



Department for  
Business, Energy  
& Industrial Strategy

ofgem

# Electricity Networks Strategic Framework: Enabling a secure, net zero energy system

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# Ministerial Foreword

The British Energy Security Strategy provides a clear, long-term plan to accelerate our transition away from expensive fossil fuels, with the invasion of Ukraine highlighting that this transition is an issue of national security as well as a matter of meeting our world-leading net zero target. The Strategy recognises the crucial role of the electricity network in supporting that transition, and the need for it to be transformed at scale and pace to ensure it is fit for the future.

It is vital that the network can manage a significant increase in demand from new sources, such as electric vehicles and heat pumps, as well as connecting new, low carbon generation to meet this additional demand. Given the recent context of record increases in global energy prices, it is also vital that the costs of this transition are kept as low as possible, including ensuring vulnerable consumers are protected.

The Government and Ofgem will work together to deliver this transformation in the electricity network, building back greener from the pandemic and creating thousands of new, green jobs across the country. This document lays out a strategic framework within which this transformation will happen, creating a platform for future policies and regulation to build on and to ensure the electricity network enables net zero, is increasingly secure and resilient, and delivers value for money for consumers.

**The Rt Hon Greg Hands MP**

**Minister of State for Business, Energy and Clean Growth**

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# Ofgem Foreword

Recent events have fundamentally changed the economics of energy.

The immense strain of high wholesale energy prices on households, businesses and parts of the energy sector is the effect of an energy system that is still largely reliant on volatile fossil fuels. To protect consumers from future price shocks, we must move further and faster to a cleaner, smarter, more flexible and more resilient electricity system.

The shift to electricity and away from gas means we will need new low carbon energy sources. We also need to upgrade our transmission and distribution networks to get that electricity to where it's needed, including the undersea infrastructure to connect up to 50GW of offshore wind the government is aiming to build by 2030.

Delivering this will require greater strategic planning to ensure the infrastructure is built in the right place, at the right time, and at the lowest possible cost to the consumers who ultimately pay for it. This will need to happen at both national and local levels.

The Electricity System Operator recently published the first holistic network design, setting out an integrated plan for the onshore and offshore transmission network upgrades needed to hit the 2030 targets. This strategic framework sets out how we will deliver this infrastructure at pace. This will require reforms to speed up planning and regulatory approvals and much faster delivery of projects by the networks industry and its supply chain.

At the local level, we have recently concluded a call for evidence on how system planning might operate. Alongside this, we have recently published a five-year plan to transform the regional energy grids, through our RIIO-ED2 price controls starting in April 2023. These proposals involve a near doubling of investment to upgrade the grids to handle millions of new electric vehicles and heat pumps, delivered at no extra cost to consumers through their bills. Beyond network infrastructure, this strategic framework sets out how the government and Ofgem will work together to maximise the benefits of new technologies, such as storage and demand-side response, in dealing with growing network congestion; interconnection with other countries to improve resilience; and opening up energy data to generate innovation that could improve network services and lower costs for consumers over the longer term.

By pursuing the actions set out in this strategic framework, we will ensure the electricity network is ready to deliver the transition to a more secure, clean and affordable energy future at the lowest cost to consumers.

**Akshay Kaul**

**Interim Director for Infrastructure & Security of Supply**

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# Executive Summary

## What is the electricity network and why do we need to act?

The energy system is undergoing profound and fundamental changes. As recent events have demonstrated, now more than ever, we must focus on generating cheaper, cleaner power to guarantee the UK's continuing energy security through a decisive shift away from expensive fossil fuels, with prices set by global markets we cannot control. In the British Energy Security Strategy<sup>1</sup>, the government set out a package of ambitious measures to accelerate this shift towards low carbon electricity generation.

In 2019, the UK was the first major economy in the world to set a binding target to reach net zero emissions by 2050. In June 2021, the government passed the Sixth Carbon Budget into law, with the aim to reduce emissions by 78% by 2035 compared to 1990 levels. The British Energy Security Strategy builds on the vision for achieving these targets set out in the Prime Minister's 10 Point Plan for a Green Industrial Revolution<sup>2</sup> and the Net Zero Strategy.<sup>3</sup> For the electricity sector, this means fully decarbonising by 2035, subject to security of supply, while accommodating an expected doubling of demand by 2050<sup>4</sup> as new sectors, especially transport and heating, move to electricity as a fuel source.

The electricity network – the wires that bring increasingly low carbon power to homes and businesses – is fundamental to net zero and reducing dependence on fossil fuels. The network needs to be transformed at an unprecedented scale and pace to accommodate decarbonisation and demand growth. The British Energy Security Strategy recognises this and includes actions to accelerate electricity network build, dramatically reducing timelines for strategic onshore transmission network infrastructure by around three years and aspiring to halve the end-to-end process by the mid-2020s.

## Our Strategic Framework for Electricity Networks

This document, a joint publication by the government and Ofgem, builds on the British Energy Security Strategy commitments and other key goals to set out a strategic framework for the transformation of the electricity network. It describes what we are doing to develop a policy and regulatory environment that ensures that the electricity network in Great Britain<sup>5</sup> enables net zero, while ensuring a secure, reliable supply of electricity and providing value for money for consumers, who ultimately pay for the network through their bills. It sets out a vision for the electricity network and a direction of travel, shared by government and Ofgem (see Table 1), while providing more detail on the relevant measures in the British Energy Security Strategy. In

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<sup>1</sup> BEIS (2022), British Energy Security Strategy, <https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy>

<sup>2</sup> BEIS (2020), Ten Point Plan for a Green Industrial Revolution, <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>

<sup>3</sup> BEIS (2021), Net Zero Strategy, <https://www.gov.uk/government/publications/net-zero-strategy>

<sup>4</sup> Total annual electricity demand could increase from 330 TWh in 2020 to between 570-770 TWh by 2050 (see Section 2.1 'Changes in electricity demand' in 'Appendix I: Electricity networks modelling').

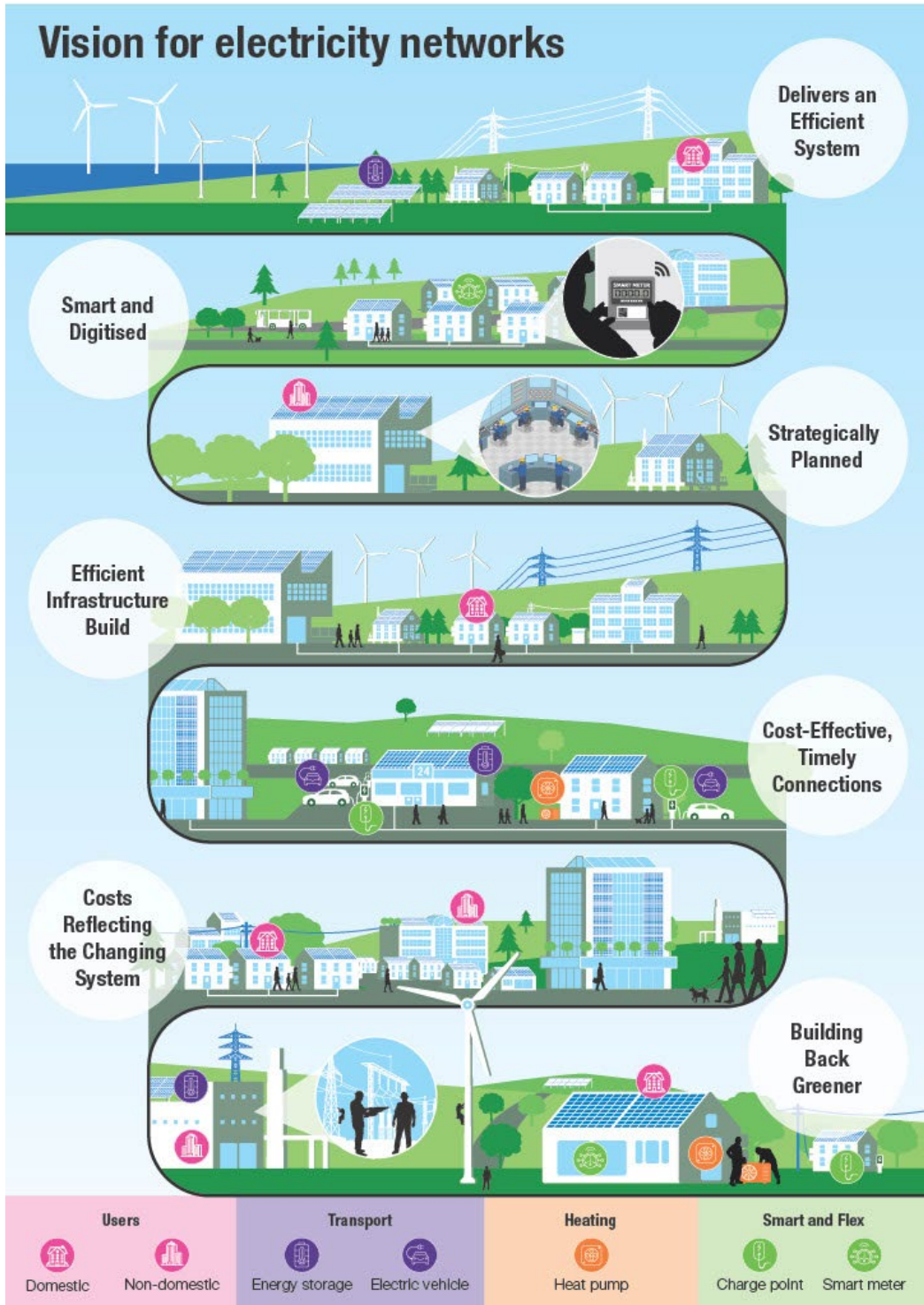
<sup>5</sup> This document applies to Great Britain (England, Scotland and Wales) as energy policy is devolved in Northern Ireland.

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a fast-moving policy and regulatory landscape, we expect to bring forward new policy in the coming months and years, but future developments will align with this framework.



# Vision for electricity networks



To meet our vision we must balance the major increase required in new, resilient physical infrastructure with maximising the potential of smart solutions to reduce costs. We must also transform our approach to network planning to be more strategic, including coordinating onshore and offshore planning more closely as we accelerate offshore wind deployment.

The government and Ofgem are working with industry to develop a strategic approach to network planning. The Holistic Network Design (HND)<sup>6</sup> and updated Network Options Assessment (NOA)<sup>7</sup>, published earlier this year, set out the strategic approach to planning the offshore and onshore transmission network to meet the government’s ambitions of connecting up to 50GW of offshore wind to the electricity grid by 2030. Over the next two years network planning will evolve iteratively into a single Centralised Strategic Network Plan (CSNP)<sup>8</sup> for both the onshore and offshore electricity transmission network. It will also provide guidance to decision makers on the development of the wider energy system, encompassing 2050 targets for CCUS, hydrogen and gas infrastructure alongside electricity.

Fundamental to achieving our goals is ensuring that the major strategic investments needed in the onshore grid can be delivered quickly. The British Energy Security Strategy sets out an ambitious plan to reduce timelines at every stage, and this document expands on that plan to provide more detail. Ensuring the electricity network becomes an enabler of net zero will also contribute to building back greener, with new green jobs and benefits for the whole economy and the environment.

## Delivering the vision

Within Table 1, we set out our vision and broad range of actions that we will take to deliver it. A full list of actions that the government and Ofgem are undertaking can be found in Annex 1.

**Table 1: Our Vision and Actions**

In the future, the electricity network...	What we are doing to achieve this
Will be planned strategically, led by the independent Future System	<ul style="list-style-type: none"> <li>The government and Ofgem will <b>implement an expert, independent Future System Operator</b><sup>9</sup> that will play a vital role in advising key decision makers on maximising the efficiency of the system and take an increasingly significant role in shaping the energy system and driving forward competition. As part of this, Ofgem proposes that the Future System Operator will take on the central strategic network</li> </ul>

<sup>6</sup> NGENSO (2022), Holistic Network Design, <https://www.nationalgrideso.com/future-energy/the-pathway-2030-holistic-network-design>

<sup>7</sup> NGENSO (2022), Networks Options Assessment, (<https://www.nationalgrideso.com/document/262981/download>

<sup>8</sup> Ofgem (2022), Consultation on our Minded-to Decisions on the initial findings of our Electricity Transmission Network Planning Review, <https://www.ofgem.gov.uk/publications/consultation-our-minded-decisions-initial-findings-our-electricity-transmission-network-planning-review>

<sup>9</sup> BEIS and Ofgem (2021), Proposals for a Future System Operator Role, <https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role>

<p>Operator (when established) and taking account of wider system developments</p>	<p>planner role.</p> <ul style="list-style-type: none"> <li>• The government and Ofgem will <b>facilitate more strategic network planning</b>: onshore, offshore (including interconnection with other countries) and at the local level, including taking a coordinated approach to network build through the Offshore Transmission Network Review and Centralised Strategic Network Plan.</li> <li>• Ofgem is undertaking a <b>review of the effectiveness of current institutional and governance arrangements</b> at the distribution level to facilitate the transition to net zero at least cost.</li> <li>• The government and Ofgem will <b>address network constraints</b> by supporting agile strategic investment.</li> <li>• The government will consult on a Strategy and Policy Statement for energy policy <b>by the end of 2022</b>, setting out strategic priorities for energy policy to guide Ofgem including <b>emphasising the importance of strategic network investment</b>.</li> </ul>
<p>Will continue to be resilient and anticipate future need, to deliver a system which is efficient overall at the accelerated pace needed to meet Government targets</p>	<ul style="list-style-type: none"> <li>• Ofgem will design and implement the <b>price control frameworks</b> to enable strategic investment.</li> <li>• Ofgem will consult <b>in the summer</b> on whether there are clear consumer benefits from introducing a package of changes to speed up the <b>regulatory approval framework for onshore transmission network investment</b>, while holding network companies to account for timely and efficient delivery.</li> <li>• The government has, as part of the 2022 Energy Security Bill, introduced clauses to enable competitive tendering in onshore networks; to provide certainty and avoid delays in the transition to competition, Ofgem will publish a list, by the end of 2022, of certain strategic projects likely to engage in the market between now and 2026 to be exempted from competition.</li> <li>• The government and Ofgem will implement actions from the review of the response to the electricity disruption caused by Storm Arwen, to build our <b>climate resilience</b>.</li> </ul>
<p>Will allow for faster infrastructure build through reforming planning and consenting</p>	<ul style="list-style-type: none"> <li>• <b>The government has appointed Nick Winser as Electricity Networks Commissioner</b> to advise government, Ofgem and industry on ways to bring together and build on the actions set out to accelerate the delivery of network infrastructure.</li> <li>• The government is <b>speeding up planning consents</b> by revising the energy National Policy Statement for the high-voltage electricity network in England and Wales to promote faster consenting, including by recognising strategic network blueprints.</li> <li>• The government is reforming the consenting process and establishing a <b>fast-track consenting route</b> for priority offshore wind and related transmission infrastructure.</li> <li>• The government is <b>reviewing land rights and consent processes</b> for electricity network infrastructure outside of the Nationally Significant Infrastructure Project regime (and therefore not covered by National Policy Statements).</li> </ul>
<p>Will continue to</p>	<ul style="list-style-type: none"> <li>• The government and Ofgem will <b>improve the affordability of connections</b> by</li> </ul>

<p>enable cost effective and timely connections of new generation and demand to the electricity network</p>	<p>reducing costs for distribution network connections and providing direct support where there are market failures.</p> <ul style="list-style-type: none"> <li>• Ofgem is putting in place a package of measures to <b>reduce network connection timescales</b>, delivering on the commitment in the British Energy Security Strategy: <ul style="list-style-type: none"> <li>• speeding up the connections process by reviewing minimum standards for connections (in particular, the time it takes a customer to connect to the distribution grid);</li> <li>• introducing a penalty-only incentive for distribution network operators to deliver on major network connections; and</li> <li>• asking the Electricity System Operator to take forward proposals to speed up connections to the transmission grid by clearing up the existing backlog of connection requests.</li> </ul> </li> <li>• The government and Ofgem will work to improve the <b>customer connections experience and consistency</b> between distribution network operators.</li> </ul>
<p>Will be smart and digitalised, with flexible solutions and markets complementing physical infrastructure</p>	<ul style="list-style-type: none"> <li>• The government and Ofgem will work with industry to <b>remove barriers to flexibility on the grid</b>, including to: <ul style="list-style-type: none"> <li>• facilitate flexibility from all resources connected to the system (including consumers through demand-side response);</li> <li>• reform markets to uncover and reward flexibility; and</li> <li>• digitalise the system to leverage the benefits of data.</li> </ul> </li> </ul>
<p>Will be kept as low cost as possible, with charges reflective of the changing system</p>	<ul style="list-style-type: none"> <li>• Ofgem is <b>reviewing network charging arrangements</b> for a changing system on a rapid decarbonisation pathway.</li> <li>• The government is considering the impacts of net zero on consumer costs to ensure they are <b>kept as low as possible, are reflective and shared fairly</b>.</li> <li>• The government will ensure that <b>local communities can benefit from onshore network infrastructure</b> in their area, exploring options <b>later this year</b> including considering scope and eligibility; whether the approach should be standardised or flexible; and the level and type of benefits provided.</li> </ul>
<p>Will support the Government's Net Zero Strategy and building back greener</p>	<ul style="list-style-type: none"> <li>• The government will develop and deliver plans to <b>reform the skills system</b> to deliver for net zero.</li> <li>• The government and Ofgem will <b>enable investment</b> in the network to support thousands of new jobs, both directly in the networks and throughout the supply chain.</li> </ul>

## How will network transformation impact consumers?

The rapid transformation of the electricity network will require significant levels of investment but the impact on consumers will depend on other key components that make up energy bills, for example cost reductions as a result of moving away from fossil fuels. The Treasury's Net Zero Review<sup>10</sup> suggested that the average electricity bill in 2050 for a household with an electric vehicle and a heat pump could be broadly similar or even lower than the average electricity, heat and transport fuel costs for a household in 2019 with an internal combustion engine vehicle and a gas boiler. BEIS modelling suggests that, while the investment required to meet our 2050 net zero target could lead to an additional £40-110bn of network costs, overall electricity demand will be increasing due to the electrification of heat, transport and industry meaning that the unit cost (cost per kilowatt hour [kWh] of electricity consumed) is expected to stay broadly the same or even decrease (further detail is set out in Appendix I).<sup>11</sup>

<sup>12</sup> While there is uncertainty in these estimates, this suggests that the overall impact on consumers from network investment could be broadly neutral. This investment should also bring wider benefits to the UK economy – onshore network investment to meet net zero could directly support an additional 50,000–130,000 FTE jobs by 2050, contributing an estimated £4-11bn of GVA to the UK economy.

Through regulation of network companies, Ofgem will continue to incentivise companies to achieve net zero at the lowest cost to consumers through ensuring economic and efficient delivery, while maintaining world-class levels of system reliability and customer service. In addition, through the Smart Systems and Flexibility Plan<sup>13</sup>, BEIS and Ofgem are committed to delivering a smart and flexible energy system which will unlock the benefits of demand side response and wider system flexibility that should materially reduce the amount of additional investment needed in networks compared to the baseline modelling.

The government and Ofgem remain committed to protecting consumers. Following the unprecedented gas prices of the past year and further pressures from the Russian invasion of Ukraine, the government is undertaking a review of our energy retail market. This includes how the retail market can achieve the best outcomes for consumers, no matter how they engage; how energy companies can help drive the private investment needed to achieve net zero; and how the retail market, its underpinning regulatory framework and the energy price cap may

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<sup>10</sup> HM Treasury (2021), Net Zero Review Final Report, p. 56, <https://www.gov.uk/government/publications/net-zero-review-final-report>

<sup>11</sup> See Section 3.1 'Network costs of reaching Net Zero' in 'Appendix I: Electricity networks modelling'. These costs are calculated over the next 30 years (2021-2050) and presented in 2020 prices. These are only the indicative costs of the electricity network (both onshore and offshore, transmission and distribution). Even in the absence of net zero, network costs would be substantial; our baseline scenario suggests these could amount to £230-240bn by 2050.

<sup>12</sup> These estimates should be interpreted as indicative of how investment costs could be recovered, rather than any forecast of exact allowed revenue decisions through the price control process. As the independent energy regulator all price control and investment decisions are a matter for Ofgem alone. All network investment proposals will be scrutinised to ensure they are good value for money for consumers.

<sup>13</sup> BEIS and Ofgem (2021), Transitioning to a Net Zero Energy System: Smart Systems and Flexibility Plan, <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

need to evolve to enable a lowest-cost, flexible and resilient energy system that continues to protect consumers.

## **Structure of the Electricity Networks Strategic Framework Document**

This strategic framework is structured in three sections. **Section A: Introduction** sets out the context for the transformation of the electricity network, includes our **Vision for the Electricity Network of the Future** and outlines **Green Jobs and Investment Opportunities**, including how electricity networks will support the government's Net Zero Strategy, British Energy Security Strategy and building back greener – with an estimated 50,000-130,000 additional jobs supported by 2050 through reinforcement of the onshore network, contributing an estimated £4-11bn<sup>14</sup> to the economy, as well as positive impacts on wider sectors.

**Section B: Drivers for Change for the Electricity Network** explores the two major drivers for change: the increase in and changing nature of generation and demand; and the need for coordination with smart and flexible solutions. Whilst recognising considerable uncertainty, it is clear that policy commitments – such as the phasing out of all new non-zero emission road vehicles by 2040<sup>15</sup>, the installation of 600,000 heat pumps per year by 2028, or the commitment to decarbonise the power sector by 2035<sup>16</sup> – will have a large impact on the electricity network. Smart and flexible solutions are a significant opportunity to optimise the operation of the electricity system and mitigate growth in peak demand.

**Section C: Policies and Regulations to support the Electricity Network of the Future** describes the actions that the government and Ofgem are taking to support the development of the network of the future in light of the drivers discussed in section B, and to achieve our vision for the electricity network.

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<sup>14</sup> Gross value added (GVA) in 2050, undiscounted, 2020 prices. See section 7 'Future employment & GVA impacts from onshore network investment' in 'Appendix I: Electricity networks modelling'.

<sup>15</sup> Subject to consultation.

<sup>16</sup> Subject to security of supply.

# Section A: Introduction and Vision

## A.1 Context and Scope

In 2019, the government set out one of the world's most ambitious greenhouse gas emissions reduction targets: to achieve net zero greenhouse gas emissions by 2050. To achieve this, electricity generation must be fully decarbonised. The government committed in the Net Zero Strategy to decarbonise the power sector by 2035, subject to security of supply, while the British Energy Security Strategy set out proposals to accelerate this decisive shift away from expensive fossil fuels. Rapid decarbonisation in the power sector in the last decade and more has already enabled **electrification to provide a solution to challenges of decarbonisation** in other sectors. This will only increase, as electric vehicles and electric heating solutions become mainstream and electrification plays a role in industrial decarbonisation.

**Electrified heat and transport systems could see a huge increase in demand.** System peak demand could grow from 58 GW in 2020<sup>17</sup> to between 130-190 GW in 2050<sup>18</sup> depending on the net zero scenario, and total annual electricity demand could increase from 330 TWh in 2020<sup>19</sup> to between 570-770 TWh by 2050<sup>20</sup>. This will necessitate significant investment in and careful planning of the electricity network – the wires that carry electricity from centres of low carbon generation into the homes and businesses of consumers.

This document sets out the range of policies and regulations that the government and Ofgem, the independent energy regulator, have put and are putting in place to **ensure electricity networks can capitalise on the opportunities and meet the challenges of the accelerated transformation required**. It seeks to provide a strategic framework within which the government and Ofgem will develop future policy, regulations and other initiatives over time.

It focuses on the **onshore electricity network across England, Wales and Scotland**, covering all voltage levels, though it also covers the important work to better co-ordinate the onshore and offshore networks. It is centred primarily on preparing for the Sixth Carbon Budget endpoint of 2037 and the 2035 power sector decarbonisation commitment, though with a view to 2050.

As well as stakeholders who are already engaged in network policy and regulation, we expect this framework will be useful for those less familiar with the policy and regulatory electricity network landscape, and who may wish to understand more. For example, those connecting

<sup>17</sup> NGENSO (2021), Winter Outlook Report, p.4, <https://www.nationalgrideso.com/research-publications/winter-outlook>

<sup>18</sup> BEIS Dynamic Dispatch Model (DDM), Net Zero Lower Demand and Net Zero Higher Demand scenarios.

<sup>19</sup> BEIS (2021), Digest of UK Energy Statistics (DUKES), p.26, <https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2021>

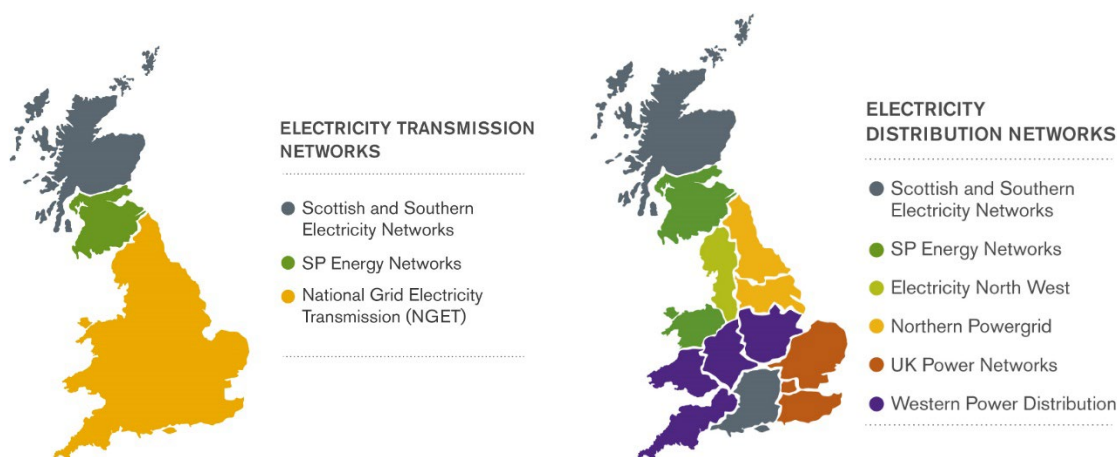
<sup>20</sup> BEIS DDM, Net Zero Lower Demand and Net Zero Higher Demand scenarios (see Section 2.1 'Changes in electricity demand' in 'Appendix I: Electricity networks modelling').

electric vehicle chargepoints, heat pumps and small-scale generation to the network, or local authorities who are planning to meet their energy needs or net zero targets.

This document is accompanied by ‘Appendix I: Electricity networks modelling’, which seeks to quantify the extent of network investment required by 2050, as well as potential employment impacts from this investment. Any figures in this document that forecast potential network investment, from Appendix I or other sources, are broad ranges with significant uncertainty. Price control decisions are a matter for Ofgem as the independent regulator, and all investment proposals will be scrutinised to ensure they are good value for money for consumers.

The electricity network is owned and operated by three transmission network companies and six distribution network companies, who are regulated by Ofgem through the RIIO price control framework.<sup>21</sup> The current ownership landscape is shown in Figure 1 below.

**Figure 1: Maps showing the current ownership landscape for energy network companies in Great Britain**



<sup>21</sup> RIIO stands for **R**evenue using **I**ncentives to deliver **I**nnovation and **O**utputs. In electricity transmission, RIIO-1 ran from 2013-2021 and RIIO-2 runs from 2021-2026. In electricity distribution, RIIO-1 runs from 2015-2023 and RIIO-2 will run from 2023-2028.



## A.2 Our Vision for the Electricity Network of the Future

The electricity network of the future:

- **Will be planned strategically, led by the Future System Operator and taking account of wider system developments**

Strategic network planning will enable coordinated and accelerated network development, including the join-up between onshore and offshore networks essential for energy security. We intend for **a more coordinated, whole-system approach to be facilitated by the Future System Operator**, which will also provide targeted, expert advice to the Government and Ofgem to ensure strategic policy decisions have fully considered whole system network impacts. At the local level, more joined-up energy planning is being considered to bring together local stakeholders to consider future demand, generation and network needs. This will include a **role for distribution system operation** to achieve more efficient solutions to network congestion problems by using local markets and new technologies to drive greater energy efficiency, smooth out peaks in demand and maximise the contribution from local sources of energy (such as solar panels and electric vehicle batteries).

- **Will continue to be resilient and anticipate expected need, to deliver a system which is efficient overall at the accelerated pace needed to meet Government targets**

The network of the future will be **increasingly reliable and resilient to extreme weather events and cyber secure**, continuing to evolve and learn lessons from previous incidents, whilst adapting to a net zero world. The network will safeguard energy security and enable power from homegrown low-carbon generation to reach consumers. Network regulation will take a **forward looking, flexibility first approach to new network investment**, enabling **enhanced network capacity to be deployed in anticipation of expected need where necessary**. Amending the regulatory approvals process will also help to **speed up** this deployment of network build. At the same time, there will be a key role for competition and innovation in network infrastructure, helping to ensure value for money for consumers.

- **Will allow for faster infrastructure build through reforming planning and consenting**

The planning consent process will be streamlined, with the Nationally Significant Infrastructure Projects regime delivering more certainty and better and faster outcomes, **cutting timescales for projects moving through the planning system**. Barriers to infrastructure build at all voltage levels will be reduced, including in relation to land rights and consents. We aspire to halve the end-to-end process for delivering strategic onshore transmission network infrastructure by the mid-2020s.

- **Will continue to enable cost effective and timely connections to the electricity network**

A growing variety and number of connecting generation and demand customers will be able to **connect to the network quickly and cost-effectively to meet their needs and those of the system as a whole**.

- **Will be smart and digitalised, with flexible solutions and markets complementing physical infrastructure**

The future energy system will match new sources of demand to renewable generation by using low carbon flexibility across the system to its optimal potential. **Flexibility will be prioritised** by networks in their management of network use, including resolving network constraints. The network of the future will be smart, with effective markets for flexibility and consumers exercising control over their energy usage in ways that benefit them and the grid. Digitalisation will enable **greater visibility of network data to inform decisions** by both network operators, consumers, and drive innovations.

- **Will be kept as low cost as possible, with charges reflective of the changing system**

The recent unprecedented rise in wholesale gas prices highlights the importance of minimising all components of energy costs. Network regulation will incentivise efficient investment to ensure costs are kept as low as possible to protect consumers. Network costs will be recovered through **revised network charging arrangements** that facilitate rapid decarbonisation of the power sector by providing the appropriate locational signals to generators and consumers. Consumers should be confident that **all energy users are sharing in the benefits and costs of decarbonisation**, including the balance of costs between gas and electricity bills. Potential schemes to benefit communities hosting electricity network infrastructure will be explored.

- **Will support the government's Net Zero Strategy and building back greener**

In promoting the development of the network, we estimate **50,000-130,000 additional green jobs could be supported** across the country. Investment in the networks will **support building back greener** from the economic shock of Covid-19 and could contribute **£4-11bn<sup>22</sup> to the economy**. In addition, this facilitates work in other sectors such as heat, transport, and hydrogen production, provides increased focus on and enables thousands of new jobs across the electricity supply chain and brings improvements to the environment.

## Our approach

1. **Consumer-focused: We will promote a network that delivers value for money and supports both connecting customers and electricity consumers** – ensuring customers are fully informed of their options will result in the best outcomes for consumers and the network. Through empowering local authorities and energy networks, we will allow for the right solutions to be deployed in the right places, meeting the needs of consumers.
2. **System-based: We expect the sector to take a whole-system approach to ensure the electricity network develops in the most efficient way possible, using both network and non-network solutions** – the electricity network of the future will use a joined-up, holistic approach to planning to address constraints. We will consider the

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<sup>22</sup> GVA, undiscounted, 2020 prices. See Section 7 'Future employment & GVA impacts from onshore network investment' in 'Appendix I: Electricity networks modelling'.

electricity network as a complete system, joining up offshore and onshore generation, transmission and distribution, to ensure that low carbon electricity is delivered efficiently to consumers. We will also more proactively coordinate electricity network planning with wider energy system planning.

3. **Aligned: Ofgem and the government will fulfil their independent roles and work together to deliver the electricity system of the future** – the government and Ofgem support an approach that delivers value for money for consumers, facilitating competition where possible to deliver efficiency. Ofgem will continue to set the price controls to enable networks to make the investments necessary to deliver a net zero ready network, and ensure network charging arrangements protect consumers, including future consumers. The government will set out its strategic energy priorities as guidance to Ofgem through the Strategy & Policy Statement and has, as part of the 2022 Energy Security Bill, introduced clauses to enable competitive tendering in onshore networks.

## A.3 Green Jobs and Investment Opportunities

Investing in Great Britain's electricity network – whether for reinforcement or new build – presents substantial opportunities for growth and jobs, both directly in the networks and in related industries. We want to see the electricity network of the future support the government's Net Zero Strategy and make a significant contribution to the UK economy, as well as bring improvements to the environment, as we look to build back greener.

Government analysis suggests that reinforcing Great Britain's onshore electricity network to meet net zero could directly support an additional 50,000 – 130,000 FTE jobs by 2050, contributing an estimated £4-11bn of GVA for the UK economy<sup>23</sup> as well as positive impacts on wider sectors.

We expect the electricity network to continue being an engine of employment and this will require industry to play its part in investing in skills and their workforce to help meet the scale of the challenge. Even under the most conservative estimate of the required work, we will see a new green workforce – with skills in both smart and traditional networks engineering.

We estimate that up to 20,000 new jobs could be created in load-related reinforcement projects in the electricity networks sector by 2035, generating up to £1.5bn of GVA for the UK economy.<sup>24</sup> These jobs will range from skilled civil and mechanical engineers, electrical engineers, design and development engineers to IT professionals (including in cyber security), software designers, physical scientists and environmental professionals (including in biodiversity and habitat management), as well as project managers and chartered surveyors, quality control and planning engineers, metal working and maintenance fitters, and experts in green construction. Digital skills and data analytics will also be core skills required in the electricity network workforce to meet net zero, with big data used for network planning, more efficient maintenance and improving risk mitigation.<sup>25</sup> These jobs will be distributed across Britain, supporting levelling up across the country.

**At the same time, there is an opportunity, as we make our electricity network fit for a net zero future, to boost the UK's emerging smart technology industry.** Flexibility from technologies such as electricity storage, smart charging of electric vehicles, flexible heating systems and interconnection could create up to 24,000 jobs by 2050.<sup>26</sup>

**An even greater economic boost will come not from the network reinforcement work itself, but from the new upstream and downstream activity that it makes possible.** By facilitating the switch to decentralised renewable generation, and by enabling the transition to

<sup>23</sup> GVA, undiscounted, 2020 prices. See Section 7 'Future employment & GVA impacts from onshore network investment' in 'Appendix I: Electricity networks modelling'.

<sup>24</sup> GVA, undiscounted, 2020 prices. BEIS modelling based on data collated from Transmission Owners (TOs) and Distribution Network Operators (DNOs).

<sup>25</sup> National Grid (2020), Net Zero Energy Workforce Report, p.14, <https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>

<sup>26</sup> BEIS (2019), Energy Innovation Needs Assessments, p.29 <https://www.gov.uk/government/publications/energy-innovation-needs-assessments>

electricity-intensive low carbon technologies, **network investment boosts a wide range of sectors**. From solar farms to offshore wind projects, from electric vehicle manufacture to heat pump installation, the burgeoning electrified UK economy will create high-quality green jobs across the country, in every region.

For example, upgrading our electricity network to handle the electrification of heat will allow the creation of up to 50,000 jobs by 2030 in heat pump installation alone.<sup>27</sup> Similarly, upgrading the networks to manage increased power-flows from all corners of Great Britain will enable the creation of jobs in renewable electricity generation – from onshore wind in the North of Scotland, to offshore wind in the East of England, to solar across the South – each requiring a broad range of skills across the workforce. Electric vehicle production, along with chargepoint installation and maintenance, will also lead to numerous and diverse jobs.



Through our Net Zero and British Energy Security Strategies, **the government is committed to growing green industries and supply chains in the UK, which will support up to 480,000 jobs across net zero industries in 2030**.<sup>28</sup> As outlined in the British Energy Security Strategy, we aspire to halve the timelines for delivering strategic onshore transmission network infrastructure by the mid-2020s. The government and Ofgem recognise the importance of a strong electricity supply chain to deliver this and will continue to work with network operators and industry to ensure we have a supply chain that has the necessary capability to enable the timely delivery of network infrastructure. The Net Zero Strategy also importantly sets out the measures we are taking to support skills and retraining for the green economy, including the following:

- **Reforming the skills system so that training providers, employers and learners are incentivised and equipped to play their part in delivering the transition to net zero** – such as through new Local Skills Improvement Plans<sup>29</sup> and including by legislating for skills required for jobs that support action on climate change and other environmental goals to be considered in the development of new local skills improvement plans.
- **Delivering a Lifetime Skills Guarantee and growing key post-16 training programmes** – such as apprenticeships, Skills Bootcamps, and T levels in line with the needs of employers in the green economy, helping individuals get the training they need for a job in the green economy, either at the start of their careers or when retraining or upskilling once already in the workforce.

<sup>27</sup> Additional heat pump installers required. BEIS (2021), Heat and buildings strategy, p.53, <https://www.gov.uk/government/publications/heat-and-buildings-strategy>

<sup>28</sup> BEIS (2021), Net Zero Strategy, p.231, <https://www.gov.uk/government/publications/net-zero-strategy>

<sup>29</sup> Department for Education (DfE) (2021), Skills Accelerator, trailblazers and pilots, <https://www.gov.uk/government/publications/skills-accelerator-trailblazers-and-pilots>

To help ensure we have the highly skilled workforce to deliver the transition, these initiatives will build on existing action already underway, such as the recently established Green Jobs Delivery Group. The Delivery Group will be the central forum through which the government, industry and other key stakeholders work together on the green jobs and skills agenda.

As we adapt our network, there is also an opportunity to establish world-leading capabilities in the new technologies that will be needed globally to tackle climate change, growing our capability to trade UK expertise around the world. In close collaboration with the Department for International Trade, **we will assist British start-ups and small and medium-sized enterprises in finding an export market for innovative products and services.** By driving forward UK action now, we can build companies that can win the lion's share of these new global markets in the future.

# Section B: Drivers for Change for the Electricity Network

## B.1 Increase and Changing Nature of Electricity Demand and Generation

Currently, the electricity network experiences demand of 330 TWh per annum.<sup>30</sup> Depending on how we reach net zero, demand is expected to increase to between 450-500 TWh by 2035 and between 570-770 TWh by 2050.<sup>31</sup>

Demand increase will be driven to a significant degree by electrification of the heat and transport systems, as these sectors shift away from fossil fuels. This demand will need to be met by large amounts of low carbon generation. For the electricity network, this means having the **capacity to deliver supply to where the demand is**, accommodating new demand and generation connections. A key challenge for the electricity network is being able to manage uncertainty and keep pace with how much demand will be needed, where it will be needed, and how it will be supplied.

### B.1.1 Increase and Changing Nature of Electricity Demand

Overall demand for electricity is expected to increase significantly over the coming years due to a range of factors, including electrification of cars, and vans and other transport, increased use of low carbon electricity replacing fossil fuels for heating, electrification of heavy industry and hydrogen production.<sup>32</sup> As a result, electricity could make up around one third of final energy demand in 2035, an increase from 14% in 2020.<sup>33</sup>

#### B.1.1.1 Transport

The government is going further and faster than ever before to decarbonise transport, as detailed in the July 2021 Transport Decarbonisation Plan.<sup>34</sup> **The government has pledged to end the sale of new petrol and diesel cars and vans from 2030 and to end the sale of all new, non-zero emission road vehicles by 2040, subject to consultation.** This will be

<sup>30</sup> BEIS (2021), DUKES, p.26, <https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2021>

<sup>31</sup> Figures for 2030 and 2050 are taken from the BEIS DDM, Net Zero Lower Demand and Net Zero Higher Demand scenarios (see Section 2.1 'Changes in electricity demand' in 'Appendix I: Electricity networks modelling').

<sup>32</sup> The analysis excludes electricity demand for hydrogen production via electrolysis, as the modelling assumes this demand is met by curtailed renewables, but future planned analysis will consider demand from electrolysis drawing from a range of generation sources.

<sup>33</sup> BEIS (2021), Net Zero Strategy, p.81, <https://www.gov.uk/government/publications/net-zero-strategy>

<sup>34</sup> Department for Transport (DfT) (2021), Transport Decarbonisation Plan, <https://www.gov.uk/government/publications/transport-decarbonisation-plan>

alongside a zero-emission vehicle mandate, which sets a target for a percentage of manufacturers' new car and van sales to be zero emission each year from 2024.<sup>35</sup>

It is estimated that the transition to electric vehicles could increase total electricity demand by 90 – 130 TWh and peak demand by 20 – 30 GW in 2050, accounting for approximately 15 – 20% of total electricity demand and system peak demand by 2050. Smart charging (discussed further in section B.2.1) could mitigate the impact of electric vehicles on the system, reduce system-wide peak in 2050 and provide opportunities for grid flexibility through demand shifting and through vehicle-to-X technologies.<sup>36</sup>

**There is still some uncertainty around where electric vehicle chargepoints and associated capacity will need to be located.** The government estimates that between 280,000 and 720,000 public chargepoints for electric cars and vans might be needed by 2030, depending on consumer charging behaviour and the types of chargepoints that are rolled out.<sup>37</sup> This is in addition to the private chargepoints installed in homes and workplaces, of which we expect to number in the millions by the mid-2020s.

**Increased electricity demand will also come from rail electrification, but this will be much smaller than that expected from electric vehicles.** Around 38% of our rail track is already electrified and the government has committed to deliver a net zero rail network by 2050, guided by Network Rail's Traction Decarbonisation Network Strategy (TDNS), which achieves 97% reduction in rail emissions.<sup>38</sup>

Although at a much earlier stage, **electrification will also contribute to decarbonisation of the maritime sector**, alongside cleaner fuels such as hydrogen, through the electrification of ports and potentially the use of highly efficient batteries on ships.<sup>39</sup>

As discussed in the government's Jet Zero Strategy, published in July 2022<sup>40</sup> there is also increasing developmental activity on **electric and hydrogen aircraft**. As well as hydrogen for zero emission aircraft, production of sustainable aviation fuel - depending on technology and feedstock - could drive significant electricity demand for electrolysis.

<sup>35</sup> BEIS (2021), Net Zero Strategy, p.24, <https://www.gov.uk/government/publications/net-zero-strategy>

<sup>36</sup> Vehicle-to-X (V2X) technologies allow an electric vehicle to export the energy within its battery for another use, for example to a home or to the electricity grid. This offers additional flexibility to the energy system and a potential revenue source for businesses and consumers.

<sup>37</sup> Department for Transport (2022), Taking charge: the electric vehicle infrastructure strategy, p127, <https://www.gov.uk/government/publications/uk-electric-vehicle-infrastructure-strategy>

<sup>38</sup> DfT (2021), Transport decarbonisation plan, p.75, <https://www.gov.uk/government/publications/transport-decarbonisation-plan>

<sup>39</sup> BEIS (2021), Net Zero Strategy, p.108, <https://www.gov.uk/government/publications/net-zero-strategy>

<sup>40</sup> DfT (2022), Jet Zero Strategy, p.41, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1091834/jet-zero-strategy.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091834/jet-zero-strategy.pdf)



### B.1.1.2 Buildings and Heating

Whilst there is uncertainty about the optimal mix of heat decarbonisation technologies, **we know that electrification will play a significant role**. In the Heat and Buildings Strategy, the government restated the aim for heat pump installations to reach 600,000 per year by 2028<sup>41</sup> and set out a comprehensive policy package to support this ambition, including targeted regulatory, market-based, and public investment measures. The commitments made by the government so far will lead to a greater load on the electricity network.

The government has committed to taking strategic decisions on the role of hydrogen for heating in 2026. But whatever future strategic decisions are made, **for many buildings heat pumps will be the optimal solution, increasing demand on the electricity network**.

Demand from electrified heating is expected to increase peak demand by between 50 – 90 GW by 2050, accounting for between 40-50% of the total system peak.<sup>42</sup>

Following implementation of the Future Homes Standard, heat pumps are expected to be installed in 200,000 of the new build domestic properties built annually from 2025.

The government has consulted on new regulations<sup>43</sup> to phase out the installation of heating systems using high carbon fossil fuels in homes, businesses, and public buildings off the gas grid during the 2020s. This could result in up to 80,000 off-gas grid buildings in England transitioning to low carbon heating each year.

The government will also support homes and businesses on the gas grid to transition away from natural gas, through grants and other interventions, which will likely cause hundreds of thousands of buildings currently connected to the gas grid to adopt heat pumps.

### B.1.1.3 Industrial Decarbonisation and Early Technologies

**Increased demand for electricity will also come from industry as it decarbonises in line with national net zero commitments.**

In March 2021, the government published an Industrial Decarbonisation Strategy<sup>44</sup>, setting out how UK industry can decarbonise in line with net zero whilst remaining competitive and without pushing emissions abroad. The Strategy sets out how different technologies, such as industrial carbon capture utilisation and storage and switching from fossil fuels to low carbon alternatives

<sup>41</sup> BEIS (2021), Heat and buildings strategy, p.14, <https://www.gov.uk/government/publications/heat-and-buildings-strategy>

<sup>42</sup> Section 2.1 'Changes in electricity demand' in 'Appendix I: Electricity networks modelling'.

<sup>43</sup> BEIS (2021), Phasing out the installation of fossil fuel heating in homes off the gas grid, <https://www.gov.uk/government/consultations/phasing-out-fossil-fuel-heating-in-homes-off-the-gas-grid>. The consultation set out proposals to phase out installation of high carbon fossil fuel heating systems in off-gas grid homes. Proposals for targeted regulations included an end to new fossil fuel heating installations in these homes from 2026, a 'heat pump first' approach from the same date and requiring high performing replacement heating systems where heat pumps aren't practical. Consultation closed 12<sup>th</sup> January.

<sup>44</sup> BEIS (2021), Industrial Decarbonisation Strategy, (<https://www.gov.uk/government/publications/industrial-decarbonisation-strategy>).

like electricity and low carbon hydrogen, can reduce industrial emissions. Where electrification is the solution, this could place significant extra demand on the electricity network in certain locations.

Electrification could reduce annual industrial emissions by between 5 and 12 MtCO<sub>2</sub>e, contributing between 14% and 43% of the (necessary) carbon abatement in industry, by 2050, based on analysis for the Industrial Decarbonisation Strategy. Overall industrial electricity demand in 2050 could range between 85 TWh and 115 TWh depending on future industrial demand, resource and energy efficiency and fuel switching choices between electricity and hydrogen.

**Hydrogen production through electrolysis will also require electricity, but can also provide wider system benefits such as flexible capacity and storage to balance renewables.** Electrolytic hydrogen production is likely to become more prevalent as fossil fuels are phased out. In the British Energy Security Strategy, the government doubled its ambition for 2030 low carbon hydrogen production capacity to up to 10GW, subject to affordability and value for money, with at least half of this coming from electrolytic hydrogen. The government recently published the UK Low Carbon Hydrogen Standard (LCHS), which sets in place requirements for how electricity should be accounted for in hydrogen production, and the permitted electricity input routes. The approach set out in the LCHS is designed to incentivise electrolyzers to operate flexibly and to minimise the impact on power sector emissions. There is also potential for hydrogen to act as a provider of electricity system flexibility. Our drive for renewables makes hydrogen especially valuable: excess renewable electricity can be used to produce hydrogen, which can be stored over time and used to generate electricity when there is less sun or wind to power the grid.<sup>45</sup> As set out in the British Energy Security Strategy and in the July 2022 Hydrogen Strategy update to the market<sup>46</sup>, we will ensure consideration is given to the siting of hydrogen electrolyzers to best use surplus low carbon electricity and manage network constraints.

**Carbon capture utilisation and storage (CCUS) technology also has the potential to increase electricity demand**, as industrial clusters<sup>47</sup> may increase electricity consumption to power CO<sub>2</sub> capture plants (in particular, CO<sub>2</sub> compression). However, for some CCUS projects and applications, combined heat and power plants or other closed system clusters may be sufficient to provide the electricity needed.

## B.1.2 Increase and Changing Nature of Electricity Generation

The UK has already made significant progress to decarbonise the power sector and move away from fossil fuel use. In 2020 electricity generation accounted for 12% of UK emissions,

<sup>45</sup> Significant challenges remain to the development of large-scale hydrogen storage, including research and innovation to increase efficiency of storage, and the long lead times and complexity of storage utilising salt caverns and depleted oil and gas fields.

<sup>46</sup> BEIS (2022), Hydrogen Strategy update to the market: July 2022, p.22, <https://www.gov.uk/government/publications/uk-hydrogen-strategy>

<sup>47</sup> Industrial clusters are places where related industries have co-located. Clustered industrial sectors tend to be those that required energy-intensive manufacturing processes, specifically: chemicals, glass, oil refining, paper and pulp, and iron and steel.

down from 25% in 1990.<sup>48</sup> 30 years ago, fossil fuels accounted for nearly 80% of electricity generation – in 2020 about 60% of generation was from low carbon sources.<sup>49</sup> This transition will only accelerate: the Net Zero Strategy set a commitment that all of our electricity will come from low carbon sources by 2035, subject to security of supply, and the British Energy Security Strategy set out measures to speed up the roll-out of renewables and the transition away from fossil fuels.

**Depending on how we reach net zero, renewable electricity capacity in 2050 could be between 175-240 GW and generation between 475-585 TWh** by 2050 (see Figure 2). In 2020, renewable capacity and generation levels were around 45 GW and 110 TWh - the 2050 projections represent between a four and five-fold increase for both.

By 2035, we expect electricity demand could increase by 40-50% on 2020 levels, with significant levels of renewable and low carbon capacity forecasted to make up the electricity mix as we progress through 2035 and toward 2050.<sup>50</sup> Whilst unabated gas generation currently plays a key role in keeping Great Britain's electricity system stable and secure, the development of clean flexible technologies means it will be used less frequently in the future.

A low-cost, net zero consistent electricity system is likely to be dominated by wind and solar generation. The UK currently has approximately 14 GW of onshore wind, 14 GW of solar photovoltaic systems, and 11 GW of offshore wind installed, together accounting for 80% of renewables capacity<sup>51</sup>, and the government continues to support further deployment including through our ambition to deliver up to 50 GW of offshore wind by 2030.<sup>52</sup> There will also be sustained increases in new onshore wind and solar generation, with up to 70GW of solar by 2035.<sup>53</sup> This raises challenges in ensuring network infrastructure can be deployed in the most efficient way to connect very large volumes of new generation to the network, in the right geographical locations across Great Britain.



These intermittent renewables need to be complemented by firm and flexible low-carbon technologies such as nuclear and power CCUS, interconnection, storage and demand side

<sup>48</sup> BEIS (2020), Provisional UK greenhouse gas emissions national statistics, Table 1, <https://data.gov.uk/dataset/9a1e58e5-d1b6-457d-a414-335ca546d52c/provisional-uk-greenhouse-gas-emissions-national-statistics>

<sup>49</sup> BEIS (2021), DUKES, p.31, <https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2021>

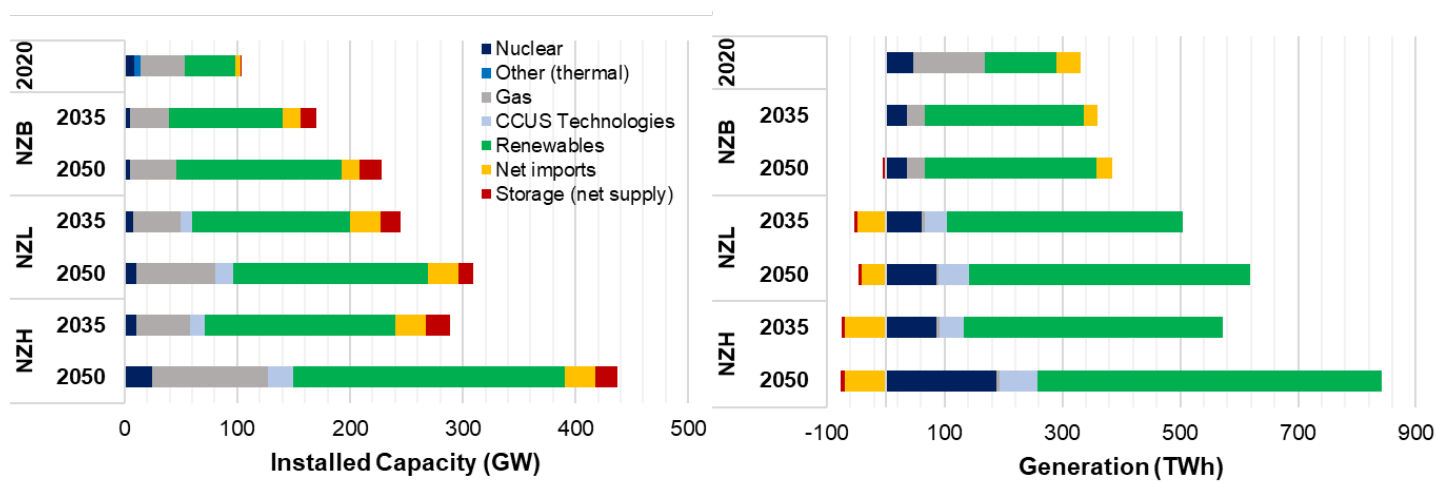
<sup>51</sup> BEIS (2021), Energy Trends: September 2021, <https://www.gov.uk/government/statistics/energy-trends-september-2021>. A 'levelized cost' is the average cost of the lifetime of the plant per MWh of electricity generated. They reflect the cost of building, operating and decommissioning a generic plant for each technology.

<sup>52</sup> Prime Minister's Office and BEIS (2020), Building Back Greener Press release, <https://www.gov.uk/government/news/new-plans-to-make-uk-world-leader-in-green-energy>

<sup>53</sup> The two cheapest electricity generating technologies in the UK today on a levelized cost basis. BEIS (2020), Electricity Generation Costs 2020, <https://www.gov.uk/government/publications/beis-electricity-generation-costs-2020>

response. All of these technologies will need to be deployed at scale to meet our 2035 ambitions. Nuclear plays an important role in reducing greenhouse gas emissions to net zero in 2050 and enabling energy security. The government ambition is to increase deployment of civil nuclear to up to 24GW by 2050 – representing up to 25% of our projected electricity demand. **New nuclear projects will likely require significant network investment and infrastructure to support them.** Alongside large-scale projects, the government is also committed to developing advanced nuclear reactors, including Small Modular Reactors. These offer potential for greater flexibility in load quantity and could require smaller connections to the electricity network.

**Figure 2: Great Britain modelled installed capacity and generation mix in Net Zero Baseline (NZB) Demand, Net Zero Lower (NZL) Demand and Net Zero Higher (NZH) Demand scenarios in 2035 and 2050, compared to 2020<sup>54</sup>**



<sup>54</sup> Data taken from the BEIS DDM: Net Zero Baseline Demand, Net Zero Lower Demand and Net Zero Higher Demand scenarios. See 'Appendix I: Electricity networks modelling', p 10-13

## B.1.3 Impacts of Changes in Demand and Generation on the Electricity Network

### B.1.3.1 Connections

**Enabling the transition to net zero will require a rapid increase in connections to the transmission and distribution networks**, for example to accommodate new renewable generation and demand from domestic heat pumps and electric vehicle chargepoints. **The electricity network will need to be prepared for this**, especially as the cost and delivery timescales of connections will vary. There are also likely to be **many more first-time connection customers** (both domestic and non-domestic, such as bus operators), who have previously not had to understand the network connections process. Network operators will help these customers navigate the connection process and secure the best solution for their needs.

### B.1.3.2 Network Constraints

**The changing nature of demand and generation will also place new pressures on the electricity network.** Given the move to significantly more offshore wind – and onshore wind, solar and nuclear in rural areas – **larger shares of generation will be situated at greater distances from centres of demand** (i.e. large cities). This is already a challenge because of significant wind generation present in Scotland, with the electricity network already experiencing increasing congestion.

Identifying where new transmission infrastructure is required, securing planning and regulatory consent and building this infrastructure takes over a decade. The lengthy delivery timeline, combined with the fact that new generating capacity will be brought online rapidly over the next decade in response to our ambitious targets, is **likely to place further pressure on an already constrained transmission network. Therefore government has committed to accelerate project delivery in the British Energy Security Strategy.**

**The distribution network is likely to face similar congestion issues, particularly as distributed generation seeks to connect and as demand from electric vehicles, heat pumps and other users such as data centres increases.** Constraints at a transmission level can also be caused by activity on the distribution network, for example surplus distributed generation being exported to the transmission network at times of peak local generation and low local demand.

Network constraints are a natural part of the electricity network system.<sup>55</sup> Where curtailment (i.e. reducing or turning off generation) is required it is usually renewable generation that is turned off, due to its location in network constrained areas, with a corresponding short-term carbon impact. This process of balancing the system to alleviate network constraints<sup>56</sup> also

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<sup>55</sup> Network constraints are in many cases a sign that incumbent network infrastructure is working at close to full capacity during its usual working life, since the cost of managing a constraint can sometimes be more economical than investing in an underutilised reinforcement asset.

<sup>56</sup> The Electricity System Operator is responsible for balancing the levels of electricity on the network. This involves monitoring the levels of supply and demand of electricity, as well as the capacity of network infrastructure to deliver these required outputs from generation to consumer. For example, if supply of electricity exceeds demand or the network's maximum carrying capacity, the ESO will instruct generators to switch off or turn down, compensating them for their loss of income through constraint payments.

has an impact on consumer bills.<sup>57</sup> Modelling by the Electricity System Operator has estimated that constraint costs could increase from around £500m per year in 2021 to a peak of between £1-2.5bn in the mid-late 2020s<sup>58</sup>, before reducing again at the end of the decade when new major transmission investments are assumed to come online.<sup>59</sup> We should aim to optimise the balance of constraints and their management through investment in network infrastructure and flexible services.

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<sup>57</sup> Balancing the levels of electricity on the network in this manner is a common practice in electricity systems around the world.

<sup>58</sup> Figures are in undiscounted terms. NGENO (2021), Modelled Constraint Costs: NOA 2020/21, <https://www.nationalgrideso.com/documents/194436-modelled-constraint-costs-noa-202021>

<sup>59</sup> Any future network constraint cost increases out to 2040 are not estimated to exceed those estimated in the 2020s.

## B.2 Coordination with Smart and Flexible Solutions

The second main driver for change is the expected increase in smart and flexible solutions enabled through markets. Whilst significant investment in the electricity network will undoubtedly be required to meet the needs of increased demand and new low carbon generation, **smart and flexible technologies are essential for helping manage network capacity as an alternative to building more physical infrastructure, and potentially at significantly lower cost.** Smart and flexible technologies are an area of rapid innovation and change, providing opportunities for efficiencies that can lower costs for consumers. Decisions on when and where to invest in infrastructure will need to take account of this. In the 2021 Smart Systems and Flexibility Plan, the government estimated that around 30GW of low carbon flexible assets may be needed by 2030, which represents a three-fold increase on 2020 levels.<sup>60</sup>

There are also opportunities within the physical network to make the network more dynamic and flexible without the need for additional cables or the addition of more traditional generation sources.<sup>61</sup> To unlock the potential of smart and flexible solutions, it is crucial that these technologies are appropriately valued for the services they provide to the system.

### B.2.1 Transport

**The take-up of electric vehicles is set to rise dramatically over the next decade, providing a source of flexibility for the electricity system and reducing peaks in demand.**

These benefits are made possible by smart charging technologies, which enable electric vehicle drivers to manage the battery's charge based on signals, such as energy prices, system capacity, and information on consumer vehicle needs and battery status.

If effectively deployed, smart charging will result in lower bills for all energy customers (due to lower energy system costs) and for vehicle owners (who can charge their vehicles when electricity prices are lower – for example, overnight).



There could be even further benefits if car batteries can be used to export electricity, for example to support the electricity grid (vehicle-to-grid) or home (vehicle-to-home). One

<sup>60</sup> BEIS and Ofgem (2021), Transitioning to a Net Zero Energy System: Smart Systems and Flexibility Plan 2021, p.5, <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

<sup>61</sup> Examples include synchronous condensators, which can provide a lower carbon method of providing network stability. Dynamic line ratings facilitated by online monitoring devices can facilitate the optimal use of network capacity, maximising the benefits achievable with existing infrastructure. Looking further ahead, ideas such as creating an AC/DC Hybrid network could facilitate greater local control and balancing markets whilst still facilitating the transfer of large volumes of power across the country.

estimate of vehicle-to-grid potential from the Electricity System Operator suggests that, by 2050, vehicle-to-grid could offer between 8-39 GW of flexible load for the electricity market in Great Britain (representing 7–17 % of total flexibility).<sup>62</sup>

## B.2.2 Buildings and Heating

**Electrifying heat in buildings in a smart and flexible way could also help manage electricity network impacts and improve outcomes for consumers.** Heat pumps with smart controls and energy storage (electric batteries, thermal and/or using the building fabric) can shift demand to make use of lower carbon and cheaper electricity, and provide flexibility services for networks, when required.

District heat networks can also offer significant flexibility benefits for the electricity network. Estimates<sup>63</sup> show that district heat networks equipped with thermal storage are second only to smart vehicles in terms of their potential for balancing the grid and reducing peak electricity demand.

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<sup>62</sup> NGENSO (2021), Future Energy Scenarios (FES) 2021, <https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021#fes-reports>

<sup>63</sup> NGENSO (2021), FES 2021, <https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021#fes-reports>



# Section C: Facilitating the Transition to the Electricity Network of the Future

## C.1 Changing How Electricity Networks are Planned and Managed

**Vision: Will be planned strategically, led by the Future System Operator (when established) and taking account of wider system developments**

A holistic approach is needed to plan the electricity network; taking account of the growth in low carbon domestic generation, demand from low carbon technologies and the increased use of smart and flexible solutions. The electricity network of the future will be planned strategically, taking a whole-system view to create a “blueprint” that will help to deliver, at pace, a joined-up network with integrated infrastructure design and build.

At the local level, we are considering how more joined-up energy planning can bring together local stakeholders to consider future demand, generation, and network needs in the round, as well as an increasing role for markets. To facilitate this, system operator functions will need to be fit for purpose.

This will be achieved through the following interventions:

- Facilitating more strategic network planning: onshore, offshore and at the local level
- Implementing an expert, impartial Future System Operator<sup>64</sup>
- Reviewing the effectiveness of institutional and governance arrangements at the sub-national level

### C.1.1 Facilitating More Strategic Network Planning

To design a net-zero-ready network, that ensures security of supply, in the most cost-efficient, secure and future-proofed way possible, **the network must be effectively planned to bring the appropriate investment and right kind of technology online at the right time, in the right places.** This will allow for the system to function as efficiently as possible, delivering for consumers and other network users.

It is necessary to take a holistic, coordinated (onshore and offshore) and cross-vector approach to network planning, with a fuller, impartial evaluation of the range of possible options for addressing system need – including smart and flexible solutions as alternatives for network build and management. It will also be important to consider synergies in planning at

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<sup>64</sup> BEIS and Ofgem (2021), Proposals for a Future System Operator Role, <https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role>

the transmission and local levels, and coordinating gas networks alongside electricity, while maintaining a long-term focus towards net zero and shifting away from fossil fuels.

### C.1.1.1 Enabling Strategic Transmission Network Planning, onshore and offshore

Given the amount of new transmission infrastructure required to meet the government's offshore wind ambition of up to 50 GW by 2030, the previous approach where offshore wind farms each build their individual point-to-point transmission to the onshore system is being changed through a process of reform under the **Offshore Transmission Network Review**.<sup>65</sup>

The Review, launched in July 2020, aims to deliver **more coordinated transmission as soon as possible, while maintaining the pace of wind deployment required to support the ambition of up to 50GW by 2030 and to facilitate net zero by 2050**. This will involve managing trade-offs between commercial, social, and environmental considerations, with network planning being one aspect of this review. A study by the Electricity System Operator<sup>66</sup> estimates that a coordinated approach to offshore transmission could deliver a considerable reduction in the amount of new infrastructure required and achieve multi-billion-pound cost savings.



The Offshore Transmission Network Review has three main workstreams – Early Opportunities, Pathway to 2030, and the Enduring Regime – with a fourth cross-cutting workstream specifically on Multi-Purpose Interconnectors. Both the government and Ofgem have published consultations<sup>67 68</sup> on respective aspects

of the Review. Ofgem have since issued minded-to decisions on the Early Opportunities, Pathway to 2030 and MPI workstreams<sup>69</sup>, and will be responding to these in the coming months.

A key part of the Pathway to 2030 workstream is the Holistic Network Design (HND), which was published by the Electricity System Operator in July 2022.<sup>70</sup> The HND is the first of a kind

<sup>65</sup> BEIS (2020), Offshore Transmission Network Review, <https://www.gov.uk/government/groups/offshore-transmission-network-review>

<sup>66</sup> NGENSO (2020), Offshore Coordination Project, final Phase 1 Report

<https://www.nationalgrideso.com/news/final-phase-1-report-our-offshore-coordination-project>

<sup>67</sup> BEIS (2021), Offshore Transmission Network Review, <https://www.gov.uk/government/consultations/offshore-transmission-network-review-proposals-for-an-enduring-regime>

<sup>68</sup> Ofgem (2021), Consultation on changes intended to bring about greater coordination in the development of offshore energy networks, <https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks>

<sup>69</sup> Ofgem (2022), OTNR – MPI Minded-to Decision on interim framework, <https://www.ofgem.gov.uk/publications/offshore-transmission-network-review-multi-purpose-interconnectors-minded-decision-interim-framework>

<sup>70</sup> ESO (2022) Holistic Network Design, <https://www.nationalgrideso.com/future-energy/the-pathway-2030-holistic-network-design>

strategic network design, providing the blueprint for coordinated connections for offshore wind that will deliver the UK's ambition for up to 50GW of offshore wind by 2030, taking into account cumulative community and environmental impacts.

**Ofgem commenced an Electricity Transmission Network Planning Review in June 2021 with the aim of ensuring that planning for the whole of the electricity transmission network can efficiently support the delivery of net zero at lowest cost to consumers.**

Ofgem recently published its minded-to decision<sup>71</sup> that there should be a new process for planning the electricity transmission network resulting in a Centralised Strategic Network Plan in the next two to three years. The proposed arrangements should:

- promote proactive identification and progression of low regret 'strategic investments' that are key to delivering net zero and other decarbonisation targets efficiently;
- create the right conditions for efficient co-optimisation of network design with the location of new demand and generation across Great Britain, which should maximise efficient utilisation;
- ensure the onshore and offshore electricity transmission networks, including interconnection, are planned holistically together;
- facilitate greater co-optimisation of the transmission network and wider energy system;
- provide clearer information, at an earlier stage, to planning authorities and local communities on the inter-relationship between electricity transmission network projects, and how environmental and community factors have been considered in design.

Subject to responses to our minded to-decision, Ofgem intends to continue working with the Electricity System Operator to develop the methodology that would underpin the enduring CSNP arrangements. This should ensure an efficient and timely transition from the current network planning arrangements. If the methodology underpinning the enduring CSNP arrangements is finalised prior to establishment of the Future System Operator, Ofgem will consider whether the enduring CSNP arrangements could potentially be carried out by the ESO before moving to the FSO.

**Case Study – Eastern High-Voltage Direct Current (HVDC)**

Typically, large projects (such as those submitted under the Large Onshore Transmission Investments Reopener in RIIO-2) have been submitted to Ofgem for regulatory review and approval, in isolation of other potentially strongly interrelated developments. While there are sometimes practical reasons for doing this (e.g. project timelines not being aligned), we consider that this approach risks missing some strategic and process benefits that could otherwise be realised. Clustering two or more large, interrelated projects for regulatory submission and planning consents purposes can be a helpful step towards a centralised strategic network planning approach to investment.

<sup>71</sup> Ofgem (2022), Consultation on our Minded-to Decisions on the initial findings of our Electricity Transmission Network Planning Review, <https://www.ofgem.gov.uk/publications/consultation-our-minded-decisions-initial-findings-our-electricity-transmission-network-planning-review>

An example of where such clustering of projects has been possible is the Eastern HVDC project. This joint project involves the construction of two HVDC links between two different boundaries of the National Electricity Transmission System, having a total capacity of 2GW. Rather than assessing these two projects separately, Ofgem has assessed the need for the two links jointly. This is because these two projects are closely linked in their drivers and their geographical proximity and has allowed a more streamlined assessment process to be followed.

### C.1.1.2 Local Level Energy System Planning

Local stakeholders, such as town planners, local authorities, and developers have a role in helping electricity network operators understand possible future electricity demand. They can work together, including with community energy groups, to develop smart local energy systems, which are local-based initiatives that bring together a range of energy issues, typically including heat, power, transport, and small-scale industry to reduce emissions in an integrated way, while also promoting local jobs and businesses.

Local authorities have a key role to play in delivering these systems by combining consideration of the need for electric vehicle charging, for example, into wider work on energy and their statutory work on housing, transport, waste, and planning, making delivery more cost-effective and preparing for a net zero future.

**The government and Ofgem recognise the need for a local area-level approach to deliver the best network for each local area, responding to their specific needs.** Local-level energy planning could help bring together key stakeholders – including local authorities and network operators – to explore routes to decarbonisation in their local area.

**The government and Ofgem are working together to consider the role local and regional energy planning could play in delivering net zero and supporting efficient network planning, including considering the respective roles of national governments, local government, a Future System Operator, distribution network operation and other key stakeholders for energy planning.**

As part of this, Ofgem has launched a Call for Input<sup>72</sup> looking into institutional and governance arrangements at a local level. This seeks views from industry, local authorities, and other interested stakeholders on existing arrangements and the changes needed to facilitate cost-effective net zero.

This work will build on what has already been done, including in early 2020, where Ofgem commissioned the Centre for Sustainable Energy and Energy Systems Catapult to report<sup>73</sup> on approaches to local energy systems and how local energy planning could support better

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<sup>72</sup> Ofgem (2022), Call for Input: Future of local energy institutions and governance, <https://www.ofgem.gov.uk/publications/call-input-future-local-energy-institutions-and-governance>

<sup>73</sup> The report covered distributional networks for electricity, gas of heat; use of distributed hydrogen; heat demand in buildings; expected demand for EV charging, and its impacts on electricity distribution systems.

network planning proposals. Ofgem referenced this report in its Business Plan Guidance<sup>74</sup> for the RIIO-2 electricity distribution price control.<sup>75</sup> Innovate UK - UK Research and Innovation commissioned Energy Systems Catapult to assess the current landscape of Local Area Energy Planning in the UK, leading to publication of a report in December 2021.<sup>76</sup> Subsequently, Energy Systems Catapult published a guidance document on how to create a Local Area Energy Plan and a report on building a governance framework for coordinated Local Area Energy Planning, in July 2022.<sup>77</sup> Innovate UK - UK Research and Innovation also led work with PricewaterhouseCoopers to assess the economic benefits of local decarbonisation approaches and ways to deliver them at scale.<sup>78</sup>

## What we have done

- The government and Ofgem are working with industry to develop a strategic approach to network planning, including through the Holistic Network Design.
- Ofgem has commenced an Electricity Transmission Network Planning Review, and as part of this, has published for consultation its minded-to decision<sup>79</sup> on what transitional and enduring Centralised Strategic Network Planning arrangements should look like.
- As part of the Offshore Transmission Network Review, Ofgem has published consultations<sup>80</sup> on potential changes to enable greater coordination in the development of offshore networks in the near and medium term and with minded-to decisions on the proposed regulatory changes for the Early Opportunities, Pathway to 2030 and MPI workstreams.<sup>81</sup>
- Ofgem has published a Call for Input<sup>82</sup> on the future of local energy institutions and governance.

<sup>74</sup> Ofgem (2021), RIIO-ED2 Business Plan Guidance, <https://www.ofgem.gov.uk/publications/riio-ed2-business-plan-guidance>

<sup>75</sup> The guidance did not mandate a requirement for DNOs to follow the CSE method in their ED2 business plans.

<sup>76</sup> Energy Systems Catapult (2021), The future of Local Area Energy Planning in the UK, <https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/>

<sup>77</sup> Energy Systems Catapult (2022), Local area energy planning guidance to help local leaders plan for Net Zero, <https://es.catapult.org.uk/news/local-area-energy-planning-guidance-to-help-local-leaders-plan-for-net-zero/>

<sup>78</sup> Innovate UK – UK Research and Innovation and PwC (2022), Accelerating net zero delivery: unlocking the benefits of climate action in UK city-regions, <https://www.ukri.org/publications/accelerating-net-zero-delivery/>

<sup>79</sup> Ofgem (2022), Consultation on our Minded-to Decisions on the initial findings of our Electricity Transmission Network Planning Review, <https://www.ofgem.gov.uk/publications/consultation-our-minded-decisions-initial-findings-our-electricity-transmission-network-planning-review>

<sup>80</sup> Ofgem (2021), Consultation on changes intended to bring about greater coordination in the development of offshore energy networks, <https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks>

<sup>81</sup> Ofgem (2022), OTNR – MPI Minded-to Decision on interim framework, <https://www.ofgem.gov.uk/publications/offshore-transmission-network-review-multi-purpose-interconnectors-minded-decision-interim-framework>

<sup>82</sup> Ofgem (2022), Call for Input: Future of local energy institutions and governance, <https://www.ofgem.gov.uk/publications/call-input-future-local-energy-institutions-and-governance>

## What we will do going forward

- The government and Ofgem will publish responses to their respective consultations under the Offshore Transmission Network Review.
- The government and Ofgem will consider the role local and regional energy planning could play in delivering net zero and supporting efficient network planning, including the respective roles of national governments, local government, the Future System Operator, distribution network operation and other key stakeholders for energy planning.

### C.1.2 Preparing for Future System Operation

**The government and Ofgem recognise the need for rules and governing institutions that adapt to the system as it undergoes a transformation.** The announced independent Future System Operator, as a body within the public sector but with operational independence from government, should play a vital role in advising key decision makers on maximising the efficiency of the system and taking on the central network planner role. The move to Distribution System Operation also allows for more flexibility and planning on the distribution network, and increased role for markets; Ofgem are undertaking a review of the effectiveness of institutional and governance arrangements at the distribution level. Below, we set out the vision for a Future System Operator and Distribution System Operation, and the next steps after consultation.

#### C.1.2.1 The Role of the Future System Operator

The transition to net zero and away from fossil fuels, and our future energy security, will require a much more integrated energy system, with increased operational and planning challenges. This needs a step-change in whole system coordination and planning, with new and enhanced roles and functions. **The reform of the system operator allows an opportunity for an independent, accountable and expert body to help ensure the energy system can meet the challenge of net zero, while delivering resilience, security of supply and efficient use of the networks.**

The government and Ofgem have announced<sup>83</sup> our commitment to proceed with the creation of the Future System Operator, as an expert, impartial body with an important duty to facilitate net zero while also maintaining a resilient, economical, coordinated and efficient system. It will take on the existing roles and capabilities within the Electricity System Operator and the longer-term elements of the Gas System Operator. We will establish the Future System Operator in public ownership, in a way which ensures it is independent – not only of asset ownership and other commercial energy interests, but also from day-to-day operational control of the government.

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<sup>83</sup> BEIS and Ofgem (2021), Proposals for a Future System Operator role, <https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role>

As a trusted and expert body at the centre of the gas and electricity systems, the Future System Operator will play an important role in coordinating and ensuring strategic planning across the sector. It will have an ambitious long-term vision and provide independent advice to the government and Ofgem. Framing these roles is the need for the Future System Operator to take a whole energy system approach (between transmission and distribution networks and across vectors, including gas, electricity, hydrogen and carbon capture utilisation and storage) when operating and planning the network. This will allow for efficient functioning of both the gas and electricity systems during the transition away from gas usage. These changes should help deliver the vision set out in this strategic framework, ensuring we have a body capable of making expert strategic and operational recommendations on the network.

### **C.1.2.2 Distribution System Operation Governance**

Changes in the way the local grids operate given the increasing prevalence of smart and flexible technologies, decentralised and more variable generation, and increasingly dispersed demand, will drive new requirements for distribution system operation, with enhanced functions in planning, operation, and market facilitation.

At a sub-national level, electricity distribution network operators have been building capabilities in planning, operating, and market facilitation for flexible resources, to drive more efficient development of the electricity system. These capabilities are currently referred to as Distribution System Operation roles. However, other institutions also play a role in facilitating the energy system transition at a subnational level, such as gas distribution networks and local government, including local and combined authorities, as well as other supporting bodies. We are committed to ensuring that devolved regional institutions such as combined authorities have a meaningful role in planning our future energy system for net zero.

Therefore, in addition to Future System Operator activities to ensure effective system operation at a national level, work is underway to review the effectiveness of existing institutional and governance arrangements to support the delivery of energy system functions at a subnational level. As part of the review, Ofgem published a Call for Input on energy system functions needed at a sub-national level to facilitate the transition to net zero at least cost, and the criteria that need to be in place to deliver these functions effectively. It also considers the suitability of current and planned institutional and governance arrangements, the opportunities and risks of change, and alternative options.

#### **What we have done**

- The government and Ofgem have committed to establishing an expert, impartial Future System Operator.<sup>84</sup>

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<sup>84</sup> BEIS and Ofgem (2021), Proposals for a Future System Operator role, <https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role>

## What we will do going forward

- The government will create the Future System Operator through primary legislation, which will be taken through the 2022 Energy Security Bill, as well as develop new licensing arrangements and code modifications with Ofgem.
- Ofgem will conclude on the review of the local energy institutions and governance at a sub-national level and will make recommendations on any necessary changes to existing arrangements.

### C.1.3 Reducing Network Constraints

The Future System Operator, as well as the government and Ofgem, will have a role in managing the increasing level of constraints on the system.

Much of the new low carbon generation needed will be brought forward through our flagship Contracts for Difference scheme, which is location neutral. We will consider whether scheme design has unintended negative impacts on constraints, and how this might be mitigated in future rounds. Currently, the 'Connect and Manage' transmission network access regime – which allows generation projects to connect to the transmission network before wider grid reinforcements are completed – is very effective in speeding up connections, including for renewable projects.

The government and Ofgem are committed to reducing the timescales for strategic transmission infrastructure build, in order to reduce the growth in constraints as new generation comes on to the network. The introduction of **network competition** will also help to **manage constraints**, by increasing the opportunity for innovative solutions to come forward to solve the constraints in new, efficient ways. This will include **smart and flexible solutions, which will play a key role in helping to mitigate constraints along with accelerated deployment of new network infrastructure.**

Constraints are managed or avoided differently on the distribution network. For general demand load growth e.g. increased domestic consumption, distribution network operators can take actions such as **investing in their networks ahead of need or procuring flexible solutions** to accommodate it. Where large numbers of electric vehicles or heat pumps are expected in a concentrated area, distribution network operators are **improving forecasting and monitoring capabilities** to help predict and manage increased demand at the street level. Connection customers are also increasingly being offered flexible connections.

Distribution network operators are also providing more capacity by utilising existing network assets. The government commissioned a “Low Voltage Network Capacity Study” to assess the potential for innovative ways to reduce the cost of low voltage network reinforcement that is needed to meet the expected increase in electricity demand by 2050. The study found that



some non-conventional options (such as network monitoring and phase balancing) had the potential to reduce costs by several billion pounds.<sup>85</sup>

### C.1.3.1 Strategy and Policy Statement

**The government intends to consult on a Strategy and Policy Statement for energy policy this year.** It is clear that the context of the energy sector has shifted substantially since the country has been working towards net zero. This document will set out the government's strategic priorities for energy policy; the outcomes the government seeks to achieve; and give clarity on the roles of the government, Ofgem and other parties which are collectively responsible for delivering these goals. Subject to Parliamentary approval, Ofgem will be required to have regard to the strategic priorities set out in the Strategy and Policy Statement when carrying out its functions and will be required to carry out its regulatory functions in a manner which is consistent both with securing the policy outcomes set out in the statement and with Ofgem's wider statutory duties. In the British Energy Security Strategy, the government stressed that an important consideration for Ofgem is the role of strategic network investment, and this will be highlighted in the revised Strategy and Policy statement. **Ofgem will retain its independence, and the Strategy and Policy Statement is intended to create a framework for Ofgem's decision making that allows the regulator to protect consumers and achieve net zero.**

#### What we have done

- The government has engaged with the Electricity System Operator and Ofgem to understand the increasing levels of constraints on the grid.
- Ofgem continues to support transmission network reinforcement through the RIIO price control framework and Large Onshore Transmission Investments process, specifically on the England to Scotland border.
- The government has published reports from a 'Low Voltage Network Capacity Study' which identified innovative, non-conventional options, with potential to expand network capacity at significantly lower cost than conventional reinforcement.

#### What we will do going forward

- To address constraints, the government and Ofgem will continue to work closely with the Electricity System Operator to ensure future system needs are identified earlier and factored into their infrastructure reinforcement recommendations.
- Ofgem is continuing to enable agile regulation so network investment can address constraints through the use of uncertainty mechanisms.

<sup>85</sup> BEIS (2022), Low Voltage Network Capacity Study, <https://www.gov.uk/government/publications/low-voltage-network-capacity-study>

- The government will consider whether features of the Contracts for Difference Scheme have unintended, negative impacts on network constraints, and how these could be mitigated in future rounds.
- The government will enable competition to address network constraints in innovative and cost-efficient ways, by taking powers in the 2022 Energy Security Bill.
- The government intends to consult on a Strategy and Policy Statement for energy policy this year, intended to create a framework that allows Ofgem to protect consumers and achieve net zero.

## C.2 Preparing our Electricity Networks for Net Zero

**Vision: Will continue to be resilient and anticipate expected need, to deliver a system which is efficient overall at the accelerated pace needed to meet Government targets**

The electricity network of the future will deliver enhanced capacity at pace, keeping up with the rapid increase in demand and low carbon generation.

While ensuring value for money for consumers, a key part of this will be funding networks to deliver ahead of need to ensure that the electricity network acts as an enabler of net zero and can support the move to an increasingly self-sufficient energy system in Great Britain.

This will be achieved through the following interventions:

- enabling strategic investment through the design and implementation of the price control framework; and
- increasing competition, where appropriate, and promoting innovation.

### C.2.1 Enabling Strategic Investment through the Design of the Price Control

There will need to be **a deliberate shift in the way network investment decisions are made**, to ensure the transition to net zero and increasing energy security can be achieved in the most cost-efficient way possible, and at pace, recognising significant uncertainty in timing, location, capacity, and technology.

In the transmission sector a key challenge is that network investment typically takes much longer than generation to develop. This means **the network will need to be designed and built in anticipation of major new generation and demand sources**. In the distribution sector a key challenge is that **network capacity for EV charging and electric heating needs to be available in a timely and strategic way**.

Ofgem's approach is to enable such strategic investment ahead of need, where there is well justified evidence to support this. As highlighted in Appendix I, under certain scenarios, building ahead of need may lead to more efficient outcomes by 'future-proofing' the network for the expected increase in demand and generation – helping to keep long-term costs as low as possible for consumers – particularly where there is a high level of electricity demand and a low level of spare capacity and limited opportunities for flexibility services. It is also likely to reduce the number of network interventions, resulting in fewer disruptions to society such as road works and road closures. However, such 'strategic' investment in an uncertain environment creates a risk of 'stranded assets' where the network will not be fully utilised. This could lead to a corresponding reduction in efficiency and negatively impact on consumer costs. Changing the way network investment decisions are made will only be possible where all parties are transparent about the uncertainty and the assumptions factoring into investment plans and decisions.

Ofgem's strategic approach to regulating networks to enable net zero is **to utilise flexibility to meet demand first where most economic and efficient to do so**, before considering network infrastructure investment. Network price controls are designed to make sure monopoly electricity networks are as efficient as possible in how they are run and financed, keeping costs as low as possible for consumers. Ofgem will facilitate and incentivise innovation throughout these different regulatory approaches.<sup>86</sup>

RIIO is the price control framework Ofgem uses to regulate monopoly networks' revenue. **Ofgem has specifically designed the electricity RIIO-2 transmission and distribution price controls<sup>87</sup> to enable investment decisions to be more flexible and adaptive, and ensure the networks have sufficient funding to enable a wide range of net zero trajectories.** At the same time the RIIO-2 price controls will drive better services for consumers at the most efficient cost. Examples of how Ofgem is doing this include:

- Requiring business plans to clearly propose and evidence how network company investments **can flex to support achieving net zero in line with a range of different pathways**. For example, for distribution network operators this includes forecasting electric vehicle and heat pump adoption; and for transmission network operators this includes identifying and designing strategic investment that takes into consideration how the network will evolve over time.
- Encouraging **whole systems solutions**, including consideration of flexibility first, allowing for avoidance or deferral of certain network investments, saving consumers money.
- **Restructuring innovation funding**, establishing a clearer pathway between innovation and strategic investment.
- For the transmission sector, **allowing significant additional funding to be made available within the price control period to manage uncertainty**. Mechanisms include: a net zero re-opener to allow for significant changes in policy to be reflected in company allowances; a 'Use It or Lose It' mechanism to enable net zero related development work and small value net zero facilitation projects; and the Large Onshore Transmission Investment re-opener for strategic investments greater than £100m.
- For the distribution sector, **proposing to almost double investment to upgrade the local electricity grids** and ensure sufficient capacity to support new demands, particularly from the decarbonisation of transport and heat. Additional mechanisms will allow investment to quickly track changes in demand over time.

The RIIO-2 electricity transmission price control has been operating from 1 April 2021. For electricity distribution, Ofgem set out its Draft Determinations for the RIIO-2 price control on 29 June 2022.<sup>88</sup> Ofgem's approach seeks to balance investment in network upgrades with the

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<sup>86</sup> Network companies are expected to achieve a level of ongoing efficiency improvements that are largely within a company's control and can be generated in a variety of ways, including investment in innovation as part of the business as usual type activities.

<sup>87</sup> The RIIO-2 price control for electricity transmission has been set up and running since 1 April 2021. The RIIO-2 price control for electricity distribution will start on 1 April 2023.

<sup>88</sup> Ofgem (2022), RIIO-ED2 Draft Determinations, <https://www.ofgem.gov.uk/publications/riio-ed2-draft-determinations>

need to maximise the potential of flexible technologies and other smart resources where those can reduce costs. It also seeks to enable the least cost investment path, for example investing strategically in additional network capacity in the short term where this can more efficiently support growth in demand over a longer-term horizon.

Ofgem will make its Final Determinations for the RII0-2 electricity distribution price control by the end of 2022, with the price control coming into effect from April 2023.

### Case Study – Green Recovery Scheme

In the shorter term, before RII0-2 for electricity distribution commences, Ofgem's Green Recovery Scheme is already accelerating over £300m of investment into upgrading the electricity network to support the net zero transition. 34% of the approved funding will be spent on improving grid capacity at motorway service areas (MSAs), benefitting 45 MSA sites in Great Britain, supporting the Government's Rapid Charging Investment Fund.

Many of the projects have a focus on assisting popular tourist areas to meet the future fluctuating, seasonal demand for charging EVs, as well as decarbonising tourist services such as ferries on Lake Windermere. Other projects include grid reinforcement to support future EV charging in busy city centres such as York, and reinforcement to allow the connection of an innovative district heating network in Scotland.

Over the next few years, Ofgem will also be developing the regulatory framework for future price controls, due to come into effect in 2026 for electricity transmission, gas transmission, and gas distribution. This will need to ensure that **the way in which networks are regulated is flexible and reflective of the changing energy industry, and able to support the transition to net zero at most efficient cost**. Ofgem will commence engagement with stakeholders on the next electricity transmission price control in 2022.

#### C.2.1.1 Investment for a Secure and Resilient Network

Alongside our efforts to ready the electricity network for net zero whilst ensuring value for money, **it is essential that we maintain a safe and secure energy supply**. The government and Ofgem work closely with the Electricity System Operator and network companies to **ensure that the electricity system remains reliable and resilient as we transition to net zero**. This includes ensuring the network is diverse and has effective mitigations and plans to prevent or reduce the risk of an event impacting the security of energy supply. The government and industry also need to ensure that there is an effective response to actual or potentially disruptive incidents. Significant work is being undertaken across industry and government to ensure network operators continue investing in their networks to keep pace with climate change, technology improvements and changes to the electricity system, including on cyber security as discussed further in section C.5.4.5 below.

Extreme weather events are expected to become more frequent with climate change, so it is crucial that we consider what we can learn from them to strengthen resilience to such events in future. In November 2021, Storm Arwen brought severe weather, particularly affecting

Scotland and the North of England, including high winds of up to 100mph, rain, snow, and ice – causing the most severe disruption to power supplies since 2005. Over 1 million customers' supplies were interrupted, with around 3,723 being off supply for more than a week. The government and Ofgem launched reviews<sup>89</sup> of the incident to identify lessons learnt and identify measures to strengthen network resilience.

Ofgem have published the final report<sup>90</sup> into the response of the networks to Storm Arwen, finding emergency plans not sufficient to deal with the scale of the storm; limited monitoring on the lower voltage networks hindered the DNOs from understanding the full scale and complexity of faults; there were issues with the availability of phone lines, websites and how efficient customer enquiries were dealt with; and that some DNOs were too slow in paying out compensation. The report has set out a clear package of recommendations including:

- **Planning and preparation:** DNOs should submit their winter preparedness plans for 2022/23 to Ofgem.
- **Network resilience:** a review of current network infrastructure standards and guidance, including those for vegetation management and overhead line designs to identify economic and efficient improvements that could increase network resilience to severe weather events and that the E3C should put forward proposals for an outcome-focused resilience standard to set Government and public expectations on restoration times during widespread power disruptions.
- **Handling of incidents:** E3C should review and update industry best practice for identifying faults and assessing the extent of network damage, to reduce customer restoration times and identify other appropriate areas where mutual aid could be appropriately and effectively deployed to reduce customer restoration times or enhance customer support during power outages.
- **Communication and support during the incident:** DNOs, in consultation with local resilience partners, should develop principles-based industry guidance on best practice in the provision of welfare support and DNOs should work with local resilience partners to agree clear roles and responsibilities during severe weather.
- **Support after the incident:** DNOs to adopt lessons learned from 2021/2022 storms in their processes, to enable timely and accurate compensation payments to customers and Ofgem will commission a review of the Guaranteed Standards of Performance for Severe Weather to identify amendments that will better acknowledge the impact of extended power cuts on customers.

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<sup>89</sup> BEIS (2021), Storm Arwen electricity disruption review, <https://www.gov.uk/government/publications/storm-arwen-electricity-distribution-disruption-review>

Ofgem (2021), Terms of reference for the review into the networks' response to Storm Arwen, <https://www.ofgem.gov.uk/publications/terms-reference-review-networks-response-storm-arwen>

<sup>90</sup> Ofgem (2022) Final Report on the review into the networks' response to Storm Arwen, <https://www.ofgem.gov.uk/sites/default/files/2022-06/Final%20report%20on%20the%20review%20into%20the%20networks%27%20response%20to%20Storm%20Arwen.pdf>

Ofgem will monitor the delivery of the actions and will continue to use all the tools within the regulatory toolkit to hold DNOs to account in delivery for their customers.

### What we have done

- Ofgem has designed the RIIO-2 electricity transmission and distribution price controls to enable investment decisions to be more flexible and adaptive, and ensure the networks have sufficient funding to enable a wide range of net zero trajectories.
- Ofgem's Green Recovery Scheme<sup>91</sup> under the RIIO-1 electricity distribution price control is enabling over £300m of investment for net zero in the electricity network, including to improve grid capacity at Motorway Service Areas.
- The government and Ofgem have published conclusions to their reviews of Storm Arwen electricity disruption.
- Ofgem's Draft Determinations for the RIIO-2 electricity distribution price control set out an initial

### What we will do going forward

- Ofgem will set out its Final Determinations for the RIIO-2 electricity distribution price control by the end of 2022. This price control will come into effect in April 2023.
- Ofgem will commence engagement with stakeholders on the design of the next electricity transmission price control in 2022.
- BEIS will oversee and monitor the implementation of actions identified as part of the BEIS and Energy Emergencies Executive Committee's Storm Arwen review, including actions on system resilience, consumer protection and additional support.
- Ofgem will oversee and monitor the implementation of actions identified within the Final report on the review of the networks' response to Storm Arwen.

## C.2.2 Accelerating the Delivery of Strategic Onshore Infrastructure

### C.2.2.1 Reducing timescales through streamlined regulatory approvals

In Summer 2022, Ofgem will consult on whether there are clear consumer benefits from introducing a package of changes to its regulatory approval framework that includes:

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<sup>91</sup> Ofgem (2021), Decision on the RIIO-ED1 Green Recovery Scheme, <https://www.ofgem.gov.uk/publications/decision-riio-ed1-green-recovery-scheme>

- **Providing early certainty on regulatory funding** to enable transmission owners (TOs) to speed up construction works by progressing certain time-critical activities, ahead of planning approvals.
- **Reducing the number of regulatory approval gates** to reduce the time taken to secure regulatory approvals and funding.
- **Providing targeted, programmatic exemptions from onshore network competition** (see C.2.3.1 for more detail).

Without further action there is a risk that these changes could lead to higher costs for consumers, particularly if TOs do not deliver key onshore infrastructure projects to an accelerated schedule. Therefore, Ofgem will also consult on the need for robust measures to ensure that consumers are protected. These could include:

- **Introducing new financial incentives for accelerated delivery** with substantial penalties for delays in delivery.
- **Ensuring that consumers are protected against inefficient expenditure** by reviewing actual expenditure incurred by the TOs (during and/or at the end of projects) and returning to consumers any expenditure that is demonstrably inefficient.
- **Placing enhanced obligations on network companies to keep projects under review** with companies required to take prompt action, including project cancellation where necessary, to protect consumers from unnecessary expenditure.
- **Increasing the proportion of project underspends that is returned to consumers –** to ensure that consumers are better protected from any adverse consequences of our expedited funding approvals process.

While these proposed changes to Ofgem's approval process could support accelerated delivery, they are not sufficient on their own. Before implementing any of these changes, we will also need to have confidence that the TOs will deliver strategic transmission infrastructure projects faster than they would have done otherwise. We expect the TOs to commit to significantly expedited delivery timetables and put forward investment plans setting out how they will deliver the necessary strategic onshore transmission infrastructure in an expedited manner. They will also need to clearly demonstrate significant consumer benefits that would result from changes to the Ofgem regulatory approval processes.

Decisions on whether to change Ofgem's regulatory approvals framework need to be made quickly to support Government ambitions. Ofgem is aiming to make a final decision on whether there is a benefit to consumers to make changes to the regulatory approval framework by the end of 2022. The extent to which proposed reforms to planning and consenting have progressed will also significantly influence Ofgem's considerations of the viability of TOs' expedited delivery plans.



## C.2.2.2 Appointing an Electricity Networks Commissioner

In the British Energy Security Strategy, the government committed to appointing an Electricity Networks Commissioner to accelerate progress on network infrastructure. Nick Winser was appointed to this role in July 2022.<sup>92</sup>

### What we have done

- The government has published the British Energy Security Strategy, committing to policy and regulatory changes to accelerate electricity network build.
- The government has appointed Nick Winser as the Electricity Networks Commissioner to advise on policies and regulatory changes to accelerate progress on transmission network infrastructure.

### What we will do going forward

- Ofgem will consult on whether there are clear consumer benefits from introducing a package of changes to its regulatory approval framework this summer.

## C.2.3 Increasing Competition and Promoting Innovation in Onshore Electricity Networks

### C.2.3.1 Onshore Competition

Even though at present the onshore electricity network is predominantly built, owned, and operated by natural monopolies, some competition already exists in electricity – through the Electricity System Operator’s Pathfinder process<sup>93</sup>, competition in network connections<sup>94</sup>, and through flexibility tenders. For example, in 2020, distribution network operators advertised over 2GW of distribution flexibility services resulting in over 1GW of procurement and contracts worth over £15m.<sup>95</sup>

The government and Ofgem consider that **there are more areas where competition can be introduced to foster additional innovative and efficient solutions to the emerging challenges faced by the electricity network**. For this reason, the government has, as part of the 2022 Energy Security Bill, introduced clauses to enable competitive tendering in the

<sup>92</sup> BEIS (2022), Appointment of Electricity Networks Commissioner, <https://www.gov.uk/government/news/new-electricity-networks-commissioner-appointed-to-help-ensure-home-grown-energy-for-britain>

<sup>93</sup> The Electricity System Operator has set up the Pathfinders process to competitively tender to solve stability issues on the electricity system, pursuant to their role as the body responsible for balancing the electricity system. The aim of this is to find new solutions and lower costs where possible. NGENSO, NOA Pathfinders, <https://www.nationalgrideso.com/future-energy/projects/pathfinders>

<sup>94</sup> Connection customers have the choice of alternative providers, in addition to DNOs, when connecting to the distribution network for the ‘sole use’ element of their connections, i.e. the assets between their projects and the existing network.

<sup>95</sup> Energy Networks Association (2020), Consolidated Flex Figures, <https://www.energynetworks.org/assets/images/ENA%20Consolodated%20Flex%20Figures%202020-PUBLISHED.xlsx>

building, ownership, and operation of the onshore electricity network.<sup>96</sup> **Opening networks to further competition through both early and late competition delivery models<sup>97</sup> should allow for new, innovative parties, with access to different sources of capital, to invest in the network infrastructure needed to achieve net zero and continued security of supply.** It will create new markets, bringing with it potential for new, green jobs across Great Britain, while **competitive forces should drive efficiency and lower costs for consumers.** We estimate that **the new regime for onshore networks could save up to £1 billion for projects tendered over the next ten years.**<sup>98</sup>

The government set out in the British Energy Security Strategy that certain strategic projects will be exempt from the introduction of onshore competition. This will provide certainty for these projects, allowing transmission owners to progress supply chain engagement and construction works more quickly, ensuring that adding competitive processes to network delivery does not slow our progress towards decarbonisation and energy security objectives. In the response to our consultation on Enabling Competition in Onshore Electricity Networks<sup>99</sup> the Government sets out how this exemption will work in practice. Certain strategic projects which are likely to engage in the market between now and 2026 will be exempt from the introduction of onshore network competition, where in consumer interests. This will help reduce the impacts of uncertainty about when competition will be in force and reduce the likelihood of adversely impacting delivery timelines for key strategic projects in the transitional period while competition is introduced. Ofgem will publish a list of projects by the end of 2022.

Beyond this initial transitional period, we expect competition to become the norm and to be incorporated into network companies' project plans from the outset. Thus, the need for exempting strategic projects will no longer apply.

As well as saving consumers money by allowing third parties to build, own and operate new network solutions, competitive processes will provide Ofgem with additional data on costs of these solutions. This will allow Ofgem to compare costs with those of the incumbent network companies in future price controls, bringing them further in line with the market and delivering for consumers.

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<sup>96</sup> Depending on the system need underpinning the project, we envisage different models of competition being used, at different stages in the project development process. One model (late competition) would focus on most efficient delivery of a known network design, whereas another model (early competition) would aim to allow network and non-network solutions to be competed against one another to meet system needs.

<sup>97</sup> Early model competition involves competition the entire detailed design, build, financing and operation of required electricity project, thereby allowing a wide range of solutions to develop to solve a network need. Late model competition focuses on competing the delivery of a specific detailed design that has already been developed. Specific decisions on whether to apply either early competition or late competition to electricity transmission projects will be determined by Ofgem based on the approach that will deliver the best outcome for consumers.

<sup>98</sup> For projects tendered over the next ten years in Net Present Value terms, as estimated in BEIS (2020), Competition in onshore electricity networks, Impact Assessment,

<https://www.gov.uk/government/consultations/competition-in-onshore-electricity-networks>

<sup>99</sup> BEIS (2022), Competition in onshore electricity networks,

<https://www.gov.uk/government/consultations/competition-in-onshore-electricity-networks>

### C.2.3.2 Innovation Funding

**The government and Ofgem are committed to supporting innovation in electricity networks.** Innovation is necessary to uncover technologies which will support the transition to a low carbon economy, as well as to enable efficiency and realise cost savings for consumers. Supporting innovation in the 2020s is vital to provide network companies and third parties with the ability to produce solutions that will enable us to meet our net zero goal.

Coordination between the government and Ofgem on innovation is essential to align funding programmes, ensure industry activities align with a common strategic direction, and enable large whole system innovation projects which span the energy supply chain.

In close collaboration with the government, Ofgem has published its Innovation Vision 2021-2025<sup>100</sup> and introduced the new Strategic Innovation Fund within its RIIO-2 network price control.<sup>101</sup> Working in partnership with Innovate UK - UK Research and Innovation, the Strategic Innovation Fund aims to find and fund ambitious, innovative projects with the potential to accelerate the transition to net zero.

**The Strategic Innovation Fund will enable an increased number of innovative whole system solutions to be taken forward**, which will be important as we rely more on electricity for our energy needs. Ensuring a stronger role for third party innovators will increase the breadth of ideas to be considered, which should provide stronger, more innovative outcomes.

**The government and Ofgem are working to enable cross-sector funding of whole-system solutions in future legislation**, to ensure that the costs of innovative whole system projects are split fairly between gas and electricity consumers.

#### Case Study - The Strategic Innovation Fund

Ofgem is enabling new technologies and creating opportunities within the energy networks via the introduction of the Strategic Innovation Fund, which is delivered in partnership with Innovate UK - UK Research and Innovation, and closely coordinated with the government.

The Strategic Innovation Fund is embracing agile delivery, enabling networks to take more risk and test a number of innovative ideas. In response to its first round of SIF innovation challenges, in March 2022, Ofgem funded 40 low value discovery phase projects – enabling network companies to test concepts, while at the same time de-risking the investment of large sums of money in innovative projects.

The partnership with Innovate UK - UK Research and Innovation has the potential to create new opportunities, brokering new partnerships between network companies and third-party innovators. Additionally, Innovate UK - UK Research and Innovation has partnered with a global energy start up programme, Free Electrons, to help commercialise and rollout innovative projects in BAU. Selected

<sup>100</sup> Ofgem (2021), Ofgem innovation vision 2021 – 2025, <https://www.ofgem.gov.uk/publications/ofgem-innovation-vision-2021-2025>

<sup>101</sup> Ofgem (2021), Strategic Innovation Fund (SIF), <https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2/network-price-controls-2021-2028-riio-2-riio-2-network-innovation-funding/strategic-innovation-fund-sif>

high growth potential innovators who have won SIF funding will get access to the Free Electrons' global network and 'Bootcamp' module. It offers the chance to work closely with leading global energy utilities, whether to refine their value propositions, establish pilot projects or explore investment opportunities.

### What we have done

- The government has published its consultation response on the implementation of competitive tenders in onshore electricity networks, including criteria to establish which projects will be eligible for competition.<sup>102</sup>
- The Government has, as part of the 2022 Energy Security Bill, introduced clauses to enable competitive tendering in onshore networks.
- Ofgem has published Innovation Vision 2021-2025<sup>103</sup> and subsequently introduced the new Strategic Innovation Fund<sup>104</sup> within the RIIO-2 price controls, enabling new, innovative projects to accelerate the transition to net zero and closer collaboration with the government.

### What we will do going forward

- Ofgem will publish a list of strategic transmission projects that will be exempt from competition by the end of 2022.
- The government and Ofgem are working to enable cross-sector funding of whole-system solutions to ensure that the costs of innovative whole system projects can be split fairly between gas and electricity consumers.
- The government and Ofgem will seek to increase the level of third-party involvement with innovation projects.

<sup>102</sup> BEIS (2021), Competition in onshore electricity networks,

<https://www.gov.uk/government/consultations/competition-in-onshore-electricity-networks>

<sup>103</sup> Ofgem (2021), Ofgem innovation vision 2021 – 2025, <https://www.ofgem.gov.uk/publications/ofgem-innovation-vision-2021-2025>

<sup>104</sup> Ofgem (2021), Strategic Innovation Fund (SIF), <https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2/network-price-controls-2021-2028-riio-2-riio-2-network-innovation-funding/strategic-innovation-fund-sif>

## C.3 Streamlining the Planning and Consenting of Networks Infrastructure

**Vision: The electricity network of the future will allow for faster infrastructure build through reforming planning and consenting**

To deliver the extra capacity required for net zero, support domestic low carbon generation and enable efficient investment, planned infrastructure must be delivered through a streamlined, accelerated process. Improvements to planning and consenting will be crucial – ensuring the process can actively support the consenting of the critical network infrastructure required while balancing the needs of the environment, communities and the wider network.

Going forward, planning and consenting processes for the high-voltage network under the Nationally Significant Infrastructure Projects (NSIP) regime will deliver more certainty and better, greener and faster outcomes. We will also seek to reduce barriers for network infrastructure that is not classed as nationally significant, including in relation to land rights and consents, to ensure the electricity network can enable the deployment of low carbon technologies as efficiently as possible.

This will be achieved through the following interventions:

- Revising the energy National Policy Statement for the high-voltage electricity network to allow for faster network build
- Reviewing land rights and consent processes for electricity network infrastructure outside of the NSIP regime

### C.3.1 Accelerating the Planning and Consenting of the High-Voltage Electricity Network

The strategic network planning undertaken through the Holistic Network Design (HND), the HND follow-on work and the work planned under Centralised Strategic Network Planning includes early consideration of environmental and community impacts. By considering those impacts up front and at the strategic level, the network blueprints can identify locations for infrastructure with lower overall impact than would be the case with a piecemeal project-by-project approach. In addition, the overall need for transmission infrastructure can be reduced via coordination. This strategic approach can help avoid consenting issues which might otherwise arise.

#### C.3.1.1 Accelerating consenting and overcoming consenting barriers

In the Electricity Transmission Network Planning Review consultation<sup>105</sup>, Ofgem sets out the potential benefits of **the proposed new Centralised Strategic Network Planning process**.

<sup>105</sup> Ofgem (2021), Consultation on the initial findings of our Electricity Transmission Network Planning Review, <https://www.ofgem.gov.uk/publications/consultation-initial-findings-our-electricity-transmission-network-planning-review>

**The more strategic approach, including the upfront consideration of community and environmental impacts, will provide a clearer demonstration of the need for infrastructure in certain locations. The process should provide more certainty in subsequent planning and consenting processes and take into account a wide range of considerations, including viability and minimising impacts on communities and the environment.** This in turn could reduce planning consent times, reduce risks for project development and speed up connection dates, thereby also reducing potential constraint costs in the future. Proposals to streamline Ofgem’s regulatory approvals process (see C.2.2.1) could also provide early comfort to transmission operators to progress projects through the planning process.

Further work to address strategic issues that create consenting risks, and work to enable a faster consenting process, is being undertaken across government including by the Department of Levelling Up, Housing and Communities (DLUHC), the Planning Inspectorate and the Department for Environment, Food & Rural Affairs, as well as BEIS. It includes the DLUHC-led **reform of the NSIP consenting regime** which is currently underway, with the ambition that some NSIPs should be able to progress through the planning system up to 50% faster for projects entering the consenting process from September 2023.

The government has also committed in the British Energy Security Strategy to enabling a **fast-track consenting route** for priority offshore wind and related transmission infrastructure, including onshore transmission, where quality standards are met. This commitment forms part of a suite of cross-government measures that work together to tackle consenting risks and accelerate the process. The enabling measures will be brought forward through the NSIP reform programme, including enabling powers in the Levelling Up and Regeneration Bill.

### **C.3.1.2 Revising the National Policy Statements for electricity networks infrastructure**

The energy National Policy Statements (NPS) are one of the main ways for the government to support accelerated consenting.

Network projects which are 132kV or above (and 2km or over) in England and Wales, are classed as nationally significant infrastructure and brought forward under the Nationally Significant Infrastructure Projects planning process.<sup>106</sup> These projects must apply for and obtain a development consent order under the Planning Act 2008 to proceed. The Secretary of State will decide whether to grant consent, using the energy NPS to determine their decision. Energy NPS EN-5 is the technology-specific Statement for the higher voltage electricity network in England and Wales.

The government is reviewing the energy NPS to ensure they reflect current energy policy, and that the planning policy framework can support delivery of the infrastructure needed at rapid pace to fulfil the transition to net zero. The government consulted in autumn 2021 on a revised

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<sup>106</sup> In Scotland, planning consent for overhead electricity lines is granted via Section 37 of the Electricity Act 1989

set of energy National Policy Statements.<sup>107</sup> Following the publication of the **British Energy Security Strategy** and the new commitments on electricity networks, **the government will now reconsult in due course, with the aim to designate as soon as reasonably practicable.**

**The government will refocus the EN-5 National Policy Statement to emphasise the urgent need for significant new network infrastructure to be built and delivered at a rapid pace, to enable net zero including the interim targets and ambitions for generation.** These include the ambition to achieve up to 50GW of offshore wind by 2030. This must continue to be balanced against community and environmental impacts, which should be avoided in the first instance, and reduced, mitigated, or compensated if not.

The **British Energy Security Strategy** committed to recognising the process involved in developing the **Holistic Network Design** (which set out proposals for co-ordinated offshore-onshore transmission), and follow-on strategic plans including the Centralised Strategic Network Plan, in the NPS. Specifically, the NPS will recognise the Holistic Network Design's demonstration of need and additional upfront assessments of community and environmental impacts which have been undertaken.



**As part of our work to ensure environmental and visual impacts are avoided, or if not possible, mitigated, the government also consulted on changing our policy on undergrounding set out in the NPS.** The government proposed pylon-supported overhead conductors should continue to be the strong starting presumption for new electricity lines, except in areas such as National Parks and Areas of Outstanding Natural Beauty. In these areas, where lines cannot be rerouted, the strong starting presumption would be that new lines should be undergrounded, unless the harm and costs of doing so outweighs the landscape and visual benefit.

The revised EN-5 National Policy Statement formally recognises the industry-standard rules for the design and siting of substations and similar assets, and clarifies that the reconfiguration or undergrounding of existing electricity network infrastructure is a viable form of visual impact mitigation. The government has proposed that biodiversity enhancements, such as reconnecting habitats via green corridors and biodiversity stepping zones, are recognised in proposed projects, with electricity network infrastructure allowing excellent opportunities for

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<sup>107</sup> BEIS (2021), Planning for new energy infrastructure: review of energy National Policy Statements, <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements>

such schemes. New constraints on the use of the potent greenhouse gas sulphur hexafluoride in our electricity network have also been included.

Additionally, the EN-5 National Policy Statement addresses the rights and interests in land for nationally significant infrastructure projects, which strongly encourages developers to pursue permanent land rights wherever possible. This change will allow electricity networks long-term stability, as well as ensuring better value for electricity billpayers.

#### What we have done

- The government's review of the National Policy Statements for energy infrastructure (including for the high-voltage electricity network) is underway and the government has consulted on the proposed new guidance.<sup>108</sup>

#### What we will do going forward

- The government will re-consult on the revised energy National Policy Statements to include further references to strategic network planning, including recognising the Holistic Network Design process and the planned Centralised Strategic Network Planning process.

### C.3.2 Reviewing Land Rights and Consent Processes for Electricity Network Infrastructure outside of the NSIP regime

Electricity network infrastructure that is not classed as nationally significant, typically the lower-voltage distribution network, can also benefit from regulation and regime changes. To build or upgrade network infrastructure, network operators need to seek the relevant planning permissions alongside negotiating access to, or purchase of, private land for installation of their equipment. This can add significant time and cost to projects. **The government has begun a Land Rights and Consents project to review whether the current consenting process for electricity lines and their associated infrastructure is sufficiently responsive and cost-efficient.**

**The government has published a Call for Evidence<sup>109</sup> alongside this Strategic Framework** to identify issues with the current consenting process; understand and assess the impact of these individual land rights and consents processes on all parties; and build a picture of the likely scale of the issue in the context of the need for the electricity network to enable net zero. We will also seek views from all relevant stakeholders on recommended improvements and likely solutions to these issues. We will seek to learn any relevant lessons from the

<sup>108</sup> BEIS (2021), Planning for new energy infrastructure: review of energy National Policy Statements, <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements>

<sup>109</sup> BEIS, (2022), Land Rights and Consents for Electricity Network Infrastructure Call for Evidence, <https://www.gov.uk/government/consultations/land-rights-and-consents-for-electricity-network-infrastructure-call-for-evidence>



processes for building electricity network infrastructure and compare with those of other utilities, such as water and telecoms.

This evidence gathering exercise will confirm the scope of the project. As a starting point, the government will consider the following as potential areas for further investigation, including:

- Considering potential improvements to the current processes for agreeing access to private land to install or maintain energy infrastructure, including voluntary wayleaves, necessary wayleaves and easements; and
- Consideration of whether the current planning consent processes for installation of network infrastructure, such as substations and overhead lines, remain fit for purpose.

Our objective for this project is to ensure that an upgraded and expanded network, fit for net zero, can be rolled out in a timely and cost-effective way.

### **What we have done**

- The government has commenced a review of the consenting process for electricity network infrastructure in light of net zero.
- The government has published a Call for Evidence<sup>110</sup> alongside this Strategic Framework to identify issues and seek recommendations on solutions to reform the current consenting processes.

### **What we will do going forward**

- The government will analyse the responses to the Call for Evidence and confirm the scope of the review.

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<sup>110</sup> BEIS, (2022), Land Rights and Consents for Electricity Network Infrastructure Call for Evidence, <https://www.gov.uk/government/consultations/land-rights-and-consents-for-electricity-network-infrastructure-call-for-evidence>

## C.4 Supporting Connections to the Electricity Network

**Vision: The electricity network of the future will continue to enable cost-effective and timely connections to the electricity network**

Low carbon technologies, from electric vehicle chargepoints and heat pumps to larger generation projects, are increasingly seeking to connect to the electricity network and this is expected to grow significantly. The connection process must therefore be accessible, speedy and deliver value for money. It must also meet the needs of customers as well as of the electricity system as a whole. Customers of the electricity network of the future will be well informed on the connection process, aware of their options, and charged commensurately for their needs.

This will be achieved through the following interventions:

- Improving the affordability of connections
- Reducing timescales, delivering on the commitments in the British Energy Security Strategy
- Improving the customer experience and consistency between distribution network operators

### C.4.1 Improving the Affordability of Connections to the Electricity Network

When connecting to the distribution network, the connecting customer must pay upfront for 'sole-use' assets<sup>111</sup>, as well as a proportion of any wider network reinforcement costs to accommodate the connection. This means that connection costs can vary significantly, and it sometimes makes connecting low carbon technologies unaffordable. Connection charging arrangements for the transmission network are different, with customers providing securities to underwrite the costs of the connection. **The government and Ofgem are committed to ensuring that connections are affordable for customers, to enable the connection of low carbon technologies that are critical for reaching net zero.** Below, we detail key areas where we are acting to reduce connection costs, incentivise competition and efficiency, and provide funding in specific areas of market failure.

#### C.4.1.1 Reducing Costs for Connecting Customers

We recognise that connection costs can be prohibitively high, particularly where significant network reinforcement is needed to accommodate the connection. Given we expect a rapidly increasing uptake of low carbon technologies, more connections and connection upgrades will be needed. This is in addition to increasing connections from more 'traditional' customers such as housing, businesses, and renewable generation. The government and Ofgem believe it is important that all customers can connect in the most cost-effective way.

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<sup>111</sup> The assets between the connecting project and the existing distribution network.

Through its Access and Forward-Looking Charges Review, Ofgem has reviewed the ‘connection charging boundary’<sup>112</sup> for the distribution network. It published its decision<sup>113</sup> in May 2022 to **reduce the costs borne by connecting customers** whose connections require wider network upgrades, such as electric vehicle rapid charging hubs, fleet or bus depots, by moving more of the reinforcement costs to the network charges paid by all electricity consumers in the area. Ofgem has directed industry to implement the changes to come into effect with the start of RIIO-2 electricity distribution price control in April 2023. BEIS will also need to revise the Electricity (Connection Charging) Regulations 2017.

As noted in section C.2.3.1, there is already competition in distribution network connections, helping to drive down costs, accelerate delivery, and promote innovation in the connections market. To meet our net zero ambitions and deal with the volume of work required, we expect there to be **an increasing role for alternative providers**. Energy solution providers are increasingly advising connection customers on how best to reduce connection costs and ongoing electricity usage, for example through onsite battery storage, solar panels, and smart charging. These solutions can reduce the connection capacity required with potential savings in connection costs, use of system charges and the potential to earn revenue by exporting power from the batteries.<sup>114</sup>

#### **C.4.1.2 Funding the Costs for Connecting to the Electricity Network**

**The government is providing direct funding to reduce connection costs** in specific areas where market failures have been identified. The Office for Zero Emission Vehicles’ £950 million Rapid Charging Fund aims to future proof connection capacity at service areas on motorways and major A roads to support the deployment of high-powered chargepoints, alleviating consumer range anxiety and preparing these sites for future demand. The Zero Emission Bus Regional Areas scheme is providing funding for local transport authorities, outside London, to support the introduction of zero emission buses and the infrastructure needed to support them. This includes the connection costs for the electrification of bus depots, if required.

Nearly £4 billion has been allocated from the Housing Infrastructure Fund to local authorities for infrastructure to unlock housing, including the physical infrastructure required ahead of need, such as electricity networks. It will help to unlock up to 324,000 new homes in areas of greatest housing need, with the grant funding allocated to local authorities on a competitive basis from 2018-19 to 2023-24.

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<sup>112</sup> The connection charging boundary is the point at which network assets are charged to users as part of the annual network tariffs rather than the costs of those assets being recovered directly from a customer.

<sup>113</sup> Ofgem (2022), Access and Forward-Looking Charges Significant Code Review: Decision and Direction, <https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-decision-and-direction>

<sup>114</sup> Examples include UPS’s Camden depot <https://www.ukpowernetworksservices.co.uk/case-studies/ups-smart-electric-urban-logistics-project/> and Newport bus depot <https://www.route-one.net/features/newport-bus-move-to-electric-can-only-be-done-via-partnership/>

### What we have done

- Ofgem has published its decision on the distribution network ‘connection charging boundary’ which should reduce or remove network reinforcement costs for connection customers.<sup>115</sup>
- The government has announced a £950 million EV Rapid Charging Fund to future proof grid capacity at service areas on motorways and major A roads<sup>116</sup> and is providing funding for grid connections through the Zero Emission Bus Regional Areas Scheme.<sup>117</sup>
- The government has allocated almost £4 billion from the Housing Infrastructure Fund to help fund physical infrastructure ahead of need, including electricity networks.<sup>118</sup>

### What we will do going forward

- Ofgem will work with industry to make the relevant code changes to implement Ofgem’s decision on the connection boundary and connection costs.
- BEIS will revise the Electricity (Connection Charging) Regulations 2017 to enable distribution network operators to implement the connection charging boundary changes from April 2023.

## C.4.2 Reducing Connection Timescales

Connection timescales can also pose a challenge to connection customers. The government committed in the British Energy Security Strategy to work with Ofgem to speed up connections to the local distribution networks and to reduce timelines for delivering strategic onshore transmission network infrastructure, including connections. This section sets out how the government and Ofgem are working with network operators to achieve this.

First, Ofgem will be reviewing the scope for **strengthening distribution network operator connection standards**, including timescales and penalties. Ofgem will also be introducing a **penalty-only financial incentive** for major network connections in the RII0-2 electricity distribution price control, this is discussed within the RII0-2 electricity distribution Draft Determinations. This will be informed by customer satisfaction surveys and hold distribution network operators accountable for delivering their strategies and connections for major

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<sup>115</sup> Ofgem (2022), Access and Forward-Looking Charges Significant Code Review: Decision and Direction: <https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-decision-and-direction>

<sup>116</sup> Office for Zero Emission Vehicles (OZEV) (2021), Rapid charging fund, <https://www.gov.uk/guidance/rapid-charging-fund>

<sup>117</sup> DfT (2021), Zero Emission Bus Regional Areas (ZEBRA) scheme, <https://www.gov.uk/government/publications/apply-for-zero-emission-bus-funding>

<sup>118</sup> Department for Levelling Up, Housing and Communities (DLUHC), Homes England, HM Treasury and Ministry of Housing, Communities and Local Government (MHCLG) (2017), Housing Infrastructure Fund, <https://www.gov.uk/government/publications/housing-infrastructure-fund>

customers. In addition, Ofgem will include in the price control tougher targets for distribution network operators to deliver new or upgraded household connections.<sup>119</sup>

Second, the Electricity System Operator is considering actions that could be taken by industry to improve the connections process and unlock network capacity, both of which should reduce connection timelines. The ESO will submit its proposals for approval by Ofgem.

Third, distribution network operators are trying to **better manage customers reserving network capacity for projects that then do not progress** – which can mean that otherwise viable projects see their connection costs and timescales increase, even though there is network capacity unused. To address this, distribution network operators are now placing milestones in new connection offers. If projects do not progress in line with these milestones, for reasons within the connecting customer's control, they risk being removed from the queue. This frees up capacity for later, more viable projects to connect. The Energy Networks Association has developed a common approach for network companies through its Open Networks project and is monitoring its implementation. A modification to the Connection and Use of System Code is currently progressing which would take a similar approach to transmission connection offers.

Finally, all distribution network operators now offer **Active Network Management schemes which allow customers to connect faster and at lower cost** than through a firm connection. In return the customers accept that under certain network conditions they will be constrained from the network. Distribution network operators are also increasingly digitalising and simplifying connection processes, particularly for smaller connections, which can reduce connection timescales. Ofgem has also proposed a change in the distribution network licence, as part of the access and forward-looking charging review, which will require all distribution network operators to offer flexible connections until firm connections are available, or in place of a firm connection, where appropriate.

### C.4.3 Improving the Customer Connections Experience and Consistency between Distribution Network Operators

Informed consumers will be essential to the efficient use of the network as we look to adopt increasing numbers of low carbon technologies. **Connection customers should be empowered to connect in accordance with their needs, in a way which delivers value for money.** This includes being fully aware of opportunities for flexible connections to reduce peak demand and thus the need for connection capacity and, potentially, wider network reinforcement. We also want practices and service offerings to be consistent across the country, which is not currently always the case. While we recognise there can be good reasons for differing DNO approaches, it can be frustrating for connection customers to follow different policies and processes in different DNO regions. Below we outline the ways in which government and Ofgem are seeking to achieve this via incentives within RIIO-2 electricity

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<sup>119</sup> Ofgem (2022), RIIO-ED2 Draft Determinations, <https://www.ofgem.gov.uk/publications/riio-ed2-draft-determinations>

distribution price control, through accessible connection guidance, and enabling greater consistency between distribution network operators.

All DNOs are providing information to customers so that they understand the connection process and options available to them, which is especially important given the changing nature of connection customers. For example, they are digitalising and simplifying the process for domestic connection load checks and upgrades which should help reduce overall connection timescales and make the process more user-friendly. The government has also provided **clear guidance for electric vehicle fleets and commercial customers on how to obtain connections** in a timely, simple, and affordable manner on the gov.uk website.<sup>120</sup>

To address differing policies and approaches to connections the government and Ofgem are challenging distribution network operators to be more consistent where any differences are not justified. We see a particular role for the Energy Networks Association in ensuring greater consistency between its members, providing guidance and standard processes where helpful.

An example of an inconsistent approach is recovering the costs of single-phase domestic connection upgrades, for example to install a heat pump. Some distribution network operators socialise more of these costs, for example to upgrade a fuse, than others. Therefore, domestic customers may face different costs for otherwise identical types of work depending on their location, which could discourage the uptake of new low carbon technologies in certain regions. Following discussions with distribution network operators via the Energy Networks Association, Ofgem published a letter<sup>121</sup> clarifying the charging approach to such upgrades in the upcoming RIIO-2 electricity distribution price control. This will mean a more consistent approach between distribution network operators. We welcome other action to bring greater consistency in connections, such as through the iIdentify project which is digitalising and harmonising the domestic connection upgrade process.<sup>122</sup> The government and Ofgem will continue to work with network companies in other areas to ensure greater consistency in approaches.

### What we have done

- Ofgem has included tougher targets and penalties for DNO connection performance in the RIIO-2 electricity distribution price control.
- The government has created guidance for electric vehicle fleets and commercial customers on

<sup>120</sup> BEIS (2021), Connecting electric vehicle chargepoints to the electricity network,

<https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network>

<sup>121</sup> Ofgem (2021), Clarification on the treatment of service updates for existing distribution connections to a single occupancy premises, <https://www.ofgem.gov.uk/publications/clarification-treatment-service-upgrades-existing-distribution-connections-single-occupancy-premises>

<sup>122</sup> iIdentify project, [https://smarter.energynetworks.org/projects/nia\\_spen\\_0049/](https://smarter.energynetworks.org/projects/nia_spen_0049/)

how to obtain connections, available on the gov.uk website.<sup>123</sup>

- Ofgem has published a letter to distribution network operators to help ensure greater consistency in recovering costs for upgrades to existing domestic connections.<sup>124</sup>

### What we will do going forward

- Ofgem will review the scope for further strengthening DNO connection standards, including timescales and penalties.
- Ofgem will consider forthcoming proposals from the ESO on industry action to help deliver faster connections through improved connection procedures and unlocking network capacity.
- Ofgem will continue to evaluate the connections incentives in the RII0-2 electricity distribution price control to ensure consistency between DNOs and improvements in connection customer service/satisfaction.

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<sup>123</sup> BEIS (2021), Connecting electric vehicle chargepoints to the electricity network, <https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network/connecting-electric-vehicle-chargepoints-to-the-electricity-network>

<sup>124</sup> Ofgem (2021), Clarification on the treatment of service updates for existing distribution connections to a single occupancy premises, <https://www.ofgem.gov.uk/publications/clarification-treatment-service-upgrades-existing-distribution-connections-single-occupancy-premises>

## C.5 Unlocking Capacity with Smart Solutions and Data

**Vision: The electricity network of the future will be smart and digitalised, with flexible solutions and markets complementing physical infrastructure**

Widespread deployment of smart, flexible technologies, supported by effective markets and a digitalised energy system will manage the challenges of rising demand and increasing intermittent renewable generation— improving system efficiency and delivering for consumers. Storage and flexibility solutions will help to efficiently manage the electricity system, facilitating energy security and resilience. New commercial models will enable consumers to exercise greater control over their energy usage in ways that benefit them and the grid, shifting demand using demand side response technology in parallel with low carbon technologies. Flexibility technologies will be able to access and compete in markets providing services to the system. Open data will be used to plan the network, leveraging flexibility to use infrastructure efficiently, and inform policy and regulatory changes.

This will be achieved through the following interventions:

- Removing barriers to flexibility on the grid
- Facilitating flexibility from all resources connected to the system (including consumers through demand-side response)
- Reforming markets to uncover and reward flexibility
- Digitalising the system to leverage the benefits of data to their full utility

Our analysis shows that smart and flexible solutions could save up to £10 billion per year by 2050 by reducing the amount of generation and network infrastructure needed to decarbonise and create 24,000 jobs. Increased flexibility could reduce system costs between £30-70bn from 2020 to 2050.<sup>125</sup>

In 2021 the government and Ofgem published a new Smart Systems and Flexibility Plan, following the original publication in 2017. Below, we set out some of the key commitments relevant to networks made by the government and Ofgem in this Plan and how we will be implementing them.

The government is also undertaking a comprehensive Review of Electricity Market Arrangements (REMA) in Great Britain, to assess their capability for ensuring energy security, with less reliance on gas, as well as meeting our climate targets and ensuring value for money for consumers. A consultation setting out a case for change and an initial assessment of reform options was published in July 2022<sup>126</sup> and the government will publish its response this winter. As part of this work, the Review of Electricity Market Arrangements will consider how to

<sup>125</sup> BEIS and Ofgem (2021), Transitioning to a Net Zero Energy System: Smart Systems and Flexibility Plan, p.11, <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

<sup>126</sup> BEIS (2022), Review of Electricity Market Arrangements, <https://www.gov.uk/government/consultations/review-of-electricity-market-arrangements>



incentivise investment in the long and short duration flexibility needed to balance the system cost effectively.

### C.5.1 Facilitating Flexibility from Consumers

With demand increasing on the electricity network, **the government and Ofgem are committed to engaging consumers in demand side response to soften peaks in electricity demand and lower their costs by utilising the network as efficiently as possible.** The market for demand side response from large non-domestic consumers is emerging, supported by industry initiatives like the Electricity System Operator’s Power Responsive campaign<sup>127</sup> and the Association for Decentralised Energy’s ‘Flex Assure’ code of conduct.<sup>128</sup> However, the infrastructure is not yet in place for consumers to participate in demand side response at scale. The Smart Systems and Flexibility Plan sets out our actions in this area.

Firstly, the Smart Meter roll-out and the move towards Market-Wide Half Hourly Settlement<sup>129</sup> will unlock an increased provision of ‘smart tariffs’, saving consumers money and more accurately measuring and predicting demand on the electricity system.

The government and Ofgem will seek to maximise customer participation in flexibility, providing opportunities for network operators to optimise the network. Part of this is about enabling and encouraging smart EV charging and smart heating, alongside smart appliances more broadly, given that smart operation of these devices can benefit both the energy system and consumers.

To support development of the market and mitigate risks to consumers and the energy system, in July 2022 Government published a consultation on setting standards for “energy smart” appliances and organisations controlling load remotely<sup>130</sup> underpinned by the principles of interoperability, data privacy, grid stability and cyber security. Government is also seeking powers to implement regulation of energy smart appliances and licence load controllers through the 2022 Energy Security Bill.<sup>131</sup>

#### C.5.1.1 Smart and Flexible Electric Vehicle Charging

To facilitate demand side response in the context of the transition to electric vehicles, **the government is taking steps to enable widespread smart charging for electric vehicles**

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<sup>127</sup> NGESO, Power Responsive, <https://www.nationalgrideso.com/industry-information/balancing-services/power-responsive>

<sup>128</sup> Association for Decentralised Energy (2019), Flex Assure, <https://www.flexassure.org/>

<sup>129</sup> The Market Wide Half Hourly Settlement scheme uses data collected from consumers’ smart meters to better understand consumption on a half-hourly basis, supporting grid flexibility and allowing suppliers to offer more flexible products designed for savings on energy bills. The scheme will be implemented over the next four years, completing by October 2025.

<sup>130</sup> An appliance which is communications-enabled, and able to respond automatically to price and/or other signals by modulating their electricity consumption.

<sup>131</sup> BEIS (2022), Delivering a Smart and Secure Electricity System, <https://www.gov.uk/government/consultations/delivering-a-smart-and-secure-electricity-system-the-interoperability-and-cyber-security-of-energy-smart-appliances-and-remote-load-control>

**across Great Britain.** The Electric Vehicle Smart Charging Action Plan will be published jointly by the government and Ofgem, to set out the actions necessary to deliver energy flexibility from EVs. From 30 June this year, new private (domestic and workplace) chargepoints sold in Great Britain must have smart functionality. The regulations also introduce a default off peak setting, which is designed to encourage electric vehicle owners to charge at times of lower electricity demand (and lower cost), while ensuring they remain in control of how and when they charge their cars. There could also be the opportunity for increased public smart charging in the future, particularly where vehicles are parked on-street overnight.

Technology enabling electric vehicle battery energy to be sent back to the grid (vehicle-to-grid) or used elsewhere continues to develop. In 2017, the government provided up to £30m of funding for vehicle-to-grid projects, making the UK a world-leader in trialling this technology. The government is also currently reviewing feedback from a recent Call for Evidence<sup>132</sup> on how to unlock the potential benefits of vehicle-to-X charging (the umbrella term for all applications of sharing energy from the battery to another use) and will publish a response in 2022. To address key barriers to enabling energy flexibility from bi-directional EV charging, which were highlighted by the previous vehicle-to-grid innovation programme and the recent Call for Evidence, a new £11.4m vehicle-to-X innovation programme was launched in March.<sup>133</sup>

### **C.5.1.2 Smart and Flexible Heating Systems**

Increased uptake of electric heating with smart functionality could help reduce heating running costs for consumers and minimise the need for wider electricity network reinforcement and generation capacity, by reducing peak demand.

The government is currently consulting on proposals for a “smart mandate” which will require electric heating appliances with the greatest flexibility potential, namely heat pumps, storage heaters, and heat batteries, to have smart functionality. This will ensure that all consumers with these appliances can use them in a smart and flexible way, similar to the current smart mandate for electric vehicle chargepoints.

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<sup>132</sup> BEIS (2021), Role of vehicle-to-X energy technologies in a net zero energy system: call for evidence, <https://www.gov.uk/government/consultations/role-of-vehicle-to-x-technologies-in-a-net-zero-energy-system-call-for-evidence>

<sup>133</sup> BEIS (2022), V2X Innovation Programme, <https://www.gov.uk/government/publications/v2x-innovation-programme>

### What we have done

- The government has regulated to mandate that all new private (domestic and workplace) electric vehicle chargepoints sold in Great Britain must have smart functionality.<sup>134</sup>
- The government has issued a Call for Evidence to better understand how to unlock the potential benefits of vehicle-to-X charging<sup>135</sup>, and will publish a response in 2022. The government has also launched an £11.4m vehicle-to-X innovation programme.<sup>136</sup>

### What we will do going forward

- The government is taking enabling powers through the 2022 Energy Security Bill to regulate 'energy smart' appliances and to licence organisations controlling load, including powers to mandate that electric heating appliances, such as heat pumps, must have smart functionality. The government is currently consulting on an appropriate regulatory framework to implement these powers.<sup>137</sup>
- The government and Ofgem will publish a joint EV Smart Charging Action Plan in 2022, setting out the actions we will take to maximise the contribution of electric vehicles to energy system flexibility.

## C.5.2 Removing Barriers to Flexibility on the Grid

The government and Ofgem are creating a best-in-class regulatory framework for electricity storage at all scales, facilitating market confidence in the technology, leading to increased deployment. **Storage can offer a range of services to help balance the system**, including the potential to alleviate generation constraints, as well as addressing many of the challenges presented by a low carbon system.<sup>138</sup> Removing barriers and reforming markets to ensure they are valuing the flexibility that storage provides to the system is a focus of the government. The Smart Systems and Flexibility Plan sets out a range of actions to achieve this, including defining storage as a distinct subset of generation in primary legislation, which will be taken

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<sup>134</sup> BEIS (2021), Electric Vehicle Smart Charging: Government Response to the 2019 Consultation on Electric Vehicle Smart Charging, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1015285/electric-vehicle-smart-charging-government-response.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015285/electric-vehicle-smart-charging-government-response.pdf)

<sup>135</sup> BEIS (2021), Role of vehicle-to-X energy technologies in a net zero energy system: call for evidence, <https://www.gov.uk/government/consultations/role-of-vehicle-to-x-technologies-in-a-net-zero-energy-system-call-for-evidence>

<sup>136</sup> BEIS (2022), V2X Innovation Programme, <https://www.gov.uk/government/publications/v2x-innovation-programme>

<sup>137</sup> BEIS (2022), Delivering a Smart and Secure Electricity System, <https://www.gov.uk/government/consultations/delivering-a-smart-and-secure-electricity-system-the-interoperability-and-cyber-security-of-energy-smart-appliances-and-remote-load-control>

<sup>138</sup> BEIS and Ofgem (2021), Transitioning to a Net Zero Energy System: Smart Systems and Flexibility Plan, p.43, <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

through the 2022 Energy Security Bill. In August 2022, the government published its response to the 2021 Call for Evidence on facilitating the deployment of large-scale, long-duration electricity storage.<sup>139</sup> As described in the British Energy Security Strategy, we will encourage all forms of flexibility with sufficient large-scale, long-duration electricity storage to balance the overall system by developing appropriate policy to enable investment.

Ofgem will continue to work with industry to facilitate innovation on the network where possible – for example Ofgem’s intention to carry out a review of the regulatory and licensing arrangements for electricity ancillary services.<sup>140</sup>

Electricity interconnection delivers lower costs for consumers, enhances security of supply, and supports the integration of low-carbon generation sources; it will be critical in realising our offshore wind target whilst maintaining security of supply, as Multi-Purpose Interconnectors can further facilitate the efficient integration of offshore windfarms more quickly and in a coordinated manner. The Smart Systems and Flexibility Plan sets out a range of actions to achieve this, including continuing to deliver projects under the current cap and floor regime, address barriers to Multi-Purpose Interconnectors as part of the Offshore Transmission Network Review and identify and remove barriers to entry for interconnectors in balancing services. In 2021, Ofgem concluded its Interconnector Policy Review<sup>141</sup> deciding: to open a cap and floor investment round in mid-2022, implement some changes to the cap and floor regime framework and design to ensure that it reflects the changing role of interconnectors in the energy system and launch a pilot scheme for Multi-Purpose Interconnectors<sup>142</sup> under an adjusted cap and floor regime, alongside our third cap and floor application window<sup>143</sup>.

### What we have done

- The government has published its response to the 2021 Call for Evidence on facilitating the deployment of large scale and long duration electricity storage.<sup>144</sup>
- Ofgem has completed its Interconnector Policy Review and published a minded-to decision on an interim framework for MPIs.

<sup>139</sup> BEIS (2021) Facilitating the deployment of large-scale and long-duration electricity storage: call for evidence, <https://www.gov.uk/government/consultations/facilitating-the-deployment-of-large-scale-and-long-duration-electricity-storage-call-for-evidence>

<sup>140</sup> Ofgem (2021), Review of the regulatory framework for ancillary service assets and clarification on our short-term treatment of synchronous condensers, <https://www.ofgem.gov.uk/publications/review-regulatory-framework-ancillary-service-assets-and-clarification-our-short-term-treatment-synchronous-condensers>

<sup>141</sup> Ofgem (2021) Interconnector Policy Review – Decision, <https://www.ofgem.gov.uk/publications/interconnector-policy-review-decision>

<sup>142</sup> Ofgem (2022), Multi-purpose Interconnectors Pilot Regulatory Framework, <https://www.ofgem.gov.uk/publications/multi-purpose-interconnectors-pilot-regulatory-framework>

<sup>143</sup> Ofgem (2022), Application Guidance for the Third Cap and Floor Window for Electricity Interconnectors, <https://www.ofgem.gov.uk/publications/application-guidance-third-cap-and-floor-window-electricity-interconnectors>

<sup>144</sup> BEIS (2021), Facilitating the deployment of large-scale and long-duration electricity storage: call for evidence, <https://www.gov.uk/government/consultations/facilitating-the-deployment-of-large-scale-and-long-duration-electricity-storage-call-for-evidence>

### What we will do going forward

- The government will define storage as a distinct subset of generation through the 2022 Energy Security Bill. We will develop appropriate policy to enable investment in large-scale, long-duration electricity storage by 2024.
- Ofgem will review the regulatory and licensing arrangements for electricity ancillary services.
- Ofgem will open a cap and floor investment round for interconnectors in mid-2022.

### C.5.3 Reforming Markets to Uncover and Reward Flexibility

**The government and Ofgem are taking a range of actions to reform flexibility markets and increase co-ordination across transmission and distribution networks.** The actions in this area ensure these technologies are properly valued for the services they provide to the electricity system. Alongside these actions, REMA will consider a range of options for reform to electricity markets and policies to incentivise investment in the long and short duration flexibility needed to balance the system cost effectively.

The government and Ofgem will continue to work with the Electricity System Operator and then the Future System Operator (when established), as well as distribution network operators to reform markets, remove barriers and increase participation of flexibility providers. We expect distribution network operators to support the growth of local markets and encourage the use of local and domestic flexibility as alternatives to network reinforcement – allowing the system to function more efficiently, reducing costs for consumers.

Greater alignment in the procurement of flexibility services across transmission and distribution will facilitate routes to market and revenue streams for low carbon flexibility providers and provide network operators with greater optionality when making investment decisions. The government will continue to support innovation to help facilitate more opportunities for low carbon flexible assets to provide additional network capacity and participate in network management services.

### What we have done

- The government and Ofgem have facilitated and widened access to markets for technologies able to provide smart and flexible solutions for network management.
- Ofgem introduced a licence condition requiring distribution network operators to procure and use flexibility services, and promote energy efficiency measures, as an alternative to network build where economic and efficient to do so. Also, Ofgem's Draft Determinations for the upcoming RIIO-2 electricity distribution price control include a new incentive to drive distribution network operators to more efficiently develop and use their network, considering flexible and smart alternatives, to defer the need for reinforcement and ultimately reduce customer bills over the price control period (2023-28).

## What we will do going forward

- The government and Ofgem will work with the Electricity System Operator and distribution network operators to deliver open, transparent, accessible and efficient markets for flexibility by 2025.
- The government is undertaking a comprehensive Review of Electricity Market Arrangements in Great Britain, including how to drive investment in flexibility. We will publish a response to our recent consultation in the Winter.

### C.5.4 Digitalising the System

The operation of a smart and flexible system requires a better understanding of the network. The system will consist of ever-growing numbers of smaller flexibility assets, as opposed to a smaller number of large generators, leading to potentially millions of energy flows that need second-by-second management. Therefore, **a digitalised energy system ensures that smart, flexible, and low carbon technologies can be deployed to provide greater accessibility and more efficient outputs, allowing the system as a whole to be planned and operated more efficiently.** Below, we describe the commitments of the Energy Digitalisation Strategy relevant to networks.

#### C.5.4.1 Energy Digitalisation Strategy



In 2021, the government, alongside Ofgem, and Innovate UK - UK Research and Innovation, published the UK's first Energy Digitalisation Strategy<sup>145</sup>. This set out a vision, approach, and suite of actions for digitalising the energy system so that we can better meet our net zero ambitions. Many of the actions are geared towards enabling better visibility of energy datasets and assets and making energy system data more open and accessible - helping network companies plan and operate more efficiently, and helping innovators create new services for consumers and businesses.

#### C.5.4.2 Energy Digitalisation Taskforce

In May 2021, BEIS launched an Energy Digitalisation Taskforce<sup>146</sup> in partnership with Ofgem and Innovate UK - UK Research and Innovation to facilitate the modernisation of the energy system to unlock flexibility. The Taskforce considered the market design, digital architecture and governance of a modern digitalised energy system and made recommendations in

<sup>145</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation (2021), Digitalising our energy system for net zero: strategy and action plan, <https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan>

<sup>146</sup> This Taskforce, like its predecessor the Energy Data Taskforce, is run by Energy Systems Catapult.

January 2022.<sup>147</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation published a joint response in July 2022, highlighting progress and setting out next steps for future work.<sup>148</sup>

### Case Study

Data, when overlaid on a map, allows powerful insights to be drawn, as services such as Citymapper and Zap-Map have proven. In October 2021, the Energy Networks Association launched a proof of concept for the National Energy System Map, which for the first time brings together in a single place and common format, published energy data across all network companies. This allows data users to find and visualise certain energy network data across all of Great Britain, opening the door to greater data-driven innovation and consumer services. This would allow users to easily identify the best connection point for small-scale assets such as electric vehicle chargepoints. The Energy Networks Association are working towards developing the product further throughout 2022. The government is also working together with Ofgem, the Energy Networks Association and the distribution network operators to facilitate increased data sharing on networks.

### C.5.4.3 Using Data to Support System Planning

**Distribution network operators need to understand where domestic low carbon technologies (e.g. heat pumps, domestic solar, and electric vehicle chargepoints) are being installed.** This helps them ensure that the individual connection and wider network can accommodate them in a safe and cost-effective manner and plan their networks more effectively. Currently, distribution network operators rely on installers to register these assets with them within 28 days of installation, and it is thought that only a small proportion of new energy assets are being registered correctly. The Energy Digitalisation Strategy outlined how government will work with industry to streamline the registration process for small-scale energy assets, to improve their visibility on the system. **BEIS launched the Automatic Asset Registration programme in April 2022, a sub-programme of the NZIP Flexibility Innovation Programme, offering up to £2 million to support the development of an automatic, automated, standardised, and secure data exchange process for registering small scale assets.**<sup>149</sup> The government has also published guidance on the registration process for new low carbon technology devices in homes and small businesses.<sup>150</sup>

<sup>147</sup> Energy Digitalisation Taskforce, Recommendations for a Digitalised Net Zero Energy System, <https://es.catapult.org.uk/news/energy-digitalisation-taskforce-publishes-recommendations-for-a-digitalised-net-zero-energy-system/>

<sup>148</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation (2022), Joint response to the Energy Digitalisation Taskforce report, <https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan>

<sup>149</sup> BEIS (2021), Automatic Asset Registration (AAR) Programme, <https://www.gov.uk/government/publications/automatic-asset-registration-aar-programme>

<sup>150</sup> BEIS (2021), How to register energy devices in homes or small businesses: guidance for device owners and installation contractors, <https://www.gov.uk/government/publications/register-energy-devices-in-homes-or-small-businesses-guidance-for-device-owners-and-installation-contractors/register-energy-devices-in-homes-or-small-businesses-guidance-for-device-owners-and-installation-contractors#additional-information>

**Ofgem are also playing a key role in ensuring that the right network data is robust, open and secure, and informing system planning decisions. They will continue to engage with industry on increasing network visibility up to and through the RIIO-2 electricity distribution price control.** Ofgem now requires network companies to have Network Visibility Strategies and Digitalisation Strategies as part of their business plan submission. Ofgem is also reforming the Long-Term Development Statement<sup>151</sup>, which is used by distribution network operators to inform stakeholders about planned network improvements, such as reinforcement. This will extend and improve visibility of assets down to the lower voltage networks, significantly improving stakeholder's visibility of assets and their capacity and utilisation rates.<sup>152</sup> Distribution network operators are also required to publish a Network Development Plan, setting out the expected needs on their network in the 5–10-year time horizon, including their flexibility needs and associated data. Alongside this, distribution network operators also have to report on their planned flexibility needs in the year ahead and confirm details for what they procured.

For transmission owners, as part of the RIIO-2 price control, Ofgem has created licence obligations that require them to regularly update their Digitalisation Strategies and Action Plans, and that they comply with Energy Data Best Practice guidance.<sup>153</sup> Ofgem has signalled that these will also be part of the licence obligations for the RIIO-2 electricity distribution price control. All these changes will help increase efficiency of network planning, keeping costs down for consumers, whilst preparing the network for net zero.

#### **C.5.4.4 Cyber Security**

Along with the benefits above, increased digitalisation will also bring new cyber security risks. Increased connectivity of assets and systems will result in a greater attack surface for malicious actors to exploit vulnerabilities and access data from consumers and businesses. The emergence of digital services providers operating in the energy system increases the potential for cascading impacts of cyber-attacks, through the supply chain and across the network. The stability of grids and markets, as well as consumer and business data, must be protected as part of the transition.

**System-wide cyber security is a core objective of the government's policy approach, to ensure the stability of the network and give consumers the confidence to engage.** The government is committed to continue this work to help understand and identify current and emerging smart energy cyber security risks, and to embed effective cyber security practices that secure the energy system. As stated in December 2021's National Cyber Security Strategy, our overriding objective is to develop a proportionate regulatory framework to ensure

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<sup>151</sup> Ofgem (2020), Next steps on our reforms to the Long Term Development Statement (LTDS) and the Key Enablers for DSO programme of work, <https://www.ofgem.gov.uk/publications/next-steps-our-reforms-long-term-development-statement-ltlds-and-key-enablers-dso-programme-work>

<sup>152</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation (2021), Digitalising our energy system for net zero: strategy and action plan, <https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan>

<sup>153</sup> Ofgem (2021), Decision on Data Best Practice Guidance and Digitalisation Strategy and Action Plan Guidance, <https://www.ofgem.gov.uk/publications/decision-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance>



the future smart and flexible energy system the UK requires to deliver net zero will be secure and resilient to cyber threats.

### What we have done

- The government, Ofgem and Innovate UK - UK Research and Innovation have published an Energy Digitalisation Strategy.<sup>154</sup>
- The government has launched the Automatic Asset Registration programme, a sub-programme of the NZIP Flexibility Innovation Programme, offering an up to £2 million funding opportunity to support the development of an automatic, automated, standardised, and secure data exchange process for registering small scale assets.<sup>155</sup>
- The government has published guidance<sup>156</sup> for device owners and installers on notifying distribution network operators of low carbon technology devices in homes and small businesses.
- As part of the RIIO-2 electricity transmission price control, Ofgem requires transmission owners to regularly update their Digitalisation Strategies and Action Plans and comply with Energy Data Best Practice guidance.
- As part of the RIIO-2 electricity distribution price control, Ofgem has set minimum standards that distribution network operators should comply with Data Best Practice<sup>157</sup>, and have clear and effective stakeholder engagement in Digitalisation Strategies and Action Plans.

### What we will do going forward

- Ofgem will reform the Long-Term Development Statement to improve visibility of assets down to the lower voltage networks by April 2023.
- The government is consulting on delivering a smart and secure energy system.<sup>158</sup> The consultation includes proposals to introduce new system-wide cyber security practices for organisations capable of remotely controlling large amounts of electrical load, as well as additional cyber security and grid stability measures for energy smart appliances.

<sup>154</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation (2021), Digitalising our energy system for net zero: strategy and action plan, <https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan>

<sup>155</sup> BEIS (2021), Automatic Asset Registration (AAR) Programme, <https://www.gov.uk/government/publications/automatic-asset-registration-aar-programme>

<sup>156</sup> BEIS (2021), Connecting electric vehicle chargepoints to the electricity network, <https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network>

<sup>157</sup> Ofgem (2021), Decision on Data Best Practice Guidance and Digitalisation Strategy and Action Plan Guidance, <https://www.ofgem.gov.uk/publications/decision-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance>

<sup>158</sup> BEIS (2022), Delivering a Smart and Secure Electricity System, <https://www.gov.uk/government/consultations/delivering-a-smart-and-secure-electricity-system-the-interoperability-and-cyber-security-of-energy-smart-appliances-and-remote-load-control>

## C.6 Ensuring Costs Reflect the Changing System

**Vision: The electricity network of the future will be kept as low cost as possible, with charges reflective of the changing system**

The government and Ofgem are committed to ensuring the costs of upgrading the electricity network are kept as low as possible, especially during times of rising wholesale energy prices and global events affecting energy markets. A key part of this will be enabling efficiencies through the numerous changes underway across the system, as detailed in earlier sections. We will also need to keep pace with wider developments and reforms underway, to ensure network costs and related policies adapt accordingly.

Network infrastructure will be required to connect new sources of low carbon infrastructure, impacting communities that host it. The government and Ofgem are exploring options for community benefit schemes which recognise the important role of communities hosting such infrastructure.

This will be achieved through the following interventions:

- Reviewing network charging arrangements for a changing system on a rapid decarbonisation pathway
- Considering the impacts of net zero on consumer costs
- Considering next steps to develop community benefit options for network infrastructure critical to meeting net zero targets

### C.6.1 Reviewing Network Charging Arrangements for a Changing System on a Rapid Decarbonisation Pathway

Network companies recover their allowed revenues under the RIIO price controls from network users, including generators and suppliers, by charging for connection and use of the system. At around £10bn annually, network charges represent approximately 20% of the typical household electricity bill. A key feature of network charges is that they are generally set to reflect the costs that different users impose on the network. This ‘user pays’ approach incentivises efficient network use and is critical in minimising costs for the end-consumer. Charges provide a useful price signal to network users to reflect how their actions can either increase or decrease network costs. In practice, this means that generators in Scotland tend to face higher transmission charges than those elsewhere in Great Britain, as much of their output is used outside Scotland and therefore drives higher transmission investment. Conversely, demand consumers in Scotland face lower transmission charges than those in the rest of Great Britain. As the system changes, so can these signals’ effectiveness in indicating system efficiency.

In approving the design of network tariffs, Ofgem ensures that the needs of a wide range of different stakeholders are met wherever possible. These stakeholders include consumers (ranging from households to the very largest industrial energy users), suppliers, network

companies and generators. To achieve this, **Ofgem balances several competing principles which sit alongside the key principle of cost-reflectivity:**

- **Enabling net zero:** network charges may have a significant effect on how net zero is delivered. Supporting arrangements should continue to recognise the relative value, benefits and disbenefits of all technologies connecting – or already connected – to the electricity network.
- **Fairness:** this has several features, including that there should be no undue discrimination between network users; earlier adopters of key low carbon technologies (such as electric vehicles and heat pumps) should not be unduly penalised through network charging arrangements; network users should not be able to unduly avoid network charges (for example through the use of private wire arrangements), and that consumers in vulnerable situations should receive an adequate level of protection.
- **Predictability of charges:** the evolution of the energy system means that network charges will inevitably need to evolve over time, but charges should also be clear to stakeholders and be as predictable as possible.
- **Transparency:** the level of network charge and the possible impact of any proposed reforms should be transparent and accessible to all relevant parties.

These principles are factored into several areas of network charging reform which Ofgem is currently considering.

Ofgem has recently issued a final decision on its Access and Forward-Looking Charges Significant Code Review.<sup>159</sup> In addition to reviewing the distribution ‘connection charging boundary’ as mentioned in section C.4, this also included a decision on the definition and choice of access rights for users of the distribution network. Ofgem has now directed industry to implement the changes in line with the next price control period for distribution network operators, coming into effect in April 2023.

Separately, following consultation in late 2021, in early 2022 Ofgem decided to separate the wide-ranging review of distribution network charges into a separate Significant Code Review.<sup>160</sup> Work on Distribution Use of System charge reforms is expected to take place throughout the year, with the expected implementation being from 2026.

A balancing services charges task force led by the Electricity System Operator concluded in 2020 and reforms to balancing services are now being taken forward through the code

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<sup>159</sup> Ofgem (2022), Access and Forward-Looking Charges Significant Code Review: Decision and Direction: <https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-decision-and-direction>

<sup>160</sup> Ofgem (2022), Distribution Use of System Charges: Significant Code Review Launch: <https://www.ofgem.gov.uk/publications/distribution-use-system-charges-significant-code-review-launch>

modification processes. Ofgem published its final decision on the first of these, the removal of balancing services charges from generation, on 25 April 2022.<sup>161</sup>

In autumn 2021 Ofgem opened a Call for Evidence on the extent to which reform of Transmission Network Use of System charges is needed. Ofgem provided an update in February 2022.<sup>162</sup> This set out a summary of the feedback received and a commitment to undertaking a significant programme of work on the longer-term purpose and structure of transmission charges in a net zero energy system. The ESO has been tasked with leading Task Forces under the Charging Futures arrangements to improve charging under the current framework and the scope of task force was confirmed in May 2022<sup>163</sup>, with approximately 12 task force meetings to be held on a fortnightly basis.

### What we have done

- Ofgem has issued a final decision on its Significant Code Review of network access and forward-looking charges, with changes coming into effect in April 2023.

### What we will do going forward

- Following a decision in early 2022 to undertake a separate review of distribution network charges<sup>164</sup>, Ofgem will progress work on distribution network charges throughout the year, with expected implementation from 2026.
- Following a Call for Evidence on potential reform of Transmission Network Use of System charges in late 2021<sup>165</sup>, Ofgem will reassess the longer-term purpose and structure of transmission charges. In the interim, industry led Task Forces will address issues with the current model.

## C.6.2 Considering the Impacts of Network Investment on Consumer Costs

**The government and Ofgem recognise the need to carefully consider costs as we work towards net zero, including seeking to ensure vulnerable consumers are protected.**

Recent increases in electricity costs, brought about by the unprecedented rise in wholesale gas prices and energy security situation given global events, have additionally raised concerns about the costs of decarbonisation in the coming years. A review into the future of the retail

<sup>161</sup> Ofgem (2022), CMP308- Decision and Final Impact Assessment, [CMP308: Removal of BSUoS charges from Generation | Ofgem](#)

<sup>162</sup> Ofgem (2022), Transmission Network Use of System Charges – next steps following the Call for Evidence <https://www.ofgem.gov.uk/publications/tuos-call-evidence-next-steps>

<sup>163</sup> Ofgem (2022) Transmission Network Use of System Charges – a Task Force Update [Transmission Network Use of System Charges – a Task Force Update \(ofgem.gov.uk\)](#)

<sup>164</sup> Ofgem (2022), Distribution Use of System Charges: Significant Code Review Launch: <https://www.ofgem.gov.uk/publications/distribution-use-system-charges-significant-code-review-launch>

<sup>165</sup> Ofgem (2021), Transmission Network Use of System Charges Reform – a Call for Evidence, <https://www.ofgem.gov.uk/publications/tuos-reform-call-evidence>

market is underway, which will ensure that the energy retail market is resilient, sustainable, and continues to protect consumers as we move to a net zero energy system. We want households and businesses to be confident that all energy users are sharing in the benefits and costs of decarbonisation.

### C.6.2.1 Electricity network impacts on consumer bills

Ofgem's principal objective is to protect the interests of GB energy consumers, both now and in the future. Through the price controls set by Ofgem network companies are incentivised to deliver net zero at lowest cost to consumers, while maintaining world-class levels of system reliability and customer service.

Network costs currently make up approximately 20% of the average electricity bill. Transforming the electricity network for net zero will require significant investment. BEIS modelling (detailed in Appendix I) estimates there could be an additional £40-110bn in network costs by 2050; a 20-50% increase in baseline costs.<sup>166</sup> This primarily reflects an increase in electricity usage, given the anticipated increase in demand across the economy. **The cost of the network per unit of electricity generated – and therefore the amount paid by consumers for each kilowatt hour – is estimated to stay broadly the same or even decrease** given wider efficiencies and the greatly increased supply of electricity.

Ofgem will continue to use the regulatory framework to push the network companies to deliver efficiencies and reduce the cost to consumers. Through delivery of the Smart Systems and Flexibility Plan<sup>167</sup>, BEIS and Ofgem are committed to unlocking the benefits of a smart and flexible system that should materially reduce the amount of additional investment needed in networks.

The net zero transition will change the make-up of the average household energy bill as gas boilers and internal combustion engine cars are replaced by other technologies such as heat pumps and electric vehicles. This means that **increases in electricity system costs, including network costs, should be considered relative to reductions in other costs** that would be incurred in the baseline scenario, such as gas system costs or transport fuel costs. This is discussed further in Appendix I.

Previous analysis from government, presented in the Net Zero Review<sup>168</sup>, showed that the average electricity bill in 2050 for a household with a heat pump and an electric vehicle could be broadly similar, or even lower, when compared to an average household's fuel costs for electricity, heat and transport in 2019 (assuming they had a gas boiler and an internal

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<sup>166</sup> Over the next 30 years (2021-2050), discounted, 2020 prices. Section 3.1 'Network costs of reaching Net Zero' in 'Appendix I: Electricity networks modelling'. These are only costs to the electricity network and do not take into account the net impact of net zero e.g. any cost reductions in heat and transport as a result of moving away from fossil fuels. The electricity network is expensive to maintain – even in the absence of net zero, network costs would be substantial; our baseline scenario suggests these could amount to £230-240bn by 2050.

<sup>167</sup> BEIS and Ofgem (2021), Transitioning to a Net Zero Energy System: Smart Systems and Flexibility Plan, <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

<sup>168</sup> HM Treasury (2021), Net Zero Review Final Report, p. 56, <https://www.gov.uk/government/publications/net-zero-review-final-report>

combustion engine car). As set out in the Net Zero Review, there is a lot of uncertainty around these estimates, however, this does illustrate that the impact of net zero on electricity networks needs to be considered alongside all the other impacts on the overall energy system.

Within the British Energy Security Strategy, the government committed to review community benefit options for network infrastructure which is strategic to helping to meet net zero targets. Any new community benefit options will not replace community engagement with developments through the existing planning and consultation processes, but will ensure that communities that host network infrastructure are recognised for their vital role in ensuring a cheaper, cleaner and self-sufficient energy supply in Britain.

The current approach to providing local community benefit packages for network infrastructure is voluntary and predominately led by the transmission operators. We intend to explore if there should be a more standardised approach or whether providing a framework or benchmark offers more flexibility that would be of benefit to the distinct needs of individual communities and projects. We intend to engage with community representatives, industry and stakeholders with an interest in community benefits. The government will also engage with transmission operators and work with Ofgem to review how benefits are currently delivered and how this can evolve, including for projects currently in flight.

### **C.6.2.2 Wider work considering consumer impacts**

Given the current climate of energy prices, the government and Ofgem are committed to ensuring consumers are protected and the retail market works for them. While network costs are not impacted by the wholesale electricity price (which is the issue in the current context), cumulative increases in bills, whatever the cause, is of course a concern for electricity customers, and a government priority. The government and Ofgem have been clear on the need to take account of the lessons from recent market issues to ensure the energy retail market is resilient, sustainable and continues to protect consumers as we move to net zero.

Ofgem have acted quickly to ensure they have a comprehensive approach to the current energy price volatility. Ofgem has focused on strengthening the financial resilience of suppliers and potential adjustments to the methodology for the price cap to continue to protect consumers without creating unsustainable risk for suppliers.

The government and Ofgem remain committed to a competitive and innovative retail market, with secure energy supplies for consumers at fair prices. In the transition to net zero, with electrification of large swathes of the economy, it is more crucial than ever that we have a retail energy market that works for all.

In late 2021, the government published a call for evidence on the future of the energy retail market.<sup>169</sup> This builds on the energy retail market strategy for the 2020s, published last year.<sup>170</sup>

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<sup>169</sup> BEIS (2021), Future of the energy retail market: call for evidence, <https://www.gov.uk/government/consultations/future-of-the-energy-retail-market-call-for-evidence>

In the British Energy Security Strategy we committed to ‘rebalancing’ the costs placed on energy bills away from electricity to incentivise electrification across the economy and accelerate consumers and industry’s shift away from volatile global commodity markets over the decade. This will also ensure heat pumps are comparatively cheap to run over time. We will publish our proposals on how to do so in 2022, considering overall system impacts and limiting the impact on bills, particularly for low-income consumers.

#### **What we have done**

- The government has announced a package of support to help households with rising energy bills, with government support for the cost of living now totalling over £37 billion this year.<sup>171</sup>

#### **What we will do going forward**

- The government and Ofgem are reviewing the strategy for the energy retail market and the price cap methodology in order to protect consumers.
- The government has a view to publish proposals on rebalancing by the end of 2022.
- The government will review community benefit options for communities hosting transmission infrastructure which is strategic for meeting net zero.

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<sup>170</sup> BEIS (2021), Energy retail market strategy for the 2020s, <https://www.gov.uk/government/publications/energy-retail-market-strategy-for-the-2020s>

<sup>171</sup> HMT (2022), Cost of Living Support Factsheet, <https://www.gov.uk/government/publications/cost-of-living-support/cost-of-living-support-factsheet-26-may-2022>

# List of annexes and appendices

**Annex 1: Full list of actions**

**Appendix I: Electricity networks modelling**



# Annex 1: Full List of Actions

<b>C.1 – Changing how Electricity Networks are Planned and Managed</b>
<b>C.1.1 Facilitating More Strategic Network Planning</b>
<i>What we have done</i>
The government and Ofgem are working with industry to develop a strategic approach to network planning, including through the Holistic Network Design.
Ofgem has commenced an Electricity Transmission Network Planning Review, and as part of this, has published for consultation its minded-to decision <sup>172</sup> on what transitional and enduring Centralised Strategic Network Planning arrangements should look like.
As part of the Offshore Transmission Network Review, Ofgem has published consultations <sup>173</sup> on potential changes to enable greater coordination in the development of offshore networks in the near and medium term and with minded-to decisions on the proposed regulatory changes for the Early Opportunities, Pathway to 2030 and MPI workstreams. <sup>174</sup>
Ofgem has published a Call for Input <sup>175</sup> on the future of local energy institutions and governance.
<i>What we will do going forward</i>
The government and Ofgem will publish responses to their respective consultations under the Offshore Transmission Network Review.
The government and Ofgem will consider the role local and regional energy planning could play in delivering net zero and supporting efficient network planning, including the respective roles of national governments, local government, the Future System Operator, distribution network operation and other key stakeholders for energy planning.
<b>C.1.2 Preparing for Future System Operation</b>
<i>What we have done</i>
The government and Ofgem have committed to establishing an expert, impartial Future System

<sup>172</sup> Ofgem (2022) Consultation on our Minded-to Decisions on the initial findings of our Electricity Transmission Network Planning Review, <https://www.ofgem.gov.uk/publications/consultation-our-minded-decisions-initial-findings-our-electricity-transmission-network-planning-review>

<sup>173</sup> Ofgem (2021), Consultation on changes intended to bring about greater coordination in the development of offshore energy networks, <https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks>

<sup>174</sup> Ofgem (2022), OTNR – MPI Minded-to Decision on interim framework, <https://www.ofgem.gov.uk/publications/offshore-transmission-network-review-multi-purpose-interconnectors-minded-decision-interim-framework>

<sup>175</sup> Ofgem (2022), Call for Input: Future of local energy institutions and governance, [Call for Input: Future of local energy institutions and governance | Ofgem](#)

Operator. <sup>176</sup>
<i>What we will do going forward</i>
The government will create the Future System Operator through primary legislation, which will be taken through the 2022 Energy Security Bill, as well as develop new licensing arrangements and code modifications with Ofgem.
Ofgem will conclude on the review of the local energy institutions and governance at a sub-national level and will make recommendations on any necessary changes to existing arrangements.
<b>C.1.3 Reducing Network Constraints</b>
<i>What we have done</i>
The government has engaged with the Electricity System Operator and Ofgem to understand the increasing levels of constraints on the grid.
Ofgem continue to support transmission network reinforcement through the RIIO price control framework and Large Onshore Transmission Investments process, specifically on the England to Scotland border.
The government has published reports from a ‘Low Voltage Network Capacity Study’ <sup>177</sup> which identified innovative, non-conventional options, with potential to expand network capacity at significantly lower cost than conventional reinforcement.
<i>What we will do going forward</i>
To address constraints, the government and Ofgem will continue to work closely with the Electricity System Operator to ensure future system needs are identified earlier and factored into their infrastructure reinforcement recommendations.
Ofgem is continuing to enable agile regulation so network investment can address constraints through the use of uncertainty mechanisms.
The government will consider whether features of the Contracts for Difference Scheme have unintended, negative impacts on network constraints, and how these could be mitigated in future rounds.
The government will enable competition to address network constraints in innovative and cost-efficient ways, by taking powers in the 2022 Energy Security Bill.
The government intends to consult on a Strategy and Policy Statement for energy policy this year,

<sup>176</sup> BEIS and Ofgem (2021), Proposals for a Future System Operator role,

<https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role>

<sup>177</sup> BEIS (2022), Low Voltage Network Capacity Study, <https://www.gov.uk/government/publications/low-voltage-network-capacity-study>

intended to create a framework that allows Ofgem to protect consumers and achieve net zero.
<b>C.2 – Preparing our Electricity Networks for Net Zero</b>
<b>C.2.1 Enabling Strategic Investment through the Design of the Price Control</b>
<i>What we have done</i>
Ofgem has designed the RIIO-2 electricity transmission and distribution price controls to enable investment decisions to be more flexible and adaptive, and ensure the networks have sufficient funding to enable a wide range of net zero trajectories.
Ofgem’s Green Recovery Scheme <sup>178</sup> under the RIIO-1 electricity distribution price control is enabling £300m of investment for net zero in the electricity network, including to improve grid capacity at Motorway Service Areas.
The government and Ofgem have published conclusions to their reviews of Storm Arwen electricity disruption.
Ofgem’s Draft Determinations for the RIIO-2 electricity distribution price control set out an initial £20.9bn programme to deliver sustainable, affordable and resilient local networks, supporting a lower carbon future for the UK.
<i>What we will do going forward</i>
Ofgem will set out its Final Determinations for the RIIO-2 electricity distribution price control by the end of 2022. This price control will come into effect in April 2023.
Ofgem will commence engagement with stakeholders on the design of the next electricity transmission price control in 2022.
BEIS will oversee and monitor the implementation of actions identified as part of the BEIS and Energy Emergencies Executive Committee’s Storm Arwen review, including actions on system resilience, consumer protection and additional support.
Ofgem will oversee and monitor the implementation of actions identified within the Final report on the review of the networks’ response to Storm Arwen.
<b>C.2.2 Accelerating the Delivery of Strategic Onshore Infrastructure</b>
<i>What we have done</i>
The government has published the British Energy Security Strategy, committing to policy and regulatory changes to accelerate electricity network build.

<sup>178</sup> Ofgem (2021), Decision on the RIIO-ED1 Green Recovery Scheme, <https://www.ofgem.gov.uk/publications/decision-riio-ed1-green-recovery-scheme>

<p>The government has appointed Nick Winser as the Electricity Networks Commissioner to advise on policies and regulatory changes to accelerate progress on transmission network infrastructure.</p>
<p><i>What we will do going forward</i></p>
<p>Ofgem will consult on whether there are clear consumer benefits from introducing a package of changes to its regulatory approval framework this summer</p>
<p><b>C.2.3 Increasing Competition and Promoting Innovation in Onshore Electricity Networks</b></p>
<p><i>What we have done</i></p>
<p>The government has published its consultation response on the implementation of competitive tenders in onshore electricity networks, including criteria to establish which projects will be eligible for competition.<sup>179</sup></p>
<p>The Government has, as part of the 2022 Energy Security Bill, introduced clauses to enable competitive tendering in onshore networks.</p>
<p>Ofgem has published Innovation Vision 2021-2025<sup>180</sup> and subsequently introduced the new Strategic Innovation Fund<sup>181</sup> within the RIIO-2 price controls, enabling new, innovative projects to accelerate the transition to net zero and closer collaboration with the government.</p>
<p><i>What we will do going forward</i></p>
<p>Ofgem will publish a list of strategic transmission projects that will be exempt from competition by the end of 2022.</p>
<p>The government and Ofgem are working to enable cross-sector funding of whole-system solutions to ensure that the costs of innovative whole system projects can be split fairly between gas and electricity consumers.</p>
<p>The government and Ofgem will seek to increase the level of third-party involvement with innovation projects.</p>
<p><b>C.3 - Streamlining the Planning and Consenting of Networks Infrastructure</b></p>
<p><b>C.3.1 Accelerating the Planning and Consenting of the High-Voltage Electricity Network</b></p>
<p><i>What we have done</i></p>
<p>The government's review of the National Policy Statements for energy infrastructure (including for the</p>

<sup>179</sup> BEIS (2021), Competition in onshore electricity networks,

<https://www.gov.uk/government/consultations/competition-in-onshore-electricity-networks>

<sup>180</sup> Ofgem (2021), Ofgem innovation vision 2021 – 2025, <https://www.ofgem.gov.uk/publications/ofgem-innovation-vision-2021-2025>

<sup>181</sup> Ofgem (2021), Strategic Innovation Fund (SIF), <https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2/network-price-controls-2021-2028-riio-2-riio-2-network-innovation-funding/strategic-innovation-fund-sif>

<p>high-voltage electricity network) is underway and government has consulted on the proposed new guidance.<sup>182</sup></p>
<p><i>What we will do going forward</i></p>
<p>The government will re-consult on the revised energy National Policy Statements to include further references to strategic network planning, including recognising the Holistic Network Design process and the planned Centralised Strategic Network Planning process.</p>
<p><b>C.3.2 Reviewing Land Rights and Consent Processes for Electricity Network Infrastructure outside of the NSIP regime</b></p>
<p><i>What we have done</i></p>
<p>The government has commenced a review of the consenting process for electricity network infrastructure in light of net zero.</p>
<p>The government has published a Call for Evidence<sup>183</sup> alongside this Strategic Framework to identify issues and seek recommendations on solutions to reform the current consenting processes.</p>
<p><i>What we will do going forward</i></p>
<p>The government will analyse the responses to the Call for Evidence and confirm the scope of the review.</p>
<p><b>C.4 - Supporting Connections to the Electricity Network</b></p>
<p><b>C.4.1 Improving the Affordability of Connections to the Electricity Network</b></p>
<p><i>What we have done</i></p>
<p>Ofgem has published its decision on the distribution network ‘connection charging boundary’ which should reduce or remove network reinforcement costs for connection customers.<sup>184</sup></p>
<p>The government has announced a £950 million EV Rapid Charging Fund to future proof grid capacity at service areas on motorways and major A roads<sup>185</sup> and is providing funding for grid connections through the Zero Emission Bus Regional Areas Scheme.<sup>186</sup></p>

<sup>182</sup> BEIS (2021), Planning for new energy infrastructure: review of energy National Policy Statements, <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements>

<sup>183</sup> BEIS, (2022), Land Rights and Consents for Electricity Network Infrastructure Call for Evidence, <https://www.gov.uk/government/consultations/land-rights-and-consents-for-electricity-network-infrastructure-call-for-evidence>

<sup>184</sup> Ofgem (2022), Access and Forward-Looking Charges Significant Code Review: Decision and Direction: <https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-decision-and-direction>

<sup>185</sup> Office for Zero Emission Vehicles (OZEV) (2021), Rapid charging fund, <https://www.gov.uk/guidance/rapid-charging-fund>

<p>The government has allocated almost £4 billion from the Housing Infrastructure Fund to help fund physical infrastructure ahead of need, including electricity networks.<sup>187</sup></p>
<p><i>What we will do going forward</i></p>
<p>Ofgem will work with industry to make the relevant code changes to implement Ofgem’s decision on the connection boundary and connection costs.</p>
<p>BEIS will revise the Electricity (Connection Charging) Regulations 2017 to enable distribution network operators to implement the connection charging boundary changes from April 2023.</p>
<p><b>C.4.3 Improving the Customer Connections Experience and Consistency between Distribution Network Operators</b></p>
<p><i>What we have done</i></p>
<p>Ofgem has included tougher targets and penalties for DNO connection performance in the RIIO-2 electricity distribution price control.</p>
<p>The government has created guidance for electric vehicle fleets and commercial customers on how to obtain connections, available on the gov.uk website.<sup>188</sup></p>
<p>Ofgem has published a letter to distribution network operators to help ensure greater consistency in recovering costs for upgrades to existing domestic connections.<sup>189</sup></p>
<p><i>What we will do going forward</i></p>
<p>Ofgem will review the scope for further strengthening DNO connection standards, including timescales and penalties.</p>
<p>Ofgem will consider forthcoming proposals from the ESO on industry action to help deliver faster connections through improved connection procedures and unlocking network capacity.</p>
<p>Ofgem will continue to evaluate the connections incentives in the RIIO-2 electricity distribution price control to ensure consistency between DNOs and improvements in connection customer service/satisfaction.</p>

<sup>186</sup> DfT (2021), Zero Emission Bus Regional Areas (ZEBRA) scheme,

<https://www.gov.uk/government/publications/apply-for-zero-emission-bus-funding>

<sup>187</sup> Department for Levelling Up, Housing and Communities (DLUHC), Homes England, HM Treasury and Ministry of Housing, Communities and Local Government (MHCLG) (2017), Housing Infrastructure Fund,

<https://www.gov.uk/government/publications/housing-infrastructure-fund>

<sup>188</sup> BEIS (2021), Connecting electric vehicle chargepoints to the electricity network,

<https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network/connecting-electric-vehicle-chargepoints-to-the-electricity-network>

<sup>189</sup> Ofgem (2021), Clarification on the treatment of service updates for existing distribution connections to a single occupancy premises, <https://www.ofgem.gov.uk/publications/clarification-treatment-service-upgrades-existing-distribution-connections-single-occupancy-premises>

<b>C.5 – Unlocking Capacity with Smart Solutions and Data</b>
<b>C.5.1 Facilitating Flexibility from Consumers</b>
<i>What we have done</i>
The government has regulated to mandate that all new private (domestic and workplace) electric vehicle chargepoints sold in Great Britain must have smart functionality. <sup>190</sup>
The government has issued a Call for Evidence to better understand how to unlock the potential benefits of vehicle-to-X charging <sup>191</sup> , and will publish a response in 2022. The government has also launched an £11.4m vehicle-to-X innovation programme. <sup>192</sup>
<i>What we will do going forward</i>
The government is taking enabling powers through the 2022 Energy Security Bill to regulate ‘energy smart’ appliances and to licence organisations controlling load, including powers to mandate that electric heating appliances, such as heat pumps, must have smart functionality. The government is currently consulting on an appropriate regulatory framework to implement these powers. <sup>193</sup>
The government and Ofgem will publish a joint EV Smart Charging Action Plan in 2022, setting out the actions we will take to maximise the contribution of electric vehicles to energy system flexibility.
<b>C.5.2 Removing Barriers to Flexibility on the Grid</b>
<i>What we have done</i>
The government has published its response to the 2021 Call for Evidence on facilitating the deployment of large scale and long duration electricity storage. <sup>194</sup>
Ofgem has completed its Interconnector Policy Review and published a minded-to decision on an interim framework for MPIs.
<i>What we will do going forward</i>
The government will define storage as a distinct subset of generation through the 2022 Energy Security Bill. We will develop appropriate policy to enable investment in large-scale, long-duration electricity storage by 2024.

<sup>190</sup> BEIS (2021), Electric Vehicle Smart Charging: Government Response to the 2019 Consultation on Electric Vehicle Smart Charging, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1015285/electric-vehicle-smart-charging-government-response.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015285/electric-vehicle-smart-charging-government-response.pdf)

<sup>191</sup> BEIS (2021), Role of vehicle-to-X energy technologies in a net zero energy system: call for evidence, <https://www.gov.uk/government/consultations/role-of-vehicle-to-x-technologies-in-a-net-zero-energy-system-call-for-evidence>

<sup>192</sup> BEIS (2022), V2X Innovation Programme, <https://www.gov.uk/government/publications/v2x-innovation-programme>

<sup>193</sup> BEIS (2022), Delivering a Smart and Secure Electricity System, <https://www.gov.uk/government/consultations/delivering-a-smart-and-secure-electricity-system-the-interoperability-and-cyber-security-of-energy-smart-appliances-and-remote-load-control>

<sup>194</sup> BEIS (2021), Facilitating the deployment of large-scale and long-duration electricity storage: call for evidence, <https://www.gov.uk/government/consultations/facilitating-the-deployment-of-large-scale-and-long-duration-electricity-storage-call-for-evidence>

Ofgem will review the regulatory and licensing arrangements for electricity ancillary services.
Ofgem will open a cap and floor investment round for interconnectors in mid-2022.
<b>C.5.3 Reforming Markets to Uncover and Reward Flexibility</b>
<i>What we have done</i>
The government and Ofgem have facilitated and widened access to markets for technologies able to provide smart and flexible solutions for network management.
Ofgem introduced a licence condition requiring distribution network operators to procure and use flexibility services, and promote energy efficiency measures, as an alternative to network build where economic and efficient to do so. Also, Ofgem’s Draft Determinations for the upcoming RII0-2 electricity distribution price control include a new incentive to drive distribution network operators to more efficiently develop and use their network, considering flexible and smart alternatives, to defer the need for reinforcement and ultimately reduce customer bills over the price control period (2023-28).
<i>What we will do going forward</i>
The government and Ofgem will work with the Electricity System Operator and distribution network operators to deliver open, transparent, accessible, and efficient markets for flexibility by 2025.
The government is undertaking a comprehensive Review of Electricity Market Arrangements in Great Britain, including how to drive investment in flexibility. We will publish a response to our recent consultation in the Winter.
<b>C.5.4 Digitalising the System</b>
<i>What we have done</i>
The government, Ofgem and Innovate UK - UK Research and Innovation have published an Energy Digitalisation Strategy. <sup>195</sup>
The government has launched the Automatic Asset Registration programme, a sub-programme of the NZIP Flexibility Innovation Programme, offering an up to £2 million funding opportunity to support the development of an automatic, automated, standardised, and secure data exchange process for registering small scale assets. <sup>196</sup>
The government has published guidance <sup>197</sup> for device owners and installers on notifying distribution network operators of low carbon technology devices in homes and small businesses.

<sup>195</sup> BEIS, Ofgem and Innovate UK – UK Research and Innovation (2021), Digitalising our energy system for net zero: strategy and action plan, <https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan>

<sup>196</sup> BEIS (2021), Automatic Asset Registration (AAR) Programme, <https://www.gov.uk/government/publications/automatic-asset-registration-aar-programme>

<sup>197</sup> BEIS (2021), Connecting electric vehicle chargepoints to the electricity network, <https://www.gov.uk/government/publications/connecting-electric-vehicle-chargepoints-to-the-electricity-network>



<p>As part of the RIIO-2 electricity transmission price control, Ofgem requires transmission owners to regularly update their Digitalisation Strategies and Action Plans and comply with Energy Data Best Practice guidance.</p>
<p>As part of the RIIO-2 electricity distribution price control, Ofgem has set minimum standards that distribution network operators should comply with Data Best Practice<sup>198</sup>, and have clear and effective stakeholder engagement in Digitalisation Strategies and Action Plans.</p>
<p><i>What we will do going forward</i></p>
<p>Ofgem will reform the Long-Term Development Statement to improve visibility of assets down to the lower voltage networks by April 2023.</p>
<p>The government is consulting on delivering a smart and secure energy system.<sup>199</sup> The consultation includes proposals to introduce new system-wide cyber security practices for organisations capable of remotely controlling large amounts of electrical load, as well as additional cyber security and grid stability measures for energy smart appliances.</p>
<p><b>C.6 – Ensuring Costs Reflect the Changing System</b></p>
<p><b>C.6.1 Reviewing Network Charging Arrangements for a Changing System on a Rapid Decarbonisation Pathway</b></p>
<p><i>What we have done</i></p>
<p>Ofgem has issued a final decision on its Significant Code Review of network access and forward-looking charges, with changes coming into effect in April 2023.</p>
<p><i>What we will do going forward</i></p>
<p>Following a decision in early 2022 to undertake a separate review of distribution network charges<sup>200</sup>, Ofgem will progress work on distribution network charges throughout the year, with expected implementation from 2026.</p>
<p>Following a Call for Evidence on potential reform of Transmission Network Use of System charges in late 2021<sup>201</sup>, Ofgem will reassess the longer-term purpose and structure of transmission charges. In the interim, industry led Task Forces will address issues with the current model.</p>

<sup>198</sup> Ofgem (2021), Consultation on Data Best Practice guidance and Digitalisation Strategy and Action Plan guidance, <https://www.ofgem.gov.uk/publications/consultation-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance>

<sup>199</sup> BEIS (2022), Delivering a Smart and Secure Electricity System, <https://www.gov.uk/government/consultations/delivering-a-smart-and-secure-electricity-system-the-interoperability-and-cyber-security-of-energy-smart-appliances-and-remote-load-control>

<sup>200</sup> Ofgem (2022), Distribution Use of System Charges: Significant Code Review Launch: <https://www.ofgem.gov.uk/publications/consultation-our-proposal-take-forward-reform-distribution-use-system-charges-under-separate-significant-code-review-revised-timescales>

<sup>201</sup> Ofgem (2021), TNUoS Reform – a Call for Evidence, <https://www.ofgem.gov.uk/publications/tnuos-reform-call-evidence>

<b>C.6.2 Considering the Impacts of Network Investment on Consumer Costs</b>
<i>What we have done</i>
The government has announced a package of support to help households with rising energy bills, with government support for the cost of living now totalling over £37 billion this year. <sup>202</sup>
<i>What we will do going forward</i>
The government and Ofgem are reviewing the strategy for the energy retail market and the price cap methodology in order to protect consumers.
The government has a view to publish proposals on rebalancing by the end of 2022.
The government will review community benefit options for communities hosting transmission infrastructure which is strategic for meeting net zero.

<sup>202</sup> HMT (2022), Cost of Living Support Factsheet, <https://www.gov.uk/government/publications/cost-of-living-support/cost-of-living-support-factsheet-26-may-2022>

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