Energy in the UK
2019
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword from Energy UK</td>
<td>4</td>
</tr>
<tr>
<td>Foreword from Committee on Climate Change</td>
<td>6</td>
</tr>
<tr>
<td>Energy and the UN SDGs in numbers</td>
<td>8</td>
</tr>
<tr>
<td><strong>Energy and the Economy</strong></td>
<td>10</td>
</tr>
<tr>
<td>Investment</td>
<td>10</td>
</tr>
<tr>
<td>People of UK Energy</td>
<td>12</td>
</tr>
<tr>
<td><strong>UN SDG 13 – Climate Action</strong></td>
<td>13</td>
</tr>
<tr>
<td>A global and national effort</td>
<td>13</td>
</tr>
<tr>
<td>A strong carbon price</td>
<td>16</td>
</tr>
<tr>
<td>Looking at climate from all angles</td>
<td>18</td>
</tr>
<tr>
<td>Reducing emissions from buildings</td>
<td>21</td>
</tr>
<tr>
<td><strong>UN SDG 7 – Affordable and Clean Energy</strong></td>
<td>23</td>
</tr>
<tr>
<td>Looking after customers</td>
<td>23</td>
</tr>
<tr>
<td>Investment and funding</td>
<td>27</td>
</tr>
<tr>
<td>Deployment of low carbon, renewable and GHG removal technologies</td>
<td>30</td>
</tr>
<tr>
<td><strong>UN SDG 9 – Industries, Innovation and Infrastructure</strong></td>
<td>35</td>
</tr>
<tr>
<td>Industrial strategy – energy is key</td>
<td>35</td>
</tr>
<tr>
<td>A smart and flexible energy system</td>
<td>39</td>
</tr>
<tr>
<td>Decarbonising road transport</td>
<td>41</td>
</tr>
<tr>
<td>Fostering innovation</td>
<td>43</td>
</tr>
<tr>
<td><strong>UN SDG 11 – Sustainable Cities and Communities</strong></td>
<td>45</td>
</tr>
<tr>
<td>Green transport for sustainable cities and communities</td>
<td>45</td>
</tr>
<tr>
<td>Smart and sustainable homes and buildings</td>
<td>46</td>
</tr>
<tr>
<td>Energy efficiency for buildings and people</td>
<td>48</td>
</tr>
<tr>
<td>Making the most of local energy</td>
<td>51</td>
</tr>
<tr>
<td><strong>Other UN SDGs supported by the energy sector</strong></td>
<td>55</td>
</tr>
<tr>
<td><strong>UN SDG 3 – Good Health and Wellbeing</strong></td>
<td>55</td>
</tr>
<tr>
<td><strong>UN SDGs 4 &amp; 8 – Quality Education and Decent Work</strong></td>
<td>56</td>
</tr>
<tr>
<td><strong>UN SDGs 10 &amp; 5 – Reduced Inequalities and Gender Equality</strong></td>
<td>58</td>
</tr>
<tr>
<td><strong>UN SDG 14 – Life below Water</strong></td>
<td>60</td>
</tr>
<tr>
<td><strong>UN SDG 15 – Life on Land</strong></td>
<td>61</td>
</tr>
<tr>
<td><strong>Energy UK Member list</strong></td>
<td>62</td>
</tr>
</tbody>
</table>
Foreword

Lawrence Slade, Chief Executive
Energy UK

Energy is all around us, in many shapes and forms, wherever we are in the world, there is no doubt that energy plays a crucial role in our lives.

That is why I was delighted when the Energy UK Board asked me to broaden our consideration of the role the sector plays for both people and the planet and to see where the industry can go further. The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a recognisable framework and shared blueprint against which to assess our role. The 17 Sustainable Development Goals (SDGs) at its heart aim to reduce poverty, improve health and education, reduce inequality, and spur economic growth; all while tackling climate change and working to preserve our oceans and forests. Within that context, it is clear that this sector has a huge role to play going forwards.

This challenge has become more prominent with the Government passing legislation committing the UK to bring all greenhouse gas (GHG) emissions to net-zero by 2050 to combat climate change, following advice from the Committee on Climate Change (CCC) in its report published in May this year. This policy will have a significant impact on how we live our lives in the future: what car we drive, how we heat our homes and how we generate our power. This change will be driven by society, but delivered by our energy companies.

In the UK we have a significant challenge and opportunity to deliver this seismic shift. Delivering net-zero will support many of the goals highlighted by the UN such as climate change, innovation and sustainability, but could have its challenges on how we pay for the transition and ensure that the benefits are distributed fairly and the costs recovered in a way that does not compound fuel poverty.

Energy UK is taking a lead in thinking about how we use energy in the next few years, in a way that is in line with the demands of a sustainable society. Our Future of Energy report explores what is needed to deliver the vision of the sector for a low carbon energy system that delivers for all its customers.

In addition, I was delighted last year to launch the independently chaired Commission for Customers in Vulnerable Circumstances to explore how customers in vulnerable circumstances could be provided with better energy services in the future. With thanks to Lord Whitty and his fellow commissioners for a thorough report, I am pleased to be taking forward immediately one of the key recommendations from the report for Energy UK to develop a new, independently monitored Code of Conduct to drive up standards of support for customers in vulnerable circumstances.

While increased climate risks predominantly fall on the most vulnerable parts of society and the planet, it is mainly the developed countries that can make all the difference through the neutralisation of greenhouse gases. This is a local, national and global challenge where energy companies have already been having a positive impact: from powering homes and businesses with low carbon electricity and leading on the move towards decarbonising heat to deploying energy efficiency measures to ensure homes are well insulated, offering to all citizens a healthy environment to live in. However, much remains to be done and cooperation among all stakeholders will be essential to succeed.
This report is centred around the four most relevant goals to the energy industry:

- **Climate Action**
- **Affordable and Clean Energy**
- **Industry, Innovation and Infrastructure**
- **Sustainable Cities and Communities**

But our impact goes beyond these four areas and in the last chapter we look at how we contribute towards others goals, such as health and well-being, decent work, life under water and life on land.

Over the coming year, we will be looking to engage with Government and all stakeholders to ensure we can deliver on the following fronts:

**Smart metering:** Our energy future will be dependent on better data gathering and using energy more efficiently. Smart meters will be key to this objective and we need to set the policy framework for post-2020 to complete the rollout.

**Future of decarbonised homes:** We need to find more sustainable ways of heating and cooling our homes across the globe. In the UK we have a particular need to find alternatives to burning natural gas in order to meet our long-term sustainability objectives. We must improve our existing and future properties through the introduction of higher standards on building regulations to reduce our energy consumption and start investing in large-scale trials of low carbon heating options.

**Sustainably financed energy industry:** The current suite of policies, including Capacity Market and Contract for Difference, has delivered investment and security of supply at lowest cost to customers. We will continue to work alongside Government to explore routes forward, including looking at alternative ways of funding large-scale, low carbon projects such as new nuclear and Carbon Capture Usage and Storage (CCUS), to bear down on costs to customers.

**Future Retail Market and vulnerable customer protections:** An increasing range of smart appliances, supported by the ongoing rollout of smart meters with appropriate consent, will allow energy retailers to offer innovative products that give consumers greater control of their energy use. We must recognise that in the future there will be certain customers who will be less able to engage, whether for the same or different reasons as today. It is likely that vulnerable customers will still need support, perhaps through targeted price protection or other means if they are not adequately served by the market alone.

**About Energy UK**

Energy UK is the trade association for the GB energy industry with a membership of nearly 100 suppliers, generators, and stakeholders with a business interest in the production and supply of electricity and gas for domestic and business consumers. Our membership encompasses the truly diverse nature of the UK’s energy industry from established FTSE 100 companies’ right through to new, growing suppliers and generators, which now make up over half of our membership. Energy UK is proud to be accredited with the Investors in People Standard and is a London Living Wage Employer.
‘The energy transition’ is a phrase that has slipped into common use. A loose term – dropped neatly into conversations about industry challenges ahead. Pause for a moment and reflect: June 2019 was the moment that Parliament committed the UK to something more than just a ‘transition’.

‘Net Zero’ greenhouse gas emissions by 2050 is an essential step, requiring nothing short of an energy transformation.

12 months ago, I might not have been so bold in my outlook. But the last year has been remarkable by any measure. It has been a period of new insights into the opportunity to reduce UK emissions and new public concern about the changes in our climate driven by continued use of fossil fuels. We’ve seen mounting evidence of more extreme weather and new temperature records broken throughout Europe. The changing climate seems now to have reached the public consciousness, but so too the awareness that something can be done. This is an energy transformation which the UK can pioneer.

I’m proud of the role that the Committee on Climate Change has played in throwing light on these issues.

In May, in one of our most comprehensive ever reports, we said to Government that Net-Zero by 2050 was necessary, feasible and cost effective. It will meet our global obligations and can be achieved through known technologies, with the right mix of effort from policy, the industry – and the consumer.

This is a whole-economy transformation. To achieve it, we must broaden our energy outlook. The closure of coal in the UK has almost been achieved – just 5% of total generation in 2018; low carbon electricity has become mainstream, accounting for a record of 54% of total UK generation in 2018.

The next set of energy challenges are more diverse. We must continue to decarbonise generation, but we must also embrace the disruption of zero carbon transport and low carbon heat. The future constraint on low carbon generation is not our ability to build it – as it once was – it is now our ability to consume it flexibly and with smart technology.
It is good to see Energy UK and its members support the recommendations made by the CCC on net-zero and the UK government setting a legally binding target for net-zero emissions. The energy industry has been leading the way in helping reduce the UK’s carbon emissions and can play a crucial role in keeping the momentum going and work with other sectors in deliver this transition to a clean energy world.

History tells us that the industry can rise to this challenge, but politics must keep pace.

Next year, the UK expects to host the UN’s global climate summit. ‘COP 26’ will be in Glasgow, an inspired choice as cradle of so many energy transitions in the past – now a city embracing a zero carbon energy future. It is a critical moment for the global effort and a showcase for the UK. As 200 world leaders arrive here, our global credibility rests on more than a net-zero target. Crucially, we must demonstrate that the UK has the policies and the industry ambition to achieve net-zero. The coming 18 months may come to define the next 30 years. So let’s demonstrate that our energy transformation is well underway.

We must continue to decarbonise generation, but we must also embrace the disruption of zero carbon transport and low carbon heat.

About the Committee on Climate Change
The Committee on Climate Change (the CCC) is an independent, statutory body established under the Climate Change Act 2008. Its purpose is to advise the UK Government and Devolved Administrations on emissions targets and report to Parliament on progress made in reducing greenhouse gas emissions and preparing for climate change. In fulfilling this role its focus is to provide independent advice on setting and meeting carbon budgets and preparing for climate change, monitor progress in reducing emissions and achieving carbon budgets and targets, conduct independent analysis into climate change science, economics and policy and engage with a wide range of organisations and individuals to share evidence and analysis.
Energy and the UN SDGs in numbers

► UN SDG 13 – Climate Change
Hours without coal in 2018: 1,900 (79 days)
2,200 (92 days) in first half of 2019
Power sector’s CO₂ emission reductions compared to 2017:
10% or 7 million tonnes

► UN SDG 9 – Industries, Innovation and Infrastructure
Jobs supported across the UK: 764,000
Tax contribution: £6.5bn
Investment in UK: £13.1bn
Economic contribution: £85.6bn

► UN SDG 7 – Affordable and Clean Energy
Electricity from low carbon sources: 53%
Money saved through energy efficiency measures installed under ECO*:
£11.2bn
Annual dedicated spend under WHD* by energy companies to help those most in need:
£325m

► UN SDG 11 – Sustainable cities and communities
Residential solar photovoltaic installations as of 2018: over 900,000
Electric vehicle public charge points installed by 2018: 19,000

*Accrued over the lifetime of the measures.
*Warm Home Discount
A workforce of **144,000 people is employed directly within the energy industry**, with a further **620,000 employed indirectly through supply chains, consulting and other energy related activities.**

This workforce is spread throughout the UK to ensure we always meets its energy needs.

Source: ONS, direct employment only, figures do not sum to 144,000 due to rounding.
Energy and the economy

Energy is central to all sectors of the UK economy. In every part of the country, the energy industry provides reliable heat and light for our homes, powers our businesses, connects and transports us, and helps provide our everyday needs. The energy sector currently employs 144,000 people directly with an additional 620,000 supported indirectly. Altogether, the industry employs one in 46 people across the UK, emphasising the role that the sector has as it goes through a rapid and vast transition.

In 2018, the energy sector continued its upward trend in contributing to the UK economy with £33.5bn created in economic value1, an increase of £1.9bn from 2017.

In comparison, £33.2bn was realised from telecoms and £19.1bn from water. In total, the energy sector generated £85.6bn in economic activity through its supply chains and intermediate consumption of goods and services from other sectors to support activities.2

The sector also contributed its share to funding public services through taxation. With around £6.5bn in taxes in financial year 2017/183, made of £2.4bn collected through income taxes and national insurance contributions, £1.9bn from the Climate Change Levy, £1.5bn from value added taxes and £0.7bn from corporate taxes.

Investment

As our recent publication Future of Energy4 outlines, transitioning to a low carbon economy will require a significant level of investment in the energy sector.

The CCC’s latest estimates now put the power sector’s annual investment at around £20 billion if we are to get to net zero by 2050. By comparison, investment in the power sector averaged around £10 billion over 2013-20175.

Investment is necessary to replace retiring generation capacity, increase low carbon generation and upgrade network infrastructure for greater flexibility. This investment will not only improve the UK’s energy security, but provide improved services for customers and health benefits with cleaner air.

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1GVA measures the value of goods and services produced, minus intermediate consumption.
2ONS, Input – Output supply and use tables, Total intermediate consumption in 2016, inflated to 2018.
3HRMC, constant prices (2018/19), corporation tax is for 2016/17, others (income tax, climate change levy and VAT) are for 2017/18.
Capital expenditure investment in gas and electricity underpins the energy sector’s commitment to transition the industry to a low carbon future. 2018 continued the long-term trend of growth in energy investment with £13.1bn invested, 2% higher than in 2017.

Looking into the future, the National Infrastructure and Construction (NIC) pipeline illustrates planned investment through both the private and public sectors to 2021 and beyond. The total number of planned electricity and gas projects stands at 107, with total planned investment at £54bn for the period 2018/2019 to 2020/21, with an additional £109bn in pipeline for 2021/22 and beyond.

Investment in renewables slowed down significantly in 2017-18 after peaking in 2016, in part due to reduced routes to market after the closure of schemes such as the Feed in Tariff and Renewables Obligation.

In 2018, renewable investment was at £6.9bn, up 23% compared to 2017. Projects under the Contracts for Difference (CfD) continued to come online in 2018, with another eight projects or 1.3 GW of capacity expected to be completed in 2019.

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6LCCC, CfD Register – https://www.lowcarboncontracts.uk/cfds
People of UK Energy

With an ambitious task on its hands, the energy sector can only succeed in its goal to decarbonise at the lowest cost if it has the right people on the ground with the right set of skills and knowledge to match this transformation.

The energy sector has a key role to play in delivering major infrastructure projects, such as interconnectors, Hinkley Point C nuclear power station and the smart meter rollout. These projects are an opportunity to create new jobs with good skills for the UK workforce with the right framework in place to account for the upcoming change in migration policy after the UK leaves the EU.

While the number of indirect jobs through supply chains has increased, we have seen some job cuts since 2017 by energy companies, looking to restructure or closing unviable coal plants. Yet, the energy sector still seems to suffer from skills shortages with 26.5% of vacancies within the sector reported as skills shortage in 2017, compared to a country-wide average of 23%7.

Energy companies work hard to recruit and train graduates and apprentices, with an annual average of 2,000 apprentices, and continue to provide hours of training for their employees. 65% of the workforce in the energy sector were trained by their employers in 2017, slightly above the economy-wide average7.

All this effort in training employees carries on paying off as productivity, an economic measure of output per employee in the sector remains strong at £220,000, keeping energy in the top three.

Case study: Investing in a future workforce

Investing in a pipeline of skilled individuals in preparation for the 2020s and to deliver SSE’s business strategy is essential. Over 2018/19, SSE invested £11.1m in internal and external learning and development. In addition, SSE’s investment in its technical pipeline programmes increased again between 2017/18 and 2018/19, from £15.4m to £17.2m. The number of people on one of these programmes also increased to 1,239, around 6% of SSE’s total workforce.

Including pipeline programmes, SSE invested a total of £28.2m in training and skills over 2018/19 and delivered an average of 22 hours of training per full-time equivalent employee. Over the past five years SSE has delivered over 600,000 learning interventions.

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The last few years have seen numerous reports and actions that clearly demonstrate the need to act on tackling climate change and the understanding that this must happen now.

The Climate Action goal sets targets that look at strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. It integrates climate change measures into national policies and strategies, improving education and raising awareness, but also implementing the commitments undertaken by developed countries to address the needs of developing countries*.

This chapter looks at the national and international frameworks under which the UK operates and the tools at its disposal to positively address climate issues.

**A global and national effort**

There is no doubt that climate change requires a global commitment and cannot be addressed in isolation. The 2015 Paris Agreement provides an international political framework that has opened the door to more ambitious targets for developed countries, including the UK. This is now reflected in the latest Committee on Climate Change report on net zero by 2050.

**Paris Agreement**

The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse gas emissions mitigation, adaptation, and finance. The agreement was adopted by 196 state parties in Paris at the 21st Conference of the Parties of the UNFCCC in December 2015.

The Paris Agreement’s long-term goal is to keep the increase in global average temperature to below 2 °C above pre-industrial levels. The Agreement limits the increase to 1.5 °C to significantly reduce the risks and effects of climate change, as well as to strengthen countries’ resilience and ability to adapt to the impacts of climate change, with adequate support for developing countries.

While the Paris Agreement and the UNSDGs have different approaches and scopes, they both result from the realisation that ‘business as usual’ is no longer an option and acknowledge the links between the business, social and environmental worlds and the need to preserve our environment. Unsurprisingly, the primary goal of the Paris Agreement falls under the Climate Action goal.

The energy industry has already taken great steps towards decarbonisation and will carry on doing so in collaboration with all the relevant stakeholders.

*https://sustainabledevelopment.un.org
The UK’s commitments on climate action

In 2008, the UK passed the Climate Change Act committing itself to pursuing a low carbon economy. The Act set a target of an 80% reduction in GHGs by 2050 compared to 1990 levels. The intermediate five-year carbon budgets set by the CCC help to ensure the UK remains on the path to achieving its decarbonisation commitments.

The Power sector leads the charge

In the eleven years since the Climate Change Act, the power sector reduced its CO₂ emissions by 54%, shrinking its share of the UK’s total emissions by one third to 27%⁸. Low carbon generation stood at 53% in 2018, with renewables alone representing 33%, up three percentage points on 2017⁹. In the meantime, the switch away from coal is well underway, with 2019 seeing the first fortnight of coal free generation¹⁰. 2018 had approximately 1,900 coal-free hours, three times the number in 2017. Midway through the year, 2019 had already surpassed 2018’s total.

In 2018, the UK’s net emissions of CO₂ were reduced to 364 million tonnes (Mt). This is 2.4% lower than in 2017. Total greenhouse gas emissions fell by 2.5% to 449 Mt of CO₂ equivalent. Carbon dioxide remains by far the main contributing greenhouse gas, accounting for 81% of the total UK GHG emissions in 2018.

The power sector continues to make the largest contribution to CO₂ emissions reductions with a 10% decrease to 65 Mt, compared to 2017. Since 1990, the power sector has lowered CO₂ emissions by 68%, representing 60% of the overall economy-wide reduction in CO₂ emissions.

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¹⁰Energy UK analysis using Gridwatch
However, climate action cannot be delivered in isolation and must be tackled on a global scale. As the UK prepares to leave the EU, the energy industry has been speaking out in unison across the EU and the UK, calling for close collaboration and alignment, both on energy and climate policy. The transboundary nature of climate challenges requires a collective response to reap the benefits to be had from a coherent transition to a low carbon economy without any compromise on energy security, economic development and affordability. The UK has an important role to play to help deliver a vision that extends past the borders of the EU to Europe and beyond.

Other sectors

- The transport sector has been the largest emitters of CO2 since 2014, representing 33% of total UK emissions\(^6\). Long-term policy direction to businesses and domestic drivers is needed to send a strong signal that everyone will be required to move away from fossil fuel powered vehicles if we are to limit the impact of climate change. Both the private and public sectors have a crucial role to play in promoting the switch to electric vehicles. The government has put in place a commitment to ban sales of internal combustion engine (ICE) vehicles by 2040, Energy UK believes this needs to be brought forward to 2035 or earlier.

- Decarbonising heat is one of the biggest challenges currently facing the UK, where over 80% of households rely on gas to heat their homes and cook their food\(^{11}\), emitting over two tonnes of CO2 each year\(^{12}\). The deployment of low carbon heat remains too low to deliver the Government’s fourth and fifth carbon budgets. While the Clean Growth Strategy published by Government in 2018 sets out some ambitions, more work is needed around developing the right framework to kick-start the transition now.

- Business represents 18% of the UK CO2 emissions, and manufacturing accounts for over 50% of these\(^{13}\). In its Clean Growth Strategy, Government announced a number of policies to improve business energy efficiency, phase out high carbon heating systems and deploy carbon capture utilisation and storage (CCUS). Strong delivery plans are now needed to back these proposals.

Committee on Climate Change’s Net Zero report

In May 2019, the CCC published its report in response to a request from the Governments of the United Kingdom, asking the Committee to reassess the UK’s long term emissions targets. The CCC recommends a new emissions target for the UK of net-zero greenhouse gases by 2050.

Energy UK supports this new ambition and agrees with the CCC’s view that the continued rollout of low carbon generation using the policy instruments and principles set up under the UK’s Electricity Market Reform (EMR) programme can support the majority of power generation decarbonisation. It is however clear that there are important policy gaps that need to be plugged to ensure that transport, heat and buildings are decarbonised and that any emissions that cannot be eliminated can be captured before they enter the atmosphere, with a need to support removal technologies such as CCUS.

Energy UK has already started its reflection and engagement with stakeholders on the pathway to net zero by 2050 and looks forward to working with the UK Government and devolved administrations to ensure this transition delivers strong benefits to society up and down the country.

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1\(^{1}\)BEIS Quarterly Switching Statistics: domestic gas meters (23.4m in Q4 2018) – ONS: households in the UK (27.2m in 2017).
2\(^{2}\)BEIS – CO2 conversion factors 2018 and assuming 12,000 kWh annual gas consumption
A strong carbon price

Carbon pricing is a key part of the decarbonisation agenda and has been driving GHG emissions down across the power sector over the last 15 years. The main instrument has been the EU Emissions Trading System (EU ETS) alongside the UK’s own carbon pricing. Other areas of the economy, such as heat and transport need to decarbonise intensely; this could be supported by a strong carbon price.

Driving decarbonisation

The EU Emissions Trading System (EU ETS) is the world’s largest emission trading scheme and the most efficient instrument to deliver carbon reductions across the traded sectors. Energy UK has supported a strong EU ETS from its inception as the most cost-efficient approach to drive GHG emissions reductions in a way that avoids cross-border distortions, enabling the delivery of affordable, reliable, and sustainable electricity across Europe. We therefore consider that there are strong mutual benefits from the UK remaining in the scheme either directly, or indirectly via a UK ETS linked to the EU ETS after the UK leaves the European Union.

Since the implementation of the scheme in 2005, the UK power sector has more than halved its volume of EU allowances (bought against each tonne of carbon equivalent emitted), from 203,000 tonnes in 2005 to 90,000 tonnes in 2018.\(^{14}\)

In a bid to further drive down UK GHG emissions, a Carbon Price Support (CPS) was implemented in 2013 as a top-up to the EU ETS price and only applies to the power sector Great Britain. As such, electricity generators pay the EU ETS and the CPS (currently fixed at £18/t CO2 until the end of March 2021).

The graph below shows the correlation between the total carbon price and the UK’s generation mix, as the amount of coal used in power generation decreased from 44% in 2012 when the carbon price was at its lowest to 6.6% in 2018 when the carbon price was at its highest.

\(^{14}\)Energy UK analysis using the EU ETS data viewer
The ongoing uncertainty around the current and future participation of the UK in the EU ETS has been negatively impacting all UK installations participating in the EU ETS and threatens to create a risk premium that might drive energy costs up as electricity generators and those purchasing electricity have no long term visibility on the carbon price. Clarity on the current and future carbon price mechanism is urgently needed.

Working together

The power sector is not the only sector participating in the EU ETS. Other sectors, including manufacturing, chemicals, cement or steel, also take part in the scheme but still benefit from a proportion of free allowances distributed to mitigate the risk to international competitiveness and of carbon leakage. As such, emissions from sectors other than energy have remained constant over the years. However, phase 4 of the EU ETS starting in 2021 should continue to see a tightening of free allowances to these sectors.

As emissions trading schemes spread around the world, an increasing number of installations worldwide will need to respond through innovation to reduce emissions at the lowest cost, improving the global level-playing field for carbon pricing. There will also be opportunities to link systems, which enhances their effectiveness and reduces costs. However, more needs to be done and a carbon price could be envisaged for other areas of the economy, such as heat and road transport, to reflect the real carbon cost of these products and services.
Looking at climate from all angles

Climate action is not limited to reducing CO₂ emissions. It is about opting for technologies that limit or eliminate them from the start, such as renewable and low carbon generation technologies. It is also about understanding and dealing with climate risks, such as flooding, and other extreme weather events, which some countries and places had not previously experienced. As such, climate adaptation is crucial.

Low carbon and renewables

The UK has made considerable progress and achieved many milestones in terms of shifting towards low carbon and renewable generation. With low carbon generation now contributing 53% of all power generated, renewables alone were responsible for 111 TWh, a third of UK’s power needs\(^\text{15}\). Since the first commercial windfarm was completed in 1991, the total wind capacity surpassed 10GW in 2013 and again doubled to 22GW by 2018\(^\text{16}\). At the beginning of 2019, the UK surpassed the one million mark on solar photovoltaics installations, totalling a capacity of 13GW\(^\text{17}\).

Only ten years ago, the total installed renewable capacity stood at 8GW. Since then, the capacity has increased over five-fold to 44GW. Between 2017 and 2018 alone, renewable capacity increased by 10%, mainly owing to increased capacity in biomass (+1.6GW) and offshore wind (+1.2GW)\(^\text{16}\). The current level of capacity provides enough renewable capacity to power all households in a country 1.2 times the size of the UK\(^\text{18}\).

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\(^\text{18}\)Mean household electricity consumption was 3,781kWh (BEIS)
Despite the robust progress in low carbon generation, the need for further electrification and decarbonisation means that a clear, market-led framework must be in place to alleviate uncertainty for investors and planners now and in the future.

The map below shows the current renewable capacity by technology within each region of the UK.

Source: BEIS Energy Trends - Renewable electricity capacity and generation (ET 6.1)
Climate adaptation

Climate change adaptation addresses climate risks, such as extreme weather events, essentially floods, droughts, very cold or hot weather, but also sea level rise, that could impact the security of our energy system and affect infrastructure, homes or businesses. New and existing buildings and infrastructure need to be assessed and made fit to withstand these risks.

When it comes to energy infrastructure, network operators as well as power generators need to understand how climate risks could affect them and take the necessary measures to mitigate them. Climate change adaptation risk assessments have been developed to test the resilience of energy infrastructure to a range of conditions. Ongoing monitoring and appropriate mitigation of the risks from a changing climate has become part of day-to-day business risk management processes.

The energy sector has been working on climate adaption in collaboration with relevant stakeholders for many years now, in order to ensure energy supply remains safe and secure in any circumstances.

Energy UK has coordinated work undertaken by power generators taking part in the Adaptation Reporting Power (ARP) under the Climate Change Act 2008. The only individual risk for electricity generation currently identified by the CCC is “Risks to electricity generation from drought and low flows”, classified as “Watching Brief”. A national review in 2018 of the resilience of electricity generation to drought and drought-related conditions concluded that the severe and extreme drought scenarios assessed were within the range of operational risks that the System Operator, i.e. National Grid, typically plans for.
Reducing emissions from buildings is a key pillar of decarbonisation at scale, but poses serious challenges both in terms of selecting the best and lowest cost approach to greening properties but also in terms of engaging those living in and utilising those properties.

This section focuses on low carbon heat while energy efficiency is addressed in more detail under Sustainable cities and communities (UN SDG 11).

**Heat, a testing challenge**

Approximately 90% of households and 70% of non-domestic properties rely on carbon-based fuels for heating, with natural gas being the most common fuel source. Providing heating and hot water accounts for around 30% of the UK’s total greenhouse gas emissions, and we need to achieve steep reductions in carbon-based heating to meet the UK’s emissions targets.

Although there are several promising replacement technologies, such as electric heat-pumps and hydrogen-based systems, it is likely that alternative solutions will cost more in the short term than the carbon-based sources used today. As such, a key component in decarbonising heat lies in the energy efficiency of buildings. For new heating technologies to be attractive and affordable on a large scale, our buildings must make the best use of the energy they consume.

When it comes to low carbon heat, the range of technologies currently available all require significant disruption to buildings, and some impact to public spaces such as roads and pavements. Engaging customers on why these disruptions are unavoidable and ensuring that they are minimised will be important to the efficient implementation of domestic decarbonisation.

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**Case study: National Grid ESO moving safely towards zero carbon by 2025**

Now legally separate from the rest of the National Grid Group, the Electricity System Operator (ESO) has announced it will be able to operate Great Britain’s electricity system with zero carbon by 2025 during periods where there is sufficient low carbon generation to meet demand.

By taking this step the ESO will help to foster greater market access for low carbon generation sources, whilst ensuring that energy continues to be transported across the country in a safe and secure manner. This will be achieved through the completion of a number of new and existing projects conducted in partnership with industry, Government and the regulator, to find resolution to the technical challenges such as frequency management, inertia challenges and voltage management management while managing and addressing climate risks to maintain a resilient network infrastructure.

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19Estimates of heat use in the United Kingdom in 2012

20 Final UK greenhouse gas emissions national statistics:1990-2017

Government’s leadership is needed for the efficient and effective decarbonisation of heat at the lowest cost to customers, recognising that local delivery will play a central role in deploying solutions at scale and that centralised funding is required to enable local implementation of decarbonisation.

Energy UK proposes a two-pronged approach to stimulating demand for low carbon solutions:

Firstly, the Government should set out a long-term plan to remove carbon emitting technologies from the marketplace. This will generate demand and provide a push for industry to develop customer-focused solutions.

Secondly, it should progressively apply reviewed taxation, subsidy and incentives across all sectors, both to signal the change required and to generate revenue to support the development and rollout of local solutions.

Energy efficiency can also play a leading role in ensuring that some of today’s overall demand for electricity can be redeployed in future to support the uptake of electric heating and transport. This will reduce the need to build additional generation and network capacity.

Case study: Heat as a service

Bristol Energy has been working with the Energy Systems Catapult to become the first energy supplier in the UK to trial selling ‘heat as a service’. Households will be offered a ‘Heat Plan’ tailored to their lifestyle, rather than buying kilowatt hours (kWh) of heat.

Capitalising on digitalisation and emerging smart home technology, the Heat Plan will provide consumers with room-by-room, hour-by-hour control over their heating. This approach is designed to give people greater control over comfort and cost as well as an incentive to use less energy and carbon.
UN SDG 7 – Affordable and Clean Energy

Ensuring access to affordable, reliable, sustainable and modern energy for all defines goal 7. To achieve this, countries should look to increase substantially the share of renewable energy in the global energy mix, double the global rate of improvement in energy efficiency and enhance international cooperation to facilitate access to clean energy research and technology.

This should be supported by investment in energy infrastructure and clean energy technology, and by expanding and upgrading infrastructure and technology to supply modern and sustainable energy services for all in developing countries*.

Looking after customers

This journey towards clean and affordable energy cannot happen without fully engaging those using the end products, i.e. us, the consumers. Despite the UK being a developed country, fuel poverty has not been eradicated; the cost of this transition to a low carbon world must be minimised for the most vulnerable.

Affordability

A competitive energy market remains the best means to ensuring customers can access affordable energy that suits their needs and priorities. The latest figures from Energy UK show that already over 3 million customers have switched their supplier in the first half of 2019, a 10% increase on the same period in 201821. Millions of customers who are not captured in these statistics will have additionally switched to a better deal with their current supplier.

Customer engagement in the non-domestic sector is also increasing with 68%22 of small and microbusinesses having had some engagement with the energy market, whether that is through switching their supplier, their tariff, or through comparing deals.

While comparing and switching tariffs or suppliers remains the best way for customers to find the best deal for their needs, the domestic sector also saw the introduction of a default tariff cap in January 2019. This temporary measure ensures that customers on default or standard tariffs are paying a fair price for their energy as work is undertaken to improve the effectiveness of competition in the market.

The industry is heavily engaged in the work required to bring about this improved competition, such as through designing faster switching processes, easier customer utilisation of data through Midata, innovation in customer offerings, and the continued rollout of smart meters which underpin the digitalised system of the future.

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22Ofgem’s 2018 non-domestic engagement survey
*https://sustainabledevelopment.un.org
UN SDG 7 – Affordable and Clean Energy

Bringing upstream costs down
Affordability is not just about the final energy bills, it often starts with technological advances and large scale deployment. Some forms of renewable power such as large-scale onshore wind and solar PV are now cost competitive and are the cheapest forms of new electricity generation in the UK. These technologies are ready to be further deployed at scale to meet anticipated future UK electricity demand and simply require support from Government in the form of revenue stabilisation CfDs.

Similarly, the upfront cost of electric vehicles (EVs) has dropped significantly over recent years as adoption has increased. While already competitive when looking at total cost of ownership, EVs are expected to reach upfront cost parity with internal combustion engine vehicles during the 2020s.

Affordability is crucial to the success of decarbonisation and as such must remain a key pillar of energy policy and of the framework that needs to start emerging on how to deliver clean and affordable energy now and in the future.

Engagement and protection as the market evolves
In addition to the increase in direct engagement with energy through switching that the market continues to see, customers are also evolving in the manner in which they access energy and related services.

Just over half of those domestic customers who switched tariff or supplier in 2018 used a price comparison website.

In the non-domestic sector, in 2018, over two-thirds of small and microbusinesses used an energy broker to help choose their current energy plan.

Three quarters of consumers in 2018 say they are satisfied with the overall service they receive from their current energy supplier, with 23% very satisfied.

This evolution is creating opportunities for the industry to further increase customer engagement, particularly as programmes to improve the effectiveness of competition are implemented alongside the continued digitalisation of the energy system.

However, as the regulatory regime has not kept pace with these changes, there is a challenge to ensure that customer confidence is retained. Price comparison websites, auto-switching services, non-domestic energy brokers, and other third-party intermediaries (TPIs) are not currently regulated. This is just one aspect of the future energy market that needs to be addressed as part of the BEIS and Ofgem joint Future Retail Market Design project, in line with recommendations from Energy UK’s Future of Energy report, in order to ensure that customers remain confident and protected no matter how they seek to access their energy.

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Protection is also needed to ensure that customers’ data and money are safe. As such, Energy UK carries on strengthening its work to improve the billing process, as well as to prevent fraud and financial crime in order to further protect customers, improve their experience and drive affordability.

The voluntary Code of Practice for Accurate Bills goes beyond government regulations and offers a rating of suppliers’ performances against the commitments it promotes. These voluntary standards help improve affordability for customers through increased efficiency in the billing process.

Some energy suppliers have also come together to work on preventing fraud and financial crime in the sector by working with stakeholders such as fraud prevention organisations and the police to identify issues and promote prompt justice. In making these crime prevention efforts, energy suppliers seek to both reduce their costs which can in turn drive customer affordability and protect customers who might suffer financial loss due to being direct victims of fraud.

These are some of the voluntary initiatives Energy UK has set up:

► Code of Practice for Accurate Bills
► Energy Switch Guarantee
► Commission for Customers in Vulnerable Circumstances
► Energy UK Safety Net, and the Prepayment Meter Principles

Cybersecurity

There have been major developments in cyber security in recent years with the energy sector, mainly due to the (EU) Network and Information Systems (NIS) Directive. This is the first form of cyber security regulation in the UK which provides ‘operators of essential service’ (OES) with a set of security principles to adhere to, providing guidance on cybersecurity protection and incident reporting. The purpose of the NIS Directive is to stop incidents happening which would have national level impacts. The Government has set the generating asset threshold at 2GW to adhere to this directive.

Through the Energy UK Cyber Security working group, Energy UK works with members and the department for BEIS voluntarily to ensure the regulations are fit for purpose.

Case study: Friends Against Scams

In 2018 British Gas began rolling out the Friends Against Scams programme to their employees. This programme from Trading Standards aims to drive awareness of what a scam is, and how to best support victims and potential victims. Similar to the British Gas Dementia Friends programme, it is being rolled out through a network of champions through both face-to-face sessions and through online learning.

As scams get increasingly more sophisticated, greater numbers of vulnerable people are at risk of being targeted by this criminal activity. British Gas believe that with their network of engineers and frontline contact centre staff, they will be well positioned to identify scam victims and provide the necessary signposting and support.
Supporting customers in difficult situations

Energy suppliers take their responsibilities towards their customers extremely seriously. Over the years, suppliers have proactively increased the support they provide to customers in vulnerable circumstances. Industry led examples of this include the Energy UK Safety Net, and the Prepayment Meter Principles. The energy industry is aware that more can always be done to support customers.

In 2018 Energy UK launched a new Commission for Customers in Vulnerable Circumstances to explore how standards of care and support could be improved. The Commission, independently chaired by Lord Whitty, was made up of commissioners from across the business, charity and consumer advice communities.

The Commission published its report in May, after hearing evidence from a wide range of stakeholders, alongside a call for evidence. The final report listed a host of recommendations for industry, Government and other stakeholders, including among others:

• The Government introducing a state-funded energy efficiency scheme for England to help tackle fuel poverty, matching those already in place in Scotland and Wales.
• Creating an independently monitored Code of Conduct for suppliers to drive up standards of support for customers in vulnerable circumstances.
• Strengthening Ofgem’s licensing regime to ensure all suppliers operating in the market are equipped to support customers in vulnerable circumstances.
• Industry working to raise awareness and the effectiveness of the Priority Service Register.
• Suppliers developing and sharing innovative practice to monitor and tackle self-disconnection.
• Retaining a social tariff for low-income vulnerable households after the default price caps end.

Furthermore, drawing on the work of the Commission and Ofgem updating their Consumers Vulnerability Strategy for the first time since 2013, Energy UK is currently developing a new Vulnerability Charter which will be published by the end of 2019. This will build on existing voluntary commitments and go further to support customers most in need.

Case study: Laundry and Food Banks

The npower Laundry Bank aims to remove the stark choice between eating and washing clothes by gifting energy efficient washing machines and dryers to schools, community centres and food banks, and the energy to use them.

In partnership with the Trussell Trust and situated within a number of the trust’s existing food banks, the npower Food Banks aim to provide two weeks’ worth of emergency support to prepayment meter users. Crucially, the customer does not have to be an npower customer to use the service.

Investment and funding

Energy UK’s Future of Energy report, which looks to address the key issues impacting the UK energy system in moving to a low carbon society from the consumer perspective, considers the challenges and requirements on infrastructure finance and future investment needed in the UK energy industry, recognising the role of both public and private funding and the need to keep the energy industry highly attractive to private investors in the UK.

Certainty for investors

The writing of this report comes at a time of uncertainty for the UK energy industry, whether it is Brexit and the uncertain future of the UK’s role in the EU Emissions Trading Scheme, or the challenges to future investment in new nuclear generation and CCUS. Fundamentally, it is essential that the Government’s policy framework ensures there continues to be the investment required to maintain security of supply and meet the UK’s legally binding carbon targets.

26Energy UK, Future of Energy report, April 2019
Energy UK firmly supports the Government’s approach to enabling long-term investment through frameworks such as the Capacity Market (CM) and Contracts for Difference (CfD). There is no need for radical change to mechanisms that have to date delivered security of supply and decarbonisation at significantly lower costs than expected.

However, recent policy changes as well as limited frameworks beyond 2020, mean the development of power projects is becoming increasingly risky. The CfD scheme gives confidence to investors and should be the main tool to support low carbon investment through the 2020s. Yet, despite having seen reducing costs of low carbon technologies such as offshore and onshore wind, solar and biomass over the past decade, some technologies are excluded and, therefore, these mechanisms are not delivering an optimal outcome.

A better outcome for customers would be to ensure that CfD auctions are technology-neutral and do not exclude low-cost options such as onshore wind and to allow all technology types the opportunity to participate in the CM.

Case study: Ffestiniog Power Station, North Wales

ENGIE is investing £50m in its Ffestiniog Power Station in North Wales thanks to a 15-year capacity market contract. In addition to providing a fast and reliable source of electricity that helps balance the nation’s electricity demand during peak times, flexible sources of power such as Ffestiniog are important for integrating the increasing amount of renewable generation so the UK can meet its carbon reduction targets at lowest cost to the consumer.

Ffestiniog is capable of generating enough electricity to supply North Wales for several hours and this investment will ensure the operational life is extended for at least 20 years.

Large-scale low carbon projects

Large projects such as new nuclear and CCUS require financing models that can attract infrastructure investors at a low cost of capital, such as those used to finance UK public infrastructure.

The collapse of the Wylfa Newydd nuclear power plant project in 2018 shows the difficulty around finding investors, and the financing issues associated with large-scale projects, highlighting the need to consider new approaches to financing large infrastructure projects. The Regulatory Asset Base (RAB) model is a good example.

Such models allow for the value of capital investment, in the project to be adjusted for the remaining useful life of the investment and revenues to be set to recover all efficient costs (construction and operation) plus a financial return on the asset value.

New nuclear and CCUS have an important role to play in creating a clean and affordable energy system that will underpins a net zero emissions society by the middle of this century.
Regulatory Asset Base (RAB) model

The RAB seeks to incentivise private investment into large projects by providing a secure payback and return overtime and sharing the risk with customers. In the case of energy companies, it allows them to manage their projects and raise revenues, often through customer bills, or via Government subsidies. The RAB model is well suited for resource-intensive projects which are expensive, complex, with long term horizons, providing investors with a fixed rate of return as the project is being built, counteracting the high cost of capital of the projects. Longer rates of return reduce the risk on investment for capital intensive projects, such as the construction of power plants.

Funding energy efficiency for affordable and clean energy

Government’s leadership is needed to fill the policy gap for energy efficiency across the domestic and non-domestic sectors. The current funding levels are not sufficient to meet the goals set out in the Clean Growth Strategy (CGS), England’s Fuel Poverty Strategy or the 2050 emissions targets\(^27\). Strong minimum standards are needed to drive action, along with incentives to support a private market for energy efficiency and public funding for those in need of support.

While the energy sector has continued to deliver the Energy Company Obligation (ECO), which has been the main driver for energy efficiency retrofitting measures in the UK, it is acknowledged that the current level of spending on ECO on its own is not enough to meet the level of change required. In 2017, Frontier Economics estimated a £4.5bn p.a. funding gap between current investment in domestic energy efficiency delivery and what is needed to meet the energy efficiency targets in the CGS\(^28\). Of this, around £1bn could be met by Government, and £3.5bn from able to pay households.

The fairest method of funding an energy efficiency programme to address fuel poverty is through general taxation. The Government should develop a centrally-funded national energy efficiency scheme to improve the quality of UK homes for those in or at risk of fuel poverty.

With the right design, ‘pay as you save’ mechanisms could provide customers with access to funding while minimising the disincentive of large upfront costs. The Government should work with the finance sector to develop green loans and mortgages for small businesses and the domestic private rented sector.

We support the Government following the Scottish Government’s example by making energy efficiency a National Infrastructure Priority. Research shows that a National Infrastructure Programme to upgrade the efficiency of homes in the UK would see £8.7bn in net benefits and a cost/benefit ratio (BCR) of at least 1.5, comparable to other high-profile infrastructure projects such as Crossrail and HS2. A National Infrastructure Priority for Energy Efficiency would allow a publicly-funded energy efficiency programme to run alongside other important funding projects.

A successful energy efficiency strategy cannot be achieved without decarbonising heat, requiring billions in investment. Continued delays to policy decisions risks undermining certainty and direction, increasing costs for consumers. The CGS allocated little money to decarbonising heat (£227m vs £3.5bn for transport). Local delivery must also play a role in deploying solutions at scale, supported by centralised funding, to enable local implementation and balancing regulation and fiscal incentives.

Energy UK has called for a restriction on the sale or tenancy of domestic and non-domestic buildings below an EPC band C from 2030 (or 2035 at the latest), subject to reasonable exemptions around cost and technical feasibility.

We consider that strong minimum standards should be backed up with incentives to provide a clear pathway to compliance, while further investment is needed in innovation, and for those less able to pay for improvements themselves.
Deployment of low carbon, renewable and GHG removal technologies

As the EU and the UK are now looking to 2050 as the date to reach net zero, the question of what is needed to get there must be answered. Where possible, emissions will be eliminated through the deployment of green technologies such as renewable and low carbon energy generation and electric cars. Where it is not feasible to generate at zero emissions, GHGs will need to be captured and removed before they enter the atmosphere via such technologies as CCUS.

Low carbon and renewables

A new wind is blowing

Over the years, the UK has moved away from heavy fossil fuel generation to low carbon, carbon neutral or renewable energy with generators, rethinking their business models and approach to embrace the low carbon world. This is leading to a transformation of the energy system with biomass, offshore and onshore wind as well as solar and bioenergy replacing coal and inefficient gas plants. Reflecting these changes, the costs for most of these technologies have gone down considerably, offshore wind being a good example with costs having more than halved in only three years between 2015 and 2017, now standing at £58/MWh for delivery in 2022/2330.

The concept of clean energy at lowest cost to consumers is now clearly the direction of travel chosen by UK based generators, backed up by ever cheaper and advanced technologies. And more of it will be needed to support the decarbonisation of other sectors such as transport and heat.

Case study: Green transformation

Ørsted's vision is a world that runs entirely on green energy. Formerly DONG Energy (Danish Oil and Natural Gas), over the past decade Ørsted has transformed from a black to a green energy company, divesting its oil and gas business to focus on renewables.

Ørsted has invested £19.5 billion in renewables globally and reduced its energy generation's carbon intensity by 72% since 2006. At the end of 2018, 75% of its energy generation was green, with a target of 99% green energy generation by 2025.

By 2030, Ørsted aims to have installed more than 30GW of renewable energy capacity globally, enough to power more than 50 million people across the world. As the global leader in developing, building and operating offshore wind farms, Ørsted has helped to drive down costs across the sector.

In 2017, Ørsted secured a contract to build its latest UK offshore wind farm, Hornsea Project Two, for a record low price of £57.50 – 50% lower than the previous auction.

30 CfD Allocation Rounds 1 and 2
Beyond Borders, the North Sea Grid

The North Seas Countries' Offshore Grid Initiative (NSCOGI) is a regional cooperation of ten countries in the North Seas region, including the UK, to facilitate the development of an offshore electricity grid in the greater North Sea area.

The region has great potential for offshore wind generation, and linking these countries via energy infrastructure can create jobs and economic growth throughout the region. Due to its geographical positioning, the UK is an essential part of the jigsaw and its participation and input is of high value.

As the UK prepares to leave the EU, it will need to look outwards towards its neighbours to develop a new collaborative approach to deliver such mutually beneficial projects. The UK’s involvement in North Sea initiatives will be important for the EU’s energy relation with Ireland, increasing interconnection between the Norwegian and Western European markets, supporting the development of offshore wind power and critical supply chains assisting the EU’s decarbonisation plans.

Strategic projects such as a North Sea grid transcend national borders and provide cost-efficiencies as well as opportunities for shared learning and best practice. Both the UK and EU/EEA States will benefit from significant intergovernmental co-operation on such potentially transformative changes in European energy systems in the years ahead, fostering regional system operation and opportunities to harness large-scale, low-carbon investments.

Case study: Offshore Transformer Modules

Siemens in the UK has supported the transmission of renewable power into the national grid, with more than 3GW connected to the grid by Siemens and two more projects, providing c 2GW due to be added in the coming years at Triton Knoll and Moray East.

These projects are being delivered from its office in Manchester using its innovative Offshore Transformer Modules (OTM®). The Siemens OTM® is significantly smaller in size and weight compared to conventional alternating current platforms and highlights Siemens’ commitment to helping power developers improve efficiencies and delivery.

In a world first, Moray East will have three OTMs connected enabling it to generate 950MW – enough to power almost a million homes and businesses.
New technologies on the horizon

Carbon Capture, Utilisation and Storage (CCUS), is a technology which allows the capture of carbon dioxide (CO₂) from fossil fuels such as coal and gas for power generation and from emissions from energy intensive industries such as steel or cement. The CO₂ can then transported to be stored in underground storage or reused in existing industrial processes or products. By preventing CO₂ from entering the atmosphere and contributing to climate change, CCUS can turn industries and power generation from low carbon into zero carbon processes, a crucial step in achieving the 2050 target on emissions reduction according to the CCC.

The Government’s Clean Growth Strategy made it an ambition to deploy CCUS at scale during the 2030s, acknowledging the need for costs to come down sufficiently. The CCC’s analysis emphasises the need for significant levels of CCUS deployment to capture CO₂ across industry, greenhouse gas removals (GGR), hydrogen production and power generation, noting however that the amount of CCS for energy generation from fossil fuels could be significantly lower than originally assumed.

Energy UK agrees with the CCC on the importance of CCUS and the need to start work on how best to utilise and deploy the technology.

**Case study: Capturing carbon: from small scale trial to global partnership**

Drax Power Station is using innovative technology developed by Leeds-based C-Capture to capture a tonne of CO₂ a day from its existing biomass generating units. If the bioenergy with carbon capture and storage (BECCS) pilot can be scaled up in the mid-2020s to deliver negative emissions, Drax Power Station would be helping to remove the gases that cause global warming from the atmosphere at the same time as electricity is produced.

Drax also proactively collaborates and seeks partners to achieve its purpose of enabling a zero carbon, lower cost energy future and to support the achievement of the UN Sustainable Development Goals.

In 2019, Drax, Equinor and National Grid Ventures signed a Memorandum of Understanding (MOU) committing them to work together to explore how a large-scale CCUS network and a hydrogen production facility could be constructed in the Humber in the mid-2020s. Scaling up the BECCS pilot project could serve as the ‘anchor’ for a regional CCUS network capturing millions of tonnes of carbon each year from nearby industrial emitters.

The partnership marks the first significant action from industry since the CCC published its Net Zero report, which found that CCUS and hydrogen technology developed in regional industrial clusters is essential if Great Britain is going to achieve a “net zero” carbon economy by 2050. The Humber could become the world’s first net zero carbon region, home to a new world leading hydrogen economy.
Energy storage comes in many forms, and a wide range of technologies are being utilised, invested in, or trialled across the UK in order to provide the required energy for consumers at lowest possible cost. Renewable generation can be stored at times of low wholesale prices for later use, reducing the cost of curtailment as well as the amount of generation asset investment needed to meet demand.

Storage assets in the UK range from large scale hydro-power facilities to small battery installations, and these all have a potential role to play. As energy service companies continue to develop new business models, customers have increasing access to small-scale storage assets that can reduce their energy bills and even make them money. Electric vehicles also offer energy storage capacity, and this capability will improve as vehicle to grid technology is further developed, allowing the energy stored in vehicles to be fed back to the grid.

**Case study: Residential electricity storage**

Social Energy is the first vertically integrated Energy Supply, Energy Storage and Energy Trading network. Harnessing the energy data of individual households, artificial intelligence softwares connect customers’ solar power to approved residential storage products, creating a virtual residential powerplant.

Energy is then stored for use at off peak times and any excess traded, giving customers the opportunity to access up to 70% savings delivered through their energy bill. This data driven, customer-centric approach puts customers in control of their energy now and in the future with the ability to tap into further developments including optimised electric vehicle charging.
Goal 9 looks at the foundations for a low carbon society through focussing on building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation.

This should include regional and trans-border infrastructure to support economic development and human well-being. Upgrading infrastructure and retrofitting industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes will provide these strong foundations*.

Industrial strategy – energy is key

The energy industry is an important contributor to the UK economy through employment, innovation, supply chains and competitiveness. Its commitment to investment in low carbon infrastructure and networks has resulted in it being one of the most productive in the UK. A whole system approach where interdependencies between power, heat and transport are understood and managed is needed to set the foundations for a strong industrial strategy and successfully deliver the Government’s decarbonisation targets at the lowest cost, whilst further benefiting from wider economic activity.

Sector deals

As part of its Industrial Strategy launched in 2017, the Government sought to complete sector deals31 in various parts of the UK economy, recognising that partnerships between the Government and industry on sector-specific issues can create significant opportunities to boost productivity, employment, innovation and skills. Nuclear and offshore wind are the two main sector deals in the energy industry.

31Introduction to sector deals
* https://sustainabledevelopment.un.org
Nuclear Sector Deal

Nuclear energy has been powering the UK for over 60 years and generates roughly 20% of our electricity today, delivering reliable power with a world-leading record for safety and supporting the transition to a low carbon energy system.

In June 2018 the Government announced a deal to ensure that nuclear energy will continue to power the UK for years to come. The deal was reported to be worth over £200 million with a £32 million contribution from both Government and industry to launch a new advanced manufacturing programme including R&D investment to develop world-leading nuclear technologies such as modular reactors. It also contained a number of commitments from industry and Government including:

- Improve diversity across the sector to achieve 40% female participation in nuclear by 2030
- Target 30% reduction in the cost of new build projects by 2030
- Savings of 20% in the cost of decommissioning by 2030 compared with current estimates.

One year on, there are a series of work-streams leading the work on:

- New Build Cost Reduction
- Legacy Cost-Reduction
- Winning UK Business
- Future Workforce
- Innovation and R&D

The work of these groups is being co-ordinated through the Nuclear Industry Council.
Offshore Wind Sector Deal

The UK is a world-leader in the offshore wind sector with six of the ten highest-capacity offshore wind projects in the world. The sector’s contribution to the UK generation mix has increased from 0.8% in 2010 to an expected 10% in 2020. Costs of the technology have plummeted by over 60% in just three years with further cost reductions expected in the upcoming CfD Allocation Round. Subject to costs coming down, it is expected that this commitment could see 30GW of offshore wind in 2030, up from 8 GW today.

In March 2019, the Government announced the Offshore Wind Sector Deal, reinforcing the Government’s Industrial Strategy to build a Britain fit for the future.

The deal also contained a number of commitments from industry and Government including:

- A £250 million industry investment into the Offshore Wind Growth Partnership to support better and high-paying jobs right across the UK.

- Government to run regular CfD auctions in the 2020s using up the £557 million budget.

- Increase UK content (value of contracts to companies operating in the UK) to 60% by 2030 to ensure that local communities benefit their fair share from the expansion of this sector.

- Increase the representation of women to at least a third by 2030 with a further ambition to hit 40%.

Adapting networks

As energy sources become more decentralised and varied, networks need to adapt to ensure they can support the transformation of the energy system. Flexibility, adaptability and fair representation of costs are key elements of this transformation with security of supply at the heart of it all.
Responding to change while ensuring security of supply

The way we interact with energy continues to change, as uptake of onsite generation, low carbon heat and transport, and energy storage increase in popularity. Each of these assets contribute to changing usage patterns, leading to an increased focus on the need for visibility across the UK’s energy networks. The Open Networks project, led by the Energy Networks Association (ENA), is working to develop effective systems to enhance visibility both of network constraints and connected assets across the UK to begin to address this.

Storage technologies are being integrated across the many levels of the system to optimise the utilisation of existing low cost, low carbon generation. This will also be aided by an increase in the amount of demand side response (DSR shifts energy use to cheaper time of use), being used as businesses and households adopt new energy services to reduce their energy bills. The deployment of renewable generation and energy storage at the Arsenal football ground, for example, has enabled them to operate at low cost and contribute to lower energy bills for the surrounding community.

UK energy markets are benefitting from this evolution, with more aggregated storage and DSR assets contracted to deliver system security at low cost.

Network charging for more efficient use

The way customers use the networks is changing as we move to a digitalised, smart and decentralised energy system. An increasing number of homes and businesses are changing the way they use energy, producing their own power through the use of solar panels, for example. As such it is essential that the system adapts to this evolution and that costs are fairly and transparently reflected.

Ofgem have launched a ‘Significant Code Review’ (SCR) which looks to ensure electricity networks are used efficiently and flexibly, reflecting users’ changing needs. They hope that consumers will benefit from new technologies while avoiding unnecessary costs on their energy bills. The project also looks forward into the future of the energy system: with the projected uptake of EVs and the electrification of heat, networks need to be able to keep up with this pace of change.

Network charges cost approx. £8bn annually and account for around a third of consumers’ end bills. Any redistribution in these charges are likely to have large impacts on industry participants. From the perspective of electricity network charging, the different charges should provide signals that allow generation and demand to compete to reduce network constraint costs.

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**Case study: PassivSystems optimises demand side response**

Hitachi Europe, Moixa and PassivSystems have created a new energy platform for the Isles of Scilly, part-funded by the European Development Fund. The Universal Smart Energy Framework (USEF) architecture and machine learning determines the best mix of demand-side response and enables dynamic changes to balance local energy generation and consumption.

Connected heat and energy stores can be triggered to turn up energy demand to make the most of the energy produced locally on the islands. This optimisation happens within preferences set by householders.

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 ► UN SDG 9 – Industries, Innovation and Infrastructure
A smart and flexible energy system

The energy sector is transitioning to a low carbon future, coupled with a data and technological revolution. As smart and flexible technologies spread across the system, interactions between participants will change, creating new opportunities for all.

Smart at home and at work

With over 14 million smart meters installed so far32, the rollout of smart meters is a key part of a responsive, resilient energy system, transforming the role of consumers from passive users to active participants. Products and offers which allow consumers to react to real-time market conditions and benefit from cheaper rates are already available, but in the future household appliances and other devices will also be connected, providing customers with granular information and control over their own energy use, further increasing the resilience of the GB grid.

The breadth and depth of data which will become available could fundamentally change how companies supply energy, how consumers engage with it, and how society views and benefits from the energy system. It is important to ensure market participants have access to relevant data, while ensuring sufficient controls are in place to protect customers.

Energy Management Services (EMS), utilising data made available by the Smart system, will bridge the gap between each household and the wider system, building a reflexive smart grid. EMS can take into account a number of internal and external factors including market signals, weather and climate conditions. Consumers can therefore take informed decisions to alter their usage accordingly.

The range of offerings from energy service companies has also increased the ability of customers to react to the needs of the system providing some new flexibility, with DSR continuing to rise in popularity across Industrial and Commercial users, aiding them in reducing their energy bills by shifting their energy use to a less busy time.

The penetration of these technologies creates a smart and flexible grid, with consumers able to fully optimise the benefits of smart technologies to their own advantage and that of the wider system.

Flexibility

Flexibility (matching the supply and demand for electricity over time and across different areas of the grid) relies on energy system actors being able to understand and respond to market signals to adapt their demand for, or supply of, energy in a way that realises direct or indirect benefits. This results in a system that helps to meet carbon targets, while delivering energy security at the lowest cost via efficient competitive markets.

A continuing rise in the capacity provided by intermittent renewable generation will increase the need for flexibility and back-up managed by dispatchable technologies such as storage or thermal generation.

At the same time, increased digitalisation and decentralisation will expand the scope of active participation in short-term balancing and ancillary services markets to a wider range of participants, with consumers taking part via aggregators. The combination should deliver a much broader and granular market, more efficient and secure - provided it facilitates and ensures the widest possible scope for competition. The current market arrangements for ancillary service procurement are fragmented and no longer suited to the evolving market, requiring reforms to ensure flexibility providers can offer cost-effective solutions to local network issues.

Competitive flexibility markets are in their infancy and work is now needed to develop a framework for commercial and domestic customers to participate in these local markets. Flexibility options should always be considered first when additional network capacity is deemed to be needed, as an alternative to grid reinforcement.

Case study: Innovating in electricity distribution: Project LEO

In 2018/19, SSEN joined together with key local and industry partners to launch Project LEO, and is now the lead partner in a collaboration of ten public, private and voluntary sector participants. The £40m project, supported by £13.8 million of funding from the UK Government’s Industrial Strategy Fund, is one of the most wide-ranging and holistic smart grid trials conducted in the UK.

An industry-first, Project LEO will explore how the growth in local renewables, electric vehicles, battery storage, vehicle-to-grid technology and demand side response can be supported by a local, flexible, and responsive electricity grid to ensure value for consumers and opportunities for communities and market providers.

Project LEO is a glimpse of the future and places SSEN firmly at the forefront of the UK’s preparations for a decentralised energy system able to accommodate a dramatic increase in EVs.

The current market arrangements for ancillary service procurement require reforms to ensure flexibility providers can offer cost-effective solutions to local network issues.
Decarbonising road transport

The decarbonisation of road transport is one of the pillars of the decarbonisation agenda and as such needs to happen as soon as feasibly possible through collaboration between local authorities, Government and the power and automotive industries to ensure the right infrastructure, products and services are in place. Energy UK calls for all new cars sold in the UK to be electric by 2035 and recommends a policy and regulatory framework that focuses on zero-emission vehicles, to support Government’s ambition for almost every car and van to be zero-emission by 205033.

Infrastructure

2018 witnessed the highest rate of electric vehicle (EV) registrations with 5,000 registrations a month34. In total, around 60,000 new EVs were registered, increasing the total stock to approximately 200,00035.

As EVs become a more familiar sight across the UK and more and more local governments embrace a green agenda, who has not been thinking about what it would be like to have an electric car? Yet, even though the average journey in a car is no more than nine miles36, potential drivers remain anxious about out-of-pattern or longer journeys.

So, while charging at home is likely to be cheaper and most convenient for most, encouraging the uptake of EVs will require a network of public EV chargers. Ultra-rapid chargers will be an important part of this network, providing confidence to drivers on long distance journeys.

There are now 19,000 charging connectors throughout the country, including 4,400 rapid chargers. However, with the Committee on Climate Change estimating that over 200,000 rapid chargers, including 2,100 ultra-rapid chargers, will be needed by 2050, there is still a long way to go37.

For this reason, and the fact that the business case does not always stack up for ultra-rapid chargers, Energy UK has called on Government to support the cost of the network connection in strategic locations. Doing so will enable the delivery of a core network of charge points across the country, encouraging investment and building on the activities of the private sector.

33Zero-emission vehicles include pure-electric (battery) and fuel cell electric vehicles
35The term ‘electric vehicles’ encompasses pure-electric, hydrogen fuel cell and plug-in hybrid vehicles
Energy System Interaction

What most standard car drivers had never really contemplated before is that it will be possible to use your EV as an electricity storage unit. With cars parked for the vast majority of the time, there is significant potential for EVs to earn all or part of their upkeep costs by providing energy services to the electricity system, through smart charging and vehicle to grid (V2G). V2G allows an EV to feed power back onto the system, unlocking a host of additional benefits to the EV user and the energy system. Energy stored in EVs will allow some customers to meet their own demand, potentially powering their home for days from their battery.

V2G allows EVs to become fully integrated energy system assets, offering the potential to reduce curtailment of renewable generation, improve system flexibility, contribute to balancing the grid, and optimise the operation of local electricity networks. Their storage potential will be instrumental in supporting the UK’s transition to low carbon, but typically less flexible, energy sources.

Energy UK members are leading trials across the country to test the technical, behavioural and economic opportunities of EVs through V2G. 2019 has seen the first V2G chargers installed in UK homes and businesses, offering new insights into the potential EVs represent for the energy system.

Case study: OVO’s domestic bidirectional EV charger

Smart charging and Vehicle-to-Grid technologies could lower the cost of decarbonising the power sector by offsetting distribution network upgrade costs and gas peaking plant. Analysis has shown that Vehicle-to-Grid charging could save the energy system up to £3.5bn a year. It also means more of our energy can come from renewables because excess generation can be stored, ready for use when it’s needed.

The 6kW Kaluza Vehicle-to-Grid Charger is the world’s first widely available domestic bi-directional electric vehicle charger. It offers drivers of certain electric vehicles the opportunity to discharge excess electricity from their cars back to the electric grid to help supply energy at times of peak demand. It is the first such product to be produced and made widely available to domestic customers at scale in the world, and works with an OVO Energy tariff to give customers the chance to charge their EV for free.
Fostering innovation

Innovation brings progress to society through new ideas, products and technologies and helps to drive costs down. But innovation is not only technical, it is also about having a vision and creating the tools to deliver it through well thought through policies, institutions and forward-looking business models. More innovation will be needed to ensure the whole economy decarbonised.

Carbon Capture Utilisation and Storage Advisory Group

The future for CCUS in the UK looked bleak when, in 2015, the Conservative government cancelled the £1bn competition for CCUS. However, CCUS is now rising back up the Government agenda due to increasing pressure to accelerate action to mitigate climate change and ensure we have a solid low carbon energy system in place sooner rather than later.

The Government set up the CCUS Council in 2018 with the purpose of reviewing progress of its commitments made in the Clean Growth Strategy. At the same time the CCUS Cost Challenge Taskforce was set up to inform and propose a strategic plan for supporting the development of CCUS in the UK, in order to meet the Government’s stated ambition of having the option to deploy CCUS at scale during the 2030s, subject to costs coming down sufficiently.

The CCUS Cost Challenge Taskforce’s report: Delivering Clean Growth released in July 2018 concludes that CCUS meets the three tests of the Clean Growth Strategy and identifies viable business models, funding mechanisms and options to support the lowest cost delivery of a potentially transformative technology. More recently the industry-led CCUS Advisory Group was formed to advise on the critical challenges that face CCUS. A public consultation on the best route for CCUS deployment in the UK is also expected.

Hydrogen, a carbon free alternative to natural gas

Hydrogen is potentially one of the most promising solutions to decarbonise the gas network, providing clean energy to homes and businesses.

A number of trials for hydrogen production and utilisation are progressing across the UK, ranging from tests of the appliances and hardware to be used in future, seen in Hy4Heat, to developing a fully Hydrogen gas network for domestic use, as seen in H100. These will continue to develop the UK’s understanding of the benefits, potential, costs, and limitations of the technology.

The H21 North of England report added to the existing evidence base for UK production and use of hydrogen, but 2019 will see practical trials begin to truly test ways to achieve the potential 53-269TWh the UK could produce in 2050, as set out by CCC estimates.
The HyDeploy project, launched in 2018 with Network Innovation Allowance (NIA) funding, will introduce a blend of up to 20% (vol) hydrogen and natural gas to 100 homes and 30 faculty buildings on Keele University's private gas network from September 2019. The 10 month trial will provide evidence on the acceptability to customers and the safety aspects of using hydrogen for domestic heat and cooking.

Following the Keele trial, there will be larger tests in the North East and North West on NGN and Cadent networks with a more diverse customer base to ensure the results are sufficiently representative for hydrogen to be used nationally. So far, 98% of appliances checked at Keele have been gas safe and 100% of those appliances have passed the bottle testing with hydrogen up to 23%. Customer questions have mainly been on the subject of cost and any inconvenience.

The HyDeploy Consortium (Cadent, NGN, HSE and Progressive Energy) continues to engage stakeholders at events to ensure hydrogen forms part of the choices for customers in future.
UN SDG 11 – Sustainable Cities and Communities

Goal 11 of the UN SDGs looks to make cities inclusive, safe, resilient and sustainable through ensuring access to safe and affordable housing and basic services as well as affordable, accessible and sustainable transport systems for all.

Sustainable cities are essential for a low carbon future as more and more people move to cities. Communities need to be strengthened through local engagement and the way the energy system is transforming will allow this engagement to grow.

Green transport for sustainable cities and communities

Sustainable cities and communities require a complete rethink of transport, whether public or private, which has until very recently mainly relied on fossil fuels. This switch to low carbon transport will not only address the decarbonisation agenda but also the health agenda by removing the main cause of air pollution. But this transition is not straightforward and will require ingenuity both in terms of making it financially and socially acceptable.

Clean air for all

The ongoing transition to a cleaner energy system encompasses more than just decarbonisation and the targets enshrined by the Climate Change Act 2008 to reduce greenhouse gas (GHG) emissions. It also has a strong positive effect on pollution and air quality.

The transition from coal to other forms of generation has clearly made a massive contribution to the reduction in GHG emissions and associated pollution problems and as such has a direct impact on the air quality agenda. The energy sector has again made major strides in cutting its contribution of other emissions – such as sulphur dioxide (SO₂), nitrogen oxides (NOₓ) and particulate matter (PM) which can have serious consequences for people’s health as well as the environment.

Between 2000 and 2017, we achieved a 97% drop in SO₂ emissions, alongside a 72% cut in NOₓ emissions and reductions in PM ranging from 71-89%. But we still have much work to do as energy generation remains the biggest source of SO₂.

*https://sustainabledevelopment.un.org
In January 2019, the Government published its Clean Air Strategy. This highlighted the significant progress already made by the power sector alongside the automotive industry in reducing harmful emissions. The electrification of vehicles is recognised as the next big step in addressing pollution from transport in cities and communities.

Clean air is a common good that needs to be protected and enhanced. In making cities and communities more sustainable, all aspects of air pollution will need to be looked at and addressed.

Engagement at all levels is key

With powers on transport increasingly devolved to regional and local actors, there is increasing scope for local governments to shape transport policy and tackle air quality issues. Alongside central government, cities will play an important role in decarbonising transport, through ambitious active travel and public transport strategies and by encouraging the uptake of electric vehicles.

Local governments understand the requirements of their areas and are therefore well placed to support the delivery of charge points, ensuring that the needs of fleet operators, taxis/private hire drivers, private drivers and other user groups are being adequately catered for.

Work being undertaken by Transport for London through its EV Infrastructure Taskforce highlights the important convening and coordinating power that local actors can play. The Taskforce has brought together national and local actors to identify the key barriers to rolling out EV charging infrastructure in the capital and is taking forward a comprehensive workplan to address them.

Smart and sustainable homes and buildings

Smart and sustainable homes and buildings will be built on new interactions between energy customers and the built environment.

This will be facilitated by the evolving energy system, from homes and businesses choosing how to control their energy use, to community projects that will make the best of energy potential in the area, such as community heat networks.

![Particulate matters emissions from power stations](chart.png)

Source: National Atmospheric Emissions Inventory - BEIS

**UN SDG 11 – Sustainable Cities and Communities**
Transforming consumers’ interaction with energy

Technical innovations often call for a change in behaviour throughout society to access the benefits of the new products and services at our disposal. Smart technologies, including smart meters, are changing the way energy consumers interact with the energy system and further engagement will appear as the technology is deployed at scale. This will need to happen in a safe environment for all and as such security remains a priority. The Smart Meter rollout provides a once-in-a-generation opportunity to engage consumers on energy efficiency. By receiving real-time information on their energy usage and costs, consumers now have greater ability to adapt their behaviour to optimise energy consumption. In turn, suppliers and other entrants have a market space to develop products incentivising energy efficient behaviours.

Suppliers are now required to provide energy efficiency advice alongside every smart meter install, to ensure customers have all the information they need to reduce their overall energy consumption. The advice provided relates to how customers can change patterns of usage, obtain energy efficient household appliances, as well as home adaptations such as wall and loft insulations.

The development of Time-of-Use and Smart Tariffs adds an extra level of financial incentive for consumers to optimise their energy usage. Consumers can shift usage away from times of peak demand and to periods when demand is lower and price is cheaper. Initial consumer feedback suggests that when advice is provided by suppliers, Smart consumers do adapt their behaviour to make energy savings where possible. Alongside the decarbonisation of heat and transport, smart homes will be another crucial part of the jigsaw to make our cities sustainable, reducing their carbon footprint in a cost-efficient manner.

**Case study: Biomass plant heats up homes and businesses**

Blackburn Meadows biomass CHP plant powers 40,000 Sheffield homes, and provides 30 jobs, using 200,000 tonnes of locally sourced recycled waste wood that would otherwise go to landfill. It captures the heat produced through electricity generation for use in a district heating scheme, providing heating and hot water to local businesses including FlyDSA Arena, iceSheffield and IKEA.

In 2017, E.ON added one of the UK’s first commercial battery systems to the site.

The 10MW system responds to frequency fluctuations within one second, absorbing or discharging power into the local distribution network, ensuring both power supply and quality are maintained.
Community heating networks

The UK Government has dedicated £280 million in funding for heat networks, due to their potential to reduce bills for consumers whilst reducing overall emissions from heating. Technologically neutral, they can be used alongside low carbon heat sources to ensure the maximum reduction in all emissions.

A heat network connects multiple customers to a single source of heat, removing individual boilers and pumping hot water around the network to deliver for the needs of consumers. The existing heat networks in the UK are typically run on large gas-fired boilers or combined heat and power plants, but there are some installations running on heat pumps and other technologies.

Heat networks are often deployed in city centres, in new-build housing estates, and for public buildings, and are relatively small-scale compared to European counterparts. In the UK, typically resulted in lower costs for consumers connected to them. However, the market has remained largely unregulated, giving consumers little protection if things go wrong. The number of complaints relating to heat networks has resulted in a series of reviews of the state of heat network regulation, and the Government has begun work to address this gap.

Energy efficiency for buildings and people

There are significant economic, environmental, comfort and health benefits to be gained from making energy efficiency improvements. Done at scale this can transform cities, reducing energy usage but also alleviating health issues due to cold or damp homes and buildings.

Reduce consumption and emissions

Energy efficiency plays a central role in reducing carbon emissions from homes in the UK and helps tackle climate change. The benefits are multiple and easy to see: reduced consumption means reduced energy bills, demand on the grid and emissions from electricity and gas use. Approximately 90% of households and 70% of non-domestic properties rely on carbon-based fuels for heating\(^{38}\), with natural gas being the most common fuel source. Heating and hot water accounts for around 30% of the UK’s total greenhouse gas emissions\(^{39}\).

Although there are several promising replacement technologies, such as electric heat-pumps and hydrogen-based systems, or potentially a combination of both, alternative solutions are likely to cost more in the short term than carbon-based sources used today. A key component in decarbonising heat lies in the energy efficiency of buildings, and making the best use of the energy they consume.

The funding commitment required to upgrade the energy efficiency of UK homes and businesses is substantial; significant investment from both Government and private sources is needed to achieve necessary carbon emissions reductions. These costs come with a range of benefits such as warmer, drier homes that cost less to heat, leading to improved health outcomes and greater productivity.

In 2018, the energy sector continued to deliver the Energy Company Obligation (ECO), which obligates suppliers of a certain size to achieve targets of carbon and lifetime energy bill savings in homes across Britain. The obligation is delivered by funding the installation of approved energy efficiency measures in eligible homes. On average, obligated suppliers are estimated to fund around £640 of energy efficiency improvements through ECO. This year saw the end of the second iteration of the scheme, ECO2, on 30 September 2018.

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Almost all targets for the scheme were exceeded, resulting in a total of 27.4Mt in carbon savings and £6.9bn in lifetime bill savings\(^{40}\).

The replacement scheme, ECO3, began in December 2018 and is fully focused on achieving lifetime bill savings among households in or at risk of fuel poverty. Across 2018, the costs to obligated suppliers to deliver ECO2 and ECO3 were around £360mn (including administration costs), which saw energy efficiency improvements installed in 167,000 homes, resulting in 3.9Mt in carbon savings and £1.5bn in lifetime bill savings\(^{41}\). ECO3 runs until March 2022, with a target to achieve £8.2bn in lifetime bill savings, treating around 1.1mn homes\(^{42}\).

<table>
<thead>
<tr>
<th>ECO measures installed</th>
<th>Lifetime energy savings</th>
<th>Lifetime carbon savings (CERO and CSCO)(^{43})</th>
<th>Lifetime bill savings (HHCRO)(^{44})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installations in 2018</td>
<td>In 167,000 homes</td>
<td>13.5 TWh</td>
<td>3.9 MtCO2</td>
</tr>
<tr>
<td>Installations since the start of ECO in 2013</td>
<td>In 2 million homes</td>
<td>144.1 TWh</td>
<td>36.4 MtCO2</td>
</tr>
</tbody>
</table>

**Engaging households and businesses**

Achieving the UK’s emissions reduction targets will require more engagement and investment from individual households and businesses on energy efficiency and sustainability, as well as industry and Government. However, competing priorities and interests, as well as barriers to uptake can present a challenge to effectively engaging these groups. More needs to be done to promote to households and businesses the benefits of energy efficiency and renewable energy, such as improved comfort, health and productivity, as well as financial savings. Like for all behavioural changes, incentives are important.

Bringing clean energy to cities and communities across the country, the energy sector has continued to deliver the Feed-in Tariff Scheme to encourage sustainable and low-carbon generation over 2018/19, with over 17,000 FiT installations recorded, bringing the total installed capacity to 6,100 MW across 838,000 installations\(^{45}\). Networks are already exploring ways to further engage households and businesses in making changes to their energy use profiles in place of network reinforcement, to make the best use of existing infrastructure.

We also consider there is a greater role for Government in taking leadership and a long-term approach to helping to drive changes, creating the conditions that will increase engagement, particularly in energy efficiency, and incentivise them to take action to reduce emissions.

\(^{40}\)Ofgem, ECO2 final determination report

\(^{41}\)BEIS Household Energy Efficiency Statistics, June 2019 release


\(^{43}\)All carbon savings for 2018 were delivered under CERO

\(^{44}\)The Home Heating Cost Reduction Obligation is aimed at reducing heating costs through energy efficiency improvements, and is measured in lifetime bill savings.

Towards zero carbon homes

Energy efficiency is crucial for sustainable cities and communities, and is a key part of shaping what homes in the future will look like.

Since the removal of the zero carbon homes policy in 2015, recent research⁴⁶ has estimated that yearly energy bills are on average £200 higher for owners of new build homes than they would have been if the policy had been kept in place.

The sector has welcomed the Government’s announcement in April 2019 that a new future homes standard will be developed to ensure new builds are constructed to high energy efficiency standards, and that carbon-based heating sources will be phased out by 2025. It is not justified to build new homes today that will require retrofitting in future to meet the UK’s 2050 carbon targets.

Case study: Solent Achieving Value from Efficiency (SAVE)

Scottish and Southern Electricity Networks’ (SSEN) project Solent Achieving Value from Efficiency (SAVE) sought to establish to what extent energy efficiency measures can be considered as a cost effective, predictable and sustainable tool for managing peak demand as an alternative to network reinforcement.

SAVE tested and compared the impact of four different interventions with 8,000 Solent customers: energy efficiency; education; monetary incentives; and community engagement. By fusing smart technologies, with customer interaction, SSEN has developed a model for investment that minimises electricity costs for customers, maximises social benefits, including those to the fuel poor and vulnerable, and reduces carbon emissions.

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Case study: Innovative external wall insulation

E.ON is working with Mauer to help bring an innovative new external wall insulation system to market and has secured the first Ofgem approved ECO (Energy Company Obligation) innovation scheme. It uses advanced laser survey, computer aided design and highly accurate off-site manufacturing techniques to create a ‘kit of parts’ that is easily assembled on site.

This improves quality, reduces waste, provides a durable realistic brick effect finish, is quicker to install and avoids the weather-related delays suffered by the more traditional insulation boards and render systems.

Reducing domestic energy consumption helps contribute to the Government’s climate change and fuel poverty reduction goals.

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UN SDG 11 – Sustainable Cities and Communities
Making the most of local energy

Community projects will play an important part in ensuring that no one is left behind in the transition to the low carbon world and in recreating a sense of community sometimes lost in big cities. Decentralised energy can be at the centre of new or existing communities and play a big role in communicating the need for change and the role that we all play in it.

Energy at the heart of communities

Energy suppliers are creating jobs and delivering investment in communities across Great Britain, not just in London or the South East of England. The history of the retail industry has meant that energy suppliers have a long standing and significant presence in the local economies of cities and regions across GB, including Cardiff, Brighton, Manchester, Leeds, Glasgow and many more. This trend has continued as the number of suppliers has grown to 59 today, many of whom have also been able to benefit from the historical geographical spread of relevant skills across Great Britain. As part of this trend, in recent years we have also seen the growth of a number of regional, council-backed energy suppliers, dedicated to better serving the needs of their local customers and communities.

Case study: Bristol Energy’s hub

The Hub offers customers the opportunity to ask questions about bills, switching and energy efficiency. Located in the centre of Bristol, it provides people with new ways to engage with energy by holding entertaining and informative events, which can reach people who might not have considered or felt comfortable picking up the phone or going online to ask for information.

The Hub reached more than 10,000 people in its first year, building brand awareness and encouraging people to switch and save money. Those who have visited the Hub have praised the opportunity to have a face-to-face conversation with a supplier and reach a quicker resolution to their queries. It also offers a free events space for community groups and local charities that share the company’s social values, and was recognised by Sustainability First’s Project Inspire as an excellent example of improving access for vulnerable customers.
With the ongoing progress of the smart meter rollout, we are also seeing energy suppliers begin to bring new innovative tariffs and products to market which will better match the needs of individuals and communities. Product’s like Octopus Energy’s ‘Agile’ tariff, launched in 2018, are now allowing customers to access and benefit from dynamic half-hourly rates based on wholesale and grid prices.

We have also seen a growing number of suppliers offering green tariffs and products, from by both traditional and specialist energy suppliers, to match growing consumer demand for such products. Today, there are over 100 green tariffs available for consumers to switch to\(^\text{47}\). With the decentralisation of energy generation towards smaller sites all over the country, such green products are likely to become more common, popular and affordable as well as locally produced electricity.

\(^\text{47}\)Energy UK analysis of Energylinx tariff data

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**Case Study: Kidbrooke Village**

E.ON’s Future Energy Home collaboration with Berkeley has seen E.ON install a range of smart energy solutions in their innovative and award-winning Urban House at the Kidbrooke Village regeneration development in south east London.

The solutions installed include solar glazing integrated into a glass canopy above the home’s roof terrace, a battery storage system, electric vehicle charge point, smart thermostats, plug sockets and light switches.

All solutions are connected to E.ON’s innovative home energy dashboard. The dashboard offers intuitive visualisation and control of installed solutions without having to navigate a maze of separate apps for each piece of technology.

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\(^\text{47}\)Energy UK analysis of Energylinx tariff data
Generating electricity locally

New renewable technologies, such as wind turbines and solar panels (PVs), alongside bioenergy and energy from waste have opened new doors for how and where energy is generated. Small-scale PVs in homes and communities already represent 20% of the UK’s total solar generation capacity\(^4\) and community wind farms are operational in many parts of the country, especially in Scotland. Waste has found a second wind by being burnt or transformed to create electricity or heat.

While solar and wind remain the two dominant technologies, East Midlands, South West and West Midlands lead the way with the highest number of anaerobic digestion installations, Scotland and Wales with hydro, and South East and North West with micro CHP under the Feed-in Tariff scheme\(^4\).

These changes mean that the UK is to some extent moving away from a focus on big power stations and transporting electricity up and down the country to smaller sites feeding in directly into the distribution networks in your area. These new opportunities can allow people, local authorities and communities to come together and make decisions on the sort of energy they want to use, including the option of generating it themselves. With this come potential benefits, including strengthening the local economy through new business and job opportunities, and decarbonising energy use.

The transformation of national and local waste strategies over the years has also created new opportunities for local communities to decide if energy from waste can be part of their local waste solution. While this is likely to require investment in new infrastructure and installations and some planning decisions (i.e. where to install the waste plant), it also offers new jobs and revenue perspectives leading to communities becoming more sustainable and self-sufficient in the long term.

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**Case study: St George’s University Hospital**

Centrica Business Solutions has partnered with the largest healthcare provider in South West London, St George’s University Hospital, to create a new energy strategy as part of a 15-year Energy Performance Contract. The contract involves installing two Combined Heat and Power (CHP) Units and four boilers.

Alongside this, Centrica Business Solutions have introduced various schemes across the site, which include: improved lighting, a building management system, chiller replacement and split unit air conditioning optimisation. The improvements will result in reduction in energy costs of £1m a year and 6,000 tons of carbon saved a year, which is equivalent to 3,000 cars being taken off the roads.

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\(^4\)BEIS: Solar photovoltaics deployment, May 2019  
\(^4\)Feed-in Tariff Annual report 2017-18  
Case study: Community Benefit Funds

As part of Ørsted’s community engagement programme for several of its UK offshore wind farms, Ørsted has established three voluntary community benefit funds (CBFs), worth approximately £1.3 million each year, with £175,000 ring-fenced for skills initiatives. These funds can make a valuable contribution to the local area, by supporting social and environmental projects over the lifetime of the offshore wind farms.

In 2018, £50,000 of Ørsted’s East Coast Skills Fund was shared between two organisations: Scientists for Global Responsibility to deliver workshops entitled “One Planet - One Life” across secondary schools in the funding area over a two-year period, and 3D Web Technologies Ltd to deliver twelve Science, Technology, Engineering and Maths (STEM) skill-focused workshops for year eight pupils to understand the complexities of offshore wind farm design.
Other UN SDGs supported by the energy sector

In this last chapter, Energy UK wanted to go beyond the energy and climate lens and offer an insight into how energy companies through developing best practice have had a positive impact not only on people’s well-being through good health, education and work, as well as reducing inequalities, but also a positive impact on the environment they operate in by looking at two other important goals: life on land and life under water.

As such, we have chosen to use case studies, mainly from our members, to show the breadth of good practice across the industry*.

UN SDG 3 – Good Health and Wellbeing

Over the last decade, we have seen a significant shift in companies’ attitude towards health and well-being, recognising the need to ensure employees find a more balanced approach to life and work to improve their quality of life overall, including their mental health. Below are case studies demonstrating the work our members are doing in this field.

Changing Mind Sets

RWE’s new strategy ensures good health and wellbeing is embedded in the company culture, with an initial focus on the promotion of mental, musculoskeletal and chronic health issues.

The business has signed up to become a Mindful Employer, committed to reducing the stigma associated with mental health. Healthy Minds workshops, which are run for all managers, ensure there is a company-wide commitment to undertake stress risk assessments (Pressure Points).

RWE’s Wellbeing Champions assist in the implementation of local activities and programmes across all sites in health and wellbeing. RWE has trained over 50 Mental Health First Aid Champions, providing employees with additional crisis support if needed. To encourage interventions, mental health training sessions educate people at all levels on approaching difficult conversations and asking ‘are you okay, really are you okay?’, then acting accordingly.

Some improvements we have already noted are more conversations to address stress at work and more discussions between employees on mental health, but also an increase in referrals to Occupational Health and Wellbeing for mental health support and an 80% increase in the use of the Employee Assistance (Healthy Minds) confidential counselling service. We are already seeing positive changes in the mind-set of employees regarding mental health, and our work will continue.

*https://sustainabledevelopment.un.org
Health through Warmth

Npower’s Health Through Warmth (HTW) is an innovative scheme helping the most vulnerable in our communities since 2000, regardless of whether or not they’re npower customers. By working closely with community workers, charities, local authorities and the National Health Service we can identify vulnerable people who need assistance to fund and install heating and insulation in their homes.

The Marmot Review on the Health Impacts of Cold Homes and Fuel Poverty (2011) clearly lays out the evidence that living in a cold home can have a significant negative impact on physical and mental health. This is why our HTW scheme is an important element to help address the wellbeing of vulnerable people and can make a real difference.

We source funding (including Government grants, charitable contributions and the npower HTW Crisis Fund) to provide a long term, practical solution to support people to keep warm and stay warm. To date, we’ve helped over 86,000 people and facilitated installation of more than £94 million worth of heating and insulation measures, including £16 million contributed from the npower HTW Crisis Fund.

UN SDGs 4 & 8 – Quality Education and Decent Work

Quality education is an essential foundation for a fruitful and rewarding professional life. As the energy industry changes and transforms itself, new opportunities for education and work emerge alongside the more traditional energy trainings and jobs.

EDF Energy’s Pretty Curious

The UK will continue to face a significant skills shortage if the number of girls studying science and technology subjects continues to stay below that of boys. EDF Energy is working to change this and to increase the percentage of women joining its workforce.

Launched in 2015, EDF Energy’s Pretty Curious programme focuses on three key areas: raising awareness of the issue, introducing teens to inspirational role models and creating empowering hands-on experiences. Since its launch, the programme has grown to deliver these experiences to more than 2,300 girls last year from just 150 in its pilot year. At these hands-on ‘hackathon’ events girls were able to experience the latest virtual reality and connected digital technology, such as droid making and artificial intelligence. To address the lack of visible role models, the events were facilitated by inspirational women working in the sector. 90% of girls attending said that the events made STEM more interesting to them.

Pretty Curious is just one of many EDF Energy initiatives in place to reach girls across the UK and thanks to its commitment last year the business increased the number of female engineering apprentices by 14% to 35%.
Young Energy Professionals (YEP) Forum

Energy UK’s Young Energy Professionals (YEP) Forum is a network of around 1,500 people, with representation spanning over 340 different companies. It brings together those considering a career in energy with those already working in industry, offering the opportunity to broaden their knowledge, share development successes and network with peers. The YEP Forum is sponsored by CGI.

The Forum runs a series of free events throughout the year, ranging from panel events on topical issues, regional networking events, and site visits to some of the UK’s major energy centres. Over the course of 2018/2019, the Forum hosted regional networking and panel events in Glasgow, Durham, Birmingham, Salford and London, and visited SSE’s Research Centre, Culham Centre for Fusion Energy and RWE’s Staythorpe Power Station.

In June 2019, the Forum hosted their annual YEP Awards ceremony, bringing together the next generation of industry professionals to recognise and celebrate their outstanding work. With over 200 industry representatives in attendance, the awards ceremony was the biggest yet, seeing a record number of applications, the highest number of different organisations shortlisted and a near equal gender balance across award winners.

Cottam coal-fired power station closure

In February 2019, EDF Energy made the difficult decision to cease generation at Cottam coal-fired power station on 30 September 2019, following more than 50 years of safe, reliable generation. This was not an easy decision and reflected the challenging market conditions over the last few years and the context of the drive to decarbonise electricity generation.

Conscious of the need to support a just transition to a low carbon energy system, a programme was put in place at Cottam for more than a year to help prepare for when the plant closes to give people individual certainty around the future of the business, how the changes impacted on them personally and do everything to support our people with their future aspirations, whether in EDF Energy or elsewhere.

158 people were working at Cottam and in scope when the decision was made. Following consultation, 66% of employees at Cottam will stay in other areas of EDF Energy, 24% of employees have chosen to leave the company and EDF Energy continues to support the remaining 15 people to find new opportunities within the company. As part of this, reskilling is used to help secure new roles.

EDF Energy is proud of the plant and its people at Cottam and is determined that Cottam will close on a positive note, delivering excellent safety and operational performance right up until the very end.
Inequalities come in many shapes and forms, through income differentials, lack of access to good education, social exclusion, class barriers, restricted access to services and discrimination. Inequalities remain high everywhere in the world, including in developed countries such as the UK.

A lot of work is going on to address these issues, such as improving social inclusion through better access to quality education for all, having safeguards in place for those in or at risk of fuel poverty, as well as eliminating discrimination in education and work place and promoting diversity and inclusion.

Breaking Barriers: inequality within and among countries

In 2018, ScottishPower worked alongside project partners ENABLE Scotland and the University of Strathclyde to run Breaking Barriers, an innovative programme that creates employment opportunities for young people with learning disabilities. The project is part of ScottishPower’s broader commitment to create a diverse workforce and inclusive environment.

The first year of the programme supported eight young people with learning difficulties to access higher education and employment opportunities. The learners aged 18-24 studied for a Certificate in Applied Business Skills at the University of Strathclyde Business School and gained valuable work experience during an eight-week placement with ScottishPower.

At the heart of the project’s success was making the business welcoming to these young people with accessible working environments, facilities and ongoing support. It was complemented by an extensive internal communications campaign, raising awareness of the programme and the benefits of a diverse workforce with differently abled people. The project was shortlisted in The Herald Higher Education Awards. Breaking Barriers will return for a second year in 2019.

Improving social mobility

Opportunity areas are an important part of the Government’s plan for improving social mobility through education and the Hinkley Point C project continues to play its part as a West Somerset Cornerstone Employer.

Working together with other members of the Opportunity Area Partnership Board, including the National Citizens Service and the Careers and Enterprise Company, the HPC project is using its education activity to build young people’s knowledge and skills, providing them with the best advice and opportunities to ensure they get the best possible start, whatever their background. The aim of the West Somerset Opportunity Area programme is to improve social mobility. Helping young people to make good career choices and be successful in gaining employment is critical to achieving social mobility.
Creating a more inclusive and diverse energy sector

The energy sector is undergoing a rapid transition and with that comes the opportunity to build a more diverse and sustainable workforce which will better represent the communities that we serve.

In 2018 Energy UK launched the Equality and Diversity Forum which brings together organisations from across the sector to share best practice and collaborate to increase diversity and inclusion in the industry.

Energy UK has also created the Pride in Energy network, a diversity forum and network for Lesbian, Gay, Bisexual and Transgender (LGBT+) members of the energy industry and their allies to address LGBT+ issues.

In September 2019 we will be hosting our first ever – free to attend – ‘Inclusion and Diversity in Energy’ conference, in partnership with Accenture. Some of the topics under discussion include creating opportunities from the transition the sector is undergoing to build a sustainable and diverse workforce, how data and innovation can help improve diversity, how to create a more inclusive workplace and how to bring your authentic self to work.

In March 2019 we marked International Women’s Day with the launch of our ‘Women in Energy’ videos. Over 50 women from across the sector and different backgrounds took part, sharing on the video why they love working in the industry and their advice to other women who want to enter the sector. Our campaign has been a finalist for a PR Week ‘Campaigns for Good Award’ in the ‘Best Equality and Inclusion Cause Campaign’ category.

There are also a number of other industry-wide groups and networks active in the energy sector committed to improving gender balance. This includes POWERful Women*, which seeks to advance the professional growth and leadership of women in the energy industry, Women in Utilities Network (WUN)* which was started to give women the skills and confidence they need to build lasting, fulfilling careers in the utilities sector, or WISE*, to promote diversity and inclusion in all aspects of the solar energy industry.

Women lead the way

Social Energy Supply has a female managing director, half of its Supply leadership team are women as well as 58% of its entire team. The women on this team are helping Social Energy lead the energy revolution to provide customers with the first vertically integrated energy supply business.

Social Energy believes in ensuring they have the best person for the job with the rights skill and ability to drive our pioneering energy services, regardless of gender.

In addition to the supply business, Social Energy has software engineers and machine learning specialists leading the way for women; developing cutting edge renewable technology solutions, ensuring the science behind its pioneering solution is always world class and built by the best in industry.

*POWERful Women – www.powerfulwomen.org.uk
*Women in Utilities Network (WUN) – thewun.co.uk
*WISE – www.solwomen.org
The energy industry has a substantial interaction with the water and marine environment whether it be inland in rivers or on or off the coast in seas and oceans. In the same way the industry has developed best practices to handle its impact on air quality, biodiversity and people, it is also looking very seriously at the impact it has on marine life. Energy UK covers a wide range of policies in this area from providing guidance on the Water Framework Directive and Eels Directive to working with Natural England on developing metrics on Intertidal biodiversity net gain, or sitting on the Seabed User Development Group and the Environment Agency’s National Drought Group.

Improving salmon monitoring

SSE wants to ensure that increasingly robust monitoring is taking place to better understand the movements of salmons ascending the various fish passes that SSE operates. SSE now has automatic resistivity fish counters in place in 18 locations, recording every fish ascending and providing photographic evidence to allow validation. In addition, Passive Integrated Transponder (PIT) tagging and acoustic tracking are now used to track and record salmon as they migrate up and down river. SSE has used PIT tagging in projects with Fishery Boards and Marine Science Scotland to accurately quantify the movement of juvenile salmon as they migrate downstream and later as they return from the sea. The results from these projects will influence the way SSE manages its facilities in the future. Acoustic tagging of salmon smolts has been used as part of the consenting process for the Beatrice offshore wind farm development on the Moray Firth.

The project was undertaken for SSE by Glasgow University working with Marine Scotland Science and the Cromarty Firth Fishery Board. It was found that the salmon were heading in the opposite direction once out at sea from what scientists had previously assumed. Information about salmon numbers and migratory patterns is shared with local fishery managers on each river, environmental regulators and the Scottish Government.

Wildlife paradise in Aberthaw Lagoon

Aberthaw Power Station both contributes to the energy economy of South Wales and the UK and supports the development of many rare species of wildlife in the diverse habitats that surround the site. The 1,500MW coal-fired power station is located on the north bank of the Bristol Channel, near Barry.

Aberthaw has around 115ha of land, including a site of special scientific interest along the shore, and a range of habitats such as rocky and sandy shore, vegetated shingle banks, salt-marsh and sand dunes.

A saline lagoon is a prominent feature of the conservation area and one of only four in Wales, supporting a variety of lagoon-dwelling specialist plants and invertebrates. In addition to the lagoon, pulverised fuel ash (PFA) from the power station has been put in a designated area on the site, where an unusual habitat has developed and several types of orchid can now be found. To support the unusual biodiversity of the site, RWE Generation has been working with the Wildlife Trust of South and West Wales. Some of the flora and fauna found at the site include sea club and saltmarsh rush, parsley water dropwort, wild celery and water crowfoot, as well as lagoon cockle, eels, grey mullet and toads and common frogs.
Power plants in the UK have developed strong best practice over the years when it comes to life on land through thorough environmental planning, protecting and enhancing biodiversity on and around their sites or waste management. As actors in their communities they have a role both in protecting the environment, but also in educating and sharing best practice. Here are some examples of what our members are doing in this field.

Enhancing golden eagle conservation in the Scottish Highlands

SSE’s Dunmaglass wind farm is situated south of Inverness in a Natural Heritage Zone (NHZ), which is home to golden eagles. As part of its work to protect, restore and promote sustainable use of terrestrial ecosystems and halting biodiversity loss, SSE commissioned a Regional Eagle Conservation Management Plan (RECMPl) to review the status of breeding golden eagle in the area. The aim is to provide an accurate reflection of factors influencing population numbers and eagle distribution to promote territory occupation and help boost the local population.

SSE provides funding and management assistance within the NHZ to enhance the conservation of breeding golden eagles. The first three years focused on surveys, satellite tagging of eagles and analysis, the results of which has provided significant insight into behavioural ecology and contributed to emerging good practice surrounding golden eagle distribution in the upland landscape.

2018 showed that NHZ conveys one of the most rapidly increasing golden eagle populations in Scotland, albeit with many seemingly suitable areas remaining vacant. In a UK context, these increases are unprecedented.

Den Brook Wind Farm, Devon

Our ecological monitoring scheme at Den Brook Wind Farm included provision of bat boxes to encourage roosting and an extensive monitoring campaign to assess the bat population.

We have been working with consultants to deliver the scheme during the wind farms operation and this work concluded in December 2018.

The report determined that the boxes on site are now achieving very good occupancy levels and states that the bat boxes are a key reason for an increase in bat activity.

The key conclusion to the monitoring was that the wind farm had no detrimental impact on bat population and some of the mitigation measures could have actually helped strengthen bat population of certain species.
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- Brockwell Energy
- Calon Energy
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- Centrica Energy
- Corby Power
- CRF Hydropower
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  - Greenstar Energy
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- Osaka Gas
- Passiv Systems
- Pöyry Management Consulting (UK)
- Publicis.Sapient
- PWC
- RSK
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- SIA Partners
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- Siemens
- Stag Energy
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- Vivid Economics
- Vuepoint Solutions
- Wood Mackenzie Global Consultants

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