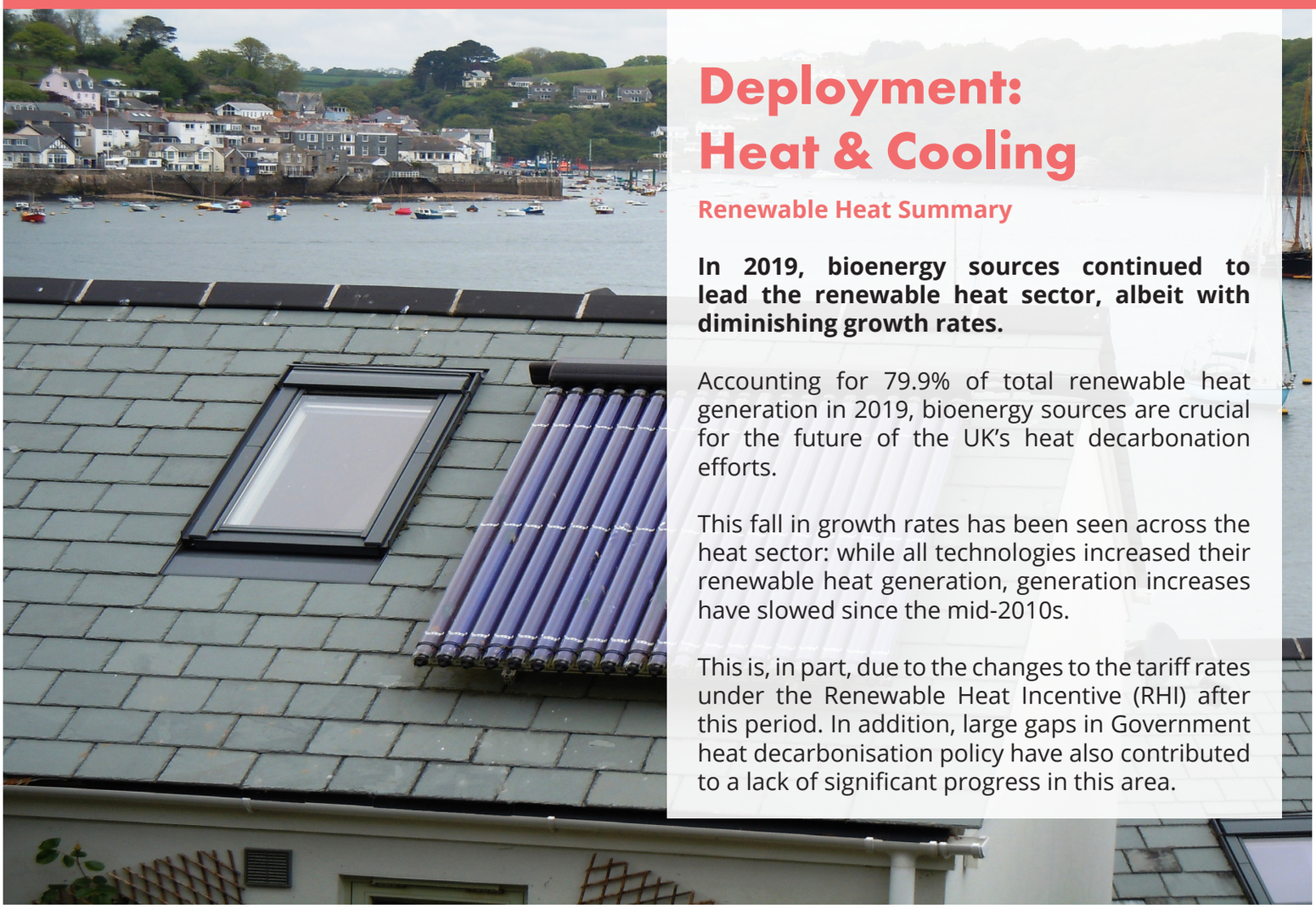
• DEVELOP DEEP, TRANSPARENT FLEXIBILITY MARKETS:
Ensure these offer rewards based on 'payment for outcome' beyond just power generation.

• REFORM INNOVATION FUNDING:
So that more renewable and clean technologies benefit from innovation funding and break into the "favoured" Government status thus lowering costs through R&D and leading to future deployment and commerciality.

• SUPPORT FOR ALL TECHNOLOGIES:
The forthcoming Government Biomass Strategy must recognise the vital value of both bioenergy and the wider bioeconomy to accelerating Net Zero ambitions.

• GRID REFORMS:
A fit for purpose, efficient grid network favouring renewables and clean tech; ensuring the Grid Code review improves the governance system, and funds smaller user representation on grid rule making boards.

• OFGEM REFORM:
An explicit, understood Decarbonisation Priority should be incorporated in Ofgem's KPIs and activities, as part of delivering its obligation to future as well as current consumers.



Deployment: Heat & Cooling

Renewable Heat Summary

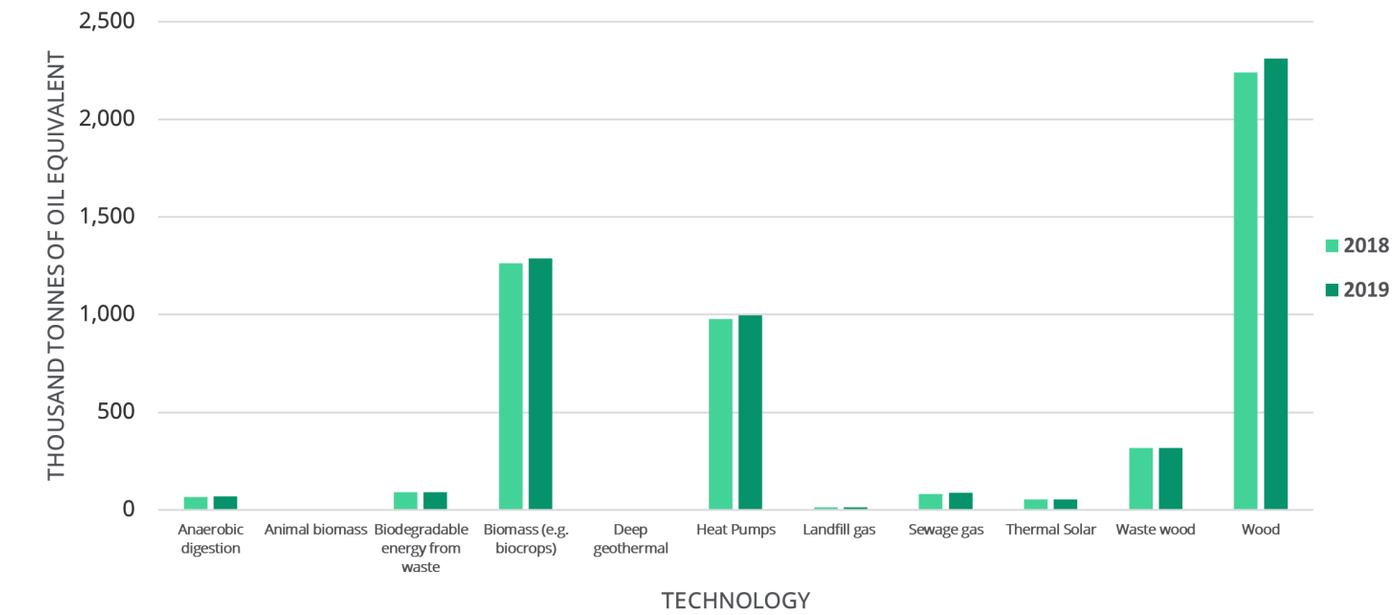
In 2019, bioenergy sources continued to lead the renewable heat sector, albeit with diminishing growth rates.

Accounting for 79.9% of total renewable heat generation in 2019, bioenergy sources are crucial for the future of the UK's heat decarbonation efforts.

This fall in growth rates has been seen across the heat sector: while all technologies increased their renewable heat generation, generation increases have slowed since the mid-2010s.

This is, in part, due to the changes to the tariff rates under the Renewable Heat Incentive (RHI) after this period. In addition, large gaps in Government heat decarbonisation policy have also contributed to a lack of significant progress in this area.

HEAT GENERATION BY TECHNOLOGY, 2018 VS 2019



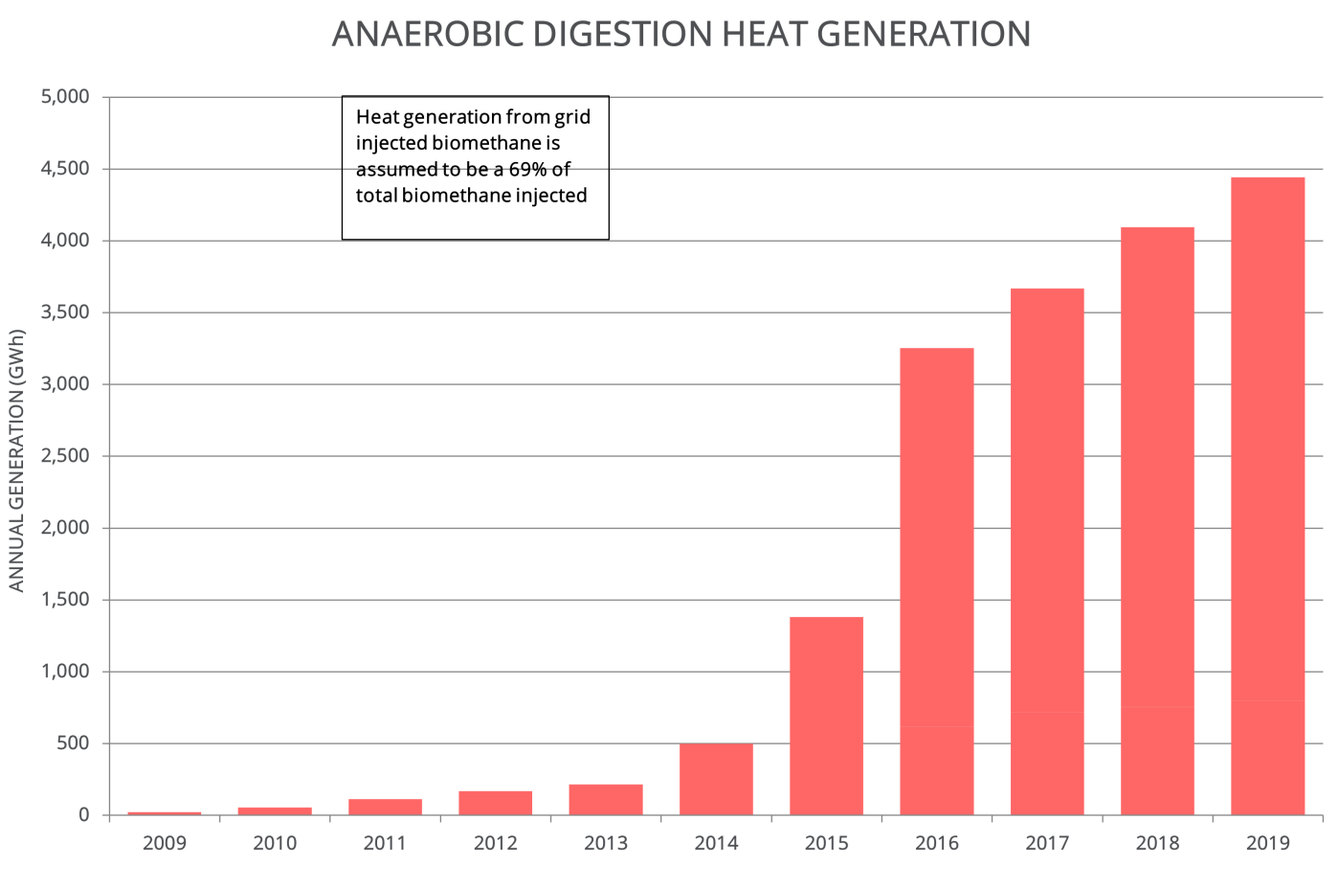
Deeper Insight: Heat & Cooling

Anaerobic Digestion

Anaerobic digestion (AD) heat generation increased by 8.4% between 2018 and 2019; a notable increase, but one that is down from 11.6% the previous year.

This figure includes an estimate of the heat generated from biomethane injected to the gas grid and used for heating.

The pace of growth was also significantly slower than the increases seen between 2013 and 2016. In short, while the sector - largely biomethane - is still expanding, the pace of growth is slowing. This slowdown in growth is for the most part due to the tariff reductions changes brought in to the RHI support scheme.



Biomass Heat (wood pellets, wood chip or energy crops)

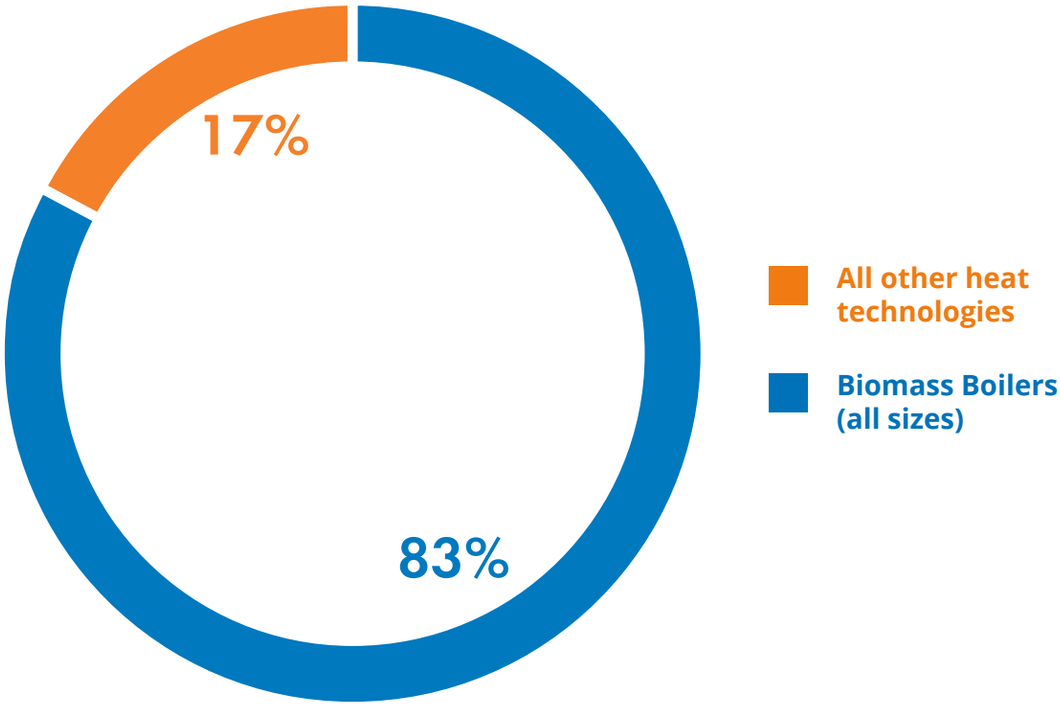
Biomass heat, utilising wood fuels within efficient biomass boilers or stoves, saw only a marginal rise in heat generation.

In 2019, unfavourable Government policy changes and RHI deployment caps hit the sector, after the peak years of growth between 2012 and 2015.

However, the technology continues to be one of the largest sources of renewable heat with its production of nearly 15,000 GWh representing a quarter of all renewable heat generation and will be critical to decarbonising the sector.

Biomass Heat (utilising wood pellets, wood chip or energy crops) has, to date, been fundamental to the delivery of heat decarbonisation in the UK, accounting for 83% of total renewable heat capacity deployed under the Non-Domestic Renewable Heat Incentive up until scheme closure in March 2021.

TOTAL RENEWABLE HEAT CAPACITY (MW) OF ACCREDITED SYSTEMS AT CLOSURE OF THE NON-DOMESTIC RENEWABLE HEAT INCENTIVE, MARCH 2021

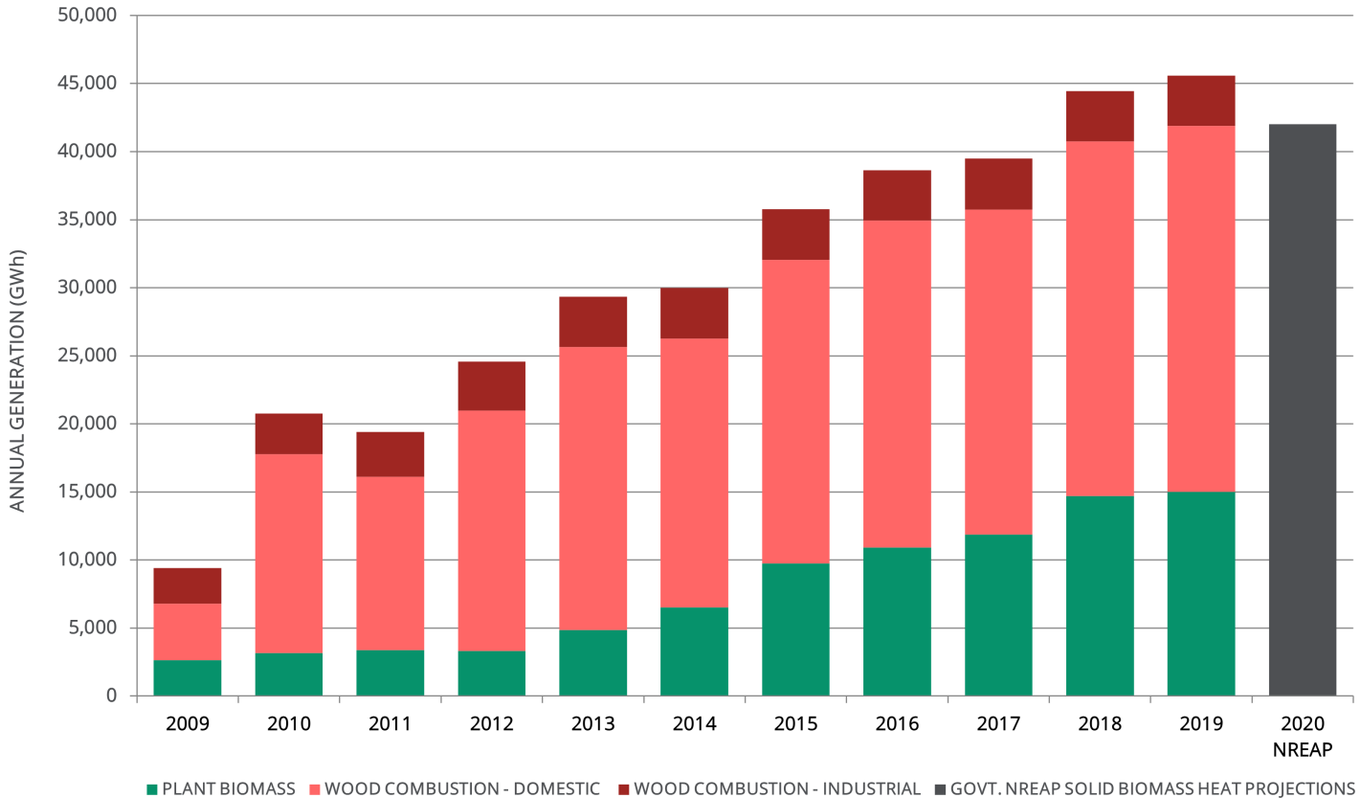


Wood Combustion (Domestic and Industrial)

Domestic wood combustion, which includes logs used in fireplaces, remains the largest source of renewable heat generation, despite limited growth in 2018-19, as policy encourages the switch to cleaner wood fuels for use in biomass heat boilers and stoves.

When combined with industrial wood combustion - which in turn did not see a rise in generation - the wood combustion sector accounts for half of all renewable heat generation.

BIOMASS HEAT (E.G. WOOD PELLETS, WOOD CHIP OR ENERGY CROPS) GENERATION



Deep Geothermal

Deep geothermal has seen no change in either heat or power generation in the last 14 years, and this remained the trend for 2019.

However, there are a number of projects currently under development, so it is hoped this could change in within the next year or so – though this will be unlikely without improved Government support for the sector.

The REA has strongly supported the development of geothermal projects in the UK for some time.

In 2021, the REA commissioned ARUP to produce a report which detailed existing deep-geothermal decarbonisation opportunities in the UK, and which strongly advocated specific forms of Government support.

The REA – ARUP deep geothermal report can be found on the REA website Resources section, or here if reading the electronic version of REview21.

www.r-e-a.net/government-urged-to-help-deliver-a-world-leading-deep-geothermal-sector-to-secure-the-uks-green-recovery/

Heat Pumps (Air and Ground Source)

Heat pump installations saw a significant increase in 2015 in line with the Domestic RHI's introduction.

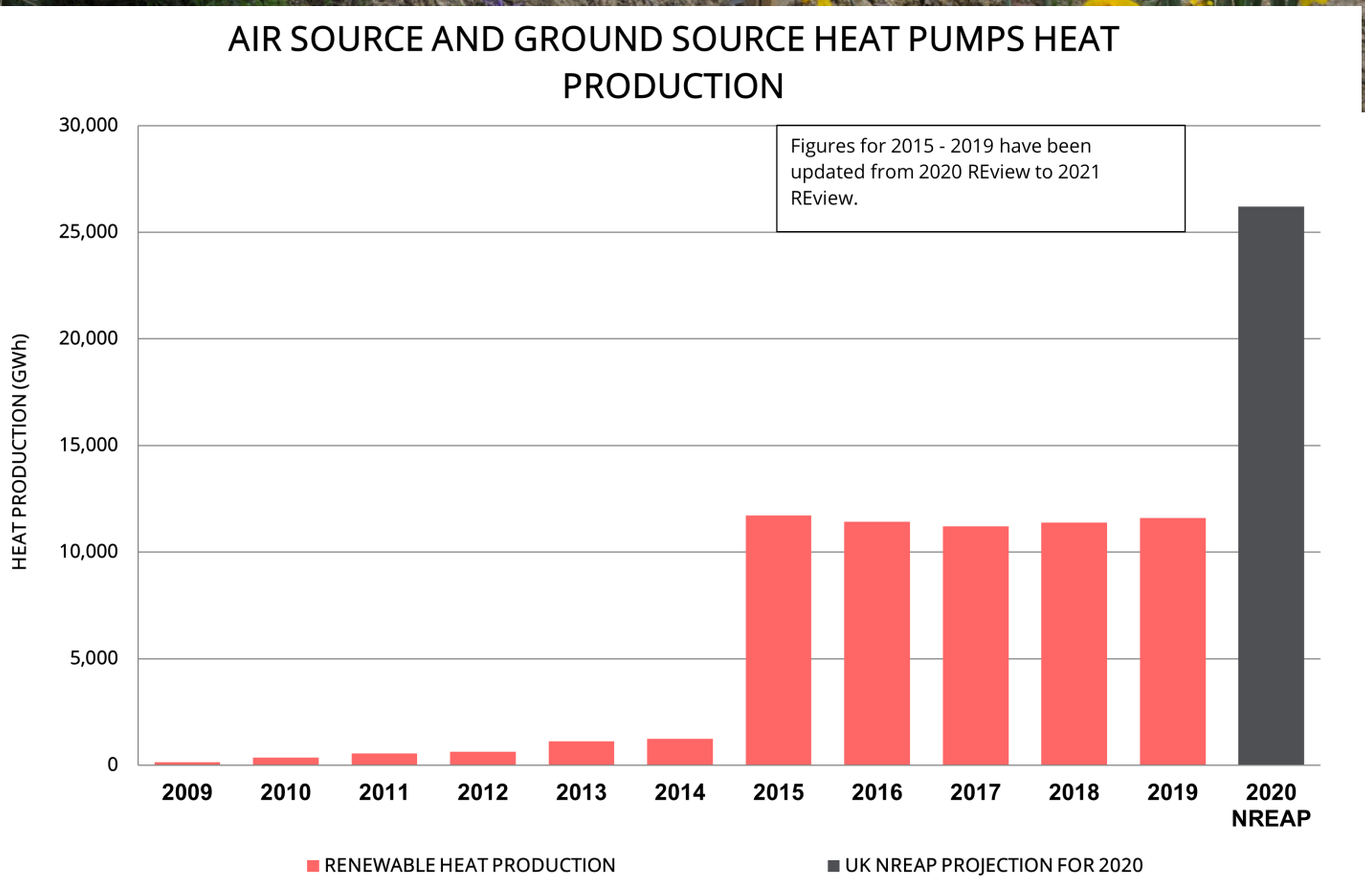
Since then, heat generation growth has largely stagnated despite a small rise in 2019. As a result, generation is still far below BEIS's 2020 NREAP projections, with the REA's projection for 2020 of the sector meeting just 45% of BEIS's estimate.

We believe this is due to a range of reasons, such as the RHI being ineffective at driving deployment and addressing the requirement for significant upfront running costs due to the fact that green levies and use of system fees are currently passed onto electricity bills.

Solar Thermal

Solar thermal saw only a small rise in heat generation in 2019, producing just 7 GWh more than in the previous year.

This has brought solar thermal's heat generation up to 620 GWh meaning that the technology still only represents a small element in overall renewable heat generation.



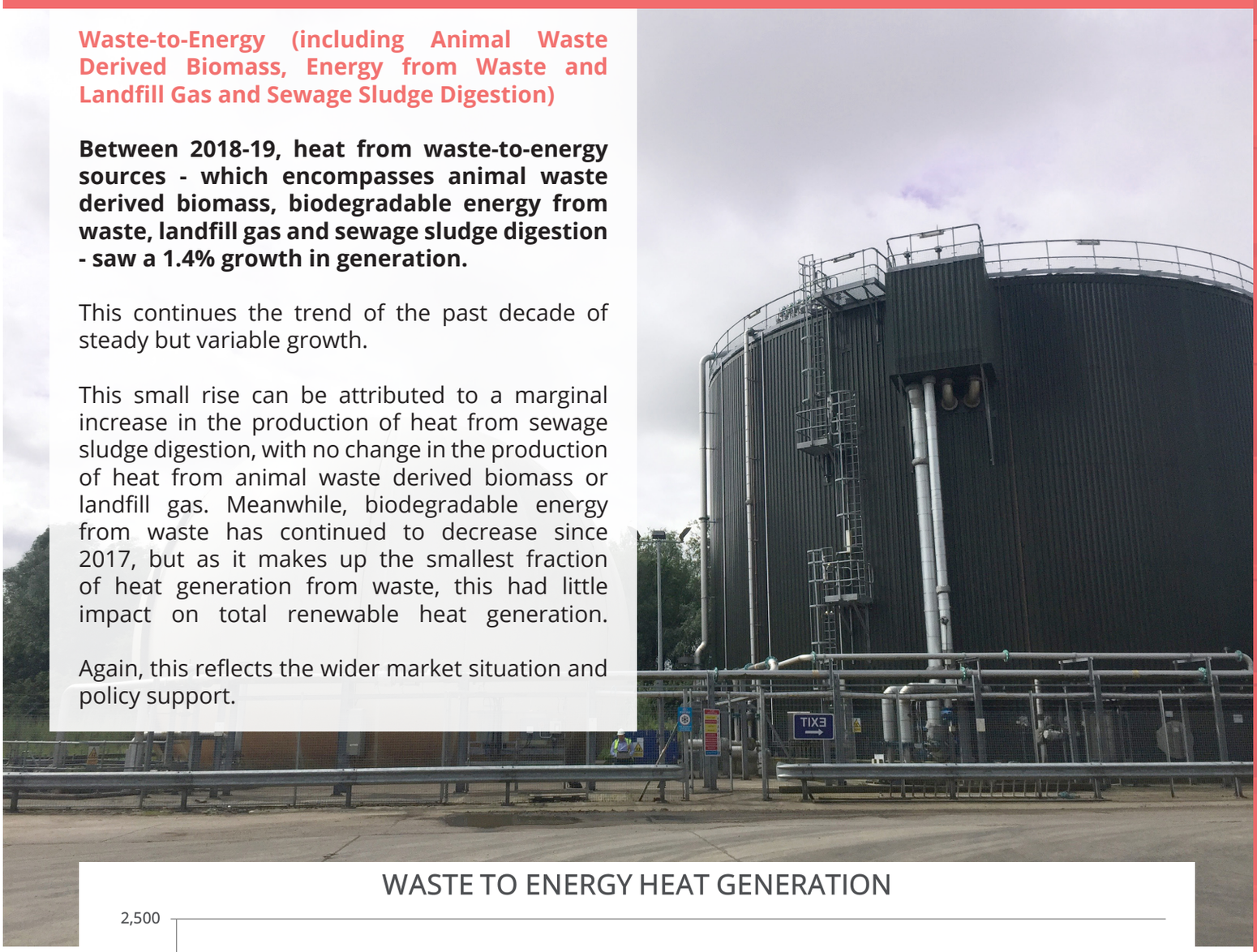
Waste-to-Energy (including Animal Waste Derived Biomass, Energy from Waste and Landfill Gas and Sewage Sludge Digestion)

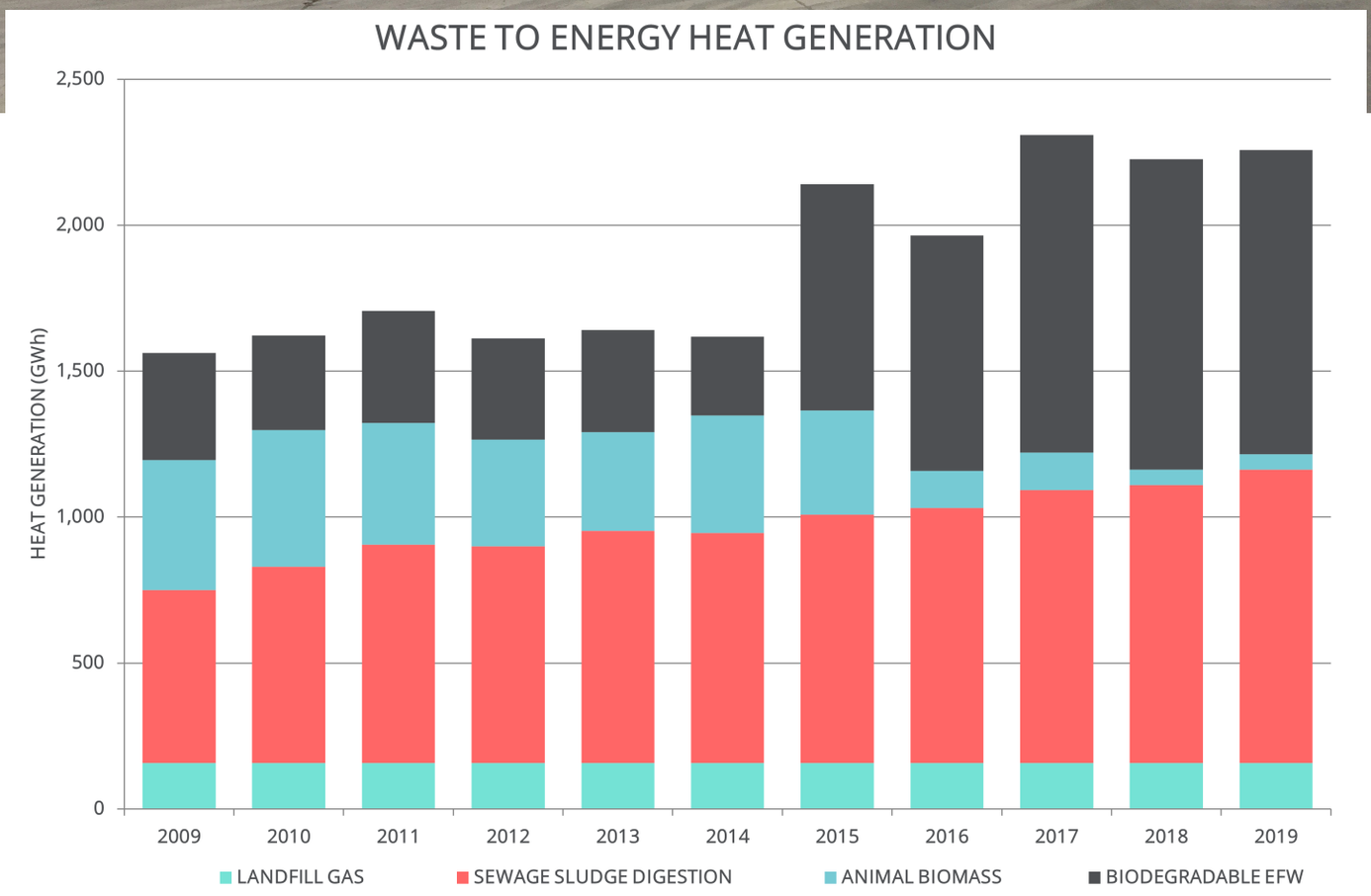
Between 2018-19, heat from waste-to-energy sources - which encompasses animal waste derived biomass, biodegradable energy from waste, landfill gas and sewage sludge digestion - saw a 1.4% growth in generation.

This continues the trend of the past decade of steady but variable growth.

This small rise can be attributed to a marginal increase in the production of heat from sewage sludge digestion, with no change in the production of heat from animal waste derived biomass or landfill gas. Meanwhile, biodegradable energy from waste has continued to decrease since 2017, but as it makes up the smallest fraction of heat generation from waste, this had little impact on total renewable heat generation.

Again, this reflects the wider market situation and policy support.





REA Strategy 'pillar' recommendations: Heat & Cooling

• OVERARCHING POLICY:
A co-ordinated, long term policy framework for heat decarbonisation is critical.

• SUPPORT ALL RENEWABLE TECHNOLOGIES:
Address the policy gap around hard-to-treat properties and build upon existing industries - bioenergy is key.

• CLOSE POLICY GAP FOR BUSINESS AND INDUSTRY:
- Tariff support for the replacement of fossil fuels within industrial heat applications and support fuel switching.
- Funded CfD for industrial heat decarbonisation, covering bioenergy, heat pumps and other low-carbon technologies and fuels.
- Tax benefits (e.g. EIS tax credit support and business rate exemptions) providing cost savings for companies installing low carbon heat.

• HYDROGEN:
A clear strategy and policy framework to support investment and mass deployment of low-carbon hydrogen, underpinned by a transparent and robust methodology for carbon accounting for different hydrogen production pathways. Delivering zero or negative GHG emissions should be the long-term goal.

• ASSESSING ALL OPTIONS:
Consider moving the cost of green levies (LCF, ECO, etc) from electricity bills to general taxation. Investigate moving to fossil fuel-based gas bills, to incentivise the electrification of heating.

Circular Bioresources

Natural Resources & the Circular Bioeconomy

The circular bioresources sector is wide-ranging and data on it often focuses on specific parts rather than the whole of it.

The previous edition of REview titled this section "Natural Resources & the Circular Economy"; this year, we focus on "Circular Bioresources", in line with the corresponding pillar from the REA Strategy.

This section includes circular management of bioresources using the following technologies: all forms of composting; Anaerobic Digestion; biological treatment of the organic fraction from residual wastes; the land-spreading of plant materials, plus compost and digestate-like-outputs from Mechanical and Biological Treatment (MBT) processes; and bio-based, biodegradable packaging and non-packaging products.

7.9m

2012-2018 RISE IN FEEDSTOCK ANNUAL TONNAGE TREATED BY AD AND COMPOSTING IN ENGLAND.

3.9%

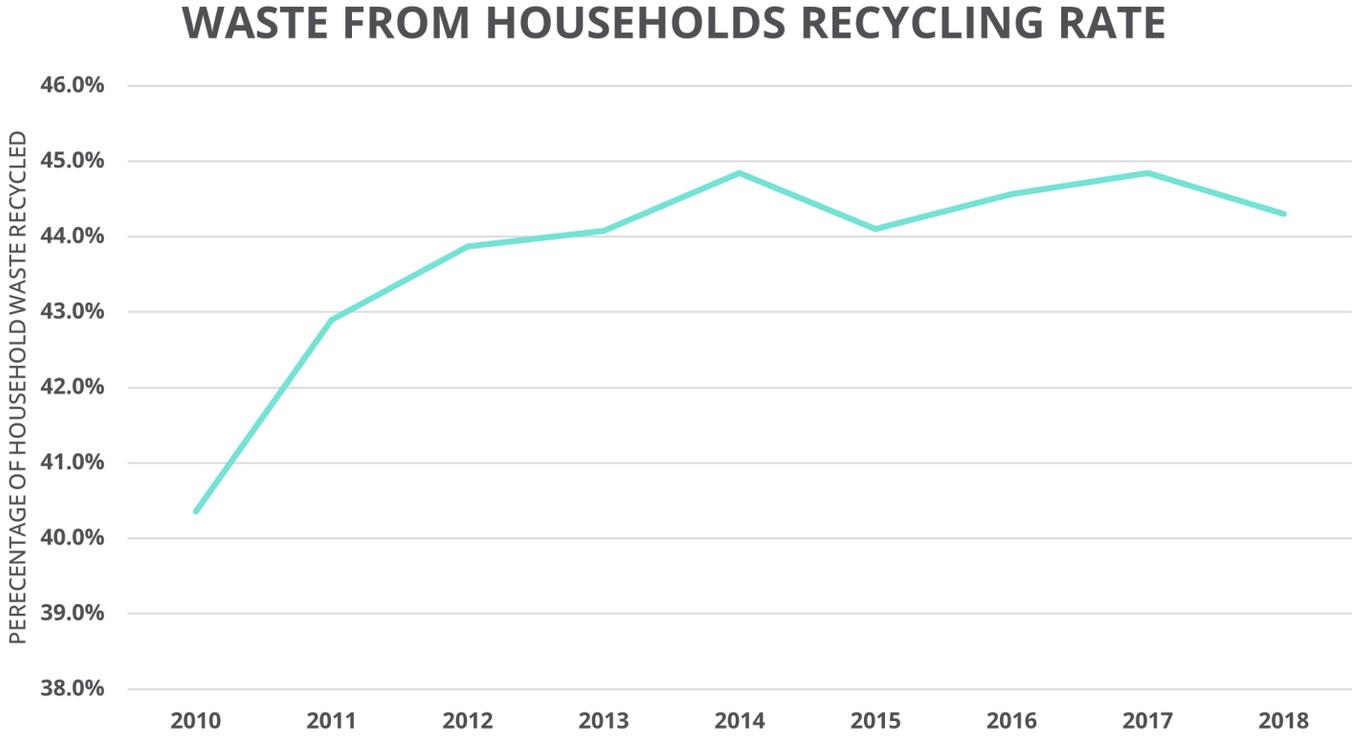
PERCENTAGE INCREASE OF RECYCLING RATES FOR ALL HOUSEHOLD WASTE BETWEEN 2010 AND 2018.

Measuring progress over such a wide-ranging sector, and collecting meaningful data for each technology and the biodegradable waste and non-waste materials they have treated, is a difficult task.

In this year's REview21, we measure progress using data from the latest WRAP industry survey, and Defra's UK statistics on waste.

This year focuses on the composting and anaerobic digestion industries, noting trends over the past decade in recycling rates for wastes from households, the number of operational sites in each industry, and the quantity of feedstocks processed.

In the UK, the recycling rate of all wastes from households (excluding IBA metals) has increased from 40.4% in 2010, to 44.3% in 2018.



Under the European Union Waste Framework Directive (WFD), EU Member States were set a target to recycle 50% of household waste by 2020; since the EC's proposal and adoption of its Circular Economy Action Plan in 2015 - and UK's exit from the EU at the end of 2020 - the UK Government has been working on transposing a selection of that plan's targets.

The increase in the UK's recycling rate from 2010 to 2018, for wastes from households, has occurred through a 543,000 tonne fall in annual arisings of those wastes and an 821,000 tonne increase in the amount of such wastes recycled during that period.

This translates to an average growth rate of -0.24% per annum for the amount of waste arising from households, and an average growth rate of 0.96% per annum for the amount of waste recycled.

The REA projects that if these rates of change in the amount of household waste arisings and the amount recycled continue, the UK's recycling rate for wastes from households may be close to 45.4% in 2020.

-58

FALL IN COMPOSTING SITES OPERATING UNDER PERMITS IN ENGLAND BETWEEN 2015 AND 2019.

This is well under the 50% required by the EU WFD and leaves us with much progress to make towards more recent targets set by Government in the UK.

While the number of operational Anaerobic Digestion sites has increased rapidly over the past decade in England, the number of composting sites operated under waste management permits has declined.

In 2012, there were 70 operational AD sites in England, rising to 372 in 2019. The number of composting sites operating under permits in England has fallen from 291 in 2010 to 272 in 2019, having peaked at 330 in 2015.

302

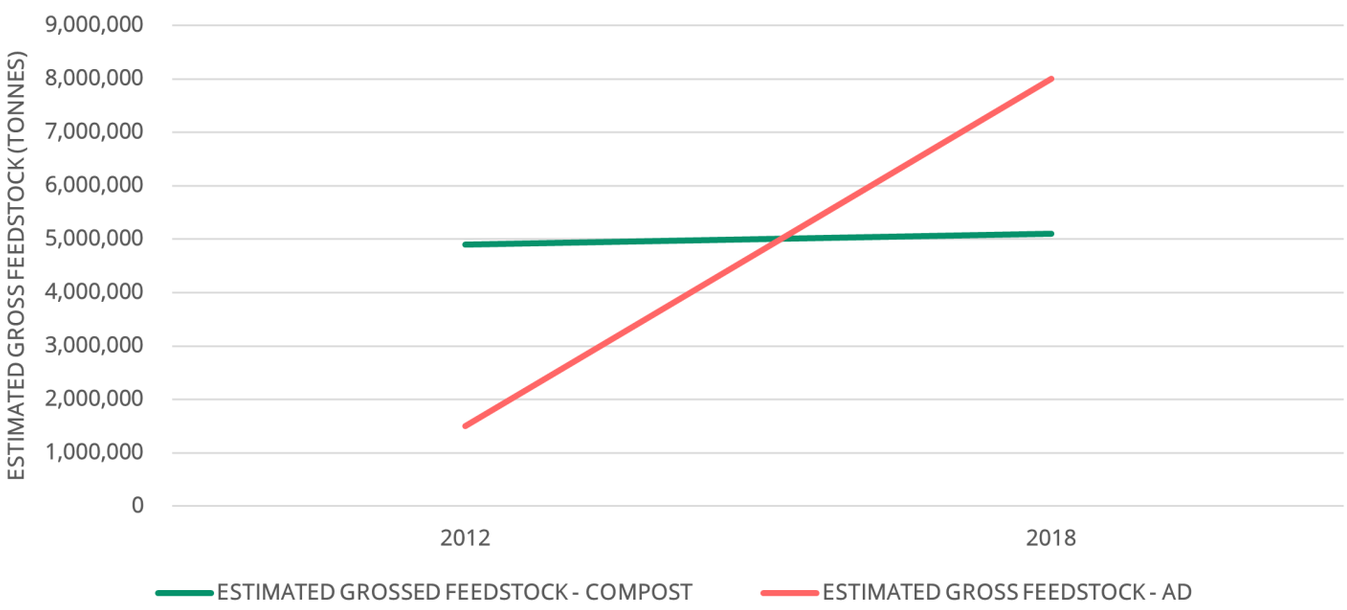
INCREASE IN THE NUMBER OF AD SITES IN ENGLAND FROM 2012 TO 2019.

The number of operational AD sites has substantially increased to provide capacity to treat much higher feedstock tonnages per annum. In England, the AD industry in 2012 processed a gross estimated 1,500,000 tonnes of feedstock, rising to 2,100,000 tonnes in 2013, and 8,000,000 tonnes in 2018.

Meanwhile, in the composting industry, the feedstock tonnages treated per annum have not grown as much and there has been a modest fall in the number of sites operated under permits since 2015.

In England, the composting industry in 2012 processed a gross estimated 4,900,000 tonnes of feedstock, rising to 5,100,000 tonnes in 2018.

COMPOSTING AND AD ESTIMATED GROSSED FEEDSTOCK



REA Strategy 'pillar' recommendations: Circular Bioresources

• FOOD AND GARDEN WASTE COLLECTION:
The Environment Bill must mandate the separate collection of food and garden waste. Allow co-collection where collecting separately is not technically or economically practicable or where it would have no significant environmental benefit.

• BETTER PACKAGING SYSTEM PROVISIONS:
Recognise organics recycling in the reformed Packaging Producer Responsibility System.

• EDUCATION:
Fund education campaigns focused on the correct disposal of waste items and good consumer habits.

• STORING TREATED ORGANIC MATERIALS:
Ensure operators can build in the costs of adequate storage capacity for treated organic materials into their business models. Support them to comply with the Clean Air Strategy by minimising ammonia emissions. Deliver fair and consistent Farming Rules for Water.

• INCREASE QUALITY, VALUE AND USE OF ORGANIC MATERIALS:
Achieve joined up policy across waste, natural capital and soils which drives up the quality of organic materials and recognition of their carbon and soil organic matter benefits, and reward land managers for managing soil health.

• PEAT PHASE-OUT:
Ensure Government phase-out of UK and international sources of peat in all growing media product types where technically feasible.

Deployment: Transport

Renewable Transport Summary

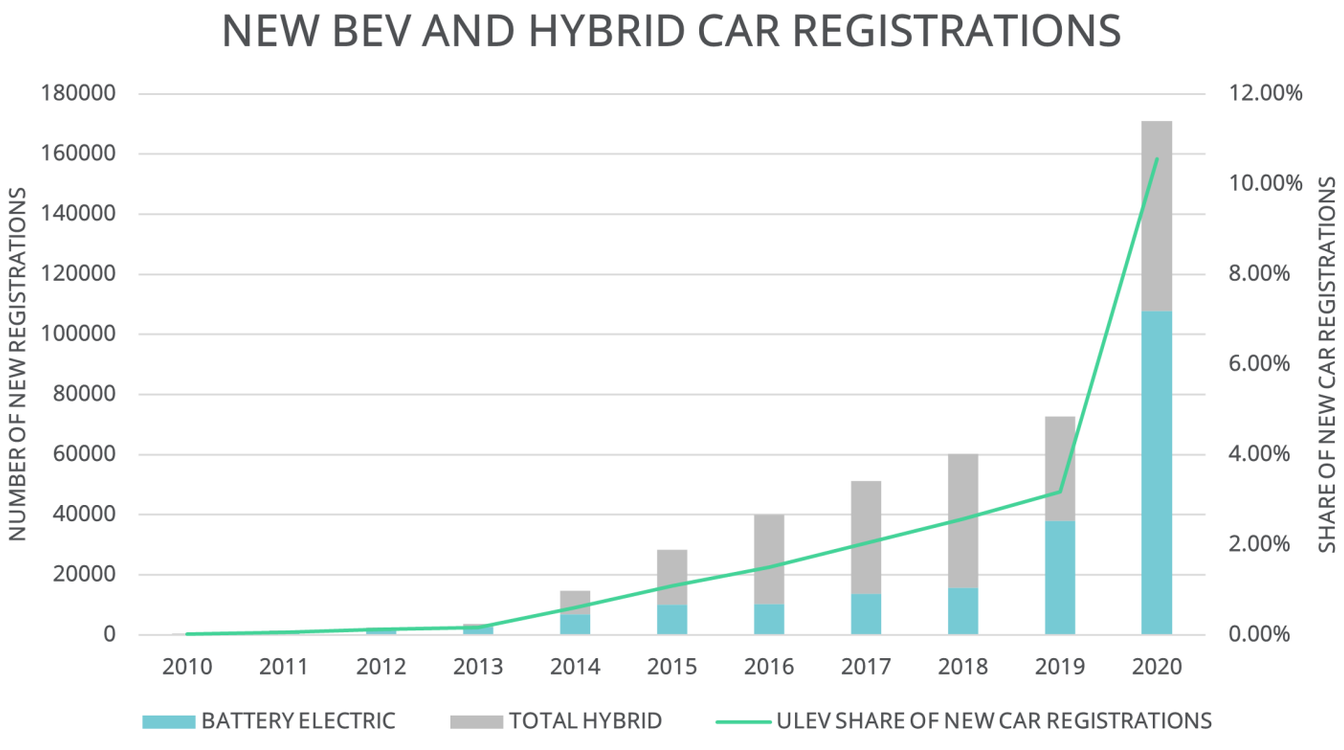
In 2019, the transport sector accounted for 34% of all carbon dioxide emissions, and 91% of transport greenhouse gas emissions came from road transport vehicles; of road transport greenhouse gas emissions, cars accounted for 55%.

Impressive progress has recently been made, however, with significant growth in the consumption of biofuels in 2018 and 2019. This is even before the implementation of E10 petrol in September 2021, which is projected to reduce emissions per road vehicle by 2%.

The Government recently consulted on modest increases to its targets for biofuels use from 2022, which should reduce emissions further.

In addition, while the Electric Vehicle (EV) and Hybrid market only saw moderate growth in 2019, the ban on new sales of petrol and diesel cars and light vans, increased consumer awareness and investment in public EV charging infrastructure sets the path for increased uptake in future years.

The impact of this is already becoming obvious, with the combined market share of new car registrations for EVs and hybrid cars rising from 3.17% to 10.56% between 2019-20. More needs to be done to equip the UK with a strategic rapid charging network and home and destination chargers, alongside improving the 'interoperability' of EV charging infrastructure, with policy developments accelerating rapidly in this area.



Deeper Insight: Transport

Electric Vehicles and EV Charging

Data on ultra-low emission vehicles (ULEVs) and EV charge-points is now more readily available, with this section covering the latest data available, while placing an emphasis on 2019 - both the ULEV and EV charge-point markets have seen significant growth recently.

The number of EV charge-points in the UK grew by 43% between 2018-19, 74% in 2019-20 and 23% in 2020-21.

The distribution of charge-points between slow, fast, and rapid has remained evenly distributed with each charge-point type making up approximately 25%, 50% and 25% of total charge-points in 2019, 2020 and 2021, respectively.

Industry is currently mapping the requirements for the UK's EV charging infrastructure overall, but it is clear the country will need many more rapid and other chargepoints in the coming years as the share of EVs rapidly increases.

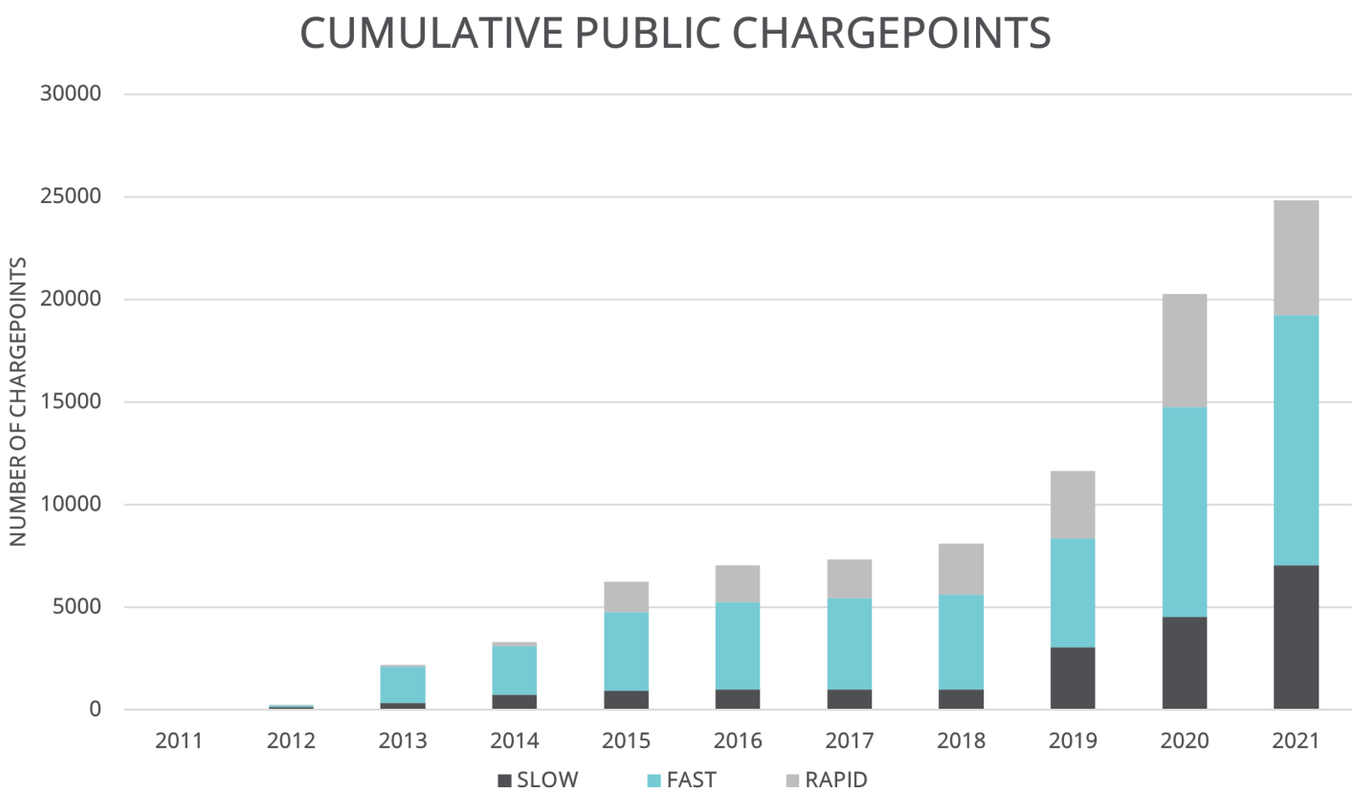
The market for EVs and hybrid cars has also expanded significantly in recent years although from a low base. The growth rate of the combined market for EVs and hybrid cars was 17.41% between 2017-18, 20.85% for 2018-19, and 134.97% growth in 2019-20. While hybrids have been a major part of this growth, battery electric vehicles (BEVs) have more recently been behind this expansion of the ULEV market. Increases of 14.03%, 140.93%, and 184.4% for the above period demonstrate that.

10.56%

EV MARKET SHARE OF NEW VEHICLE SALES IN 2020, UP FROM 3.17% IN 2019.

Meanwhile, the market for sales of new hybrid cars has grown and shrunk repeatedly in the past five years, varying considerably. This paints an inaccurate picture of the decarbonisation of the transport sector and it must be noted that these figures only represent new registrations. The variation in the lifespan of cars, and the existence of second-hand markets, makes it difficult to track the actual presence of ULEVs on the road.

The uncertainty around hybrid cars is offset by the rapid expansion of EVs, which collectively increased their market share of new vehicle sales from 3.17% in 2019, to 10.56% in 2020 (albeit a very low year for new car sales due to the pandemic).



Renewable Transport Fuels

The consumption of renewable transport fuels grew by 27.3% from 2018-19, building on an increase of 36.9% in 2017-18.

However, despite this strong growth in 2018 and 2019, the three preceding years saw stagnant growth and meant that, in 2019, liquid biofuel consumption was only 41.3% of BEIS's 2020 NREAP projections.

The market for deployment and use of these fuels is largely driven by the Government's support policy, the Renewable Transport Fuel Obligation (RTFO). Concerns over the potential impacts of crop-based fuels led to the policy severely curtailing its ambition over much of the last decade. Over that time, the potential impacts of crop feedstocks have become much better understood and the policy has refocussed to incentivise low risk, waste-derived fuels and innovation. This includes supporting hydrogen for transport applications made from a range of sources, gasification and pyrolysis and other innovative production pathways.

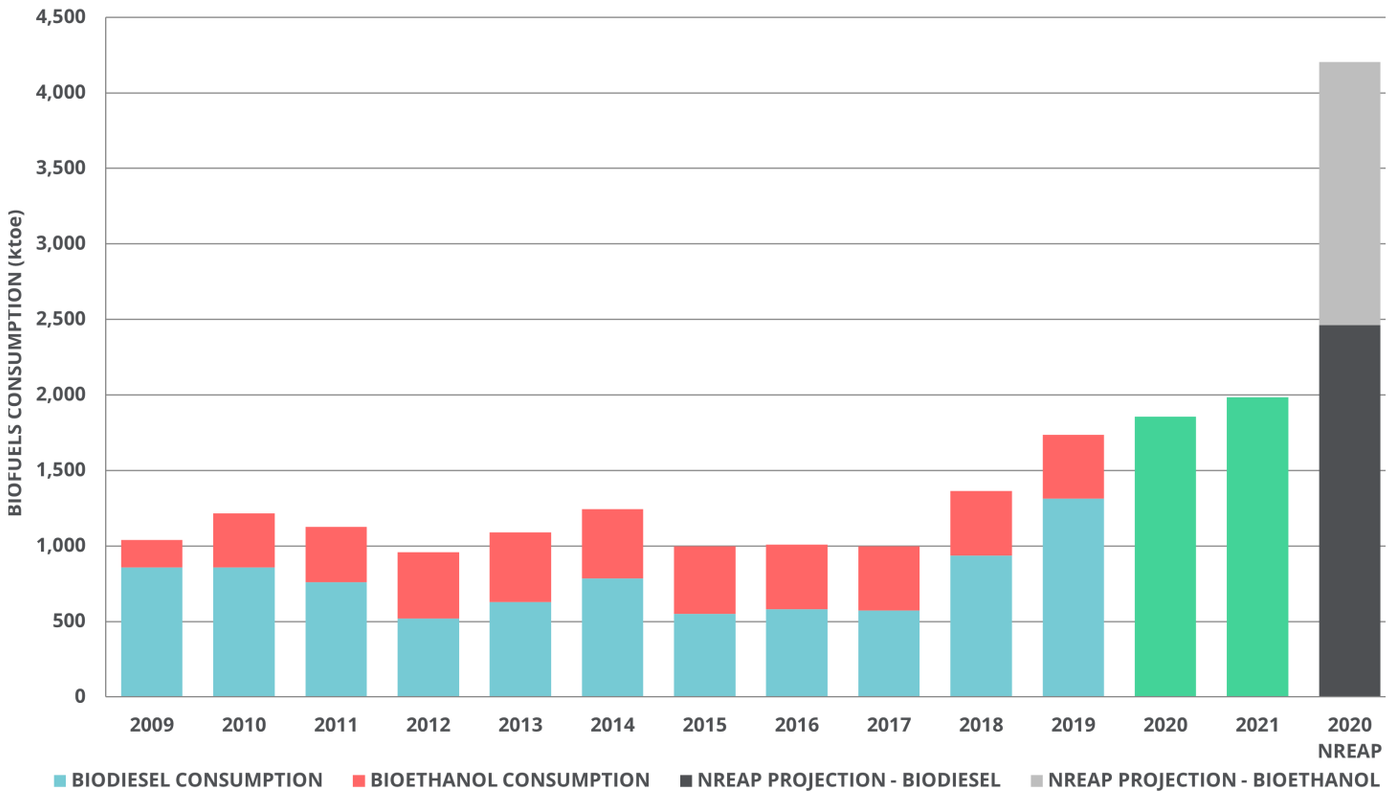
The policy is also looking at areas where there are fewer alternatives and in particular those where electrification is unlikely to be viable in a reasonable timeframe. Biomethane is one of the key fuels that is available now and has seen

significant growth in recent years, both in use and the fuelling infrastructure to support it.

The major HGV manufacturers are also bringing out competitively priced models that run on 100% biomethane. Other sectors in which the Government is looking to drive greater use of renewable fuels include aviation and marine.

While the introduction of E10 in September 2021 and changes to the RTFO mean that we expect to see continuing growth in the market for biofuels, the COVID-19 pandemic has resulted in much lower consumption in 2020 and 2021. There is no reason to believe these changes will be permanent unless there is a corresponding long-term change to peoples' travelling habits.

BIOETHANOL AND BIODIESEL CONSUMPTION AND PROJECTED GROWTH



REA Strategy 'pillar' recommendations: Transport

• OFFER LONG-TERM SUPPORT:
Set increased targets in the RTFO to match the scale of decarbonisation needed - for 2032 and beyond.

• BRING INNOVATIVE TECHNOLOGIES TO MARKET:
Provide additional support for infrastructure and financial backing to bring investment in first of a kind production plant to the UK.

• GO BEYOND E10:
Support higher blends of fuels in transport - with ethanol, biodiesel and biomethane all able to make a contribution in the near term.

• INTRODUCE AMBITIOUS POLICIES:
The Government must deliver detailed and far-reaching policy for sectors where fuels will have a key role in decarbonisation - particularly aviation and marine.

• FOCUS ON HGVS:
Government should clarify when it expects new diesel HGV sales to be phased out.

• EV SUPPORT:
Maintain adequate grant funding to overcome areas of market failure and provide targeted support to help local authorities to improve their local EV charging infrastructure networks.

Finance

Employment: Renewables & Clean Tech

Every year, the REA's REview report provides an insight into the level of employment and investment in the renewable energy and clean technology sector.

The report includes the latest jobs and investment figures, as well as the total number of companies operating in the sector. This year's analysis covers the financial periods 2018/19 and 2019/20.

Working alongside Innovas, and using their technical modelling to understand the spread of Full Time Equivalent (FTE) jobs, the number of active companies, and market value, we have concluded that for the financial year 2018/2019, there were 133,977 people employed in the renewable energy sector, and in 2019/2020, there were 138,264 people employed in the renewable energy sector; this translates to an increase of 5,032 or 3.9% from 2017/18 to 2018/19, and of 4,287 or 3.2% from 2018/19 to 2019/20.

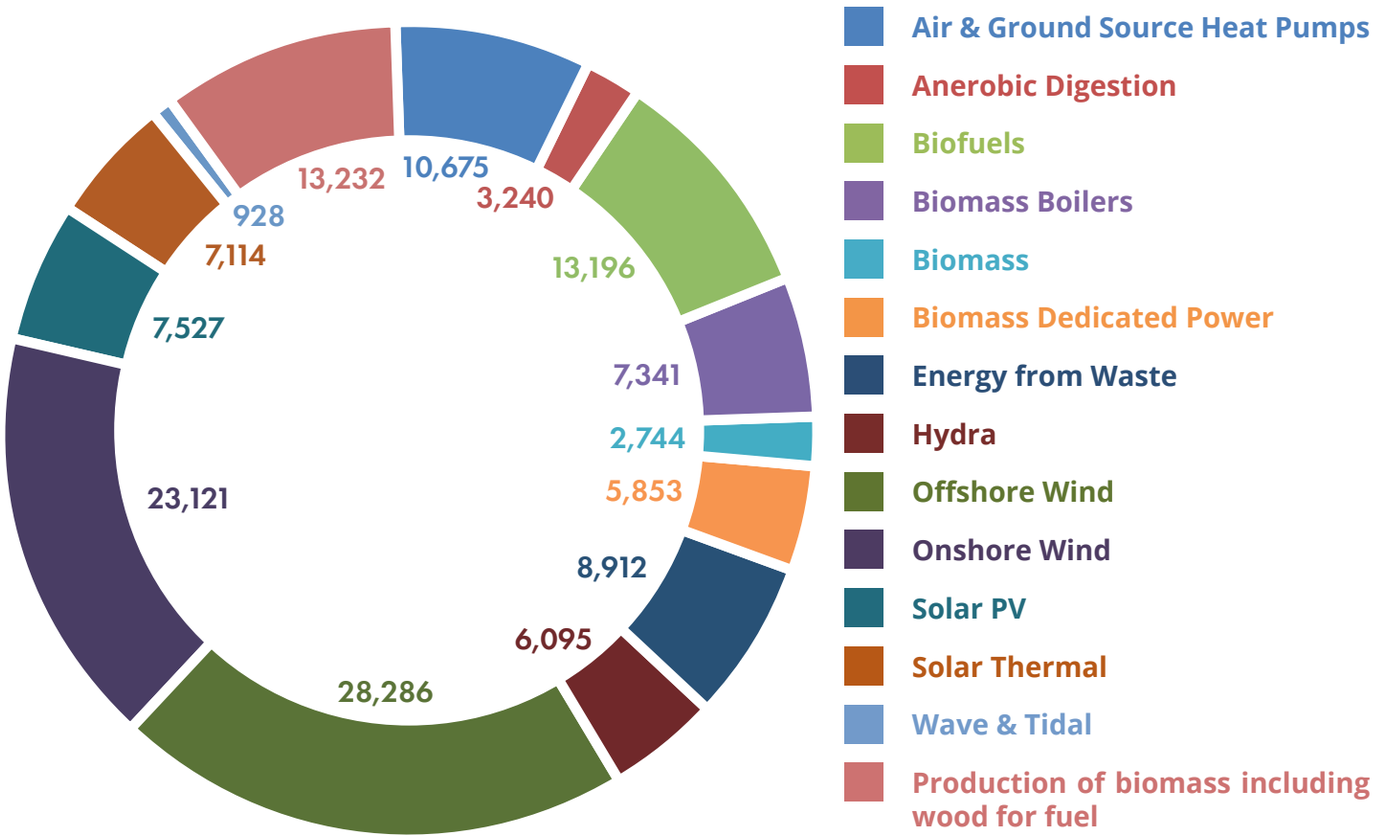
In addition, the renewable energy sector has seen growth of 9.6% in market value to £20.6 billion in 2018/19, and of 8.7% in market value to £22.4 billion in 2019/20. Since 2014, the renewable energy sector has employed an additional 15,433 people and increased in value by £5.4 billion. The continued growth of the renewable energy sector in 2018/19 and 2019/20 comes ahead of policy changes in 2020 and the shocks caused by the COVID-19 pandemic.

£22.4bn

MARKET VALUE OF THE RENEWABLE ENERGY SECTOR IN 2019/20, AN 8.7% INCREASE ON THE PREVIOUS YEAR.

Detailed economic figures are not yet available for the period 2020/21, which will reveal some of the impact of COVID-19 on the renewable energy sector in the UK. However, early analysis by Innovas suggests that there are signs that show a large decrease in new installations being built and commissioned.
This is due to lockdowns, restricted access to access to both domestic and non-domestic installation sites, disruptions to the movement of installation teams internationally, and the recent impacts of the international shipping crisis.

EMPLOYMENT IN 2019/20 BY SECTOR



Some of the negative impacts of the COVID-19 pandemic are likely to be mitigated by the furlough scheme and some welcome specific emergency changes and exemptions granted to the sector.

This year's version of REview comes at an unprecedented time. While the period covered by the report covers 2018–2021, the employment section will specifically look at the financial years 2018/19 and 2019/20. This is due to the writing of REview 2020 being disrupted by the pandemic.

In this report, we take a look back, and forecast forwards, to understand how far our industry has come and understand where opportunities lie in our market and in our country. In addition, the REA Energy Transition Readiness Index (ETRI) - previewed ahead of its publication later this year - will consider if the right policy support is in place in the UK to support the development of a strong renewable energy and flexible clean technology sector.

Using data from the REA Bioenergy Strategy, in addition to data from the Bloomberg NEF "Flexibility Solutions in High Renewable Energy Systems" report which the REA supported, alongside Innovas employment modelling, we have forecast that there could be 333,000 jobs in renewable energy and clean technologies by 2035, more than double the employment levels in 2019/20, should there be a favourable policy environment which takes into account REA policy recommendations.

This year, we have broken down our modelling on projected employment in the renewable energy sector to the regional level. This highlights the potential jobs created by growth in the renewable energy sector in each devolved nation, as well as each region in England.

138,264

NUMBER OF PEOPLE EMPLOYED BY THE RENEWABLE ENERGY SECTOR IN 2019/20, A 3.2% INCREASE.

Looking Back

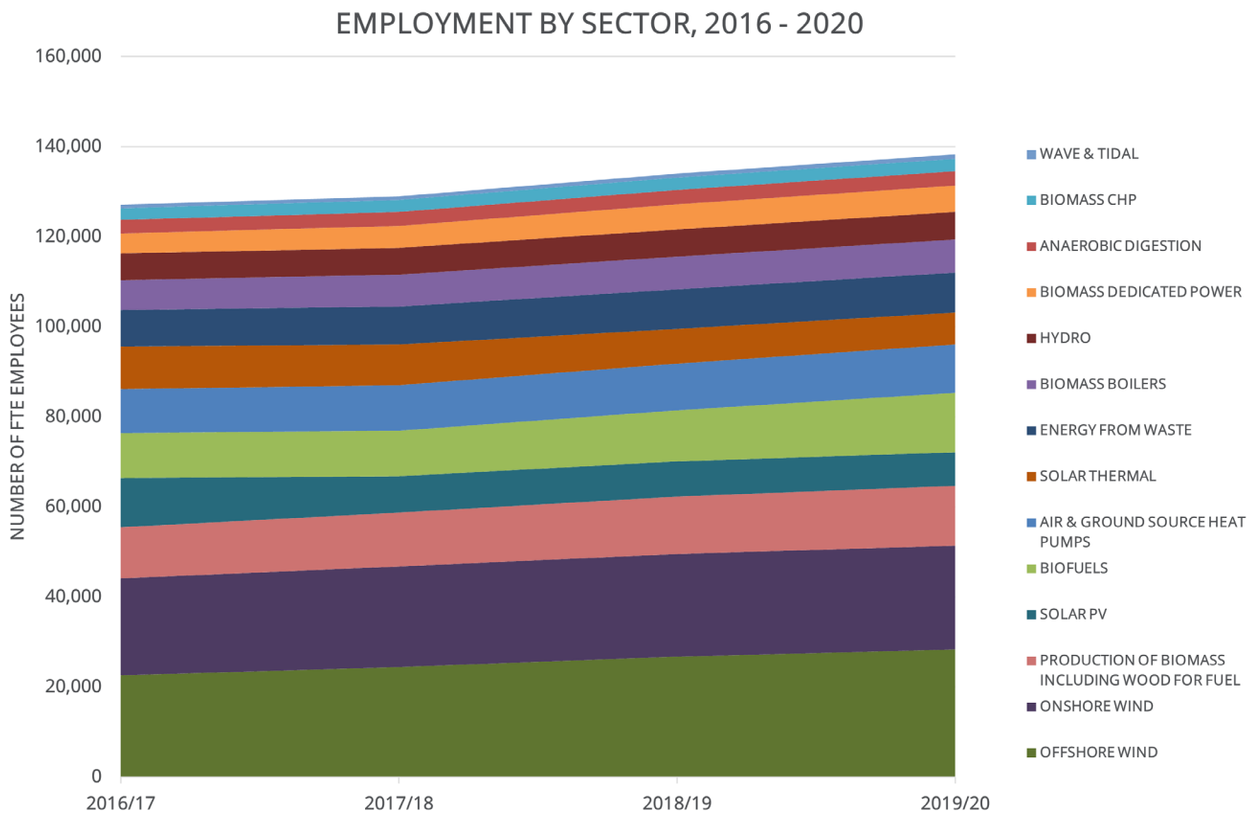
Analysing the UK's employment & investment

The largest subsector in terms of market value is the offshore wind sector, which employs around 28,300 people and has a market value of £5.4 billion. This is an increase of 33% and 15.9% from 2017/18 to 2018/19 then to 2019/20.

Onshore wind was the second largest subsector with a market value of £3.8 billion and employing around 23,100 people. This is an increase of 7.2% and 3.5% from 2017/18 to 2018/19 and from then to 2019/20. This shows that the offshore wind subsector is increasingly dominating the wind energy sector in the UK. The disparity in growth rates are predicted to continue once markets settle down again after the recovery from the COVID-19 pandemic comes into effect. Growth for the offshore wind sector in particular is expected to be at least 10% for each of the next few years due to planned projects in the North Sea and Government support through Contracts for Difference and the 40GW deployment target set out in the PM's 10 Point Plan for climate change.

The biofuels subsector has continued to show strong growth over the previous two years, with increases of 26% from 2017/18 to 2018/19, and 31.8% from 2018/19 to 2019/20. This change has been driven by the rise in the use of biodiesel, rather than bioethanol, suggesting that the move to B7 diesel is having the impact desired. The biodiesel subsector in 2019/20 had a market value of £2.9 billion, employing about 13,200 people.

Employment for the production of biomass has also shown good growth of 12.7% from 2017/18 to 2018/19, and 7.8% from 2018/19 to 2019/20. The biomass subsector has a market value of £2 billion and employs 13,200 people. This growth is driven largely by the biomass power subsector which has shown growth of 17.4% and 7% over the last two years. Growth in the broader biomass subsector is being supported by increased capacity at sites such as Drax due to a major 'interim CfD' project commissioning in this time period and small increases in the number of biomass systems at utility, commercial, and domestic levels partly as a result of the Renewable Heat Incentive which was still open in the period being looked at. While the above sectors have shown strong growth, the biomass boiler subsector, the energy from waste subsector, and the solar PV subsector have all shrunk or shown signs of decreasing growth. However, the solar PV sector, which had shrunk significantly in recent years, is now shrinking at a slower rate. Stagnant growth is expected over the next few years for small scale projects. The solar thermal sector has suffered as well, because the technology has not benefited from the Renewable Heat Incentive as much as air source heat pumps.



Sectors	16/17 to 17/18	17/18 to 18/19	18/19 to 19/20
Air & Ground Source Heat Pumps	2.86%	2.54%	3.32%
Anaerobic Digestion	4.33%	1.79%	1.63%
Biofuels	0.87%	13.00%	15.90%
Biomass Boilers	6.33%	1.79%	1.79%
Biomass CHP	1.31%	1.97%	1.97%
Biomass Dedicated Power	7.60%	17.49%	3.50%
Energy from Waste	4.24%	4.22%	1.47%
Hydro	1.36%	1.19%	1.33%
Offshore Wind	8.01%	9.50%	5.80%
Onshore Wind	3.70%	2.10%	1.40%
Solar PV	-25.59%	-4.01%	-3.41%
Solar Thermal	-4.10%	-14.57%	-8.57%
Wave & Tidal	4.15%	8.08%	6.79%
Production of biomass including wood for fuel	5.94%	6.35%	3.89%
Totals	**1.45%**	**3.90%**	**3.20%**

Percentage Change in Employment, by sector, from 2016/17 to 2019/20

Companies and Turnover

The number of active companies in the renewable energy sector has grown overall by a very small number.

From 2017/18 to 2018/19, the number of companies fell by three, 0.04% overall. From 2018/19 to 2019/20, the number of companies rose by 34, 0.5% in percentage terms. This means that in 2019/20, there were 6,718 companies active in the renewable energy sector. This likely reflects the reduction in policy support for solar and onshore wind but continued steady growth in other sub-sectors such as offshore wind.

Over the two years covered in these figures, the number of companies has grown for all subsectors with the exception of the solar PV and solar thermal subsectors which, particularly from 2017/18 to 2018/19, shrunk at a significant rate of -6.9% and -3.8%, respectively, due to the significant reduction of policy support.

Energy Storage

In the UK, there are currently almost 1 million solar PV installations, the vast majority of which have no battery system.

Innovas have used the Bloomberg NEF "Flexibility Solutions in High Renewable Energy Systems" to project the potential capacity, market value, and employment levels for the solar PV battery storage systems sector.

The projections feature three variations of the base scenario from Bloomberg, based on low, medium, and high uptake of battery storage systems for solar PV installations. In the base scenario, we project that there could be 5 GW of domestic solar PV capacity in 2020, rising to 12 GW in 2035.

Using this projection, we calculate potential storage capacity, market value, and employment based on the three solar PV uptake scenarios. In the high uptake scenario, this amounts to a potential market value of £1.1 billion, and 12,267 people employed by 2035 – up from a market value of £390 million and 2,133 people employed in 2020. In the low uptake scenario, this amounts to a potential market value of £365 million, and 1,480 people employed in 2035 – up from a potential market value of £130 million and 711 people employed in 2020. This vast range for just one type of storage technology demonstrates the vast potential of the energy storage sector, and signifies the importance of immediate and targeted support, to support the integration of variable sources of renewable energy generation and maximise the efficiency of our energy systems.

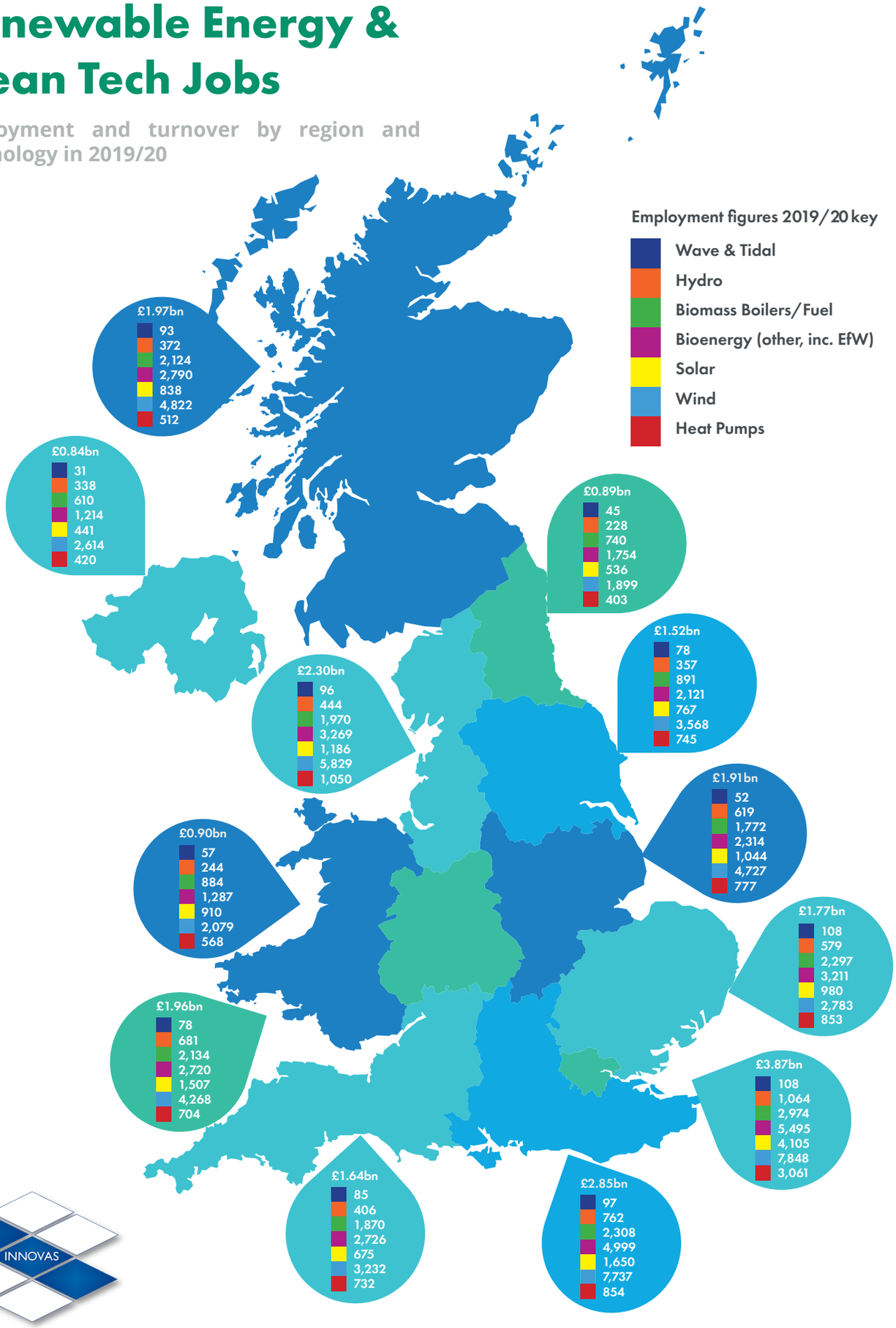
6,718

NUMBER OF COMPANIES ACTIVE IN THE RENEWABLE ENERGY SECTOR IN 2019/20.

Made in Britain 2019/20

Renewable Energy & Clean Tech Jobs

Employment and turnover by region and technology in 2019/20



Looking Forward

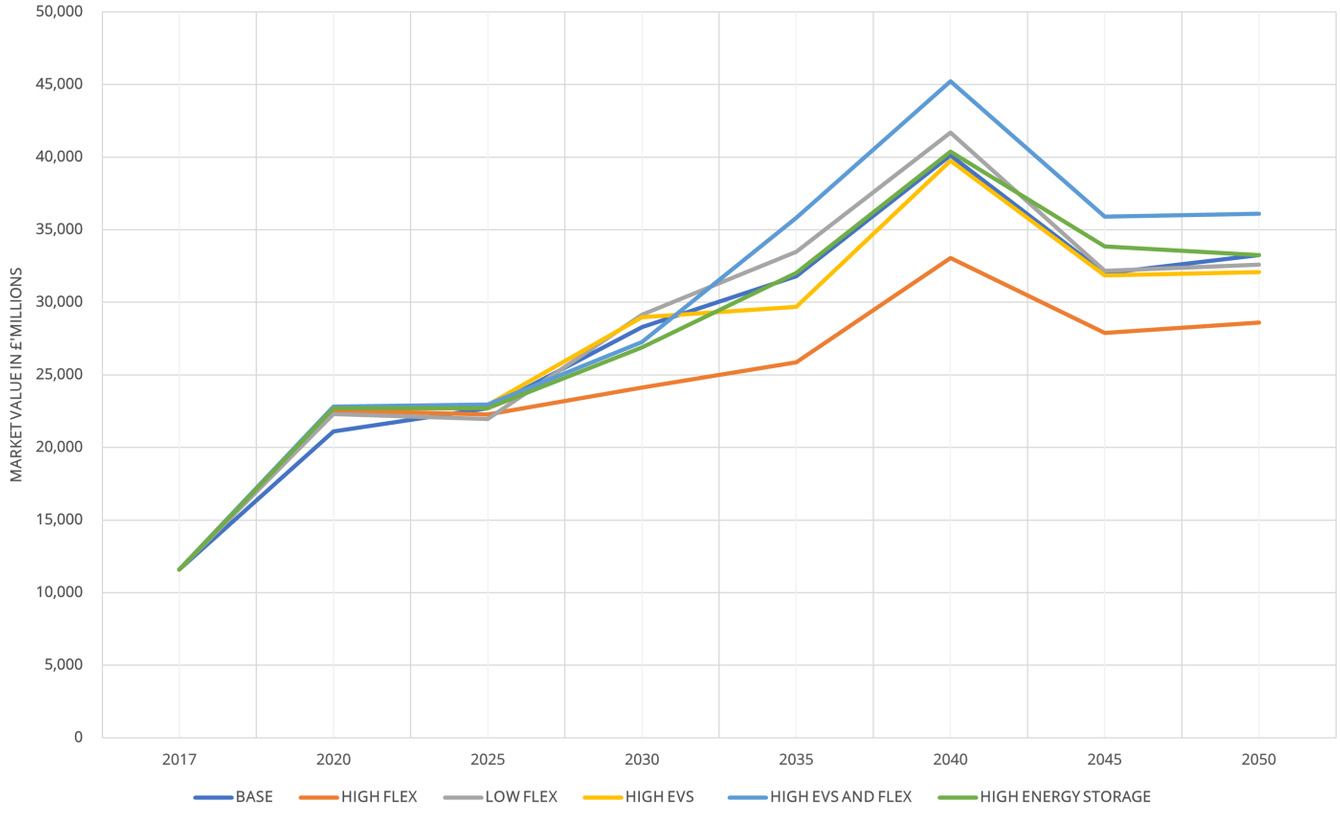
Employment and investment to 2035

In last year's REview report, the REA attempted to project forwards in terms of future job numbers for the renewable energy sector. This year, we have updated our projections and broken down these figures to the regional level.

The projections included in this report are based on two major studies conducted in 2019 by the REA or in collaboration with the REA. We have referenced the REA Bioenergy Strategy for 'Bioenergy' jobs (i.e. those associated with biomass, anaerobic digestion, renewable transport fuels, waste to energy, organics recycling, and related technologies) and the Bloomberg New Energy Finance 'Flexibility Solutions' report for what we term 'Connected – non-fuelled' technologies, such as solar, wind, energy storage, and 'smart' EV charging.

While the base data of these reports is from 2019 or earlier, data which has been made available since is in line with the projections of these two reports. In addition, projections made using the Bloomberg New Energy Finance 'Flexibility Solutions' report have been updated in analysis conducted by Innovas.

MARKET VALUE COMPARISONS FOR SIX SCENARIOS



Bioenergy Jobs Projections & the REA's Bioenergy Strategy

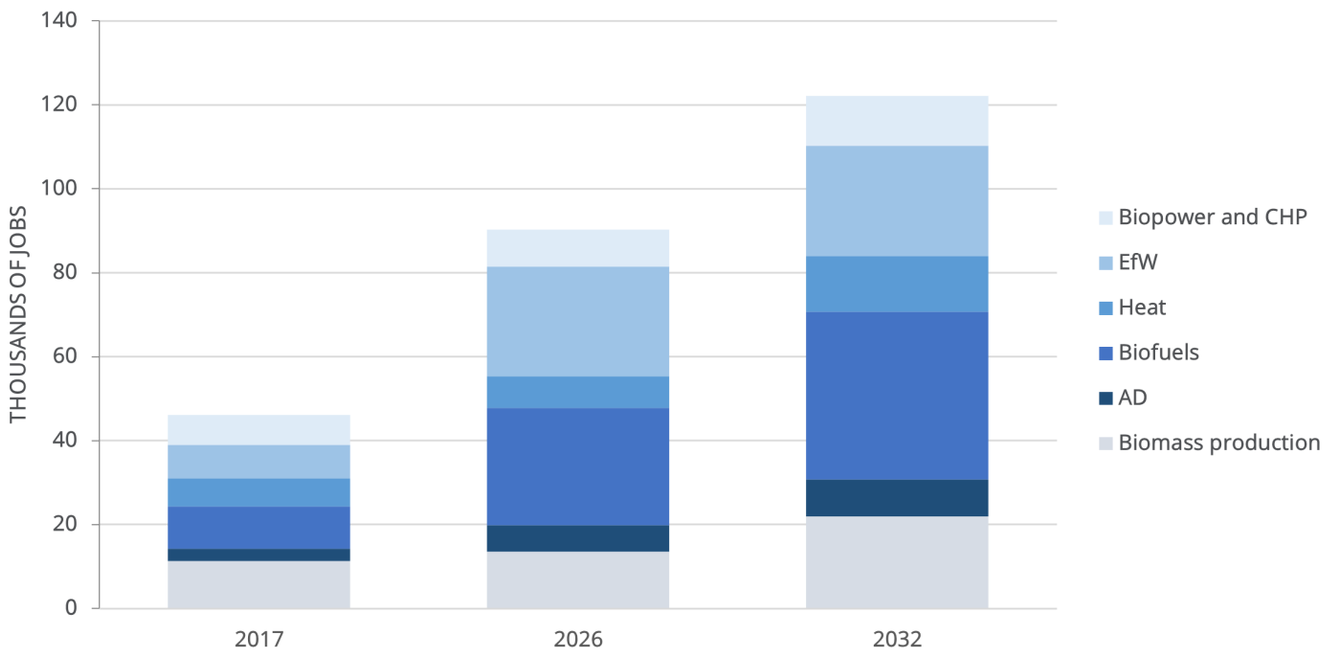
The REA's 2019 Bioenergy Strategy demonstrated that the bioenergy industry could sustainably grow to meet 16% of primary energy demand in the UK by 2032 with the right policy environment.

In mapping this growth, the strategy also made preliminary estimates for the number of jobs that would be stimulated if the projected growth was realised, by scaling up the number of jobs in each sector according to the proposed increases in energy delivered. The results indicated a rise of between 80,000 to 90,000 by 2026 and to 100,000 to 120,000 jobs by 2032, across the whole sector.

The above estimates were based on previous REview21 data that suggest there were just over 46,000 bioenergy jobs across the UK in 2016/17, including those involved in the production of biomass for wood fuel. Our latest REview figures suggest this has increased to over 54,000 jobs in 2019/20 (before damaging policy changes occurred in 2020), in line with previously growth estimates.

Further delivery against this projection will also depend on the delivery and implementation of a strong Government Biomass Strategy (currently being developed) that maintains the UK's commitment to a vibrant bioenergy industry operating in accordance with the existing stringent sustainability governance regime.

BIOENERGY EMPLOYMENT PROJECTIONS



'Connected, non-fuelled' Technologies Jobs Projections – Bloomberg Flexibility Solutions for High Renewable Energy Systems

The six scenarios used in this analysis are based on the Bloomberg report which uses a base scenario showing a large increase in wind, both offshore and onshore, and solar PV at utility scale, for an additional capacity of about 120GW supported by energy storage capacity of 33GW.

It assumes that fossil fuels will be gradually phased out with a baseline of nuclear and gas power generation retained. This is primarily focused on power generation and does not include heating requirements or broader technologies.

Our analysis focuses on the potential impacts of various projected scenarios on market value and employment. It does not include any commentary on the likelihood of this happening from a legislation or technical viewpoint, grid connection and smart grids being a case in point, or the challenges faced from such large-scale deployment particularly of solar PV and offshore wind.

It takes into account only the technologies stated in the scenario and does not include any added potential for export jobs gained by the development of home markets. Market value and employment forecasts include service and maintenance of the cumulative deployed technologies and replacement of installations every 25 years, maintaining technology deployment levels at 2040 onwards.

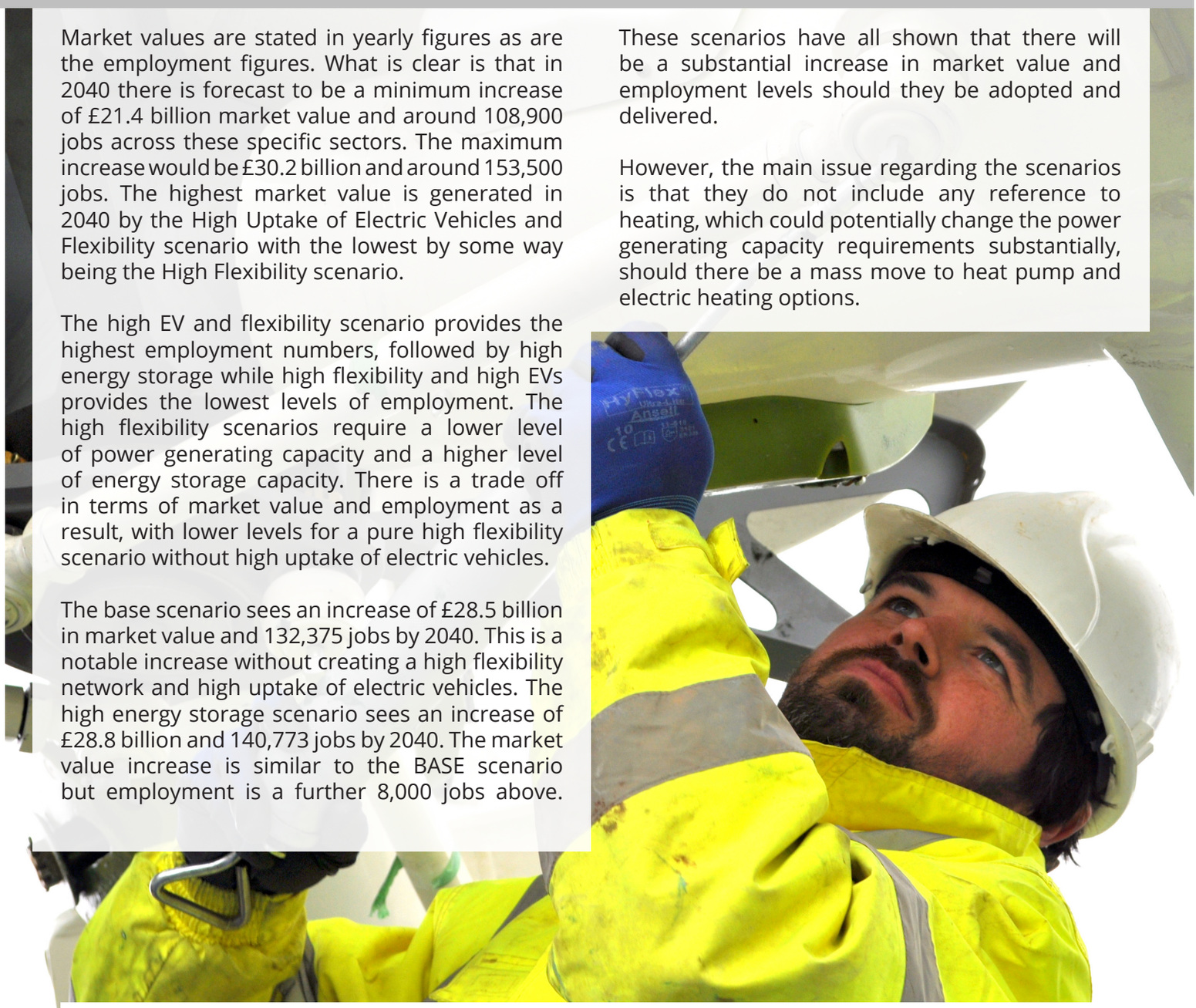
Market values are stated in yearly figures as are the employment figures. What is clear is that in 2040 there is forecast to be a minimum increase of £21.4 billion market value and around 108,900 jobs across these specific sectors. The maximum increase would be £30.2 billion and around 153,500 jobs. The highest market value is generated in 2040 by the High Uptake of Electric Vehicles and Flexibility scenario with the lowest by some way being the High Flexibility scenario.

The high EV and flexibility scenario provides the highest employment numbers, followed by high energy storage while high flexibility and high EVs provides the lowest levels of employment. The high flexibility scenarios require a lower level of power generating capacity and a higher level of energy storage capacity. There is a trade off in terms of market value and employment as a result, with lower levels for a pure high flexibility scenario without high uptake of electric vehicles.

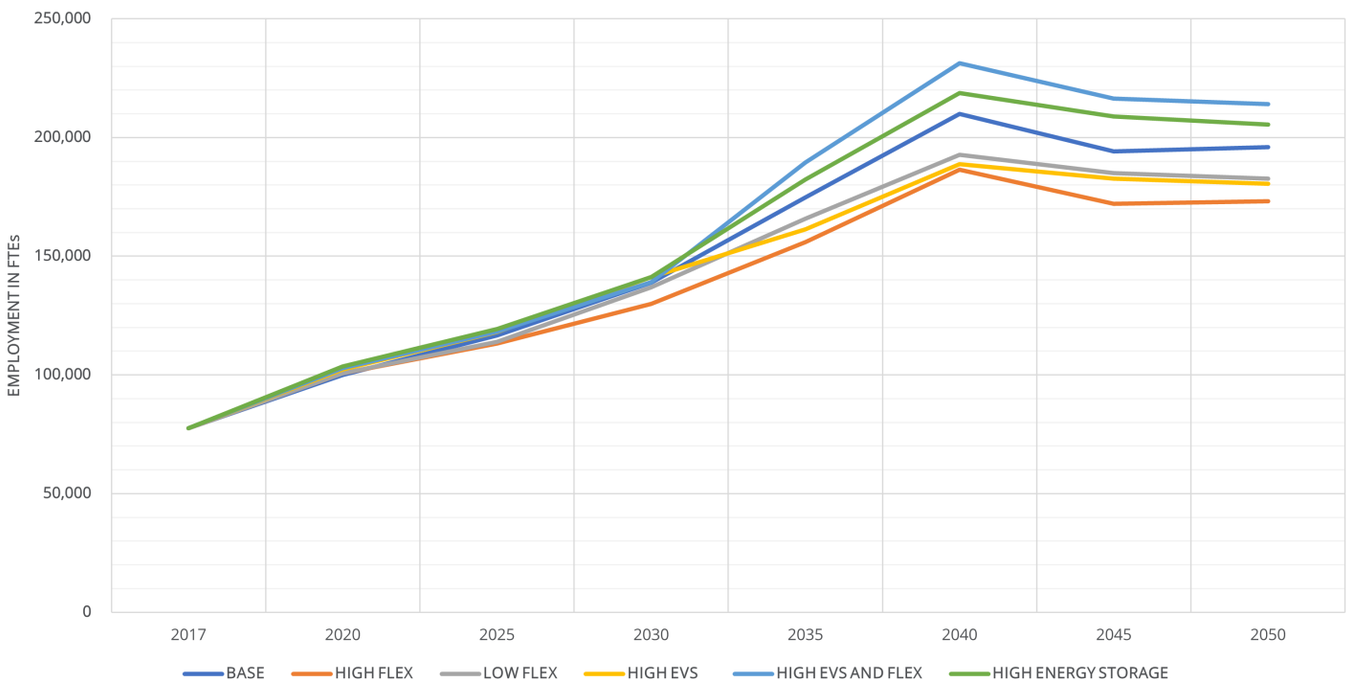
The base scenario sees an increase of £28.5 billion in market value and 132,375 jobs by 2040. This is a notable increase without creating a high flexibility network and high uptake of electric vehicles. The high energy storage scenario sees an increase of £28.8 billion and 140,773 jobs by 2040. The market value increase is similar to the BASE scenario but employment is a further 8,000 jobs above.

These scenarios have all shown that there will be a substantial increase in market value and employment levels should they be adopted and delivered.

However, the main issue regarding the scenarios is that they do not include any reference to heating, which could potentially change the power generating capacity requirements substantially, should there be a mass move to heat pump and electric heating options.



EMPLOYMENT COMPARISON FOR SIX SCENARIOS



Region by Region

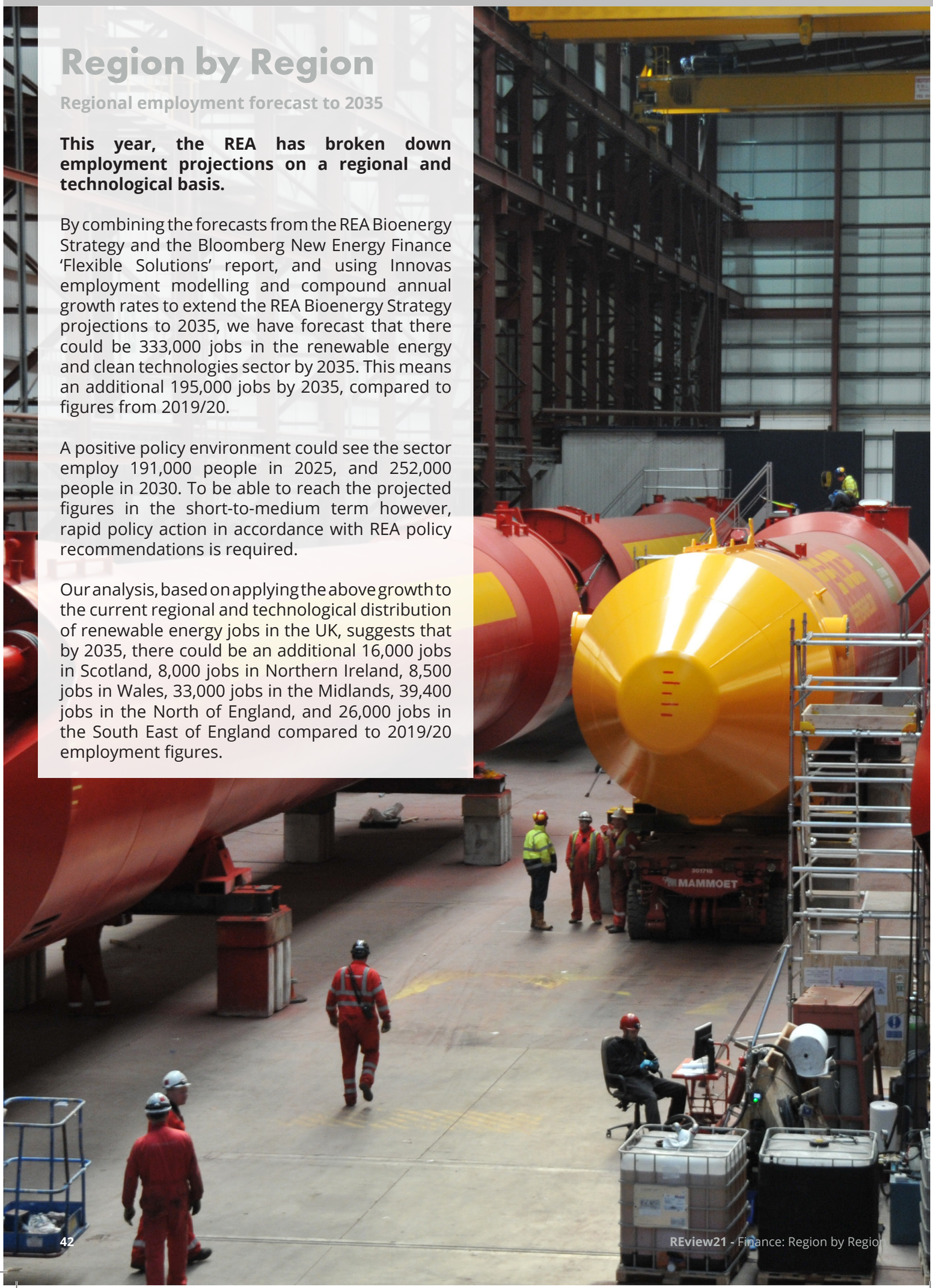
Regional employment forecast to 2035

This year, the REA has broken down employment projections on a regional and technological basis.

By combining the forecasts from the REA Bioenergy Strategy and the Bloomberg New Energy Finance 'Flexible Solutions' report, and using Innovas employment modelling and compound annual growth rates to extend the REA Bioenergy Strategy projections to 2035, we have forecast that there could be 333,000 jobs in the renewable energy and clean technologies sector by 2035. This means an additional 195,000 jobs by 2035, compared to figures from 2019/20.

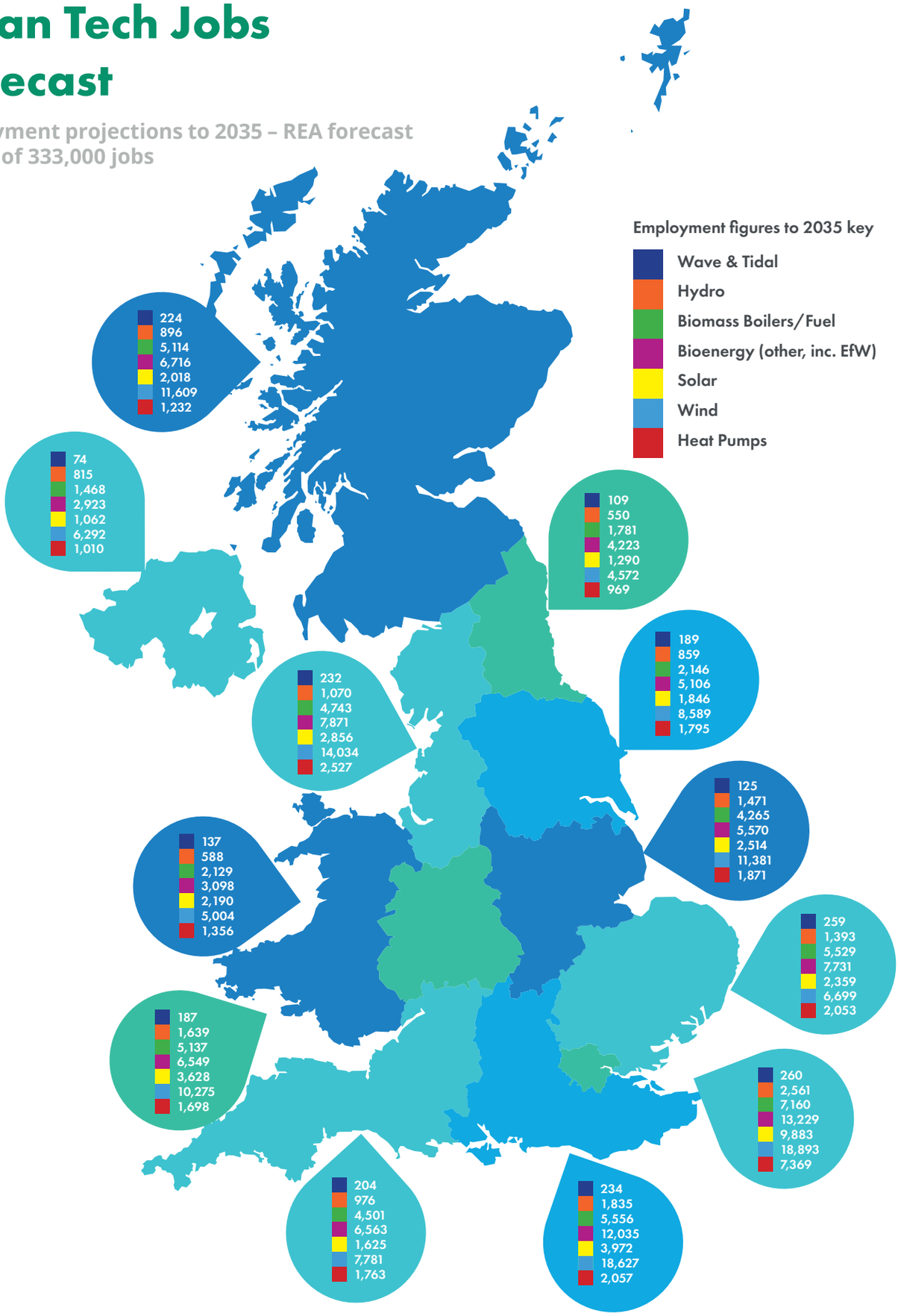
A positive policy environment could see the sector employ 191,000 people in 2025, and 252,000 people in 2030. To be able to reach the projected figures in the short-to-medium term however, rapid policy action in accordance with REA policy recommendations is required.

Our analysis, based on applying the above growth to the current regional and technological distribution of renewable energy jobs in the UK, suggests that by 2035, there could be an additional 16,000 jobs in Scotland, 8,000 jobs in Northern Ireland, 8,500 jobs in Wales, 33,000 jobs in the Midlands, 39,400 jobs in the North of England, and 26,000 jobs in the South East of England compared to 2019/20 employment figures.



Made in Britain 2035
Renewable Energy & Clean Tech Jobs Forecast

Employment projections to 2035 – REA forecast a total of 333,000 jobs



EAST MIDLANDS 2035

In 2019, the East Midlands renewable energy sector employed 11,306 FTEs. The REA projects that this could rise to 27,217 FTEs by 2035, an increase of 15,912.

41.8% of employment in the East Midlands renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the East Midlands has remained relatively constant from 2014 to 2020, at 8.2%.

41.8%

OF EMPLOYMENT IN THE EAST MIDLANDS RENEWABLE ENERGY SECOR COMES FROM WIND ENERGY, COMPARED TO 37.2% IN THE UK AS A WHOLE.

East Midlands FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	777	1,871	+1,094
	Combined Biomass Boilers/Fuel	1,772	4,265	+2,493
	Bioenergy (inc. EfW)	2,314	5,570	+3,256
	Hydro	619	1,491	+872
	Combined Solar	1,044	2,514	+1,470
	Wind Energy	4,727	11,381	+6,653
	Wave & Tidal	52	125	+73
	Total	**11,306**	**27,217**	**+15,912**

EAST OF ENGLAND 2035

In 2019, the East of England renewable energy sector employed 10,810 FTEs. The REA projects that this could rise to 26,023 FTEs by 2035, an increase of 15,214.

21.2% of employment in the East of England renewable energy sector comes from the biomass boiler or biofuel sectors, compared to 14.9% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the East of England has risen slightly from 7.68% in 2014/15 to 7.82% in 2019/20, equal to an additional 1,836 FTEs for this period.

7,700

BIOENERGY JOBS COULD BE SUPPORTED IN THE EAST OF ENGLAND BY 2035. IT IS THE ONLY REGION WHERE WIND IS NOT THE LARGEST RENEWABLE EMPLOYER.

East of England FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	853	2,053	+1,200
	Combined Biomass Boilers/Fuel	2,297	5,529	+3,232
	Bioenergy (inc. EfW)	3,211	7,731	+4,519
	Hydro	579	1,393	+814
	Combined Solar	980	2,359	+1,379
	Wind Energy	2,783	6,699	+3,916
	Wave & Tidal	108	259	+152
	Total	**10,810**	**26,023**	**+15,214**

GREATER LONDON 2035

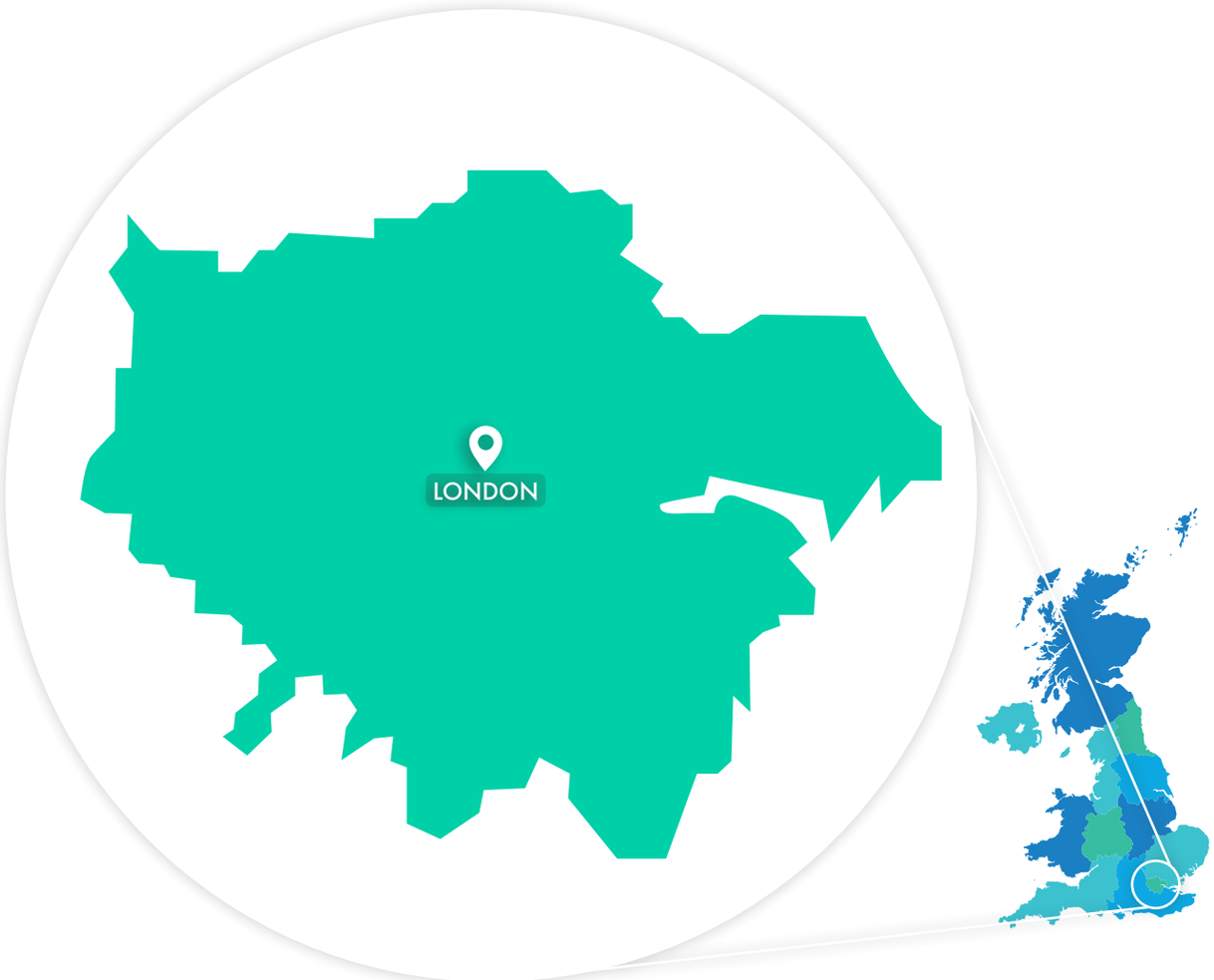
In 2019, Greater London's renewable energy sector employed 24,655 FTEs. The REA projects this could rise to 59,355 FTEs by 2035, an increase of 34,700.

16.7% of employment in Greater London's renewable energy sector comes from the solar PV and solar thermal sector, compared to 10.6% in the UK as a whole.

The proportion of UK renewable energy jobs situated in Great London has fallen slightly, from 18.8% in 2014/15 to 17.8% in 2019/20.

34,700

NEW JOBS COULD BE CREATED IN LONDON BY 2035, THE LARGEST INCREASE OF ANY REGION OR COUNTRY IN THE UK. NEARLY 60,000 PEOPLE WILL BE WORKING IN THE SECTOR.



Greater London FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	3,061	7,369	+4,308
	Combined Biomass Boilers/Fuel	2,974	7,160	+4,186
	Bioenergy (inc. EfW)	5,495	13,229	+7,734
	Hydro	1,064	2,561	+1,497
	Combined Solar	4,105	9,883	+5,778
	Wind Energy	7,848	18,893	+11,045
	Wave & Tidal	108	260	+152
	Total	**24,655**	**59,355**	**+34,700**

NORTH EAST 2035

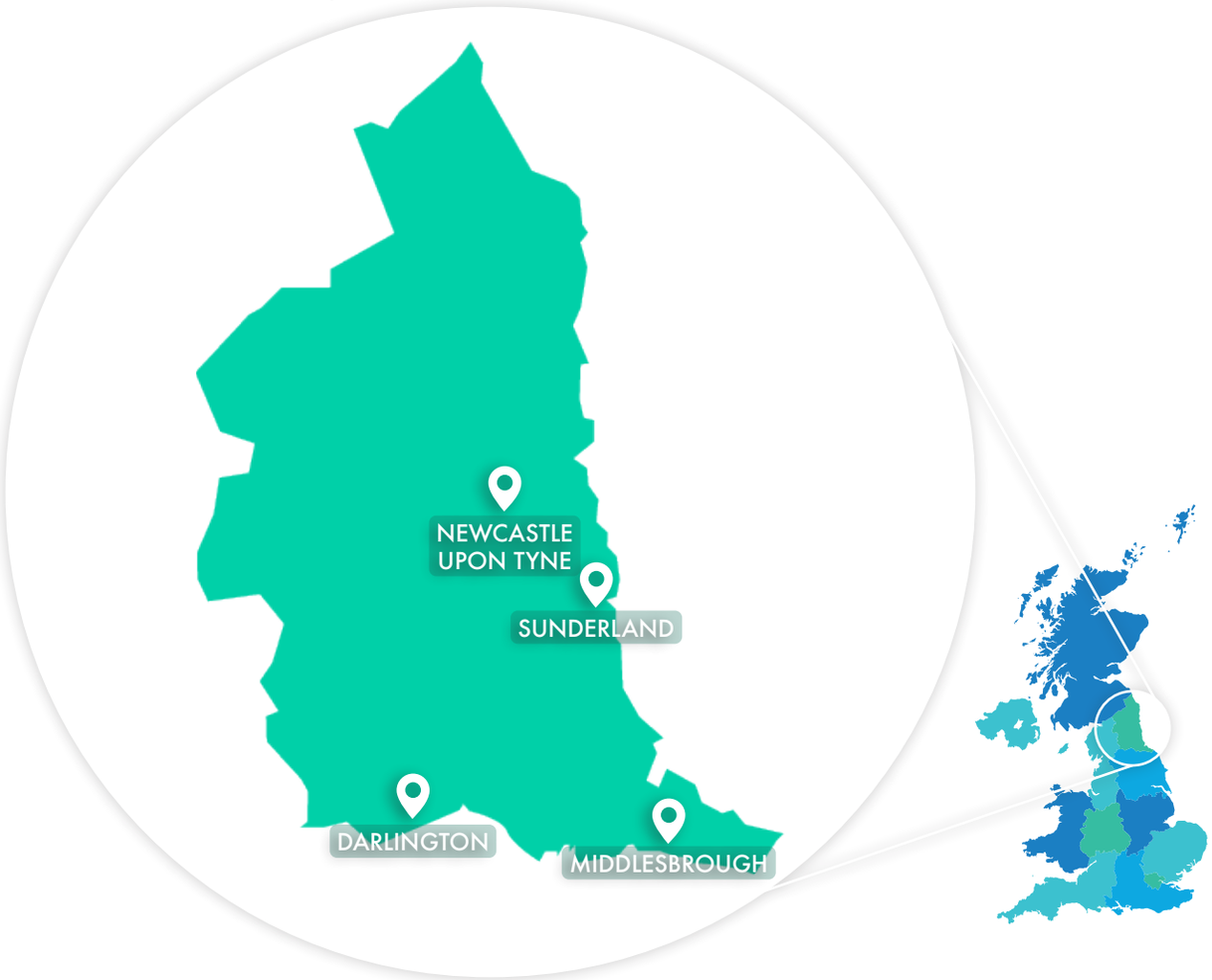
In 2019, the North East of England renewable energy sector employed 5,605 FTEs. The REA projects that this could rise to 13,494 FTEs by 2035, an increase of 7,889.

31.3% of employment in the North East of England renewable energy sector comes from the bioenergy sector, including energy from waste, compared to 24.5% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the North East of England has risen considerably compared to other regions, from 3.6% in 2014/15 to 4.1% in 2019/20, equal to an additional 1,347 FTEs for this period.

31.3%

OF EMPLOYMENT IN THE NORTH EAST'S RENEWABLE ENERGY SECTOR IS IN BIOENERGY (INCLUDING ENERGY FROM WASTE), COMPARED TO THE UK-WIDE FIGURE OF 24.5%.



North East FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	403	969	+567
	Combined Biomass Boilers/Fuel	740	1,781	+1,041
	Bioenergy (inc. EfW)	1,754	4,223	+2,469
	Hydro	228	550	+322
	Combined Solar	536	1,290	+754
	Wind Energy	1,899	4,572	+2,673
	Wave & Tidal	45	109	+64
	Total	**5,605**	**13,494**	**+7,889**

NORTH WEST 2035

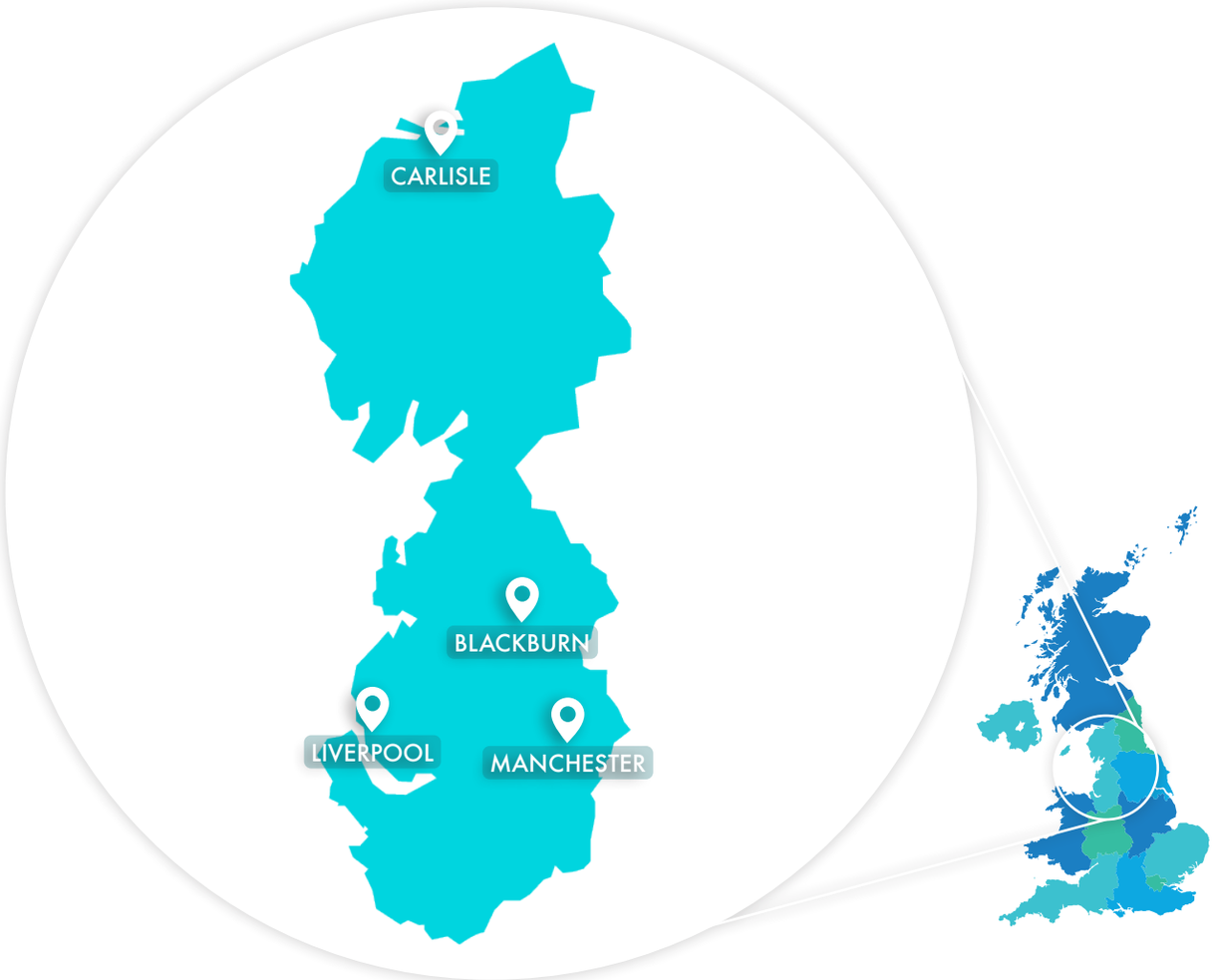
In 2019, the North West of England renewable energy sector employed 13,846 FTEs. The REA projects that this could rise to 33,332 FTEs by 2035, an increase of 19,486.

42.1% of employment in the North West of England renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the North West of England has risen slightly from 9.6% in 2014/15 to 10% in 2019/20, equal to an additional 2,670 FTEs for this period.

42.1%

OF RENEWABLE AND CLEAN TECH EMPLOYMENT IN THE NORTH WEST OF ENGLAND COMES FROM WIND ENERGY, NEARLY 5% MORE THAN THE NATIONAL AVERAGE.



North West FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	1,050	2,527	+1,477
	Combined Biomass Boilers/Fuel	1,970	4,743	+2,773
	Bioenergy (inc. EfW)	3,269	7,871	+4,601
	Hydro	444	1,070	+625
	Combined Solar	1,186	2,856	+1,670
	Wind Energy	5,829	14,034	+8,204
	Wave & Tidal	96	232	+136
	Total	**13,846**	**33,332**	**+19,486**

SOUTH EAST 2035

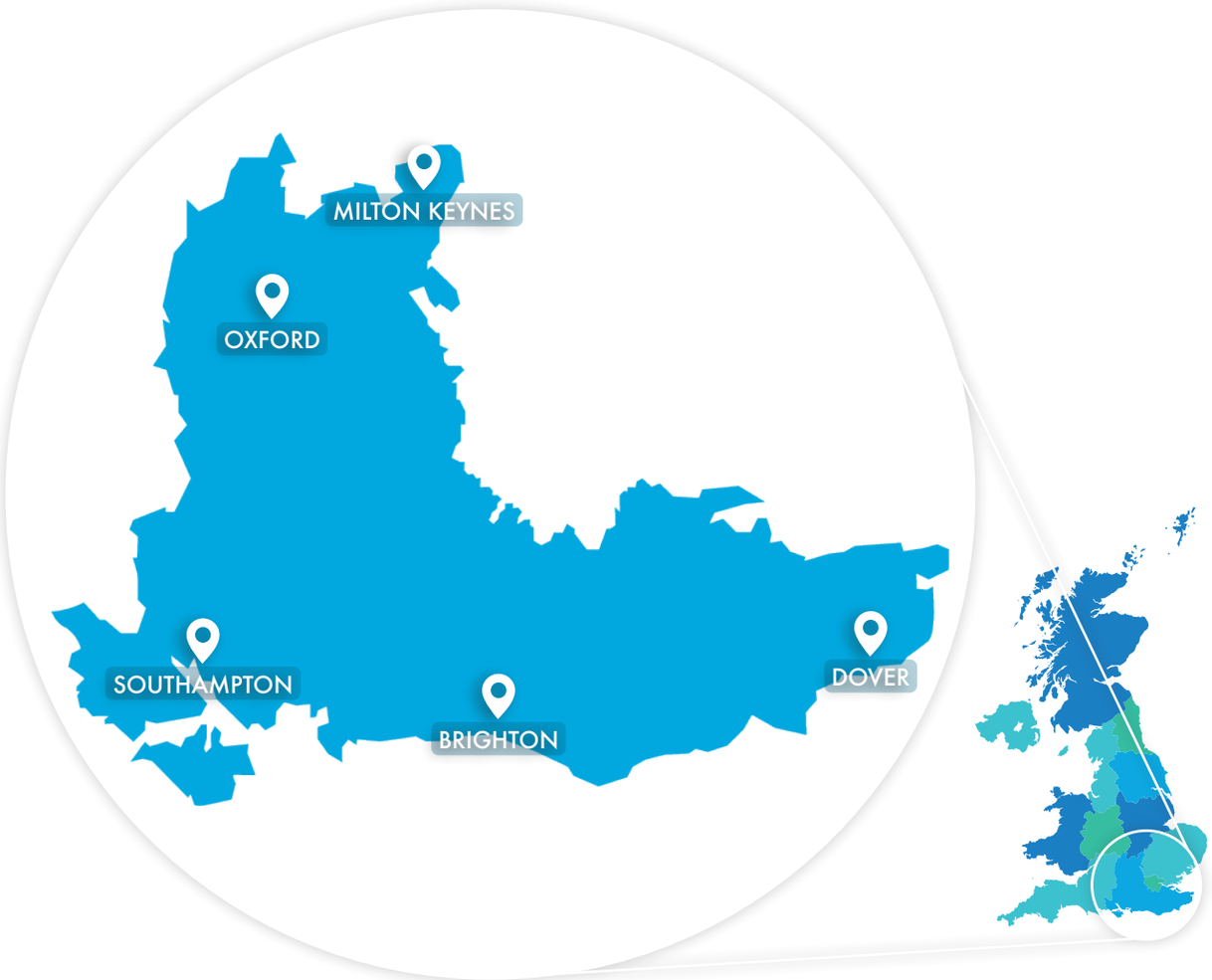
In 2019, the South East of England renewable energy sector employed 18,408 FTEs. The REA projects that this could rise to 44,316 FTEs by 2035, an increase of 25,907.

42% of employment in the South East of England renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the South East of England has remained relatively constant from 2014 to 2020, at 13.3%.

25,000

MORE THAN 25,000 NEW JOBS COULD BE CREATED IN THE SOUTH EAST'S RENEWABLE SECTOR BY 2035, THE 2ND LARGEST INCREASE IN THE COUNTRY.



South East FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	854	2,057	+1,202
	Combined Biomass Boilers/Fuel	2,308	5,556	+3,248
	Bioenergy (inc. EfW)	4,999	12,035	+7,036
	Hydro	762	1,835	+1,073
	Combined Solar	1,650	3,972	+2,322
	Wind Energy	7,737	18,627	+10,890
	Wave & Tidal	97	234	+137
	Total	**18,408**	**44,316**	**+25,907**

SOUTH WEST 2035

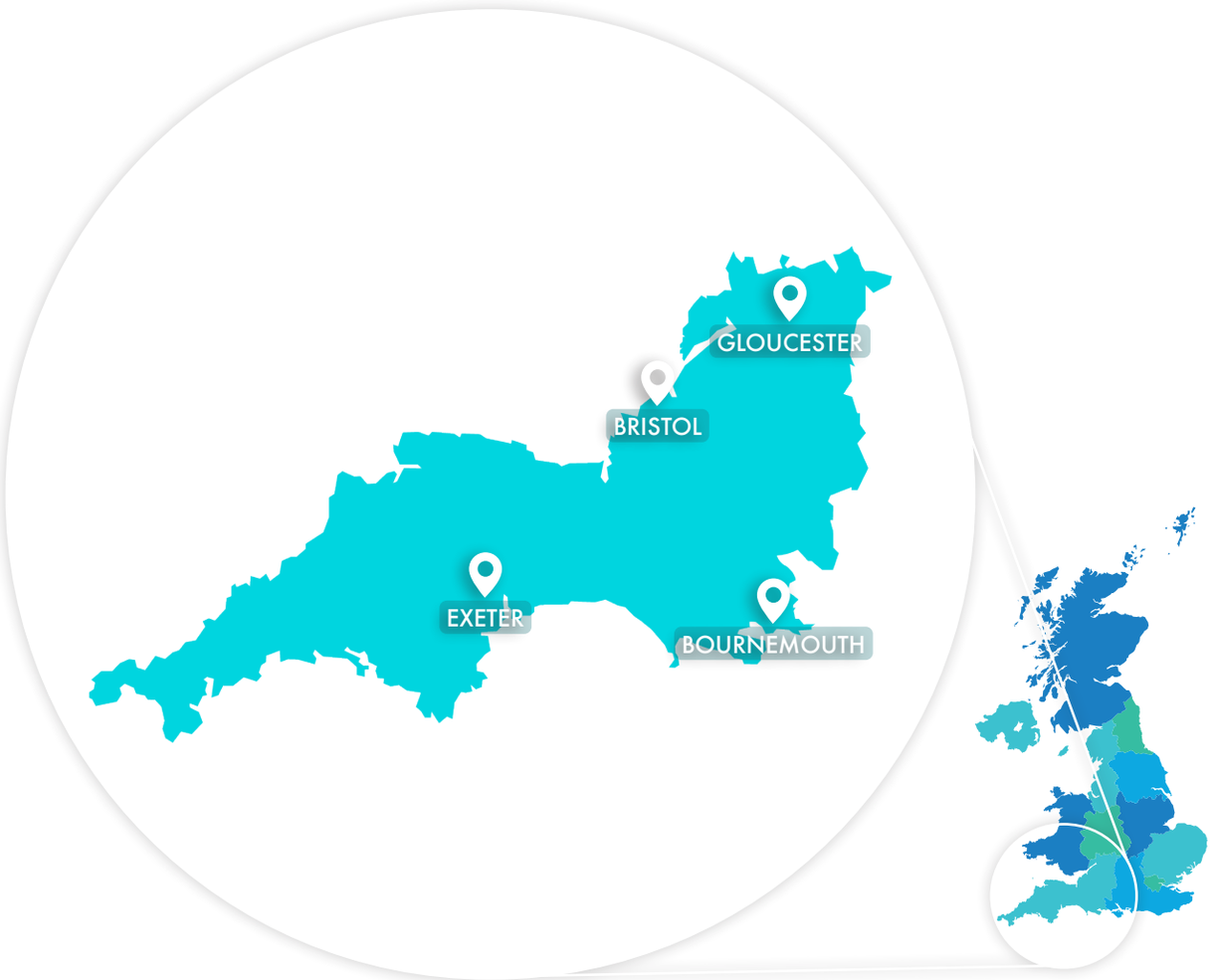
In 2019, the South West of England renewable energy sector employed 9,725 FTEs. The REA projects that this could rise to 23,413 FTEs by 2035, an increase of 13,687.

19.2% of employment in the South West of England renewable energy sector comes from the biomass boiler or biofuel sectors, compared to 14.9% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the South West of England has remained relatively constant from 2014 to 2020, at 7%.

19.2%

OF EMPLOYMENT IN THE SOUTH WEST'S RENEWABLE ENERGY SECTOR COMES FROM THE BIOMASS BOILER OR BIOFUEL SECTORS, COMPARED TO 14.9% IN THE UK AS A WHOLE.



South West FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	732	1,763	+1,031
	Combined Biomass Boilers/Fuel	1,870	4,501	+2,631
	Bioenergy (inc. EfW)	2,726	6,563	+3,837
	Hydro	406	976	+571
	Combined Solar	675	1,625	+950
	Wind Energy	3,232	7,781	+4,549
	Wave & Tidal	85	204	+119
	Total	**9,725**	**23,413**	**+13,687**

WEST MIDLANDS 2035

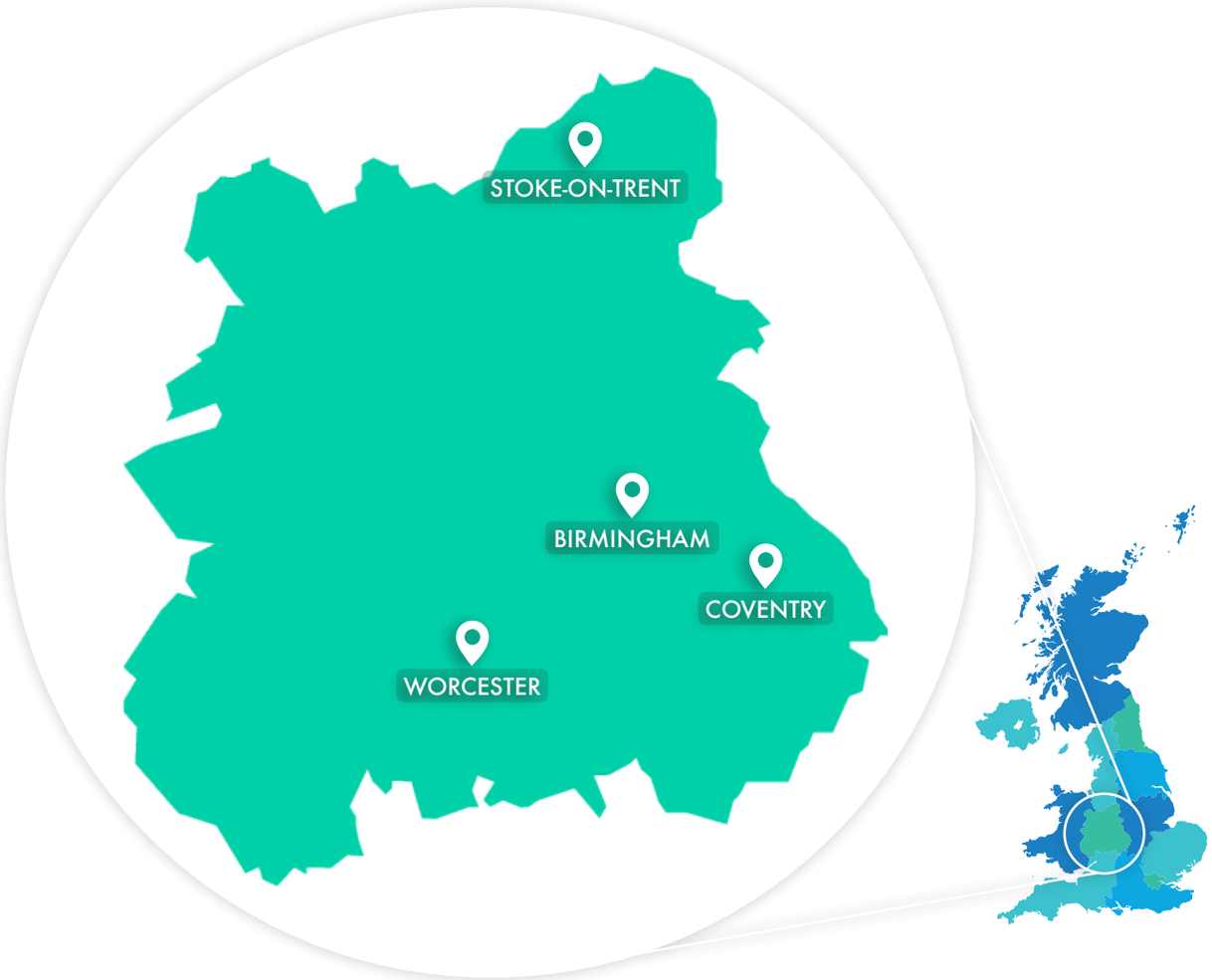
In 2019, the West Midlands renewable energy sector employed 12,092 FTEs. The REA projects that this could rise to 29,110 FTEs by 2035, an increase of 17,018.

17.6% of employment in the West Midlands renewable energy sector comes from the biomass boiler or biofuel sectors, compared to 14.9% in the UK as a whole.

The proportion of UK renewable energy jobs situated in the West Midlands has fallen considerably compared to other regions, from 9.3% in 2014/15 to 8.7% in 2019/20.

-0.6%

THE PROPORTION OF UK RENEWABLE JOBS SITUATED IN THE WEST MIDLANDS HAS FALLEN FROM 9.3% IN 2014/15 TO 8.7% IN 2019/20.



West Midlands FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	704	1,695	+991
	Combined Biomass Boilers/Fuel	2,134	5,137	+3,003
	Bioenergy (inc. EfW)	2,720	6,549	+3,829
	Hydro	681	1,639	+958
	Combined Solar	1,507	3,628	+2,121
	Wind Energy	4,268	10,275	+6,007
	Wave & Tidal	78	187	+110
	Total	**12,092**	**29,110**	**+17,018**

YORKSHIRE & HUMBER 2035

In 2019, Yorkshire and Humber renewable energy sector employed 8,528 FTEs. The REA projects that this could rise to 20,529 FTEs by 2035, an increase of 12,002.

41.8% of employment in Yorkshire and Humber renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in Yorkshire and Humber remained relatively constant from 2014 to 2020, at 6.2%.

20,500

PEOPLE COULD BE EMPLOYED BY THE RENEWABLE ENERGY AND CLEAN TECHNOLOGY SECTOR BY 2035 IN YORKSHIRE AND HUMBER.

Yorkshire FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	745	1,795	+1,049
	Combined Biomass Boilers/Fuel	891	2,146	+1,255
	Bioenergy (inc. EfW)	2,121	5,106	+2,985
	Hydro	357	859	+502
	Combined Solar	767	1,846	+1,079
	Wind Energy	3,568	8,589	+5,022
	Wave & Tidal	78	189	+110
	Total	**8,528**	**20,529**	**+12,002**

NORTHERN IRELAND 2035

In 2019, the Northern Ireland renewable energy sector employed 5,667 FTEs. The REA projects that this could rise to 13,643 FTEs by 2035, an increase of 7,976.

46.1% of employment in the Northern Ireland renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in Northern Ireland has remained relatively constant from 2014 to 2020, at 4.1%.

8.9%

46.1% OF EMPLOYMENT IN NORTHERN IRELAND'S RENEWABLE ENERGY SECTOR COMES FROM WIND ENERGY, 8.9% HIGHER THAT THE UK'S AVERAGE OF 37.2%.

N. Ireland FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	420	1,010	+591
	Combined Biomass Boilers/Fuel	610	1,468	+858
	Bioenergy (inc. EfW)	1,214	2,923	+1,709
	Hydro	338	815	+476
	Combined Solar	441	1,062	+621
	Wind Energy	2,614	6,292	+3,678
	Wave & Tidal	31	74	+43
	Total	**5,667**	**13,643**	**+7,976**

SCOTLAND 2035

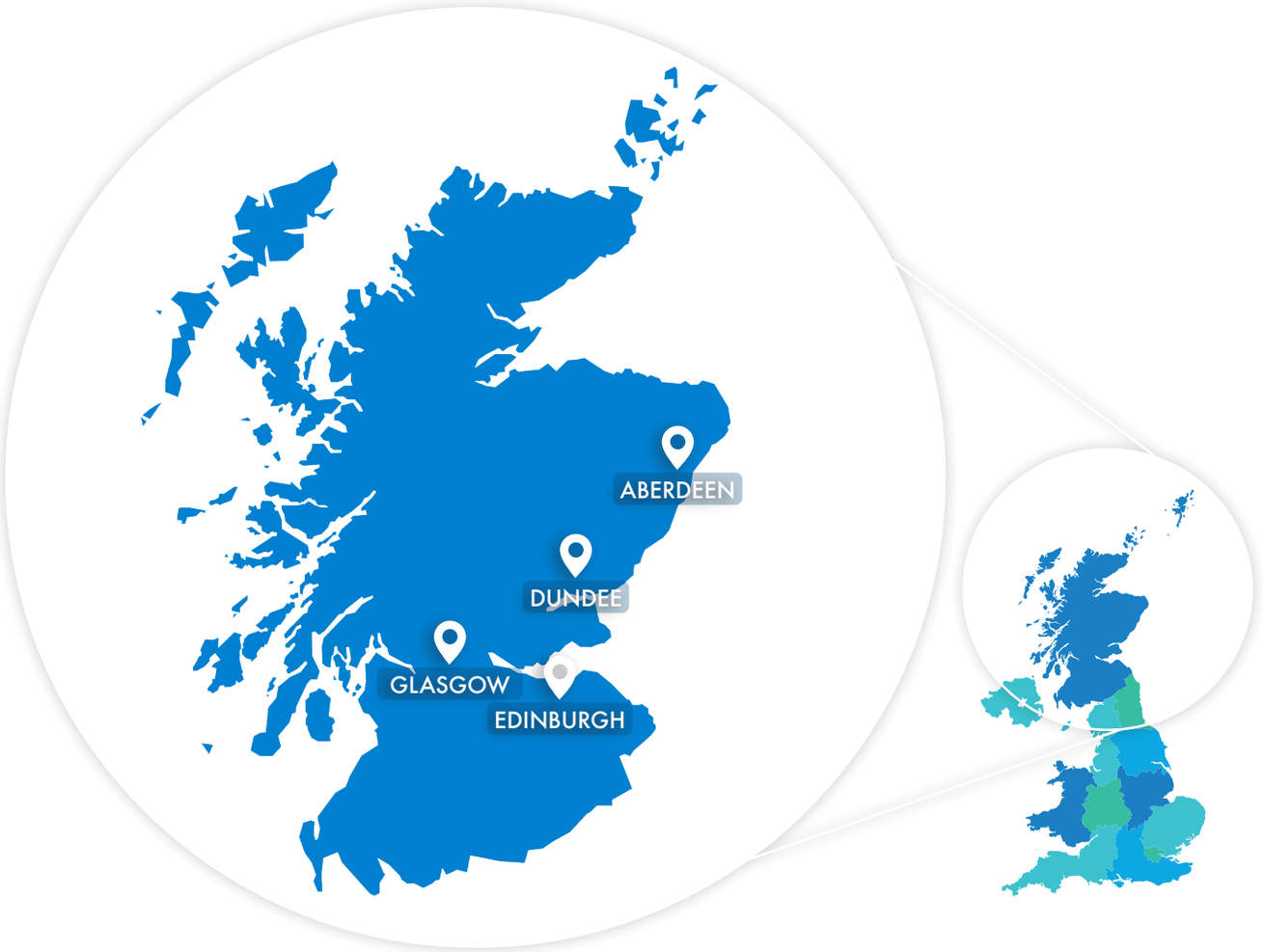
In 2019, the Scotland renewable energy sector employed 11,552 FTEs. The REA projects that this could rise to 27,809 FTEs by 2035, an increase of 16,258.

41.7% of employment in the Scotland renewable energy sector comes from wind energy, compared to 37.2% in the UK as a whole.

The proportion of UK renewable energy jobs situated in Scotland has risen slightly from 7.9% in 2014/15 to 8.4% in 2019/20, equal to an additional 2,312 FTEs for this period.

+0.5%

THE PROPORTION OF UK RENEWABLE ENERGY JOBS SITUATED IN SCOTLAND HAS RISEN FROM 7.9% IN 2014/15 TO 8.4% IN 2019/20.



Scotland FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	512	1,232	+720
	Combined Biomass Boilers/Fuel	2,124	5,114	+2,989
	Bioenergy (inc. EfW)	2,790	6,716	+3,926
	Hydro	372	896	+524
	Combined Solar	838	2,018	+1,180
	Wind Energy	4,822	11,609	+6,787
	Wave & Tidal	93	224	+131
	Total	**11,552**	**27,809**	**+16,258**

WALES 2035

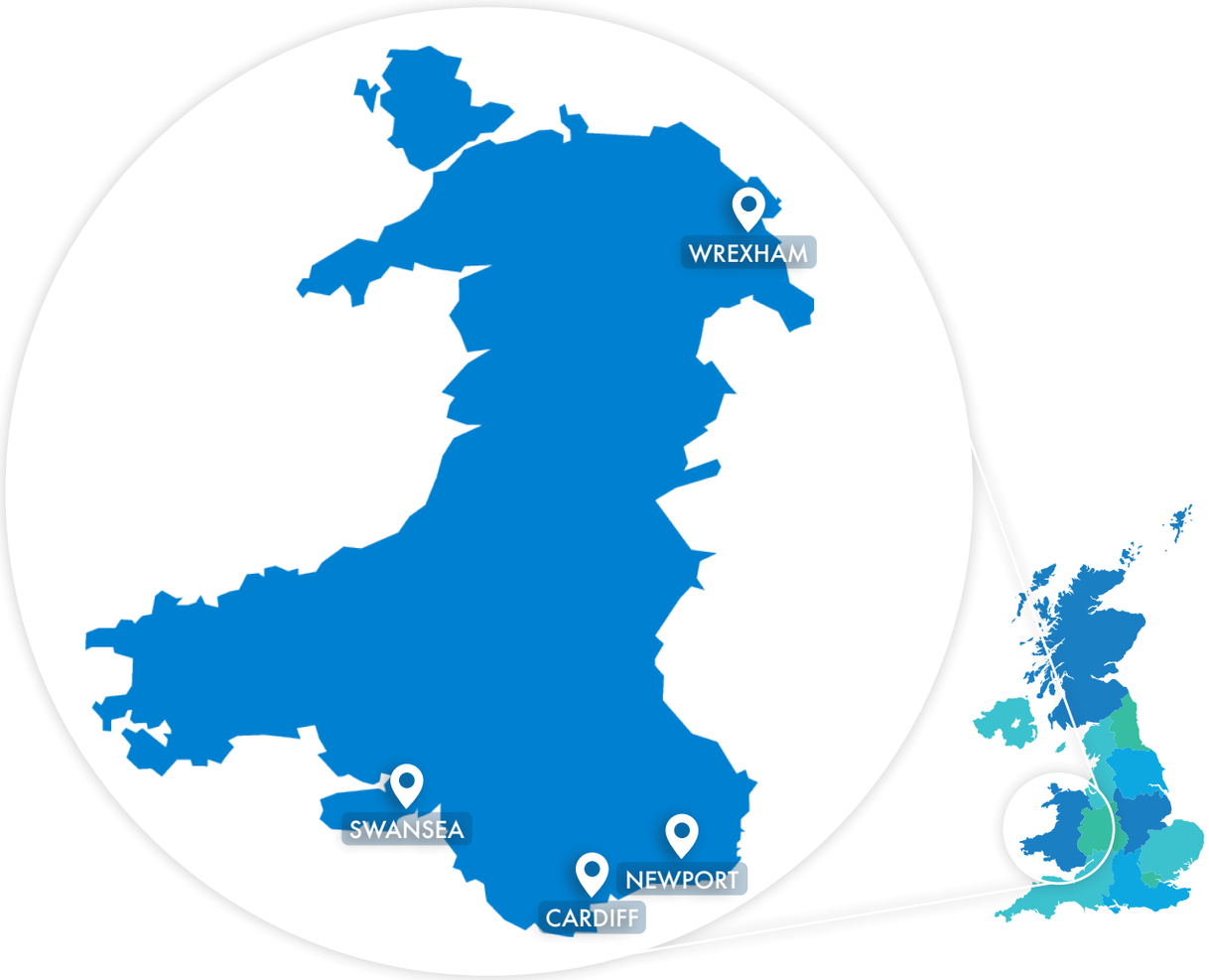
In 2019, the Wales renewable energy sector employed 6,024 FTEs. The REA projects that this could rise to 14,503 FTEs by 2035, an increase of 8,479.

15.1% of employment in the Wales renewable energy sector comes from the solar PV and solar thermal sectors, compared to 10.6% in the UK as a whole.

The proportion of UK renewable energy jobs situated in Wales has fallen slightly from 4.7% in 2014/15 to 4.4% in 2019/20.

15.1%

OF EMPLOYMENT IN WALES' RENEWABLE ENERGY SECTOR COMES FROM THE SOLAR PV AND SOLAR THERMAL SECTORS, COMPARED TO THE UK AVERAGE OF 10.6%.



Wales FTE: 2035	Renewable Energy Sector	2019	2035	Increase
	Heat Pumps (Air & Ground Source)	563	1,356	+793
	Combined Biomass Boilers/Fuel	884	2,129	+1,245
	Bioenergy (inc. EfW)	1,287	3,098	+1,811
	Hydro	244	588	+344
	Combined Solar	910	2,190	+1,280
	Wind Energy	2,079	5,004	+2,925
	Wave & Tidal	57	137	+80
	Total	**6,024**	**14,503**	**+8,479**

Energy Transition Readiness Index 2021

Introduction

In 2019, the Association for Renewable Energy & Clean Technology (REA) published the first Energy Transition Readiness Index (ETRI).

The report assessed the readiness of selected European electricity markets for the energy transition, from the perspective of investors in flexibility services that support deployment of renewable power and decarbonisation.

This first report assessed progress across nine Western European countries. The Netherlands, Norway, Sweden, Finland, Denmark, and Ireland were more highly ranked while Germany, the UK and France lagged behind. ETRI 2021 will update the ranking of the original nine countries to measure progress over the last two years, and has added Italy, Spain and Switzerland, making a total of 12 countries.

The report describes some of the key electricity market characteristics for each country, assessing the current and future need for flexibility resources. Selected case studies have been included to demonstrate emerging best practices relating to the development of flexibility markets and technologies.

The assessment and scoring for this year's report was based on a survey of expert stakeholders across the different countries/regions selected, followed up by one-to-one interviews to understand the underlying reasons for responses.

Early findings

The full report will be published later this year in September, but these are our initial findings.

Rapid growth in variable renewable electricity generation such as wind and solar has meant that power systems and markets must be more flexible to compensate for the greater volatility in this generation and keep balance with customer demand.

Such flexibility resources are forecast to grow significantly in the future - electricity markets are key to enabling this investment and growth. Electricity sector flexibility services offer major new investment opportunities, and strongly support the key goals of decarbonisation.

All the countries studied show strong ambition towards decarbonisation targets, but the higher-ranking nations have flexibility markets that better deliver fair, transparent, and simple access for all participants.

ETRI 2021 ranks the following countries:

DENMARK, FINLAND, FRANCE, GERMANY, ITALY, IRELAND, NETHERLANDS, NORWAY, SPAIN, SWEDEN, SWITZERLAND AND THE UK

Transition factors

Market access

- Regulation enables fair access for all providers
- Trading - markets are open and effective
- Transaction costs are fair for flexibility

Socio-political support

- Flexibility needs are recognised
- Supportive political and public consensus
- Public policy and regulation aligned

Technology potential

- Grid accessibility
- EV infrastructure deployment enabled
- Digitalisation enabled
- Innovation enabled

Methodology

Deployment (Data & Growth Projections)

The intention of this report is to present both historic data and forward projections for renewable energy capacity and generation from authoritative sources, so that the reader can judge progress to date as well as the Government's view of the contribution that might be made in 2020, the year by which the Renewable Energy Directive (RED) requires the UK to have achieved a 15% contribution to energy consumption from renewables.

The RED also has a sub-target for all Member States to achieve a 10% renewable energy contribution in the transport sector.

We have therefore chosen to draw on official Government sources for all deployment data included in the Deployment chapter of REview21 report, with the exception of figures pertaining to site numbers and feedstocks in the Circular Bioresources section, which are drawn from the latest WRAP industry survey. Some graphs which visualise the data used in this report feature projections, or continued growth trends, for the calendar years 2020 and 2021 – these are based on the average annual growth rate since 2014.

It should be noted that this extrapolation is for indicative purposes only – there is no suggestion that future performance will follow that of the recent past, but the purpose is to show what could be achieved if recent trends were to continue. In addition, some graphs include projections and targets from the DECC (now BEIS) updated Energy and Emissions Projections (UEP), published in 2013, and from the UK National Renewable Energy Action Plan (NREAP), published in 2010 – these are included for comparative purposes, but it should be noted that the industry has evolved considerably in the years since, and that there are in some cases differences in measurements between the data sets used by the REA and the UEP/NREAP projections and targets. Further details on UEP/NREAP are provided below.

Updated Energy Projections (UEP)

At the time of our first REView report, every year the then DECC (now BEIS) published Updated Energy Projections (UEPs), analysing and projecting future energy use and greenhouse gas emissions in the UK, based on assumptions of future economic growth, fossil fuel prices, electricity generation costs, UK population and other key variables. Renewables are only one part of the UEP, indeed the technology breakdown for renewables was only published in November 2013 following a special request, two months after the initial publication. We have included the UEP projections for comparative purposes.

National Renewable Energy Action Plan (NREAP)

Under the RED, each Member State was required to publish a National Renewable Energy Action Plan and the UK's was published by the then DECC in 2010. Although somewhat dated now, it provides the Government's official statement of how it plans to fulfil the UK's obligations under the Directive. In particular Tables 10 - 12 provide year-by-year indicative projections of deployment, broken down by technology, from 2010 to 2020 for electricity, heat and transport. The table indicating the UK's progress towards its RED targets comes from the BEIS DUKES, section 6.7, published July 2020.

The Renewable Power sector

Renewable power deployment statistics are published by BEIS quarterly in Energy Trends (ET) and annually in its Digest of UK Energy Statistics (DUKES). In this year's edition of REview, data for the power section come from BEIS Energy Trends (ET) section 6.1, published in March 2021. The exception is the projection and target figures pertaining to UEP/NREAP, described above.

The Renewable Transport sector

Renewable transport sector deployment draws on data from three sources. Figures on the consumption of biofuels for transport in the UK come from BEIS Energy Trends (ET) section 6.2, published in March 2021. This is published quarterly by BEIS, drawing on HMRC's Hydrocarbon Oils Bulletin. The data in section 6.2 includes annual consumption data for bioethanol and biodiesel from 2005 to 2019, with provisional data for 2020. Figures on the total number of electric vehicle (EV) charge points in the UK comes from the National Charge Point Registry, first established in 2011 and last updated in August 2020. Figures on the number of new battery electric vehicles (BEV) and hybrid vehicles come from dataset VEH0171,

collected by the Department for Transport and the Driver and Vehicle Licensing Agency, and published in May 2021.

The Renewable Heat sector

Renewable heat generation figures in this year's edition of REview come from BEIS DUKES section 6.6, published in July 2020. The exceptions are the projection and target figures pertaining to UEP/NREAP, described above, as well as the figures pertaining to renewable heat capacity of accredited systems, which draw on the BEIS RHI monthly deployment data. In past editions of REview, the NREAP heat projections have been used for comparative purposes. However, the NREAP definitions of technologies does not align well with many of the technologies included in DUKES 6.6. This year, for all heat technologies, with the exception of air source and ground source heat pumps, we have removed the NREAP 2020 projections.

The DUKES methodology for quantifying the heat generation from anaerobic digestion (AD) has changed compared to previous years. Previously, it was assumed that all grid-injected biogas was used for heating purposes. As the proportion of grid-injected biogas used for power purposes increased however, from 2016, the data for AD no longer includes grid-injected biogas. In 2019, DUKES notes that an estimated 31% of gas was used for electricity generation. The REA has therefore assumed that 69% of grid-injected biogas for the period 2016 – 2019 was used for heating purposes, and added it to the DUKES AD heat generation figure.

The Circular Bioresources sector

Data used in the circular bioresources section of this year's REview21 comes from two sources: the Defra UK Statistics on Waste, ENV23; and the 2020 Waste and Resources Action Programme (WRAP) AD and Composting Industry Market Survey Report. ENV23 is compiled to comply with the EU WFD and Waste Statistics Regulations, and was last updated in March 2020. ENV23 includes figures on the quantity of waste from households and the quantity of waste from households recycled in the UK from 2010 to 2018. The REA included projections of the waste from household arisings and the waste from household arisings which were recycled for 2019 and 2020, assuming the continuation of the average growth rate from 2010 to 2018 for these years.

The 2020 WRAP industry survey includes figures on the number of composting sites operating under waste management permits in England for 2012 and 2019, figures on the number of operational AD sites in England for 2012 and 2019, and figures on the quantity of feedstocks processed by each industry in England.

Employment (Jobs data by Innovas)

Standard Industrialisation Codes (SIC) are used to classify businesses according to the type of their economic activity. New sectors such as renewables are not currently covered by the SIC categorisation in detail and this has led to a lack of robust data on jobs associated with the sector. Headline data on the low carbon sector has been produced by Innovas for Government; however a detailed breakdown of the renewables and clean tech sector by technology or geographical area had not been published until REview.

For the first time this year we have also included data on the composting sector.

The REA produces an annual update of this analysis and data, although ideally the Office for National Statistics (ONS) would be providing this information.

Definition of sector

The research undertaken by Innovas is based upon a data methodology developed by Knowledge Matrix Ltd and used widely in the UK. This methodology uses a broader definition of the renewable sector than other studies, because it includes the contribution from supply and value chain companies. It relies on 'bottom up' data based on what companies actually do, rather than what they are classified as doing under the SIC system. Innovas's definitions are consistent with (but not limited by) SIC and NAICS codes and extend down to eight-digit code classifications which specify activities.

Innovas's final data levels go beyond SIC code definitions.

Data sources

The study draws from over 700 sources. It includes activities undertaken by companies across the renewable supply chain including related network activity, commercial R&D* only, through manufacturing into distribution, retail, installation, and maintenance services. Companies are included in the supply chain where 20% of their turnover is supplied into the sector, but only the sales activity relating to the renewable sector is

included in the analysis. In order to limit the risk and error the numbers are informed by multiple sources. Innovas carry out a sensitivity analysis with the aim to provide a confidence level of 80% within a range of +/- 20%.

Model

The full sector analysis model is a bottom up, multi-staged model that uses econometric techniques, sources and methods (such as data triangulation) to verify and enrich source data drawn from multiple sources.

The approach uses data from actual, live and accumulated business cases and computes confidence levels for final reported numbers, based upon a rigorous assessment of the source data. The model also measures activity in the supply chain for each sub-sector, totals are aggregated from 2,300 discrete individual product group lines for the whole low carbon and environmental goods and services sector.

Each of these lines uses specific data sources and can be analysed individually, unlike traditional studies which often group together data sources. The methodology mitigates against double counting risks by checking and comparing the numbers over a period of years, with multiple validated and verified data sources.

Modelling for the forward-looking data on Energy Storage, Electric Vehicle Charging, and Interconnectors to the Nordics, was derived from the Bloomberg New Energy Finance report, "Flexibility Solutions in High Renewable Energy Systems" – UK Edition, which mapped out expected capacity in four scenarios, to 2050.

Modelling for the forward looking data on bioenergy, was derived from the REA Bioenergy Strategy Report – Phase 3 , which maps out expected employment to 2032 in the scenario that REA Bioenergy Strategy policy recommendations are implemented.

These two forward looking forecasts were merged to create the overall renewable energy to 2035 employment forecast. As the Bloomberg flexibility scenarios data originally modelled bioenergy deployment as well, these figures were removed from the Bloomberg NEF data when collating with the REA Bioenergy Strategy data, so as not to cause bioenergy jobs to be double counted.

Key terms

Employment is a measure of the estimated employment numbers across all aspects of the supply chain – these are direct full time equivalent jobs. National, regional and other economic data sources have been used to estimate current employment levels. Where employment information is scarce, or where Innovas are estimating employment for a proportion of a company's sales, they rely on comprehensive case study materials to provide sensible industry-specific ratios and benchmarks, or for some technologies REA's member fora have in the past contributed data (these are set out in additional adjustments).

Number of companies is a measure of the total number of companies in the region that match (or fit within) the activity headings for the renewables sector. Due to the limitations of using SIC codes the methodology uses a unique analytical process to allocate companies to the renewables activity headings. The total number of companies in this report has been arrived at by a bottom-up analysis of company stock within the country/region using such sources as: Companies House, European credit agencies, British Telecom, institutional listings and UK credit agencies.

Sector turnover estimates are based upon where economic activity takes place i.e. the location of the business rather than the location of the income earner. In the calculation of turnover value Innovas consider: turnover by sub sector within postcode sets; capital asset adjustment by sub-sector within postcode sets; Office of National Statistics (ONS) GDP calculations; supply chain procurement value sub-sector by sub-sector by postcode sets; and sub-sector specific sales reporting where available. Global market value uses the same methodology as above for each of the main country markets with the largest 50 markets by market value being analysed to the same level of detail i.e. 2,300 discrete lines.

Regional data methodology: Having identified the total company stock in the region, product and service outputs have been identified and verified by accessing further databases that include: institutional data sets, Yellow Pages, proprietary databases, Euromonitor, Dun and Bradstreet and Thompson. The methodology measures where the economic activity actually occurs and is reported, rather than just at the headquarters or main facilities.

Consultation with stakeholders: The analysis and data were then sense checked with industry participants, these included some REA sector groups, REA sector heads, developers of certain technologies, and expert members.

Sector adjustments: The adjustments to the data following consultation with stakeholders, or where the Innovas methodology was not used were:
** Government and European funded R&D is not included.*
*** The gathering of data through several sampling strategies in order to enhance confidence in results.*

Regional Data Projections

Figures on the distribution of employment by region and technology are provided by Innovas using methodology described in the section above. These figures have been provided using the same methodology to the REA for several REview editions. In this year's edition of REview, the REA has:

- Combined the regional and technological breakdown of employment noted above with the employment projections, found by combining employment models from the REA Bioenergy Strategy and the Bloomberg NEF flexibility scenarios data, to model the breakdown of projected employment in 2035 by region and technology.

- Analysed the regional breakdown of employment from 2014 – 2020, with a focus on observing any geographic shift in employment in the renewable energy sector.

The regional data projections make the strong assumption that the breakdown of jobs by region and technology is the same in 2035 as it is in 2019, and therefore apply the same single growth rate established in the combined REA Bioenergy Strategy and Bloomberg NEF model equally to all regions and technologies. While we expect that this distribution will change over time, it is largely dependent on Government initiatives over the next decade. The REA also notes the relative technological strengths of each region by comparing the percentage of jobs that each technology contributes to each region to the percentage of jobs that each technology contributes to the UK as a whole.

The analysis of the regional breakdown of renewable energy sector employment focusses on the proportional regional employment, and it's evolution over time. The REA notes the year-on-year growth rates, the percentage of national employment that each region contributes over time, and the change in this percentage.

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Abbreviations

AD	Anaerobic Digestion
B7	7% Biodiesel blend
BEIS	Department for Business, Energy and Industrial Strategy
BEV	Battery Electric Vehicle
CBR	Circular Bioresources
CCC	Climate Change Committee
CfD	Contract for Difference
COP26	The 2021 United National Climate Change Conference, and the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change
DECC	Department for Energy and Climate Change (now Department for Business, Energy and Industrial Strategy)
E5 / E10	5%/10% Bioethanol blend in standard petrol supplies
ECO	Energy Company Obligations
EfW	Energy from Waste, such plants generate energy using waste as a feedstock
EIS	Enterprise Investment Scheme
ETRI	The Energy Transition Readiness Index
EU	European Union
EV	Electric Vehicle, being an electric rather than Internal Combustion Engine, powered vehicle
EWP	Energy White Paper
FTE	Full Time Equivalent (numbers of people employed)
GHG	Green Homes Grant
GWh	Gigawatt Hour
HBS	Heat and Buildings Strategy
HGV	Heavy Goods Vehicle
IBA metals	Incinerator Bottom Ash metals
KPI	Key Performance Indicator
LCF	Levy Control Framework
MBT	Mechanical Biological Treatment
MWh	Megawatt Hour
NHS	National Health Service
NREAP	National Renewable Energy Action Plan: a series of projections from the mid 2010s
Ofgem	Office of Gas and Electricity Markets
R&D	Research and Development
REA	Association for Renewable Energy and Clean Technology
RED	Renewable Energy Directive, forming the UK's 2020 renewable energy targets
RHI	Renewable Heat Incentive
RO	Renewables Obligation
Solar PV	Solar Photovoltaic
UEP	Updated Energy Projections (published by the then Department for Energy and Climate Change)
ULEV	Ultra Low Emission Vehicle
VAT	Value Added Tax
WFD	Waste Framework Directive
WRAP	Waste & Resources Action Programme

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