Smart energy

Mapping your path to net zero

Energy Whitepaper 2023

SUMMARY

The pressure on industry to decarbonise, and do so rapidly, has never been greater.

At the same time volatile energy prices and changing regulations are putting greater emphasis on energy efficiency, renewable generation and storage which are demanding that industry flexes and responds in ways not previously conceivable.

To have a realistic chance of net zero success by 2050, UK government needs to:

(1) **act urgently to set out a clear UK Energy strategy** which deals with energy supply (generation) and demand (efficiency); and

(2) **collaborate closely with industry to map out a clear and realistic path on how the transition can be delivered** – specifically addressing the growing energy skills gap, securing sustainable energy provision and timely connections, and ensuring adequate research & development funding is available to deliver the technological innovation needed for a sustainable UK Energy Future.

Introduction

The UK government wants net zero by 2050. This is a big ask.

When looking at the UK carbon footprint, research figures released on 30 March 2023 indicate:

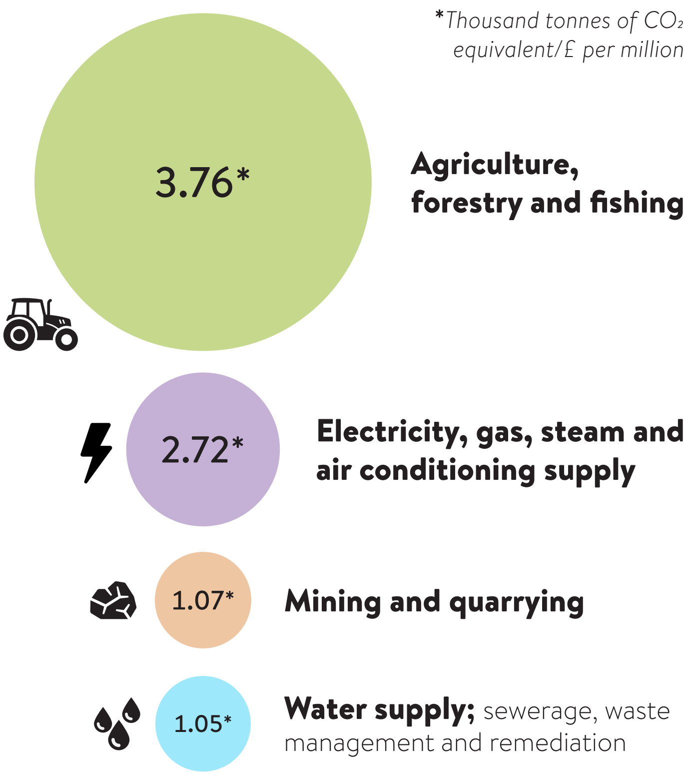
- The total UK territorial greenhouse gas emissions were 417.1 million tonnes carbon dioxide equivalent (MtCO2e) or 2.2% lower than in 2021.[1]
- In 2021 consumer spending, electricity, gas, steam and air conditioning supply, manufacturing and transport industries accounted for 72% of emissions. Of this, consumer expenditure accounted for 27% of all UK greenhouse gas (GHG) emissions.[2]
- The latest figures attribute the fall in CO_2 emissions to a large drop in emissions from the residential sector. However, greenhouse gas emissions in 2022 were 0.7% higher than in 2021 when taking temperature into account.
- Also noticeable was the reference to the long-term fall in UK emissions being linked to the decrease of emissions from power stations, due to the shift in fuel use within power stations away from using coal for electricity generation towards gas and renewables.

In 2020, 0.44 thousand tonnes of CO_2 equivalent/£ per million GHG emissions was recorded. Transport and storage accounted for 0.81 thousand tonnes of CO_2 equivalent/£ per million. Construction accounted for 0.11 thousand tonnes of CO_2 equivalent/£ per million.

1 2022 UK greenhouse gas emissions: provisional figures - statistical summary (publishing.service.gov.uk)

2 Latest published figures Greenhouse gas emissions, UK - Office for National Statistics

The biggest contributors of 2020 on a per capita basis were:[3]



Globally, the manufacturing and production sectors were found to consume 54% of the world's energy sources and accounted for one-fifth of the world's carbon emissions.[4] Within this, the global electronics industry accounted for 4% of GHG emissions.[5]

The UK government states it is trying to accelerate this change and rightly so.

In November 2022, UK government announced plans to create a "British Energy Industry" alongside plans to take forward the **UK Energy Bill** in order to "build a secure future powered by cheaper, cleaner British energy, for Britain".[6]

3 Atmospheric emissions: greenhouse gas emissions intensity by industry - Office for National Statistics

4 Reducing the carbon footprint of the manufacturing industry through data sharing | World Economic Forum (weforum.org)

5 IDTechEx's "Sustainable Electronics Manufacturing 2023-2033" report

6 UK government takes major steps forward to secure Britain's energy independence - GOV.UK (www.gov.uk)

The UK Energy Bill, last updated on 29th March 2023, is currently under review in the House of Lords and sets out the UK's strategy around:

- energy production and security
- the regulation of the energy market, including provision about the licensing of carbon dioxide transport and storage
- commercial arrangements for industrial carbon capture and storage and for hydrogen production
- new technology, including low-carbon heat schemes and hydrogen grid trials
- how the energy system is managed
- gas and electricity industry codes
- heat networks
- energy smart appliances and load control
- energy performance of premises
- the resilience of the core fuel sector
- about offshore energy production, including environmental protection, licensing and decommissioning
- about the civil nuclear sector, including the Civil Nuclear Constabulary; and for connected purposes.[7]

In the latest Budget delivered on 15th March 2023, the Chancellor of the Exchequer announced a £20bn investment in carbon capture and storage over the next 20 years. Notably without the detail and allocated funds available to put these measures in place until after the next General Election. These plans have already come under scrutiny from Industry, asking why the investment was not made in renewables, particularly solar.

7 Energy Bill [HL] - Parliamentary Bills - UK Parliament

In 2021 solar PV accounted for more than 10% per cent of renewable generation in the UK and more than 4% of total electricity generation.[8]

Solar demand growth is expected to exceed 20% in 2023-25.[9] Similarly, solar capacity is expected to surpass a terawatt (one trillion watts) by the end of 2023. It is estimated that more than half, 56%, of power generation could be provided by solar and wind by 2050.

Interestingly, wind proved to be the real winner of 2022, despite bottlenecks connecting to the grid, accounting for 24.6% of electricity generation according to figures from the National Grid. That is enough to power around 22.8 million homes. In March 2023, wind accounted for 29% - nearly a third - of generation in one month alone. Plus it has already been proven as the cheapest way to generate electricity and there is a growing pipeline of around 99.9GW[10] in offshore wind projects.

According to the Department for Energy and Net Zero, Renewables collectively produced 41.4% of electricity in 2022.

In terms of **net zero targets**, the UK government has now revised its Net Zero Strategy as demanded by the High Court.

Why, you ask? In 2022, the government's plan for achieving net zero was deemed unlawful by the High Court. The court stated: "the emissions reduction plan was inadequate in its assessment of contributions at levels beyond national and sectoral, necessitating a revision to incorporate quantifiable measures and a more realistic evaluation."

8 Energy Trends: March 2022 - GOV.UK (www.gov.uk)

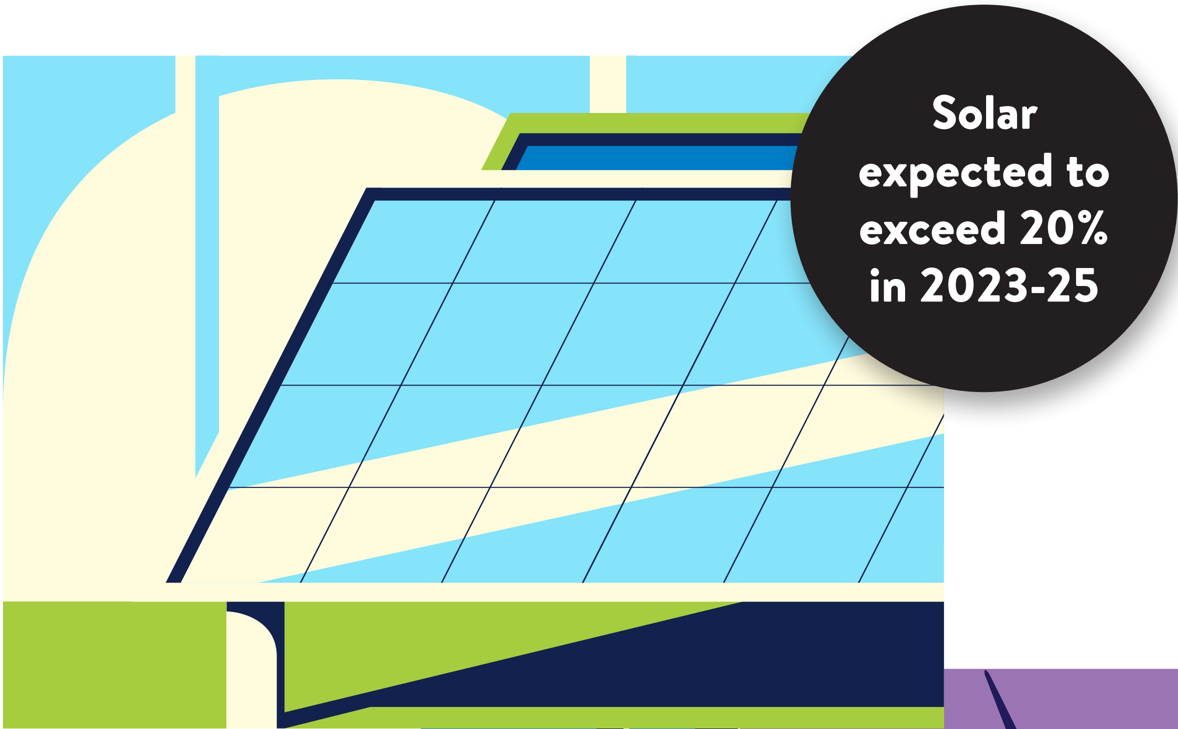
9 Trends in the Energy Industry | Clear Treasury

10 UK offshore wind pipeline reaches nearly 100 gigawatts - while global pipeline hits over 1,100GW - RenewableUK

The **Powering up Britain** document published on 30 March – pulls together the UK government's Energy Security Plan and Net Zero Plan.[11]

Whilst these measures to "diversify, decarbonise and domesticate" energy should be welcomed for many reasons, achieving net zero by 2050 without the required impetus, right choice of renewable energy sources, levels of financial and legislative support, right skills and significant, whole-industry collaboration around innovation and technology deployment, will be very difficult indeed.

Let's explore some of the detail and what steps industry can reasonably take now to make achieving the net zero target more likely.



11 Powering up Britain - GOV.UK (www.gov.uk)

Electricity Demand, Charging Legislation and Site-Specific Complexity

To achieve the British Energy Security Strategy, UK government has set a target of 70GW by 2035 – representing a more than fivefold increase in generation from 14GW.[12]

Much of this strategy relies on the rapid development, deployment and acceleration of "clean" or renewable energy sources e.g. solar, wind, green hydrogen, etc. As mentioned earlier, solar demand growth is expected to exceed 20% in 2023-25, representing the fastest-growing energy sub-sector in 2023.

In 2022, 3.4GW in new renewable capacity has been added - a 6.9% increase. Most of this, 2.8GW, was from offshore wind.[13]

Although 18% higher than in 2021, unfavourable weather conditions and some onshore wind outages meant that the third quarter (Q3) of 2022 was the lowest third quarter since 2017. Collectively renewable electricity generation was 28.2TWh in Q3 2022, still representing only a fraction of the current usage and future demand.

In March this year, National Grid reported 47% of electricity came from zero carbon sources, with a peak of 83% of electricity coming from zero carbon sources in one day.

However, gas still remained the largest source of generation, with 33.7% of electricity being generated by gas. Wind generation came a close second, contributing 29% of generation.[14]

12 British Energy Security Strategy (publishing.service.gov.uk)

13 Energy Trends: March 2022 - GOV.UK (www.gov.uk)

14 Great Britain's monthly electricity stats | ESO (nationalgrideso.com)

The reality is, the electrification and charging of vehicles, removal of gas boilers for heating, hydrogen conversion, etc. will all significantly increase the demand for electricity.

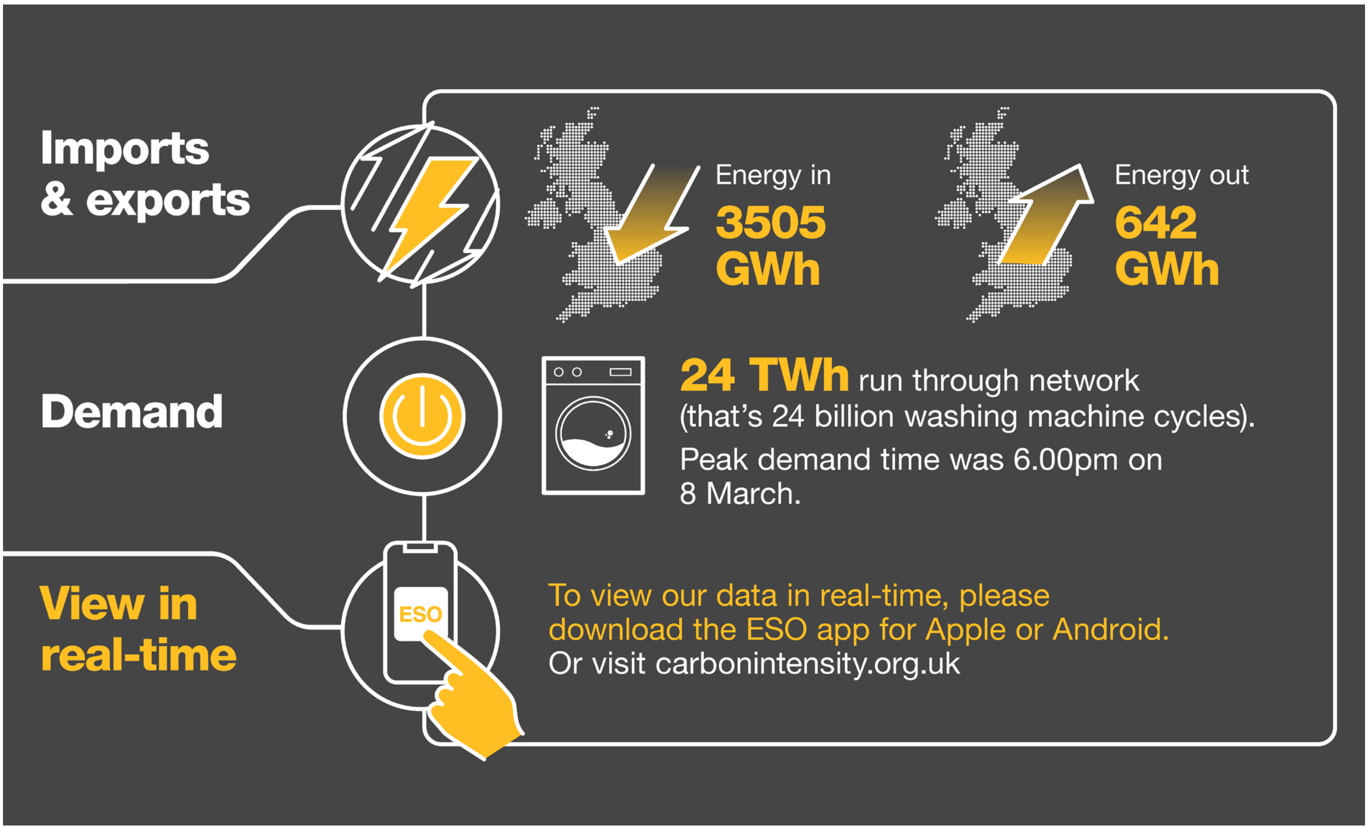
Consider too that demand on the electricity network is already at an all-time high. For example, the figures below were reported by National Grid for March 2023. Plus remember that in some parts of the country, congestion is so bad, there is simply no headroom between the available capacity and demand left.

These pressures, if not addressed urgently and sensibly – i.e. build smarter, not faster, not only impact on industry's ability to develop the very innovation sites needed to further "green industry" technological development, but also sites deemed as "generation" sites, e.g. solar farms, etc.

Fundamentally, we would argue, the network will need a total rethink.

At present, the system is designed to have large central power stations far from the load and not small generation embedded near the load with power flowing in both directions. To achieve the Energy Security the UK government keeps talking about, a different way of looking at generation, supply and storage is needed and this requires the right levels of legislation balanced with incentives. It is also important to take inspiration from elsewhere in the world and the Australian example of utility-scale batteries for energy storage is certainly one example worth looking at.[15]

15 Energy storage in Australia - CSIRO



Great Britain's monthly electricity stats | ESO, March 2023 (nationalgrideso.com)

Closer to home, there are changes afoot. To streamline the process for connecting new electricity users to the grid, Ofgem introduced **Access SCR** (Access and Forward-Looking Charges Significant Code Review), on 1 April 2023.

Under Access SCR, the DNOs (District Network Operators) will now be responsible for reinforcement costs in most circumstances – paying for assets like higher capacity cables, etc. rather than the connecting customer – developer, etc.

These costs were previously payable upfront, usually significant, thus making some development sites prohibitively expensive.[16]

Under Access SCR, access to the electricity network should be easier and potentially less expensive, including the ability to access the appropriate mix of electricity sources and uses of technology. However, it is essential to get appropriate guidance around the alignment of demand vs. available capacity, phasing and safeguarding your development from being considered "speculative" and therefore subject to reinforcement costs.

16 Electricity connections of the future – Buro Happold considers what these should look like - Buro Happold

What happens currently?

At present, when connecting to the electricity network, the responsible Distribution Network Operator (DNO) – there are 14 covering different regions - looks at what work is needed to enable the connection. New "assets" such as cables, switches, transformers, etc. are needed to extend the existing network to the customer site.

In some cases, the connection will also require the DNO to upgrade or expand the capacity of the existing shared network assets to make the new connection possible. This is called "reinforcement". The costs for reinforcement are then charged in full unless the reinforcement is needed by the DNO or another customer in which case the costs are shared.

Why is this a problem?

Currently, the connecting customer – whether an investor or the developer, is liable for all the connection costs associated with the connection. These costs can be significant making some development sites prohibitively expensive.

There is more: connecting customers are also subject to "shallow-ish" connection boundaries. This means the connecting customer and wider distribution network customers share the costs for the reinforcement. Connecting customers may also be encouraged to connect to the network where there is spare capacity – which may not be in the same location as the proposed/desired development. In this case the DNO's wider customer base effectively pays for any reinforcement that has been done. The spare capacity may be historic or created by recent planned upgrades, but still is not charged in the connection fee.

Ofgem was concerned that the existing charging arrangements were no longer suitable to achieve wider UK energy reforms. Under current arrangements, connecting customers could be encouraged to "free ride", where prospective customers wait until reinforcement has been requested or "triggered" by another customer or the DNO first. Similarly, DNOs could undertake reinforcement works sporadically, rather than looking at the wider network holistically.

Finally, Ofgem was concerned that the current reinforcement cost rules could create barriers to investment in low carbon technologies. Ofgem also raised concerns that differences between current connection charging arrangements at the point of distribution and transmission level could result in a mismatch between electricity generators when connecting to the different networks.

What happens after April 1st?

	Extension Assets	Reinforcement Assets at Connection voltage	Reinforcement Assets at Connection voltage +1
Current Arrangements	Connecting customer pays 100%	Connecting customer pays a proportion of the reinforcement costs	Connecting customer pays a proportion of the reinforcement costs
New Arrangements (Demand)	Connecting customer pays 100%	**Fully funded by the DNO via DUoS**	**Fully funded by the DNO via DUoS**
New Arrangements (Generation)	Connecting customer pays 100%	Connecting customer pays a proportion of the reinforcement costs	**Fully funded by the DNO via DUoS**

Visual representation of the changes to the distribution connection charging boundary

Essentially, connecting a development site to the electricity network could cost less – however this is subject to a number of variables.

The Access SCR Decision introduces a 'fully shallow' connection charging boundary around electricity demand. This means connecting customers, e.g. developers, pay for extension assets only and not for reinforcement costs around new electricity connections.[17]

For generation connections, Access SCR introduces a 'shallow-ish' connection charging boundary. This means connecting customers pay for extension assets plus a contribution towards reinforcement costs at the voltage level at the point of connection.

17 A cap will apply here up to a level of reinforcement costs (see Ofgem's Access SCR Decision, section 3.50 onwards)

However, Access SCR has also retained and introduced a series of mitigations, where connecting customers will pay more towards reinforcement in certain circumstances. These include developments where the high-cost cap threshold (a £/KW value for certain types of connections) is triggered and generation connections with a high-cost project threshold - currently set at £200/kW.

Let us consider the **development of a data centre** for **example**. Research suggests that the global market for data centre construction is predicted to reach £24bn by 2027 and that demand for data centres is expected to increase tenfold between 2018 and 2050. To develop one – lucrative because nearly 70% of the development cost is mechanical and engineering work, there is a large network capacity demand. Once built, substantial amounts of energy (electricity) are required to keep the data centre functioning optimally. More specifically, to keep the data centre cool.

In 2022, it was predicted that data centres would deliver 204MW of new supply in Q4.[18] For reference one megawatt of electricity is enough to power roughly 285 homes. So that is the equivalent of 58,140 homes.

Whilst the above changes address SCR, there are also changes around **Access** to the network - specifically around **non-firm** (curtailable) **access arrangements**.

Until recently, users were limited in terms of when, for how long and how much they could access the network. These "firm" arrangements required the DNO to ensure there was enough capacity for the user within the network via a standard connection. To "speed up" connection requests in constricted areas of the network where reinforcement for a standard connection was often required, DNOs also offered flexible connections - "non-firm" or "curtailable" access to the network as an alternative to paying for and/or waiting for the network reinforcement. However, there was no limit on the extent to which this could occur.

Under Access SCR Ofgem is looking to introduce better standards and greater consistency; offering connecting customers more certainty around how much curtailment they can expect and what impact this will have; whilst also incentivising the DNOs to look at the network holistically and make the necessary overall improvements rather than approaching it sporadically.

18 Data Center Trends | CBRE

The following reforms to distribution network access rights will now apply:

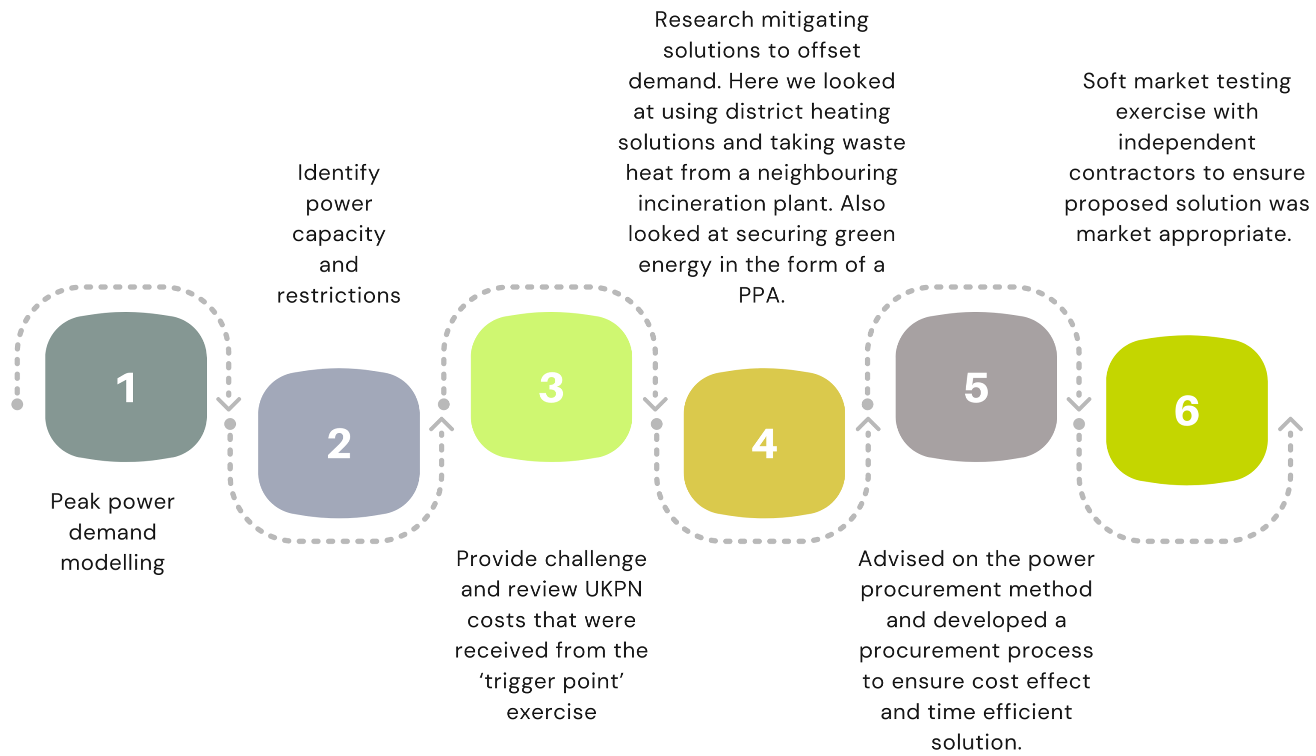
- Non-firm arrangements will be available to users where reinforcement is required and where local network constraints make curtailment necessary. This will not be available to small e.g. domestic users.
- Limits to curtailment will apply and these will be detailed in the connection offer. Should curtailment above this limit be necessary, the DNO will need to procure this from the market.
- Non-firm arrangements will have explicit end dates, after which the connection will need to be made firm. There are exceptions and these can be found here.[19]

Access SCR is a fundamental reform to new electricity connections and how these are charged. And whilst positive, the Ofgem Decision could result in even greater demand for electricity connections as developments previously considered economically not viable could now be reconsidered, placing even more pressure on the network.

In addition to the above, it is important to note that the cost and time associated with the delivery of utilities infrastructure to a site are key risks to a project's financials and programme. Add to that, every site and/ or development is different i.e. has **site-specific considerations**.

To understand what those considerations are and then mapping those requirements against the available capacity, utilities and technology is complex and requires expert guidance.

19 Access and Forward-Looking Charges Significant Code Review: Decision and Direction | Ofgem



Private residential property developer example

Let us consider this **example** from a **private residential property developer**. The developer was looking to develop:

- 1200 residential homes
- 4200 m² school
- 1200 m² retail/ heritage centre
- adjacent business park

The energy requirement needed to be sufficient for powering all the above across two sites. Understandably, the developer wanted to procure energy in the most cost effective and time efficient way. Additionally, the developer was open to looking at alternative, green supply agreements for the business park and looked at ways in which the impact of the development could be offset.

This required extensive engagement with the IDNO/ ICPs and ESCos around the possibility of a waste-from-heat solution.

In a traditional procurement exercise, i.e. using the statutory provider, the developer would face a "sunk" i.e. non-negotiable cost and delivery time. Fortunately, competition within the marketplace means developers now have several options including individual connections and even an independent network.

By following an **alternative procurement process**, the developer can save both time and money and ensure the best commercial arrangements for the development.

Retrofit vs. New

When looking at the numbers, it is difficult to ignore the impact the built environment has on carbon emissions.

As outlined in the Introduction, construction accounted for 0.11 thousand tonnes of CO2 equivalent/£ per million in 2021 according to the ONS (figures published November 22). Add to that contributing sectors like transport, water, waste, utilities and quarrying and it is not surprising some argue that the built environment contributes up to 40% of the UK's emissions, whilst approximately 60% of the UK's waste comes from construction, demolition, and excavation.[20]

Figures from the Royal Institute of Chartered Surveyors (RICS) estimated that a typical office development emitted 35% of its lifecycle carbon before the building was even opened. For residential premises the figure is 51%. Not surprisingly then that RICS introduced **Whole Life Carbon Assessments** (WLCA) for the Built Environment. Now in its second edition, the standard measures carbon within the built environment and encourages industry to reuse, recycle and redevelop.

The standard also aims to help professionals manage carbon budgets, reduce lifetime emissions and build a net-zero future by giving visibility of the carbon cost of different design choices.

In the case of organisations like local authorities, higher education providers, science parks, etc. with existing and often large "estates", the considerations in the drive to net zero are many. Meeting these targets are often costly with no obvious, immediate return on investment.

So why do it?

For one thing, most major organisations now have net zero targets as part of their ESG strategy and/ or governance. Additionally, it fundamentally helps with creating longer term energy security.

Consider, for example, that renewables are already cheaper than fossil fuels and through self-generation and energy storage, the UK is much better insulated against energy price volatility. Plus, the cost of not acting now, will mean it will cost more later given rising material costs and wages.

To find out where to start, it is worth considering a **site-wide energy analysis**. This will tell you how every building is performing in terms of energy-efficiency; considering glazing, lighting, insulation, etc. When reviewed alongside existing infrastructure, different intervention scenarios can then be considered as well as looking at onsite renewable electricity generation, retrofitting legacy buildings with materials such as smart PV for energy integration, batteries for energy storage, rainwater harvesting, heat pumps, heat-from-waste solutions, etc.

The analysis can help accurately inform your carbon reduction plan. This can then be costed, planned, implemented and monitored in a systematic, whole system-view way as part of the ongoing capital investment planning and estate strategy.

20 UK statistics on waste - GOV.UK (www.gov.uk)

Calling up the skilled British Energy Industry

Time for the tough stuff. Our collective future relies heavily on our ability to develop and implement "green" technologies that will enable us not just to meet net zero and carbon negative targets, but provide the sustainable transport, energy and technology solutions our country requires.

However, a recent analysis undertaken by PwC states that the UK's **"green skills"** gap now stands at 200,000.[21]

Green skills refer to those people trained and upskilled to deliver renewable and low carbon energy generation required to keep the energy transition going. The reality is many working in the existing energy industry have the skills, but are retiring – around 20%.

A fresh pipeline of talent is needed, urgently, to fill the approximately 480,000 roles predicted by UK government, but the UK simply does not have enough people coming through.

21 Energy-transition-constrained-by-green-skills-gap-of-c200000-jobs-PwC-GJB

Likewise, the power electronics industry – where electronics is applied to the control and conversion of electric power in electric vehicles for example - faces a similar challenge. Across Europe, the picture looks bleak too. A recent survey suggests 59% of employers across the EU were experiencing a shortage of skilled workers. Belgium displayed the highest percentage with 65%, followed by the United Kingdom, the Netherlands, and Ireland.[22] In Europe, investments in areas such as semiconductor manufacturing and renewable energy have resulted in new job opportunities. The EU, for example, is investing over EUR43bn in the semiconductor industry as it aims to become self-sufficient. For reference, the EU uses twice as many chips (used in computers, phones, electric vehicles, etc.) at it manufactures and this supply chain reliance on South East Asia poses both a significant risk and increases costs throughout the supply chain into other sectors. Similarly, the UK relies heavily on imports of semiconductor chips (around $888m semiconductor devices were imported in 2021).[23] Thus, it will be interesting to see how UK government responds to geopolitical and supply chain concerns and it would be encouraging to see greater support for the **semiconductor cluster** in defining a "risk and resilience strategy"[24] in Wales and re-shoring of UK manufacturing i.e. local suppliers rather than from overseas, pan out.

In terms of renewables, Germany has allocated USD31bn into transitioning to renewables. The UK £31bn, France £27bn and Spain £11bn. Interestingly Germany is also looking to become the biggest EV player with more than 30% of EU passenger vehicles produced there in 2020. Germany has also announced plans to convert gas power stations into hydrogen.

22 The Talent Tug-of-War: Over half of UK employers struggle to land employees | SD Worx

23 Semiconductor Devices in United Kingdom | OEC - The Observatory of Economic Complexity

24 The semiconductor industry in the UK (parliament.uk)

What all this means is that demand for skilled people is growing and rapidly so.

The EU electronics industry currently employs approximately 2.4 million workers. In 2019, Make UK figures showed the UK electronics industry employed 300,000 people in more than 12,000 companies, adding £16bn to the economy and £8.4bn of GVA (Gross Value Added) in 2017.

In 2021, the UK's low carbon economy was worth more than £200bn[25] , almost four times the size of the country's manufacturing sector. More than 1.2 million were employed across more than 75,000 businesses from wind turbine manufacturers to recycling plants. IPC, the Electronics Trade Association, predicts 500,000 power electronics workplace training positions need to be created across the EU within the next five years.

At present though, a recent IPC report showed that finding and attracting skilled personnel in the power electronics fields was becoming increasingly difficult with 57% of European companies finding it tough.

Germany, who has made its ambitions around EV particularly clear, will need more than 100,000 electronics engineers than are currently being trained in the country in the next ten years. In 2020, the VDI-/IW-Ingenieurmonitor reported that there were 92,400 vacancies in Germany relating to the power electronics and IT (Information Technology) sectors. In 2022, this figure hit an all-time high of 151,300.

The announcement of the Net Zero and Nature Workforce Action Plan in 2024 and Skills Bootcamps from 2023 in the Powering Up Britain document sound promising, but there is a lot more to be done and this is where **close collaboration with industry** will be essential.

Technology Trends

The global pace of change coupled with an ever-increasing focus on decarbonisation mean the need for not just the right skills, but sustainable renewable future technologies, are higher than ever. In identifying and then developing these future technology solutions, the UK manufacturing industry should both be recognised and praised for its efforts in the first instance.

To meet the UK government target of 95% low carbon electricity and 80% of all car sales fully electric (EV) by 2035, the industry is looking not just at innovative renewable technologies and generation, but also addressing the volatile supply chain situation by refocusing on making more of the electronic and electrical components required locally (re-shoring).

The EV market is a good example of both the challenges and opportunities presented. Making cars fully electric requires the use of more semiconductor chips. Specifically, a regular car uses between 300 to 1000 chips, an electric car around 3000. Similarly, EVs require several electronics components for electric power. Previously, printed circuit boards (PCBs), etc. would primarily be imported from South East Asia. Changing demand and limited supply following the outbreak of Covid-19 resulted in much higher prices which manufacturers had little choice in absorbing. This also significantly affected the global production of these and all other cars.[26]

Although things are still far from being back to normal, several measures have since been taken to try and balance out this market volatility. This includes the EU taking giant leaps towards building a self-sustaining semiconductor future, the re-shoring of UK

25 UK's Green Economy is Now Four Times Bigger than Manufacturing Sector, and It's Growing (earth.org)

26 EV prices in Jan 2022 were 54.1% higher than the year before supply chains and even contract electronics manufacturers running several designs in parallel to meet customer demand. EU, and UK, legislation within the automotive industry has done much to facilitate this transition e.g. the looming EU ban on the sale of new petrol cars. However, this has recently been amended to include internal combustion engine cars running on e-fuels. The UK is expected to follow suit.

Likewise, the cost of making renewable energy devices such as wind turbines and solar panels has increased. In solar panels for example, there are also other expensive materials such as steel, aluminium and silver – not just semiconductor chips. More generally, material costs have been rising rapidly in recent years, however there now appears to be a slowdown in construction material costs according to an industry report.[27] A note of caution here though that we need to consider the impact of Covid-19 in these figures. The price per kWh for renewables look set to drop massively over the long term.

Yet change we must. In 2022, the cost of fuel and power imports in the UK rose to £117 billion from £54 billion in 2021. That is around £4,200 per household.[28]

Yet electricity generation increased in Q3 of 2022, up 14% to 77.7 TWh. This was driven by high demand for electricity exports over eight times higher than Q3 2021. Of this, low carbon sources generated 50.3% of the total in Q3 2022, down 0.5 percentage points on the previous year, as the growth in renewable and low carbon generation was outpaced by the growth in gas use.

Interestingly domestic and industrial demand decreased in Q3 2022 while demand from commercial users increased. Electricity consumed by the industrial sector was down 7.8% while consumption by other final users (including commercial users) increased by 0.9%.[29] The **UK Energy Bill**, currently under review in the House of Lords, should help enable this transition. For example, the Bill describes the setting and management of low carbon heat targets; and identifies the need for district and communal heat networks as well as energy storage.

The £32m Heat Network Efficiency Scheme is expected to help update existing heat networks through the replacement of out-of-date equipment to produce cheaper energy and reduce carbon emissions.[30]

In the deployment of heat pumps, The Department for Business, Energy and Industrial Strategy (BEIS) figures highlight the grid carbon factor - a measure in grams of CO_2 equivalent emitted for each kWhr of electricity generated on the National Grid: grams CO2e/kWhr.

Projections up to 2040 show a steady decline down to an emissions intensity of 67 grams CO2e/kWhr by 2040. It is this significant fall in the grid carbon factor that signals the **Electrification of Heat** as the clearest route to decarbonisation of heating – and the use of heat pumps as the only practical and economic route to achieving net zero.

It is therefore good to see UK government ambitions of making heat pumps at "a scale never seen before" and the introduction of the £30m Heat Pump Investment Accelerator.[31] Yet it should be noted that we are still well off the 300,000 target initially set so we would like to see more detail on how the predicted over 600,000 heat pumps p.a. by 2028 target will be met. We would also like to see the detail around the "rebalancing" which

27 Mace's latest quarterly market report said materials prices were slowing down, with falls in four of the last five months of 2022

28 Energy import cost doubles to £117bn as price cap sends borrowing to record high (msn.com)

29 gov.uk Energy Trends

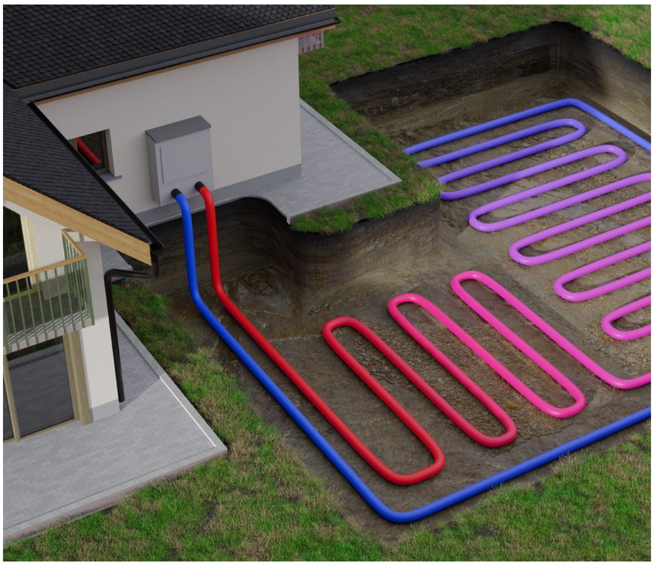
30 Apply for the Heat Network Efficiency Scheme (HNES) Round 1 - GOV.UK (www.gov.uk)

*31 *Powering Up Britain - Joint Overview (publishing.service.gov.uk)*

UK government says will generate the clear short-term price signal necessary to shift both households and businesses to lower-carbon, more energy efficient technologies like heat pumps.

In helping large organisations maximise heat pump deployment as part of their wider decarbonisation plans, our Energy team is already working with both Bristol and Plymouth Councils at City level and several other councils at district level to see how this can be deployed on a community level. This involves access to the UK Net Zero Innovation Portfolio awarded under Heat Pump Ready.[32] We will also be looking to scale this to include upskilling installers and working with other local authorities across the UK.

In addition to generation, the **storage** of energy longer term will be critical. It is encouraging to see the predicted growth in the Stationary Energy Storage market to approximately $200bn by 2031 from $35.2bn currently.[33] However, we agree that lack of standardisation and battery safety issues could be a barrier to this growth overall, at least initially.



Ground Source Heat Pump example

32 Heat Pump Ready Programme - GOV.UK (www.gov.uk)

33 Global Energy Storage Market (2022 Edition) - Analysis By Type (Battery, PSH, TES, Others), End-User, By Region, By Country: Market Insights and Forecast with Impact of Covid-19 (2022-2027) (researchandmarkets.com)

How much will it cost to reach net zero?

It is hardly surprising that the upfront investment required to reach net zero will be substantial.

In 2020 around £10bn of public and private investment in the UK went towards low-carbon projects. The independent Climate Change Committee (CCC) thinks that by the late 2020s this will need to increase to around £50bn per year – specifically spent on buildings, transport and renewables. Moreover, the investment should remain at that level until 2050. That is a lot of investment at a time when industry and Government are feeling the squeeze on multiple levels.

However, the CCC thinks this extra capital investment will be offset by reductions in day-to-day operational spending, by the late 2030s.

Interestingly the Office for Budget Responsibility (OBR) estimated a net cost of the UK reaching net zero by 2050 to be £321bn, or just over £10bn per year.[34] Overall costs are estimated at around £1.4trn, offset by £1.1trn in savings.

34 July 2021 report on fiscal risks

CONCLUSION

There is a lot still to do and not much time to deliver change.

Understandably, whatever scenario we pursue, the requirements on the electricity network look set to increase significantly. And whilst we welcome changes like Ofgem's Access SCR as it helps to streamline the process around connection, fundamental change is needed around how the network is designed and operated.

Our concern is that although change is happening, **the rate at which it is occurring is not fast enough**, with a focused clear direction or at a sufficient level to meet the growing needs of UK plc. Together with our energy colleagues, we would certainly be keen to understand and get involved in discussions around **accelerating grid delivery** and will be keeping a keen eye out for the UK connections action plan due for release in the summer.

Similarly, like many of our energy and environmental colleagues, we are not convinced that the **carbon capture and storage** working at scale argument and economics match up. We would like to see far greater detail if we are not just using this to further subsidise the fossil fuel lobby.

Likewise, there are number of questions to be answered around **hydrogen**, specifically its relative cost and fusion for generation. Whilst the deployment of a range of options is good practice, how realistic and achievable these are within the timescale remains to be seen.

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