



House of Commons  
Environmental Audit Committee

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# Enabling sustainable electrification of the economy

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**Sixth Report of Session 2023–24**

*Report, together with formal minutes relating  
to the report*

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## Environmental Audit Committee

The Environmental Audit Committee is appointed by the House of Commons to consider to what extent the policies and programmes of government departments and non-departmental public bodies contribute to environmental protection and sustainable development; to audit their performance against such targets as may be set for them by His Majesty's Ministers; and to report thereon to the House.

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## Summary

The UK Government has committed to transitioning the economy to a fully decarbonised electricity system by 2035, supported by targets on the deployment of solar, wind, hydrogen and smart meters among others. In this inquiry, we have taken a broad look into the further electrification of Great Britain, examining energy generation, storage and flexibility; supply chains and skill constraints; planning and community engagement and system governance, energy security and resilience. For the UK to deliver on its sustainable electrification target for the GB grid, energy generation, flexibility and storage must increase alongside network infrastructure. As the UK drives towards net zero, electricity demand is expected to dramatically increase, and the transmission and distribution network must develop and expand alongside the growth in supply and demand.

The pipeline of planned renewable energy generation projects is sufficient to deliver the UK's highly aspirational targets but is currently being held back by slow grid connections, limited grid capacity, inappropriate planning regulations and market uncertainty. We recommend that the Government, with Ofgem and the National Energy System Operator, develop a detailed pathway and delivery plan that sets out what necessary investment and rollout of electricity infrastructure is required to deliver the UK's low carbon electricity generation targets. This should be completed by the end of 2024 at the latest.

Grid-scale energy storage can store energy and then supply it back to the grid at a more advantageous time. The level of energy storage required in the UK's future energy system is currently unclear with a range of figures and conclusions depending on the models and data used. The UK will require a significant level of low carbon energy storage in order to achieve its net zero energy goals while maintaining energy security and avoiding energy shortfalls. The form that this energy storage should take has not been made clear by the Government and therefore the sector lacks strategic direction, inhibiting private investment and the possible future rollout of energy storage. We recommend that, by the end of 2025, the Government should issue analysis that indicates to the market what level and type of both short-term and long-term energy storage will be required in a net zero energy system.

The Government has said that a more efficient and locally responsive system of energy flexibility could potentially bring down costs by up to £10 billion a year by 2050. To encourage their flexible use of heat pumps and electric vehicles, consumers need energy tariffs which provide varying rates across the course of the day. Half-hourly settlements, in which energy consumption can be recorded every half hour using smart meters, can provide benefits to both the grid and the consumer but is not yet standard in Great Britain. The Government had confirmed that in April 2024 it would implement a Clean Heat Market Mechanism, a measure to increase competition and drive down prices for heat pumps. This measure was intended to provide clarity and direction to the industry alongside incentives for companies to invest in manufacturing and supply chains. In March 2024, Government delayed the introduction of the scheme by a year. We recommend that the Government support an accelerated rollout of flexible energy technology to homes and businesses through the enhanced policy support envisaged

under the Clean Heat Market Mechanism by the end of 2025. This rollout should be accompanied by clear and effective communication about the financial benefits that these technologies can provide to electricity consumers. We additionally recommend that Ofgem expedite its delayed programme for delivery of market-wide half-hourly settlement.

The inability to connect to the electricity grid is hampering energy projects, with a queue that has more than twice the amount of energy generation in the queue than is needed for the 2035 decarbonised energy system target. Recent reforms have been undertaken by Ofgem and the Electricity System Operator, but the impact of these reforms has been questioned and is unlikely to be felt until late 2024 when the first projects will approach their first milestone. We recommend that the Government and the regulator should further prioritise connection reform and the delivery of transmission capacity associated with new connections. Current queue reforms should be further strengthened through the front-loading of milestones, so as to bring projects ready to connect to the grid to the front of the queue. In addition, Ofgem should monitor and publicly report on the status of the queue and progress in managing it on a monthly basis.

In order to deliver the necessary energy infrastructure, appropriate supply chains and a sufficiently skilled workforce both need to be in place. Currently, the UK suffers from strained and vulnerable supply chains and a significant shortage of skills needed for the transition. A high number of essential minerals and materials for low carbon technology are concentrated in a handful of countries, leading to high reliance on nations such as China. We recommend that the Government work with industry to provide incentives such as financial support to ensure that essential elements of the electricity infrastructure supply chain are based in the UK, so as to counter competitive incentives from other countries racing to develop their domestic electricity grids. Government policy in this area should prioritise the maintenance and development of the clean UK steel industry as well as driving the UK technology sector.

The UK workforce overall lacks the skills that are fundamental to delivering a net zero energy system, but the Government is yet to publish its long-promised green skills plan and is yet to state how it will measure progress towards its green skills target. We reinforce the recommendation from our 2021 report on *Green Jobs* that the Government set out how it will measure progress towards its green jobs target, including a definition of ‘a green job’, and how it will measure the number, type and location of these over the 2020s, for the purpose of monitoring and evaluating the impact of its policies.

Planning is a significant barrier in the move to net zero energy, with limited capacity in local authorities due to resource constraints and a lack of internal expertise has led to and slow planning application approval times preventing the necessary level of development. We urge the Government to ensure that relevant planning authorities have adequate resources to obtain and develop the skills and capacity necessary to prevent the planning system being a bottleneck to the rollout of energy infrastructure. An increase in planning fees is a justifiable measure to provide more adequate resources to planning authorities: but additional funding should be provided, and finances should be ring-fenced for local authorities. The Government should also develop a plan to ensure

sufficient staffing of planning authorities, and should expedite the delivery of a training programme designed to provide the necessary skills which will support well-considered and timely consideration of planning applications for electricity infrastructure.

This transition cannot be done without bringing communities on the journey, with community and stakeholder engagement being a fundamental aspect of the deployment of energy infrastructure. Communities who are engaged and invested, and who can have input into the way in which infrastructure local to them is developed, are more likely to accept a greater level of infrastructure and support the energy transition more broadly. The Government must require meaningful developer-led community engagement at the outset of major electricity projects. We recommend that Ministers also develop guidance for operators and local authorities on best practice in community engagement.

The governance of the energy system is currently in a state of flux. A new public body—the National Energy System Operator (NESO)—is taking on a number of roles, including system planning. The relationship between the Government, Ofgem and the NESO is complex: the NESO is consolidating a number of existing functions as well as adopting new functions, including giving advice to Government and working with local authorities through the new regional energy system planning process. The role and performance of the NESO should be kept under close review, particularly in its first years. Good corporate governance, including a functioning independent board, is needed from the outset and Ofgem and the Department for Energy Security and Net Zero should ensure that the NESO is subject to thorough annual reviews to ensure good value for money and high performance.

The Government has recognised the vital importance of energy security. The Secretary of State for Energy Security and Net Zero is ultimately responsible for ensuring energy security in the UK, but how this works on a day-to-day practical basis in a distributed energy system reliant on energy storage in both short-term and long-term forms is unclear. Despite the importance of energy security to the national interest, overall responsibility for progress on security, resilience and decarbonisation is to be distributed among several bodies. The Government and Ofgem should maintain clear indicators of progress on decarbonisation and energy security to allow the public to monitor progress in the proportion of renewable electricity on the system compared to expected needs, the security of supply and the progress on connections.

## Introduction

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1. In April 2022, following Russia’s full-scale invasion of Ukraine and the consequent impact on gas supplies, the UK Government published its British Energy Security Strategy.<sup>1</sup> This strategy set an ambition to deliver 50 gigawatts (GW) of power from offshore wind by 2030 and 70 GW of power annually from solar by 2035. As the UK transitions to a net zero and less fossil fuel dependent future, the fundamental shift in the way the country produces its energy is set to continue. The Government has committed to a fully decarbonised electricity system by 2035, subject to security of supply considerations, as part of the move to net zero by 2050 and to maximise energy generated in the UK.<sup>2</sup> This requires the full decarbonisation of the electricity grid serving Great Britain.<sup>3</sup> This is one of the most challenging undertakings faced by any government in peacetime, with some of the most ambitious timescales: the work is to be achieved in just over one decade.

2. In its Powering Up Britain Plan, published in March 2023, the Government reconfirmed these strategic objectives and set out further measures to promote delivery of the Strategy’s ambitions.<sup>4</sup>

3. Demand for electricity is expected to increase markedly over this period of decarbonisation. Ofgem, the UK energy regulator, expects an increase of generation capacity from 120 GW to 300GW by 2035.<sup>5</sup> The Climate Change Committee’s Balanced Pathway scenario for delivery of net zero by 2050, which has informed the Government’s plan for delivering the Sixth Carbon Budget, projects annual electricity demand to be around 50% higher than pre-Covid levels in 2035 and 100% higher by 2050.<sup>6</sup> According to that Committee’s Widespread Innovation scenario, electricity demand could double, or even treble, by 2050 as more sectors of the economy electrify.<sup>7</sup>

4. New infrastructure will be necessary to support the increase in the number of renewable projects and expected future capacity. In Great Britain, Ministers estimate that four times as much new electricity transmission network will be needed in the next six years as has been built since 1990.<sup>8</sup> In addition to the increases in the capacity of the existing network, many major new connections are required for new generating stations. Securing timely connections to the grid is a process which is already slowing down the completion of electrification projects.<sup>9</sup>

5. Delivery of power to the current grid is underpinned by the structures of the market in electricity supply and demand. The National Grid Electricity System Operator (ESO) estimates that even with optimal reinforcement of the grid, under existing market

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1 Department for Business, Energy & Industrial Strategy, [British Energy Security Strategy](#), April 2022

2 *Ibid.*

3 Electricity is transmitted across the majority of Great Britain (England, Scotland and Wales) and the Isle of Man by a contiguous, synchronous high-voltage electric power transmission network connecting power stations and major substations and ensuring that electricity generated at one point on the grid can be used to satisfy demand elsewhere. Some Scottish islands have limited connectivity to the GB grid. The Northern Ireland electricity grid is separate and forms part of the integrated electricity system on the island of Ireland, though there are interconnectors between the Great Britain and Ireland grids.

4 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

5 [Q49](#)

6 Climate Change Committee, [Delivering a reliable decarbonised power system](#), March 2023

7 *Ibid.*

8 Secretary of State for Energy Security and Net Zero, [Transforming Great Britain’s Electricity Network](#), HCWS62, 22 November 2023

9 Regen ([ESE0026](#)), para 8



arrangements the annual constraint costs—the compensation payments made, ultimately by billpayers, to energy generators when they are asked to reduce energy generation owing to excess supply—could treble by 2030.<sup>10</sup>

6. The analysis we undertook in our inquiry indicates that several policy objectives must be delivered in alignment to achieve the transition to a net zero energy system in Great Britain by 2050. These include:

- a significant increase in clean electricity generating capacity;
- a quadrupling in the prevailing rate of electricity infrastructure delivery, including connection to the grid;
- planned and targeted development of the training and manufacturing base to support the necessary skills and supply chains, and
- a resolution of persistent planning system issues, including bottlenecks in consenting and challenges arising from inadequate community engagement.

7. Despite the high-level ambitions for generation set out in the British Energy Security Strategy and the subsequent development of targets, the Government is yet to publish an overarching plan for the delivery of the infrastructure essential for achievement of its ambitions for a secure net zero energy system. This has made it difficult for the Climate Change Committee, the Government’s statutory adviser to the Government and Parliament, to assess the credibility of individual policies, whether those policies are sufficient and what delivery risks they face.<sup>11</sup>

8. In this report we will look at the current state of the UK’s move to decarbonise the energy sector, the barriers it must overcome to transition to low carbon energy and the steps the Government ought to take to achieve the targets it has set out. We will consider whether significant reforms are required to current policy on, and governance of, the regulation of electricity markets and networks. Given the rapid rates of innovation in technology and institutional structures, we will examine whether progress in current arrangements for Government monitoring of the development of physical infrastructure are appropriate to ensure coherence in energy policy and governance.

## About this report

9. We launched our inquiry in May 2023.<sup>12</sup> We received 69 submissions of written evidence and held five oral evidence sessions.<sup>13</sup> In February 2024 Committee members visited the control room facility of the National Grid Energy System Operator (ESO) in Berkshire, where we were briefed on the operation of the transmission network: we are grateful to staff of the ESO for their assistance in this visit. We appointed Dr Richard Lowes as a specialist adviser to this inquiry: we are very grateful to him for his expertise and advice.<sup>14</sup>

10 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

11 Climate Change Committee, [Progress in reducing UK emissions—2023 Report to Parliament](#), June 2023

12 The call for evidence is published on the Committee’s inquiry page at <https://committees.parliament.uk/call-for-evidence/3121/>

13 The written evidence received is listed on pages 54 to 56. The oral evidence taken is listed on page 53.

14 Dr Richard Lowes had no interests to declare on appointment.

10. We have examined a number of areas including energy generation, energy storage and energy flexibility; grid connections; supply chains; skills gaps; planning and energy system governance. This report is focused on Great Britain rather than the wider United Kingdom due to the separate governance arrangements for the integrated electricity grid on the island of Ireland. Similar issues with the development of electrification of the economies in Northern Ireland and the Republic of Ireland have been examined by Committee C of the British-Irish Parliamentary Assembly (BIPA) in its recent report on government energy strategies and consumer energy policy in the jurisdictions covered by BIPA.<sup>15</sup>

# 1 Energy generation, storage and flexibility

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## Developing energy generation capacity

11. Total UK electricity generation in 2022 was 325 terawatt hours (TWh). Of this, 38% was provided from gas generation, 29% from wind and solar, 15% from nuclear and 11% from other renewables.<sup>16</sup>

12. The UK Government's policy of increased electrification requires a scaling up of the UK's capacity to generate low-carbon energy and supply it to the GB grid.<sup>17</sup> Ofgem, the regulator, acknowledges this: Eleanor Warburton, their Director for Energy Systems Management and Security, told us that while current total generation capacity was in the region of 120 GW, she expected generation capacity from renewables and other zero-carbon sources to reach 300GW by 2035.<sup>18</sup> We outline below the published Government policies on future energy generation capacity across the principal renewable technologies, including solar, offshore wind and onshore wind, which currently deliver 29% of the UK's generation.

### Solar generation

13. In the Powering Up Britain energy security plan issued in March 2023 the Government confirmed its ambition to achieve 70 GW of solar by 2035, a five-fold increase in current deployed capacity.<sup>19</sup> The Government is looking to facilitate and promote extensive deployment of rooftop solar on industrial and commercial property to make maximum usage of available surfaces for business as well as to achieve environmental and climate benefits. Ministers are also seeking large-scale ground-mount solar deployment across the UK, looking for development mainly on brownfield, industrial and low and medium grade agricultural land.<sup>20</sup>

14. On 15 May 2024 the Secretary of State for Energy Security and Net Zero, with the support of the Secretaries of State for Levelling Up, Housing and Communities and for Environment, Food and Rural Affairs, announced a number of measures to clarify the Government's expectations about the delivery of solar generation projects under the Nationally Significant Infrastructure Projects planning regime to balance energy security and food production.<sup>21</sup> Applicants for Nationally Significant Infrastructure Projects are now expected to avoid, where possible, the use of Best and Most Versatile agricultural land (land at grades 1, 2 and 3a).<sup>22</sup> The Secretary of State also announced an expansion of the

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16 Department for Energy Security & Net Zero, [UK Energy in Brief 2023](#), 1 September 2023

17 Department for Business, Energy & Industrial Strategy, [British Energy Security Strategy](#), April 2022

18 [Q49](#)

19 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

20 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

21 Secretary of State for Energy Security & Net Zero, [Solar and protecting our Food Security and Best and Most Versatile \(BMV\) Land](#), HCWS466, May 2024

22 The Ministerial statement is intended to clarify the following passage in the National Policy Statement on energy infrastructure: "Where the proposed use of any agricultural land has been shown to be necessary, poorer quality land should be preferred to higher quality land avoiding the use of "Best and Most Versatile" agricultural land where possible." Issues with the current planning process are discussed in greater detail in Chapter 3.

Renewable Energy Planning Database so as to avoid the cumulative adverse impacts from a clustering of projects in certain areas, together with measures to boost the deployment of rooftop-mounted solar installations.

### Offshore wind

15. The British Energy Security Strategy increased the UK's ambition for offshore wind to up to 50 GW by 2030, with up to 5 GW from floating offshore wind.<sup>23</sup> If this trajectory is followed, by 2030 over half of all renewable energy generated in the UK ought to be from wind.<sup>24</sup> Progress towards this ambition depends on regular increases in capacity. These have typically been incentivised by Government-issued Contracts for Difference (CfD), which have guaranteed a return on investment to project developers.<sup>25</sup> The fifth allocation round for CfD auctions launched in March 2023 did not result in any bids to develop new offshore wind projects.<sup>26</sup> While the Government claims to have identified and rectified the issues with the process before launching the current (sixth) allocation round, the failure of the fifth round indicates that developer investment in the generation pipeline cannot to be taken for granted, not least as other countries step up their investment to build offshore renewable capacity in a more competitive environment.<sup>27</sup>

### Onshore wind

16. Onshore wind currently accounts for 24 gigawatts of generating capacity, roughly one quarter of the total installed renewable capacity: it remains one of the lowest-cost forms of energy available.<sup>28</sup> The fourth Contracts for Difference allocation round, launched in December 2021, secured 1.5 GW of onshore wind power capacity. In 2022, the Government confirmed that it would continue to support onshore wind through annual Contracts for Difference auctions.<sup>29</sup> None of the successful onshore wind projects supported by the CfD auctions held in 2022 or 2023 were proposed for construction in England: this is likely to reflect the impact of planning rules for onshore wind projects in England established in 2015 which were modified in September 2023.<sup>30</sup> On 14 May 2024, the Government announced plans to consult on the permitted development rights regime for the installation of single on-farm wind turbines on small-scale farms, with the aim of assisting farmers in meeting their farms' energy requirements and supporting their transition to renewable energy.<sup>31</sup>

23 Floating wind is an offshore wind turbine mounted on a floating structure that allows the turbine to be placed where the depth of water where a fixed foundation is not possible

24 Department for Business, Energy & Industrial Strategy, [British Energy Security Strategy](#), April 2022

25 A Contract for Difference is a private law contract between a low carbon electricity generator and the Low Carbon Contracts Company, a government-owned company. It is the government's main mechanism for supporting low carbon electricity generation.

26 Energy and Climate Intelligence Unit news story, "[Offshore wind: government failure in next renewables auction could mean Britain misses chance to cut foreign LNG gas dependency by half](#)", 14 November 2023

27 Department for Energy Security & Net Zero news story, "[Boost for offshore wind as government raises maximum prices in renewable energy auction - GOV.UK \(www.gov.uk\)](#)", 16 November 2023

28 Department for Energy Security & Net Zero, [Electricity generation costs 2023](#), November 2023

29 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

30 Secretary of State for Levelling Up, Housing and Communities, [Planning Update](#), HCWS1005, 5 September 2023

31 Department for Environment, Food and Rural Affairs, [A blueprint to grow the UK fruit and vegetable sector](#), May 2024

## Delivering generation capacity

17. Neither the Government, nor Ofgem, nor National Grid, the current Electricity System Operator for Great Britain, has produced a detailed delivery plan of the generation and storage necessary to fulfil the Government's strategic ambitions for energy capacity, the optimum locations for installation or the electricity grid infrastructure necessary to connect generation capacity to the network. In November 2022 Ofgem announced that a transmission network planning output, called the Centralised Strategic Network Plan (CSNP), would be delivered,<sup>32</sup> but this is not expected to be promulgated until 2026.<sup>33</sup>

18. In September 2023, on the recommendation of Nick Winsor, the UK Electricity Networks Commissioner, the Government announced it would produce a Strategic Spatial Energy Plan (SSEP). If the recommendation were implemented in full, the SSEP would provide direction on the specific location for the energy assets envisaged in Government strategies: for example, hydrogen production targets would be reflected in plans for the construction of production facilities in specific locations intended to produce specified volumes.<sup>34</sup> Ofgem expects the first SSEP to be produced before the end of the 2024/25 financial year.<sup>35</sup>

## Our view

19. **The Government has set stretching overall ambitions for the generating capacity required to supply the GB electricity grid with decarbonised energy by 2035. To meet these, current capacity will have to increase by 250% in a little over a decade. Planning for this wholesale electrification of the economy ought to be well under way to ensure that the 2035 deadline is met.**

20. **While we welcome the commissioning of a Centralised Strategic Network Plan and a Strategic Spatial Energy Plan, the relationship between the two is unclear: unless they are developed in tandem, in an environment where the relationship between the two is actively nurtured, there is an evident risk that the two plans will deliver suboptimal outcomes. We are struck by the current lack of evidence of a unified overall approach to delivery planning for the energy system in a way which explicitly facilitates the joint development of interim net zero energy targets, network system planning and requirements for public and private investment in setting out a path to 2035.**

21. *We recommend that the Government, together with Ofgem and the National Energy System Operator, establish a multidisciplinary planning cell tasked with the development of a detailed pathway to the decarbonised grid. This unit ought to be commissioned to produce a delivery plan that sets out the necessary investment and rollout of electricity infrastructure required to deliver the Government's current ambitions for low carbon electricity generation. The cell should be established as soon as possible, with a view to producing initial pathways and plans by the end of 2024 at the latest.*

32 Ofgem, [Centralised Strategic Network Plan: Consultation on framework for identifying and assessing transmission investment options](#), July 2023 (last accessed April 2024)

33 Ofgem, [Decision on the framework for the Future System Operator's Centralised Strategic Network Plan](#), 13 December 2023

34 Energy Systems Catapult, [Electricity Networks Commissioner: companion report findings and recommendations](#), June 2023

35 Ofgem, [Decision on the framework for the Future System Operator's Centralised Strategic Network Plan](#), 13 December 2023

## The role of energy storage in supporting the grid

22. Renewable energy generation is intermittent and relies on conditions such as sun or wind. The oversupply to the grid of energy created from renewable sources when conditions are favourable for generation is stored for later deployment. Facilities for this type of storage are termed **grid-scale storage**.

### *Technologies supporting grid-scale storage*

23. The most widely used grid-scale storage technology worldwide is **pumped-storage hydropower**, where water is pumped into a reservoir and then released to generate electricity at a different time. There are evident geographical and geological limitations to the deployment of this technology: in the UK the only pumped-storage hydropower facilities in use are at Dinorwig and Ffestiniog (both in Snowdonia), Foyers (on Loch Ness) and Cruachan (on Loch Awe).<sup>36</sup>

24. **Batteries** are playing a growing role in grid-scale storage: the International Energy Agency reports that battery technology is presently the most scalable means of storing surplus energy from a grid.<sup>37</sup> The largest single installation globally, at Moss Landing, Monterey Bay, California, has storage capacity of 3GWh.<sup>38</sup> Lithium-ion batteries can be used to store electricity at grid scale, though this technology currently performs best when required to support short-term grid flexibility where storage of no more than two hours is required.<sup>39</sup>

25. **Hydrogen storage with electricity generation** is a nascent technology which has the potential to ensure consistent access to sufficient electrical energy: modelling undertaken for the Climate Change Committee in 2023 indicated that hydrogen storage would have “a strong role” in meeting the needs of the UK’s future energy system.<sup>40</sup> Under this scenario, hydrogen can be produced using cheap excess electricity from the grid and stored for conversion back to electricity when there are shortfalls in supply. The technology can also therefore support generation capacity to be used more efficiently.<sup>41</sup> Hydrogen can be stored as a gas in underground salt caverns, underground aquifers and depleted gas fields and is expected to be a very important ‘inter-seasonal’ electricity storage vector.<sup>42</sup> Hydrogen can also be converted to other gaseous or liquid synthetic fuels which may be easier and/or cheaper to store and transport.<sup>43</sup>

### *The role of short-term flexibility*

26. Short-term flexibility is a feature of the current GB electricity grid: frequent use is made of short-term battery and pumped hydroelectric storage to balance the relatively minor in-day fluctuations in electricity demand and supply, together with other demand-side

36 British Hydropower Association, [Pumped Storage Hydro](#) (last accessed 13 May 2024)

37 International Energy Agency, [Grid-scale Storage](#) (last accessed 12 May 2024)

38 House of Lords Science and Technology Committee, [Long-duration energy storage: get on with it](#), 1st Report of Session 2023–14, HL Paper 68, March 2024

39 International Energy Agency, [Grid-scale Storage](#) (last accessed 12 May 2024)

40 Climate Change Committee, [Delivering a reliable decarbonised power system](#), March 2023, p. 102 ff

41 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

42 *Ibid.*

43 Miao Yang, Ralf Hunger, Stefano Berrettoni, Bernd Sprecher, Baodong Wang, “[A review of hydrogen storage and transport technologies](#)”, *Clean Energy*, vol. 7, issue 1, February 2023, pp. 190–216



responses to grid requirements, such as promoting demand-side consumer behavioural change, drawing on electricity supplied through interconnectors to other grids, and seeking short-term flexibility from generators.<sup>44</sup>

27. Flexibility in output from generators, including from gas-fired power stations, is a feature of current grid arrangements. In the full clean electricity system envisaged by the Government, gas generation without associated carbon capture technology cannot be used as it results in greenhouse gas emissions.

28. Replacing the flexibility afforded by gas generation is likely to pose a challenge to the development of a fully decarbonised grid. The National Infrastructure Commission reports that around 15 GW of low carbon supply side flexibility is currently available to provide short-term generation to match demand.<sup>45</sup> It estimates that 60 GW of short-term flexible capacity will be needed by 2035 to provide an efficient highly renewable low cost electricity system: two thirds of this target (40 GW) may be needed by 2030.<sup>46</sup> Since the technologies that provide this short-term flexibility have different characteristics, the Commission finds that a portfolio of technologies will offer benefits to the system while minimising deployment risks.<sup>47</sup>

29. In order to increase the resilience of the energy system and energy costs, the National Infrastructure Commission additionally recommends that the Government should establish a strategic energy reserve to provide resilience to infrequent but high impact energy price shocks. The Commission has recommended that this energy storage ought to be hydrogen-based in the long term, though owing to the current lack of hydrogen-fired generation capacity it acknowledges a short-term requirement for natural gas generation. This store should be equivalent to around 60 days of non-renewable electricity generation and would equate to around 25 TWh by 2040.<sup>48</sup> Existing fossil gas storage sites could also be repurposed to store hydrogen.<sup>49</sup>

### **Future electricity storage requirements**

30. Short-term flexibility is likely to be able to provide much of the within-day flexibility needed in a clean energy system but by 2035, when the electricity system is ultra-low carbon, modelling for the NIC suggests that 30 TWh of longer term persistent flexible generation will be needed to manage the potential for prolonged shortfalls in renewable electricity generation during winter. The Commission expects this gap to be filled predominantly from a mix of hydrogen-fired generation and gas generation with carbon capture and storage.<sup>50</sup>

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44 'Demand response' entails balancing the demand on power grids by encouraging customers to shift their electricity demand to times when electricity is more plentiful or general demand is lower. This is typically done through energy prices or other monetary incentives and allows consumers to play an active role in balancing the grid.

45 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

46 *Ibid.*, p. 42

47 *Ibid.*

48 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

49 Centrica news story, "[Centrica bolsters UK's energy security by doubling Rough storage capacity](#)", 30 June 2023

50 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

31. The largest non-fossil fuel storage is from conventional or reservoir hydropower, which accounts for 2.8 GW of storage capacity.<sup>51</sup> The newest of the four pumped-hydropower schemes in Great Britain which provide this capacity has been operational for over 40 years.<sup>52</sup>

32. Justin Tomlinson MP, Minister of State at the Department for Energy Security and Net Zero, told us that the Government had indicated that, to meet future electricity demand, up to 55 GW of short duration flexible capacity, and between 30 and 50 GW of long duration flexible capacity, was likely to be required by 2035.<sup>53</sup> Departmental modelling indicates that Great Britain will need more inter-day and inter-seasonal storage to avoid reliance on unabated natural gas to balance the network: the Government indicates that this is “in the order of terawatt-hours (TWh) to tens of TWh” but has not published a more detailed projection.<sup>54</sup>

33. Outside Government, the projections of storage capacity required are more detailed but offer a range of estimates. For instance, the National Infrastructure Commission believes that at least 8 TWh of hydrogen storage capacity will be needed by 2035. The Royal Society has estimated that a future energy system in which all the UK’s electricity was provided by solar, wind and hydrogen would require around 760 TWh per year of wind and solar energy supply and 100 TWh of hydrogen storage.<sup>55</sup>

34. The Climate Change Committee (CCC) has not estimated future storage requirements, but its reporting on current storage projects indicates that grid storage will increase to around 7 GW by 2025 and between 8 GW and 9 GW by 2028, with the majority of this increase coming from battery storage.

35. In addition to grid storage, the CCC also estimates that 5% of electricity demand in 2035 will be provided by hydrogen.<sup>56</sup> The Government’s stated aim, set out in its Hydrogen Strategy, is to work with industry to achieve 5 GW of low carbon hydrogen production capacity by 2030.<sup>57</sup>

### *Government measures to increase grid-level storage*

36. The UK Government’s energy storage targets provide limited direction to the market: it appears that Ministers are relying primarily on market price signals to drive investment in the capacity required. Price signals may encourage investment in short-term storage: there has been rapid recent growth in the availability of short-term energy storage to the grid, mainly through battery installations.<sup>58</sup> This deployment is partly attributable to the strong business case for providing short-term, responsive energy storage.

37. In January 2024, the Government launched its consultation into long duration electricity storage in order to design a policy framework to enable investment in long

51 House of Lords Science and Technology Committee, [Long-duration energy storage: get on with it](#), 1st Report of Session 2023–14, HL Paper 68, March 2024

52 [Q264](#)

53 Department for Energy Security and Net Zero ([ESE0075](#)), para 6

54 *Ibid.*, para 12

55 The Royal Society policy briefing, [Large-scale electricity storage](#), September 2023

56 Climate Change Committee, [The Sixth Carbon Budget—The UK’s path to Net Zero](#), 9 December 2020

57 Department for Energy Security and Net Zero, [UK Hydrogen Strategy](#), August 2021

58 Energy Storage News story, [“UK energy storage deployments grew by record 800MWh in 2022”](#), 1 February 2023 (last accessed 12 May 2024)



duration storage.<sup>59</sup> This identified a number of barriers such as lack of revenue certainty, high upfront capital costs and long build times.<sup>60</sup> The consultation has asked for evidence on the design of a cap and floor regime that would provide revenue certainty for investors and has been used previously for the development of interconnectors.<sup>61</sup> Evidence provided to us by Kate Gilmartin, Chief Executive of the British Hydropower Association made clear that this cap and floor mechanism would assist in bringing forward the pipeline of hydropower storage projects through improving investor confidence and reducing the cost of capital.<sup>62</sup>

38. Capacity mechanisms are temporary support measures that counties can introduce to remunerate energy generators for medium and long-term security of electricity supply.<sup>63</sup> These capacity payments are in addition to the earnings generators gain by selling electricity on the energy market. Ed Porter, Director of Revenue at Modo Energy, highlighted that while Contracts for Difference had been effective, there was a need for a capacity mechanism that could ensure both renewables and storage are available to the energy system.<sup>64</sup>

39. The business case for financing longer-term grid-scale storage facilities appears to be less clear cut. Simon Virley, Head of Energy and Natural Resources at KPMG, told the House of Lords Science and Technology Committee inquiry into battery storage that the challenges for long-duration energy storage projects to become commercially viable included long lead-in times, high capital expenditure requirements and “a very uncertain market arrangement”.<sup>65</sup> Michael Liebreich, Chair and CEO of Liebreich Associates, a clean energy consultancy, told that Committee that there was “almost no investment” into storage longer than 48 hours:

Private companies can do all sorts of things, but they will not just go off and do it voluntarily when the returns are so variable and questionable, so long-distance.<sup>66</sup>

40. The Royal Society has suggested that for longer term storage such as hydrogen, greater government intervention is likely to be needed in order to create an investment framework for assets which may only be used sparingly.<sup>67</sup>

41. Less than one TWh of grid-scale hydrogen storage is currently available. Thousands of TWh of hydrogen storage capacity are theoretically available, in the form of salt caverns and depleted oil and gas reservoirs: but lead times of up to a decade are estimated to be required for the development of geological features into operational storage facilities.<sup>68</sup>

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59 Department for Energy Security & Net Zero, [Long duration electricity storage consultation: designing a policy framework to enable investment](#), January 2024

60 *Ibid.*

61 *Ibid.*

62 [Q247](#)

63 European Commission policy briefing, [Capacity mechanisms](#) (last accessed 12 May 2024)

64 [Q251](#) [Ed Porter]

65 House of Lords Science and Technology Committee, [Long-duration energy storage: get on with it](#), 1st Report of Session 2023–14, HL Paper 68, March 2024

66 House of Lords Science and Technology Committee, [Long-duration energy storage: get on with it](#), 1st Report of Session 2023–14, HL Paper 68, March 2024

67 The Royal Society policy briefing, [Large-scale electricity storage](#), September 2023

68 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

## Our view

42. There appears to be a significant mismatch between the Government's plans for energy storage to support the operation of a decarbonised grid and the projections of the National Infrastructure Commission as to the likely requirement for long-term storage. Of the technologies available, expansion of existing pumped hydroelectric power facilities beyond those currently in use appears restricted by the availability of further suitable sites; the prospects for reliable lithium-ion battery storage on the scale and of the duration required are uncertain; and extensive investment and preparation will be required to develop facilities for hydrogen storage to the extent likely to be necessary. There is little evidence available to us to indicate that the Government is planning for the development of facilities at anything like the scale the Commission envisages would be required.

**43. Currently the UK relies on mostly imported gas for electricity system balancing needs. Low carbon long-term energy storage has the potential to reduce the UK's carbon impact whilst maintaining or improving its levels of energy security.**

**44. While short-term energy storage has some market drivers, the development of long-term, inter-seasonal storage at the scale expected to be required faces market, policy and regulatory barriers. The UK economy will require a significant level of low carbon energy storage of this type in order to achieve the Government's net zero energy goals while maintaining energy security and avoiding energy shortfalls.**

**45. The form that this energy storage should take has not been made clear by the Government. It is by no means clear to us that Ministers have grasped the scale of the storage facilities likely to be required, nor the Government action likely to be necessary either in providing long-term storage or establishing the conditions for it to be developed. The sector therefore lacks strategic direction, inhibiting private investment and delaying the future rollout of grid-scale energy storage.**

***46. The Government must address as a matter of urgency the barriers to long term energy storage for the UK to ensure it can provide its citizens with clean and reliable energy during periods of limited renewable generation. This can be delivered through direct Government intervention and investment in infrastructure, as well as through regulatory and policy reforms, such as cap and floor mechanisms or a reformed capacity mechanism, that signal to the market the value of long-term energy storage.***

***47. By the end of 2025 at the latest, the Government must publish an energy storage strategy, underpinned by robust analysis, that indicates to the market the capacity and type of both short-term and long-term energy storage which will be required in a net zero energy system, and the measures that Ministers plan to take to ensure that sufficient capacity is in place to meet the system's needs in 2035 and in 2050.***

## Energy flexibility

### Energy flexibility targets

48. In its British Energy Security Strategy, the Government stated it would ensure a more flexible system of measures including time of use tariffs, battery storage through electric vehicles and ensuring that all new homes are designed so that smart meters can be

fitted. The Government said that a more efficient and locally-responsive system of energy flexibility could potentially bring down overall energy system costs by up to £10 billion a year by 2050.<sup>69</sup>

49. Energy tariffs which provide varying rates across the course of the day are important measures to encourage consumers into more flexible use of heat pumps and electric vehicles. Half-hourly settlement, in which energy consumption can be recorded every half hour, is a practice which can support demand-side flexibility and provide benefits to both the grid and the consumer. Recording energy consumption at more regular intervals provides richer data on energy use, an asset vital to a highly renewable energy system. It will also facilitate lower consumer energy prices for consumption at times when demand is low and supply is high, encouraging the use of energy at cheaper times and bringing down typical bills.<sup>70</sup>

50. Half-hourly settlement is not yet standard in the GB consumer market. In April 2021 Ofgem published its decision on implementation of market-wide half-hourly settlements, but this is yet to be comprehensively rolled out. Given delays in the full deployment of smart meters to GB consumers, it may be some years before the decision is capable of being implemented. In 2011, the Government set a target for completing the smart meter rollout by 2019. This was then readjusted to have 80% of meters in homes to be smart by the end of 2025. As of March 2023, the rate was 57% of all electricity and gas meters.<sup>71</sup> Whilst good progress has been made recently, it is slower than the Government expected: in June 2023 the National Audit Office found that only one out of the 13 largest suppliers had achieved its electricity and gas smart metering installation targets for 2022.<sup>72</sup>

### *Electricity technologies supporting a flexible grid: heat pumps and electric vehicles*

51. Increased take-up of heat pumps and electric vehicles is expected to provide a significant source of energy flexibility. Regen, an independent not-for-profit centre of energy expertise, has claimed that over 40 GW of flexibility could be provided by domestic heating and EV charging in 2050.<sup>73</sup> Government policy initiatives to promote the use of flexible technologies have not been an unqualified success to date.

52. Heat pumps can add flexibility to the electricity system, allowing consumers to heat their homes whilst reducing peak demand. Their widespread use could provide up to 4 GW of flexibility in the system, while delivering substantial improvements in domestic energy efficiency.<sup>74</sup> In 2022, buildings were the second highest-emitting sector in the UK, accounting for 17% of its total emissions.<sup>75</sup> Heat pumps can reduce heating-related carbon emissions by up to 70%, are cost effective and suitable for around 90% of UK homes.

69 Department for Business, Energy & Industrial Strategy, [British Energy Security Strategy](#), April 2022

70 Ofgem blogpost, "[How half-hourly settlement will help cut energy bills](#)", 26 July 2017 (last accessed 12 May 2024)

71 National Audit Office, [Update on the rollout of smart meters](#), HC 1374, June 2023

72 National Audit Office, [Update on the rollout of smart meters](#), HC 1374, June 2023

73 Regen ([ESE0026](#)) para 25

74 Centre for Research in Energy Demand Solutions (CREDS), [Summary of findings from heat pump flexibility expert workshop](#), 4 October 2023 (last accessed 12 May 2024)

75 Climate Change Committee, [Progress in reducing UK emissions—2023 Report to Parliament](#), June 2023

53. The Government has set a target to increase the deployment of electric heat pumps from 55,000 a year in 2021 to 600,000 a year by 2028.<sup>76</sup> The CCC estimated that 130,000 installations would be required in 2022 for the UK to stay on its ‘balanced pathway’ to deliver the Sixth Carbon Budget: in fact only 72,000 have been installed.<sup>77</sup> To increase take-up, in November 2023 the Government confirmed that in April 2024 it would implement a Clean Heat Market Mechanism, a measure to increase competition and drive down prices for heat pumps.<sup>78</sup> This measure was intended to provide clarity and direction to the industry alongside incentives for companies to invest in manufacturing and supply chains.<sup>79</sup> But in March 2024 Ministers delayed the introduction of the scheme by a year and invited the Competition and Markets Authority to conduct a review of the home heating appliance market in view of “unjustified price hikes for gas boilers by some manufacturers with considerable market power”.<sup>80</sup>

54. Electric vehicles can also provide significant energy flexibility benefits, as vehicles can be charged when general demand is low and can act as additional energy storage when demand outstrips supply.<sup>81</sup> The Government’s zero emission vehicle mandate, which took effect in January 2024, establishes a requirement for 80% of new cars and 70% of new vans sold in Great Britain to be zero emission by 2030, increasing to 100% by 2035; 300,000 charge points are to be provided by 2030 to support EV use.<sup>82</sup>

55. The Government indicates that it has provided more than £2 billion as incentives for greater electric vehicle use through mechanisms such as a plug-in van grant of £2,500 for small vans and £5,000 for large vans, available until at least 2025, and £350 off the cost of a homeplace charging point for people living in flats.<sup>83</sup> The Society of Motor Manufacturers and Traders reports that 13.1% of the new cars sold in 2023 were battery electric vehicles, and 21.3% were plug-in hybrid or hybrid electric vehicles.<sup>84</sup> The Department for Transport reports that as of 1 April 2024, 59,670 public electric vehicle charging devices of all types were installed in the UK.<sup>85</sup>

### **Integration of flexibility technology into the grid**

56. In March 2023 the National Grid initiated its EQUINOX (Equitable Novel Flexibility Exchange) project. This project aims to address the challenges that Distribution Network Operators (DNOs) face with the electrification of heat. The project is intended to develop commercial arrangements and supporting technologies to deliver additional flexibility in residential low-carbon heating and to address consumer demand.<sup>86</sup> If the Government achieves its target of 600,000 heat pump installations per year by 2028, new solutions

76 Department for Energy Security and Net Zero, [Heat Pump Investment Roadmap](#), April 2023

77 Climate Change Committee, [Progress in reducing UK emissions—2023 Report to Parliament](#), June 2023

78 Department for Energy Security and Net Zero, [Clean Heat Market Mechanism: consultation](#), March 2023; Department for Energy Security and Net Zero, [Clean heat market mechanism: summary of responses received and government response](#), November 2023

79 *Ibid.*

80 Secretary of State for Energy Security and Net Zero, [Energy Efficiency Update](#), HCWS341, 14 March 2024

81 Department for Business, Energy and Industrial Strategy, [Electric vehicle smart charging action plan](#), January 2023

82 Department for Transport news story, [“Government sets out path to zero emission vehicles by 2035”](#), 28 September 2023

83 *Ibid.*

84 Society of Motor Manufacturers and Traders, [Electric Vehicle and Alternatively Fuelled Vehicle Registrations: January 2024 and Year-to-Date](#) (last accessed 12 May 2024)

85 Department for Transport, [Electric vehicle public charging infrastructure statistics: April 2024](#), 30 April 2024

86 National Grid, [EQUINOX \(Equitable Novel Flexibility Exchange\) project](#) (last accessed 12 May 2022)

will be required to efficiently manage this energy load: DNOs are expected to experience a substantial increase in peak energy demand and significant network reinforcement is likely to be required.

### **Potential additional grid capacity from increased flexibility**

57. Modelling undertaken for the Energy White Paper issued in December 2020 indicated that increased flexibility from demand-side response, storage and interconnection would provide significant cost savings in a decarbonised electricity system.<sup>87</sup> This flexibility has greatest impact in a system with lower carbon intensities: the Government estimated that it could provide potential consumer savings of between £6 and 10 billion per year in 2050. The illustrative scenarios prepared for the White Paper indicated that around 30 GW of flexibility capacity might be required by 2030, three times more than had been deployed in 2021.<sup>88</sup>

58. Rachel Fletcher, Director for Regulations and Economics at Octopus Energy, set out the overall cost benefits of implementing greater flexibility: for every gigawatt of peak energy demand that is reduced through behavioural change, the UK saves around a billion pounds in capital investment. Two thirds of that saving is attributable to needing fewer energy generators providing electricity, the remaining third arises from needing less network capacity.<sup>89</sup>

59. Analysis published by the consultancy Cornwall Insight and by Smart Energy GB, the industry body promoting the use of smart meters, appears to corroborate these projected cost savings. Cornwall Insight suggests that if flexible energy solutions were implemented, system electricity costs could be cut by an annual £4.6bn in 2030 and £14.1bn in 2040, while households participating in flexible electricity initiatives could cut wholesale electricity costs by more than 14% in 2030 and 50% by 2040. They estimate that this could save an average household £115 a year in electricity costs by 2030 and £375 a year by 2040.<sup>90</sup>

### **Our view**

60. There have been some signals from Government, regarding slowing the pace of some behavioural changes, which appear to have contributed to a perception of slowing UK climate ambition.<sup>91</sup> In September 2023 the Prime Minister announced a number of changes to net zero delivery measures, including a relaxation of policies on ending sales of petrol and diesel cars and vans and removing fossil fuel technologies from home heating. No analysis was presented to explain the effect that these changes were anticipated to have on the Government's overall plans for decarbonisation.

61. We pressed the Prime Minister for further details of the impact of the changes and their likely effect on the Government's overall plans for meeting its carbon budget obligations.<sup>92</sup> In response, the Secretary of State for Energy Security and Net Zero explained that the

87 Department for Business, Energy and Industrial Strategy, [Modelling 2050: electricity system analysis](#), December 2020

88 Department for Business, Energy & Industrial Strategy, [Smart systems and flexibility plan 2021: Appendix I—Electricity system flexibility modelling](#), July 2021

89 [Q140](#)

90 Cornwall Insight paper, [The power of flex: rewarding smarter energy usage](#), August 2023

91 Climate Change Committee, [COP28—Key outcomes and next steps for the UK](#), January 2024

92 [Letter from the Chair of the Environmental Audit Committee to the Prime Minister](#), 29 September 2023



Prime Minister’s announcements represented “a fairer and more pragmatic approach to meeting net zero that eases the burdens on working people” without changing the Government’s current targets.<sup>93</sup> Ministers “remain committed to delivering net zero and are clear this will require us to decarbonise virtually all heat in buildings”; the zero emission vehicle mandate remains in place and non-ZEVs sold between 2030 and 2034 will have their CO<sub>2</sub> emissions limited.<sup>94</sup>

62. Nevertheless, analysis undertaken by the Climate Change Committee following the Prime Minister’s speech showed an increased delivery risk to building decarbonisation, transport decarbonisation and renewable electricity generation from the high-level policy changes announced.<sup>95</sup> The pace of demand-side electrification, already behind the targets set by Ministers, threatens to slow further.

**63. The benefits to the energy sector of developing grid flexibility are substantial. These benefits are underpinned and sustained by increased usage of decarbonised consumer technologies such as smart meters, heat pumps and electric vehicles in ways which make best use of the energy supply.**

64. We are nevertheless concerned that recent Government adjustments to the incentives for take-up of these technologies by consumers may affect the capacity of the grid to deliver the benefits of flexibility in the short- to-medium-term: this in turn may affect the willingness of investors to commit to leading and supporting grid development initiatives. It is desirable that, as far as possible, Ministers should publish the rationale behind all decisions on changes to energy transition policies, including the underlying analysis: communication of such decisions should be informed by an assessment of their likely impact on achieving relevant net zero targets.

65. The flexibility in the GB energy system provided by the development of demand-side response and energy storage capacity can provide significant cost savings to consumers. But the current slow rate of rollout and take-up of flexible technologies which can benefit from demand-side response is delaying the realisation of these benefits. The Government’s 2035 targets of 600,000 heat pump installations a year and 100% of new cars being zero emission both face real challenges.

*66. We recommend that the Government support an accelerated rollout of flexible energy technologies to homes and businesses, at a minimum through the enhanced policy support envisaged under the Clean Heat Market Mechanism, by the end of 2025 at the latest. This rollout must be accompanied by clear and effective communication about the financial benefits that these technologies can provide to electricity consumers.*

*67. We further recommend that Ofgem expedite its programme to deliver market-wide half-hourly settlement. We expect Ofgem to provide a progress report in response to this recommendation, setting out current barriers to delivery of this objective, identifying measures to overcome them, and indicating a target date for final delivery.*

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93 [Letter from the Secretary of State for Energy Security and Net Zero to the Chair of the Environmental Audit Committee](#), 19 October 2023

94 *Ibid.*

95 Climate Change Committee, [CCC assessment of recent announcements and developments on Net Zero](#), 12 October 2023

## 2 Developing an electricity grid ready for net zero

68. Extensive new transmission infrastructure will be necessary to support the expected future capacity of the GB electricity network. Ministers estimate that four times as much new electricity transmission network will be needed by 2030 as has been built since 1990.<sup>96</sup>

69. In July 2022, the Government appointed Nick Winser as the UK's first Electricity Networks Commissioner to assist Ministers in ensuring the right electricity infrastructure is in place for a decarbonised energy system.<sup>97</sup> In August 2023, the Commissioner published his recommendations to improve the development of new transmission infrastructure. Among Nick Winser's recommendations were the development of the Strategic Spatial Energy Plan, the creation of Electricity Transmission Design Principles and the automation of route design.<sup>98</sup>

70. The Commissioner has identified the transformation of the energy system as vital to supporting the increase in demand from the proposed decarbonisation of the economy.<sup>99</sup> Central to this is the electricity transmission network connecting clean generation capacity to the demand centres across the country: Nick Winser points out that investment in the development of this network has not kept pace with the UK's success in stimulating investment in generation from renewables.

### Connecting new generation projects to the grid

71. The Commissioner observes that the development of the transmission network will have to proceed at an “unprecedented scale and pace”. Current timescales for the development of new transmission infrastructure are between twelve to fourteen years, and the infrastructure required is often on the critical path for the connection of new generation facilities.<sup>100</sup>

72. The ability for energy generators to connect to Great Britain's electricity grid has repeatedly been identified as a barrier to achieving the UK's net zero targets.<sup>101</sup> The queue of projects waiting to connect has consistently grown, with demand outstripping operator connection capacity. This was due to a ‘first-come, first-served’ approach which has led to a long queue of energy projects awaiting connection. Combined, these projects could theoretically generate almost 400 GW of electricity—well in excess of what is needed to power the entire British energy system.<sup>102</sup>

96 Secretary of State for Energy Security and Net Zero, [Transforming Great Britain's Electricity Network](#), HCWS62, 22 November 2023

97 Department for Business, Energy & Industrial Strategy news story, [“New Electricity Networks Commissioner appointed to help ensure home-grown energy for Britain”](#), 6 July 2022 (accessed 12 May 2024)

98 Energy Systems Catapult, [Electricity Networks Commissioner: companion report findings and recommendations \(publishing.service.gov.uk\)](#), June 2023

99 *Ibid.*, p 4

100 *Ibid.*

101 Energy Systems Catapult ([ESE0012](#)), para 11; InterGen ([ESE0016](#)), para 12; Regen ([ESE0026](#)), para 12; E.ON ([ESE0030](#)), para 7; EDF ([ESE0031](#)), para 8

102 Ofgem press release, [“Ofgem announces tough new policy to clear ‘zombie projects’ and cut waiting time for energy grid connection”](#), 13 November 2023 (last accessed 12 May 2024)

73. Queue management reforms were attempted by the network operators National Grid and Scottish Power Energy Networks in 2017, and the Energy Networks Association has been working with DNOs to propose milestones and measures to help in active management of the queues.<sup>103</sup>

### *Project milestones*

74. In November 2023 Ofgem announced a new policy to speed up grid connections. Procedures were introduced to speed up connections for viable projects and to allow stalled or speculative developers to be forced out of the queue.<sup>104</sup> New project milestones were introduced by the National Grid Electricity System Operator with effect from November 2023 and cover both existing and future connection agreements.<sup>105</sup> These ‘User Progression Milestones’ will require projects to achieve key stages of progress towards completion by prescribed dates and if not, the ESO has the right to terminate the connection contract—in effect introducing a ‘use it or lose it’ feature to the queue.<sup>106</sup> The milestones can include planning permission, securing land rights, a construction plan, a project commitment and project construction.<sup>107</sup> They are calculated by working backwards from the project’s connection date: the first milestone is likely to be set at a date around four years before a project aims to connect.

75. The setting of milestones with reference to the expected connection date risks the queue being blocked by projects which are not making sustained development progression (and may never deliver) and therefore slowing the overall deployment of low carbon energy generation. The renewable energy company Low Carbon suggested that bringing the milestones forward and ‘front-loading’ them would alleviate this problem and allow faster rollout of energy generation.<sup>108</sup>

### *The Connections Action Plan*

76. In addition to the milestones, the Department for Energy Security and Net Zero (DESNZ) and Ofgem have introduced a Connections Action Plan.<sup>109</sup> The ambition of this plan is for transmission connection dates to be offered a connection date no later than six months beyond the date requested by the customer, a substantial reduction from the current five years.<sup>110</sup> The plan contains actions that are to be taken, both in the short-term and long-term, across six main areas, including raising the entry requirements of projects, better utilisation of the existing network capacity and improvement of data and processes.<sup>111</sup>

77. The Connections Action Plan does not explicitly set out a preference for renewable technologies, but highlights a number of actions currently under way, such as improving

103 National Grid, [GB Connections Queue Management](#), March 2017

104 Ofgem press release, [“Ofgem announces tough new policy to clear ‘zombie projects’ and cut waiting time for energy grid connection”](#), 13 November 2023 (last accessed 12 May 2024)

105 *Ibid.*

106 Ofgem, [Decision on Connection and Use of System Code \(CUSC\) proposal CMP376: Inclusion of Queue Management process within the CUSC](#), 13 November 2023

107 *Ibid.*

108 Low Carbon ([ESE0072](#)), para 10

109 Department for Energy Security & Net Zero, [Connections Action Plan: Speeding up connections to the electricity network across Great Britain](#), November 2023

110 *Ibid.*

111 *Ibid.*



the interaction between the transmission and distribution networks as well as stating that further actions need to be taken by the ESO and network companies.<sup>112</sup> The Plan identifies that for many connections more network infrastructure needs to be built to accommodate them and stronger forward planning, that focuses on anticipating actions to manage the future pipeline of connections, will minimise delays. It does not clarify what connections should be a priority now or in the future.<sup>113</sup>

### *Initial impact of connection reform measures*

78. It is difficult to ascertain the immediate initial impact of these measures on the current connection queue, since summary information on the size of the queue is not readily available. Data from transmission and distribution network operators necessary to ascertain progress is spread across a range of different publications rather than amalgamated, making it difficult to see the full extent of the connections queue.<sup>114</sup>

79. Nevertheless, and despite the initiation of the queue reform process in November 2023, we were told that by January 2024 the capacity contained in the connections queue had grown from some 400 GW to 675 GW.<sup>115</sup>

### **Connections to regional substations**

80. We considered whether the rate at which new generating installations are connected to the network could be increased by amendments to current rules on grid access. The industry has established a code of practice governing how accredited network operators provide connections.<sup>116</sup> In the course of discussions during our visit to the National Grid ESO, we heard that developers were presently only authorised to construct short connections from their installations to the regional substations which service the distribution networks, and that connections over a certain length were required to be provided by National Grid or the relevant regional distributor.

81. We asked the Department and Ofgem about the current process and the scope to revise connection rules so as to allow a broader range of construction firms, with proven experience of undertaking grid connection work, to provide grid connections. Eleanor Warburton of Ofgem indicated that connections built by independent distribution network operators (IDNOs) were permitted under certain circumstances, and that connection work was often outsourced.<sup>117</sup> The regulator was working with the sector to explore ways to increase this flexibility, subject to Ofgem's concern to maintain the integrity of network standards and to establish clear understandings about responsibility for the ownership and maintenance of third-party connections. She agreed that there was scope for further reform of the process to accelerate connections.

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112 *Ibid.*

113 *Ibid.*

114 Energy Networks Association, [Connections data](#) (last accessed 12 May 2024)

115 [Q273](#)

116 Competition in Connections, [Energy Networks Association Competition in Connections Code of Practice](#) (last accessed 22 May 2024)

117 [Qq279-280](#)

## Impact of energy market pricing on grid development

82. As the economic regulator of the network, Ofgem sets price controls which balance the relationship between investment in the network, company returns, and the amount that energy network companies can charge for operating their networks.<sup>118</sup> Since energy network companies are monopoly businesses, Ofgem set these price controls as a ceiling on the amount that companies can earn from charging to use the network in order to protect consumers, who pay for the cost of the networks through their bills.<sup>119</sup>

83. Separate price controls apply to the distribution and transmission networks.

- The electricity distribution network, where network companies take power from the transmission network and deliver it at safe, lower voltages to homes and businesses, is subject to the RIIO-ED2 price control system, which runs for five years from 2023 to 2028.<sup>120</sup>
- RIIO-T2 is the price control system for the high voltage electricity transmission networks and high-pressure gas transmission networks which transmit energy across Britain from where it is generated. It runs for five years from 2021 to 2026.<sup>121</sup>

84. Enertechos, a clean technology company that focuses on electricity cabling, expressed concerns about the RIIO-ED2 price control mechanism. In its view, Ofgem lacked a consistent approach in strategic funding to enable operators to invest in new technology. Enertechos cited the withdrawal of the Losses Discretionary Reward which incentivised operators to improve and manage electricity losses.<sup>122</sup>

85. Hitachi Energy considered that while the current emphasis in the price control mechanisms was, appropriately, on the cost to consumers, the definition of ‘best value to consumer’ focused on the lowest capital costs of projects. Hitachi observed that the best value for the consumer was now most likely to be delivered through accelerated investment in a net zero power system.<sup>123</sup> The National Infrastructure Committee made a similar observation, noting that the transition away from fossil fuels for heating and for generation could act to drive down energy prices overall in the long run.<sup>124</sup>

86. The Connect and Manage transmission access regime was implemented in February 2011 with an aim to improve access to the transmission network by offering generation customers connection dates ahead of the completion of wider transmission system reinforcements.<sup>125</sup> Nick Winser told us that while Ofgem had a duty to protect consumers from overspending, the National Infrastructure Commission thought there was a need for further anticipatory investment.<sup>126</sup> RWE told us that:

118 Ofgem, [Network price controls 2021–2028 \(RIIO-2\)](#), (last accessed 12 May 2024)

119 Ofgem blogpost, “[Tougher price controls for energy networks](#)”, 7 March 2018 (last accessed 12 May 2024)

120 Ofgem, [Network price controls 2021–2028 \(RIIO-2\)](#) (last accessed 12 May 2024)

121 *Ibid.*

122 Enertechos ([ESE0023](#)), para 16

123 Hitachi Energy ([ESE0041](#)), para 33

124 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

125 Ofgem, [Monitoring the ‘Connect and Manage’ electricity grid access regime](#)”, Sixth Report from Ofgem, 14 December 2015

126 [Q10](#) [Nick Winser]

This transition requires a radically different approach to the planning, construction, and operation of the grid... The challenge for grid operators in this will be to ensure that grid investment is anticipated ahead of that need. To date, grid development has been largely reactive—now, we must shift to a highly proactive approach. This means moving from “as little network as possible, as late as possible” approach, to a more forward-looking, anticipatory approach where grid infrastructure is built ahead of need.<sup>127</sup>

### *Our view*

**87. Ofgem and the Energy System Operator have sought to improve grid connection timeframes through reforming grid queue procedures and introducing milestones. Early evidence suggests that the reforms introduced to date appear not to have yet had the immediate and radical effect on reducing grid connection times which they were designed to deliver: two months after the introduction of milestones, the queue had markedly lengthened, a development likely to have been due to a significant increase in applications.**

**88. Overall visibility of the grid connections queue is limited, and it is possible that the immediate effect of the reforms introduced has been to lengthen the connections queue as developers react to the new regime. While we welcome the Ofgem project milestone reforms which took effect in November 2023, the measures entailed in the Connections Action Plan may take longer to have a positive effect on the queue.**

**89. Delivery of renewable energy projects at pace, and securing their connection to the transmission network, is essential to achieving the generation capacity required under the Government’s strategy for energy security. The connection of generation capacity to the grid is being held up by delays to the ‘critical path’ of grid readiness. Delays in project connections are unlikely to improve the confidence of investors in electrification projects. While the connection reforms brought in by Ofgem and the commencement of implementation of the Connection Action Plan measures are welcome, further work is likely to be required to reduce the time taken to connect generation projects to the transmission grid.**

**90. Sustained and consistent action by Government and the regulator will be required to manage the grid connections queue down so that commissioned renewable generation projects are able to deliver outputs to the grid without unreasonable delays.**

***91. We recommend that the Department for Energy Security and Net Zero and Ofgem actively monitor the progress of connection reform initiatives and the delivery of the transmission capacity required to facilitate new grid connections, and, where appropriate, streamline the measures already introduced. In particular, we recommend that Ofgem review its milestone queue reforms with a view to advancing projects which are demonstrably ready to connect to the grid to the front of the queue.***

***92. We recommend that, in the interests of transparency, Ofgem monitor and publicly report on the status of the queue and its progress in managing it on a monthly basis.***

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127 RWE ([ESE0057](#)), paras 15 and 16

93. *The Government and Ofgem must implement in full the changes proposed in the Connections Action Plan. This must entail, for example, the prioritisation of short-term grid requirements, so as to incentivise network operators to prioritise renewable energy connections. The connection of grid inputs from solar and wind, generation, and outputs serving decarbonised applications such as heat pumps and electric vehicle charging, must be prioritised in parallel with connections for larger nuclear and carbon-emitting technologies.*

94. We recognise the rationale for the current restrictions on the commissioning and construction of connections to regional substations. The GB electricity network must be constructed to certain minimum standards which ensure coherence, reliability and interoperability, under arrangements which provide long-term certainty over responsibility for maintenance. Nevertheless, we consider that there is in principle scope to accelerate grid expansion by authorising experienced third parties to build connections which meet approved standards.

95. *We recommend that Ofgem work with the NESO, the Department for Energy Security and Net Zero and the Energy Networks Association to ensure that developers can call on the fullest possible range of providers when seeking to connect their generation facilities to the grid.*

96. The benefits from this approach will of course only be realised if those providers are able to draw on a sufficiently skilled workforce, a matter we discuss in greater detail below.

97. We consider that the current model of Ofgem electricity network regulation, based around lengthy multi-year business plans, risks not being responsive enough to an energy system which is in rapid flux. The present regulatory model locks in market controls over many years: in the current climate, this risks slowing down innovation and restricting network development.

98. *We recommend that the Government examine the operation of the current ED2 (distribution) and T2 (transmission) price control periods to establish whether the measures are driving the necessary connections and increases in capacity. If not, these price control periods should be re-opened or modified so as to incentivise immediate network reform. Future network regulatory reviews should be geared to respond as rapidly as possible to the potential for further innovations to decarbonise the economy.*

99. A general focus by Ofgem on ‘just in time’ network investment means that limited current network capacity can be a barrier to new connections. *We recommend that the Government and Ofgem work together to encourage anticipatory investment where it is apparent that new demands on the system are likely. This should be done through clear direction based on the Centralised Strategic Network Plan, as well as through targeted market incentives and reform of the network price control review process.*

## Supply chains for grid infrastructure

100. International events over which the UK has little or no direct control can have negative impacts on supply chains into UK markets. Recent examples include the blockage of the Suez Canal in March 2021, the effects on energy and food supplies and prices arising

from the Russian full-scale invasion of Ukraine in March 2022 and the diversion of international shipping away from the Red Sea since the autumn of 2023 occasioned by attacks by Yemen-based Houthi rebels on certain vessels.

101. Energy security is no longer solely about energy resources. Clean energy systems rely on supplies of critical materials such as copper, lithium, cobalt and nickel. These essential materials are primarily produced in a handful of countries. The UK's reliance on the supply chains originating in these countries is unavoidable: any disruption increases the potential impact on delivery times and costs.

102. As we discovered in the course of our short inquiry into the supply chain for battery electric vehicles in 2021, these minerals are scarce and international competition for them is fierce. One of the biggest risks is the concentration of material sourcing and component production in particular countries. For example, 60% of all rare earth elements are currently located in the territory of the People's Republic of China. The International Energy Agency reports that Chinese plants refine 60-70% of lithium and cobalt, and China has at least 60% of the world's manufacturing capacity for several mass-manufactured clean energy technologies including solar photovoltaic panels, wind power systems and batteries for energy storage.<sup>128</sup> Of the 18 recognised critical minerals, China is the primary producer of 12.<sup>129</sup> The Foreign Affairs Committee has recently highlighted areas where it considers the Government has fallen short when addressing the UK's need for critical minerals in its net zero transition.<sup>130</sup>

103. The IEA's projections, in the context of increased international demand for electrification, suggest that production of essential minerals could fall short of what is required to meet global demand in 2030: the Agency anticipates potential deficits of up to 35% for mined lithium and 60% for nickel sulphate production.<sup>131</sup> This pressure on the supply of essential materials is already increasing costs to UK businesses, as Tom Glover, UK Country Chair for RWE made clear:

What we found post Covid and in the current global environment is that almost every single economy in the world is doubling or tripling down on renewables, so the supply chain is extremely squeezed. We have seen for a variety of that supply chain constraint, plus inflation, our costs across almost all renewable technologies going up between 20% and 40%.<sup>132</sup>

Offshore Energies UK, the body representing North Sea oil and gas businesses, has reported that while it will be costly to establish the supply chains necessary for the energy transition, or to transfer them from supplying the oil and gas industry, they nevertheless offer significant opportunities for the UK to capitalise on private investment.<sup>133</sup>

104. Bringing manufacture of more elements in the clean electricity supply chain such as clean steel, turbines and substations, into the UK would not only boost the economy

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128 International Energy Agency, [Energy Technology Perspectives 2023](#), p. 83 ff

129 Foreign Affairs Committee, [A rock and a hard place: building critical mineral resilience](#), First Report of Session 2023–24, HC 371, December 2023. Details of our own work on the supply chain for battery electric vehicles are published on the Committee website at <https://committees.parliament.uk/work/1223/technological-innovations-and-climate-change-supply-chain-for-battery-electric-vehicles/publications/>.

130 *Ibid.*

131 International Energy Agency, [Energy Technology Perspectives 2023](#), p. 36 ff

132 [Q153](#)

133 Offshore Energies UK, [Business & Supply Chain Outlook 2024](#), March 2024



but also strengthen the resilience of supply chains and decrease the UK's reliance on importing components. To this end the Government has introduced the Green Industries Growth Accelerator, an initiative to which £960 million was committed in the 2023 Autumn Statement<sup>134</sup> as part of a wider £4.5 billion package of funding for manufacturing to support private sector investment in strategic sectors across the UK from 2025–26 for 5 years.<sup>135</sup>

**105. Energy infrastructure supply chains are often very fragile and are affected by fierce global competition. The shoring up of these supply chains serving the UK's electrification requirements will require urgent and significant anticipatory investment to ensure that the rollout of infrastructure can take place at reasonable value for money.**

*106. We recommend that, alongside managing investor confidence through market certainty, the Government work with businesses in the sector to create an electrification supply chain roadmap, setting out how the Government will seek to ensure that the energy sector supply chain is resilient in the short term and is insulated as far as possible against possible future price volatility on international markets. This electrification supply chain roadmap should be published within three months of the State Opening of the next Parliament.*

**107. Moving essential elements of the energy infrastructure supply chain into the UK is likely to strengthen the supply chain while creating jobs, improving the UK economy and protecting existing skills.**

*108. We recommend that the Government work with industry to provide incentives, including financial support, to ensure that essential elements of the electricity infrastructure supply chain are based in the UK, so as to counter competitive incentives from other countries racing to develop their domestic electricity grids. Government policy in this area should prioritise the maintenance and development of the clean UK steel industry as well as driving the UK technology sector.*

## Skills

109. In our inquiry into green jobs, on which we reported in October 2021, we highlighted concerns that skills shortages would affect delivery of the Government's long-term environmental goals.<sup>136</sup> These concerns remain valid in our current inquiry: we have heard that the UK workforce overall presently lacks sufficiency in the skills that are fundamental to delivery of the net zero energy system which the Government envisages. Evidence from a number of stakeholder organisations made clear that the industry currently faces skills shortages in occupations such as electrical engineers, infrastructure experts and planning specialists.<sup>137</sup> Projections of the workforce change required demonstrate the scale of the

134 HM Treasury, [Autumn Statement 2023](#), CP 977, November 2023

135 *Ibid.*

136 Environmental Audit Committee, [Green Jobs](#), Third Report of Session 2021–22, HC 75, October 2021

137 Dr Thomas Fender (Energy Systems Policy Research Fellow at University of Birmingham); Christopher Harrison (Energy Systems Policy Research Fellow at University of Birmingham); Laurie Duncan (PhD Researcher in Local Energy Policy at University of Birmingham); Dr Jonathan Radcliffe (Reader in Energy Systems, Policy and Innovation at University of Birmingham) ([ESE0033](#)), para 11; NextEnergy Capital ([ESE0036](#)), para 13; myenergi Ltd ([ESE0022](#)), para 14

shortfall. National Grid estimated that between 2020 and 2050 the UK would need to recruit 400,000 people into the occupations essential to delivering and sustaining the energy transition: 117,000 of these would need to be recruited before 2030.<sup>138</sup>

110. Recruitment on this scale requires significant investment in training and reskilling, together with direction from Government over the future requirements of the labour market. Dorset Council told us that long-term consistency in approaches to policy was as essential to successful private sector investment in supply chains as it was to local delivery of skills training programmes.<sup>139</sup> Joanna Campbell, Assistant Director at the National Infrastructure Commission, concurred with this view: “give long-term certainty about the policy, invest in it, and then the private sector will deliver the skills.”<sup>140</sup>

111. In May 2023 the Climate Change Committee produced an extensive overview of the evidence on the potential impacts of Net Zero for the workforce: this was intended to inform the production of the Net Zero and Nature Workforce Action Plan which Ministers were expected to issue early in 2024.<sup>141</sup> The Climate Change Committee called for a comprehensive assessment of when, where and in which sectors there will be skills gaps specific to net zero.<sup>142</sup> They further said that this assessment should consider particular barriers to labour markets entry into occupations needed for the transition.<sup>143</sup>

**112. The UK workforce is currently deficient in many of the skills relevant to several aspects of energy decarbonisation. At present the information available on the scale of the problem is insufficiently detailed to inform good policy making.**

*113. Ministers must communicate clearly to industry their expectations on the rollout of energy and electrification infrastructure to meet Government policy objectives in a timely fashion. In tandem with this, we recommend that the Government conduct a nationwide electrification skills needs assessment across all relevant sectors, so as to inform a comprehensive plan which ought to include robust policies for addressing skills gaps. The Government should also take an active role, through promotion and funding and deployment of development and training programmes, the promotion of electrical education colleges in each region and the delivery of clear career pathways for skilled roles.*

**114. Despite recognising the electrification skills shortage in the UK, the Government has delayed the publication of its green skills plan. We reinforce the recommendation from our 2021 report that the Government sets out how it will measure progress towards its green jobs target, including a definition of ‘green jobs’ and how it will measure the number, type and location of these over the 2020s, for the purpose of monitoring and evaluating the impact of its policies.**

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138 National Grid, [Building the Net Zero Energy Workforce](#), January 2020

139 Dorset Council ([E5E0032](#)), para 7

140 [Q41](#)

141 Climate Change Committee, [A Net Zero workforce](#), May 2023

142 *Ibid.*

143 *Ibid.*

## 3 Planning, community engagement and community benefit

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### Nationally Significant Infrastructure Projects

115. The Planning Act 2008 established a specific consent process for Nationally Significant Infrastructure Projects (NSIPs) in England and Wales.<sup>144</sup> This process was established to provide greater certainty for large-scale infrastructure projects by removing decision-making from local authorities and giving it to the Secretary of State.<sup>145</sup>

116. Under the NSIP regime, the Government, with parliamentary approval, sets out the needs case for specific types of national infrastructure development in National Policy Statements (NPS). The Planning Inspectorate examines applications for development consent in areas where a NPS is in force and recommends to the relevant Secretary of State whether to grant development consent orders (DCOs) in respect of them. The relevant Secretary of State makes the final decision on nationally significant infrastructure projects in line with the relevant NPS in force, where one exists. For electricity infrastructure projects, decisions currently fall to be taken by the Secretary of State for Energy Security and Net Zero.

117. Revisions to several National Policy Statements were proposed in 2023 and entered into force in January 2024.<sup>146</sup> The NPSs on renewable energy infrastructure and electricity networks infrastructure were both revised in this process, together with the overarching NPS for energy.<sup>147</sup> Nevertheless in a March 2024 report the Linear Infrastructure Planning Panel, an independent initiative seeking to develop good practice in the use of new technologies in the planning of major infrastructure, observed that further revisions to relevant National Policy Statements were still required to enable more coherent and adaptable planning processes and to address issues of fragmentation in the current system.<sup>148</sup>

118. A study by the National Infrastructure Commission published in April 2023<sup>149</sup> made a number of recommendations to speed up the planning regime for NSIPs to which Government has formally responded.<sup>150</sup> The recommendations included the better sharing of environmental data, a demonstration of clear benefits for communities and an improvement to arrangements for oversight from the centre.

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144 Planning Act 2008, [s. 33](#)

145 House of Commons Library briefing paper, [Planning for Nationally Significant Infrastructure Projects](#), CBP 6881, July 2017

146 Department for Energy Security & Net Zero, [National Policy Statements for energy infrastructure](#), 22 November 2023

147 *Ibid.*

148 Linear Infrastructure Planning Panel, [Delivering net zero, resilience and nature recovery](#), March 2024. More information on the Panel is available on the GOV.UK website at <https://www.gov.uk/ai-assurance-techniques/linear-infrastructure-planning-panel-a-collaborative-approach-to-ai-governance>

149 National Infrastructure Commission, [Delivering net zero, climate resilience and growth](#), April 2023

150 Department for Levelling Up, Housing & Communities, [Government response to the National Infrastructure Commission's report on Delivering net zero, climate resilience and growth: improving nationally significant infrastructure planning](#), 22 November 2023



## The National Planning Policy Framework

119. The National Planning Policy Framework (NPPF) sets out the Government’s planning policies for England and how these should be applied. The NPPF was revised in December 2023 in response to the Government’s consultation on reforms to national planning policy consultation arrangements: the revision accompanies the planning system reforms introduced by the Levelling-up and Regeneration Act 2023.<sup>151</sup>

120. The policies in the NPPF must be taken into account by local authorities in the preparation of local plans and neighbourhood plans and are a ‘material consideration’ in deciding planning applications. However, the NPPF does not dictate how local and neighbourhood plans should be written or planning outcomes: it is a framework for producing distinctive local and neighbourhood plans and development orders which meet local needs.<sup>152</sup>

121. Chapter 14 of the NPPF sets out policies for “meeting the challenge of climate change, flooding and coastal change”. The chapter is supported by planning practice guidance on renewable and low carbon energy.<sup>153</sup> The NPPF encourages local plans to “help increase the use and supply of renewable and low carbon energy and heat” but does not contain specific policies for electricity transmission or network infrastructure. The impact of these changes, if any, on deployment is not yet clear.

## Planning application issues

122. Planning consent is a significant barrier to the rollout of energy infrastructure, whether this is for energy transport or energy generation. In England, complicated planning systems, misalignment between planning policy and guidance, and bottlenecks in local authority capacity have limited the capability for Great Britain to sufficiently develop its energy system infrastructure.

123. Planning applications take a significant amount of time to move through the system and be accepted or rejected. The electricity provider EDF asserted that:

with respect to wind developments, it currently takes around 3-5 years to move through the consenting phase which covers the work needed to secure consent and manage the development process through to financial close. This is due to a combination of under-resourcing within planning authorities and environmental regulators, unclear guidance to those bodies, and a lack of streamlining within the process.<sup>154</sup>

124. Local authorities provide planning permission for a significant portion of the energy projects being proposed: but these organisations are under pressure and have increasingly stretched resources. This has slowed planning application decisions and has limited the ability of the sector to deploy the necessary energy assets. Between 2013 and 2020, 25% of local authority planners left their roles. The impact this is having on projects is

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151 Department for Levelling Up, Housing & Communities, [Government response to the Levelling-up and Regeneration Bill: reforms to national planning policy consultation](#), December 2023

152 Department for Levelling Up, Housing & Communities, [National Planning Policy Framework](#), December 2023

153 Department for Levelling Up, Housing & Communities, [Planning practice guidance on renewable and low carbon energy](#), June 2015

154 EDF ([ESE0031](#)), para 33

significant.<sup>155</sup> Octopus Energy told us that many local authorities were heavily resource-constrained and did not necessarily possess the tools or expertise effectively to translate national policy into local-level plans.<sup>156</sup> Rt Hon Graham Stuart MP, then Minister of State for Energy Security and Net Zero, recognised that not all local authorities had the capacity at present to handle planning applications for the development of energy assets:

Across the whole system, one of the issues has been about capacity and trying to understand, on the critical path, that every bit has to have that capability.<sup>157</sup>

125. Planning-related fees were introduced so that users of the planning system, rather than taxpayers in general, meet the costs incurred by local planning authorities in deciding planning applications. The overall planning service is funded from a local authority's core spending power, which includes Council Tax, retained business rates, and central government grants. The planning application service is also funded by fees for planning applications.<sup>158</sup> The planning fee is set by central Government and in December 2023 it was increased by 35% for major developments and 25% for all other applications.<sup>159</sup>

126. In September 2023 the Secretary of State for Levelling Up, Housing and Communities updated policy on planning for onshore wind development in England. While decisions on onshore wind developments were in theory made by local planning authorities in England (regardless of the size of the development), the rules governing these decisions were in effect extremely restrictive, requiring local authorities to have to proactively identify sites and allowing a single complaint to stop a development.<sup>160</sup> The revised policy appears to allow more flexibility in pursuing opportunities in onshore wind.<sup>161</sup>

127. The Energy Act 2023 contains provisions to implement the Offshore Wind Environmental Improvement Package announced in the British Energy Security Strategy, including power to make regulations to adapt environmental assessments for offshore wind.<sup>162</sup> Offshore wind projects that meet the necessary quality criteria will be able to benefit from the new fast-track consenting process.<sup>163</sup>

### *Our view*

**128. Local authorities generally do not have the resources or in-house knowledge to manage the effective determination of the significant number of planning applications required for the rapid growth of clean energy infrastructure.**

**129. *We urge the Government to ensure that the planning authorities have adequate resources to obtain and develop the skills and capacity necessary to prevent the planning system being a bottleneck to the rollout of energy infrastructure. The increase in planning***

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155 [Q201](#)

156 Octopus Energy ([ESE0051](#)), para 51

157 [Q288](#)

158 Department for Levelling Up, Housing and Communities, [Fees for planning applications](#) (last accessed 12 May 2024)

159 Department for Levelling Up, Housing and Communities, [Letter from the Chief Planner to Chief Planning Officers concerning National Planning Fee Increase](#), 14 November 2023

160 See, for example, TaylorWessing, [Renewed push for onshore wind power in the UK](#), 8 February 2024

161 Secretary of State for Levelling Up, Housing and Communities, [Planning Update](#), HCWS1005, 5 September 2023

162 Energy Act 2023, [ss. 290 to 294](#)

163 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

*fees is a justifiable measure to provide more adequate resources to planning authorities: but additional funding should be provided, and finances should be ring-fenced for local authorities.*

130. *We recommend that the Government develop a plan to ensure that planning authorities, are sufficiently well resourced, in terms of personnel and expertise, to support the timely determination of planning applications for energy infrastructure and facilities. Ministers should expedite the delivery of a training programme designed to provide the necessary skills which will support well-considered and timely consideration of planning applications for electricity infrastructure.*

131. **Despite recent reforms to the Nationally Significant Infrastructure Projects regime in respect of energy infrastructure and to the National Planning Policy Framework, we are not convinced that the current design of the planning system is adequate to balance local concerns and interests against the need for rapid rollout of electricity infrastructure.**

132. *The Government should further review the application of planning regulations to electricity infrastructure so as to bring the relevant provisions of the Nationally Significant Infrastructure Projects regime and the National Planning Policy Framework into full alignment. We recommend that the review address the impact of the planning consenting system on the timely deployment of renewable energy generation and energy infrastructure, including the particular conditions which currently apply to applications for onshore wind development. It should further support measures prioritising rooftop solar installations, and mandate the delivery of appropriate solar generation capacity in all suitable new-build properties, both domestic and commercial, subject to suitable connections being available.*

## Community engagement

133. Active engagement of local communities and of broader stakeholder communities is a fundamental aspect of any planning system which depends on democratic consent. It is no less necessary where the deployment of energy infrastructure is concerned: even though there is broad political agreement nationally on the measures required for the successful transition of the economy to net zero, the consent of those directly affected by infrastructure development cannot be taken for granted.

134. Local communities are vital stakeholders in democratic planning processes: engaging local citizens so as to understand attitudes and preferences can help to ensure that development proposals are acceptable.<sup>164</sup> The public consenting process for new infrastructure projects is a way of exercising democratic accountability. Ensuring that it works fairly and effectively is an essential element of procedural justice. Nevertheless, the Linear Infrastructure Planning Panel has observed that many communities consider that change is currently being done to them rather than with them, often by seemingly remote providers.<sup>165</sup>

135. In his report on accelerating electricity transmission network deployment, the Energy Networks Commissioner, Nick Winser, observed:

164 Energy Systems Catapult ([ESE0012](#)), para 58

165 Linear Infrastructure Planning Panel, [Delivering net zero, resilience and nature recovery](#), March 2024.

The needs and preferences of citizens are not considered in a timely and effective way. People and the communities in which they live and work will be impacted by transmission infrastructure build. These impacts may be seen as negative (e.g., loss of visual amenity) or positive (e.g., economic opportunities) but in either case, there is a need for constructive engagement to ensure that citizens have the benefit of clear information to enable proper individual and collective assessment.<sup>166</sup>

In his report Nick Winser outlined practical methods, such as route design standardisation, for improving engagement with communities and providing clarity to Ofgem, transmission operators and communities. He envisaged communities being offered choices around the infrastructure they host where possible within these design principles: the principles can provide the clarity on the weighting that should be given to community feedback and concerns.<sup>167</sup> The Linear Infrastructure Planning Panel has also indicated a number of possible approaches to improving community engagement, including the development of community and stakeholder-facing tools that can give people greater agency in feeding into planning decisions.<sup>168</sup>

136. Dan Stone, Senior Planner at the Centre for Sustainable Energy, highlighted to us the benefits of involving local people much earlier in the process of planning and talking to them about their landscape: these forms of engagement are beneficial in developing opinions and securing backing for projects.<sup>169</sup> Barbara Hammond MBE, CEO and Executive Director of the Low Carbon Hub IPS, reinforced the importance of early community engagement:

We need the ability—or the invitation—to get in and work with developers very early on so that they understand the benefit to them and that it will not actually cost them. It is much harder to retrofit a solution when a project has been scoped and the financial structuring has been done than if you do it very early on.<sup>170</sup>

**137. Early, well-run community engagement is an essential aspect of successful rollout of energy infrastructure. Communities who are engaged and invested, and who can have input into their local infrastructure, are more likely to accept a greater level of infrastructure and support the energy transition more broadly.**

**138. We recommend that the Government develop a major public engagement strategy to communicate the need for further electrification of the economy, its likely benefits and the infrastructure development it will entail.**

**139. The Government must also require meaningful developer-led community engagement at the outset of major electricity infrastructure projects. We recommend that Ministers also develop guidance for operators and local authorities on best practice in community engagement.**

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166 Energy Systems Catapult, [Electricity Networks Commissioner: companion report findings and recommendations](#), June 2023

167 *Ibid.*

168 Linear Infrastructure Planning Panel, [Delivering net zero, resilience and nature recovery](#), March 2024

169 [Q179](#)

170 [Q195](#)

## Community benefit

140. Alongside community engagement, community benefits can be a powerful mechanism for accelerating the deployment of infrastructure. In its infrastructure planning study issued in April 2023 the National Infrastructure Commission recommended that by the end of 2023 the Government should develop a framework of direct benefits for local communities hosting nationally significant infrastructure which delivers few local benefits. The Commission recommended that the provision of community benefit should be compulsory.<sup>171</sup>

141. Similarly, the Electricity Networks Commissioner has recommended that “guidance on community benefits which are the subject of a current consultation should be delivered and adopted quickly” by the Government and Ofgem: “This guidance should clearly set out what Transmission Owners are able to offer as community benefits and what can be recovered through the regulatory process.”<sup>172</sup> The report recommended that such benefits should have two components: a lump sum payment for individual households close to new lines and a community fund to be distributed in their locality.<sup>173</sup>

142. In November 2023, the Government published the response to its May 2023 consultation on community benefits for electricity transmission infrastructure. Its proposals, to be developed further through collaboration with Ofgem, industry and community representatives, include the following:

- Mandatory community benefits for electricity transmission infrastructure, to ensure that communities benefit from hosting network infrastructure in a way that is consistent and fair.
- Electricity bill discount for properties located closest to transmission network infrastructure, of up to £10,000 per property (£1,000 per year, ~£80 per month, over 10 years).
- Wider benefits for the local community of around £200,000/km (~£320,000/mile) for overhead lines, £40,000/km (~£60,000/mile) for underground cables, and £200,000 per substation.<sup>174</sup>

The Government has consulted on similar proposals for local electricity bill discounts to be offered as community benefits for onshore wind developments.<sup>175</sup>

143. There is evidence to suggest that the provision of benefits to the community as well as to individual households can play a positive role in community acceptance of essential infrastructure development. Dr Rebecca Windemer, the planning and communities lead at Regen, told us that:

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171 National Infrastructure Commission, [Delivering net zero, climate resilience and growth](#), April 2023

172 Energy Systems Catapult, [Electricity Networks Commissioner: companion report findings and recommendations](#), June 2023

173 *Ibid.*

174 Department for Energy Security and Net Zero, [Community Benefits for Electricity Transmission Network Infrastructure: government response](#), May 2023

175 Department for Energy Security and Net Zero, [Developing local partnerships for onshore wind in England: government response](#), February 2024

Where there has been a fund that has responded to local needs and people have been able to shape the use of that benefit fund, it has had a genuine impact, has created a long-lasting impact and has created an impact that is benefiting the wider community.<sup>176</sup>

### *Our view*

144. **Engaging early and fully with local communities to explain why renewable energy infrastructure through their area is necessary and of benefit to them is essential to ensure positive public participation and acceptance. Badly-designed community benefits, or those forced upon communities without adequate consultation, can create tension and objection to new infrastructure while adding costs to consumer bills nationwide. Approaches to engagement and consultation which are poorly thought out or ineptly executed will not help to speed up infrastructure development and will be likely to cause more resistance to its deployment overall.**

145. *We recommend that the Government expedite the implementation of its current proposals for community benefits to be considered as part of community engagement in the delivery of certain transmission projects. A toolkit of illustrative community benefits and potential levels of support should be developed in order to inform communities what options are available to them as well as providing incentives to developers to mitigate visual or community impacts as far as possible. Progress in implementing community benefit measures should be monitored following deployment, and the effectiveness of the overall approach should be reviewed at least every three years.*

146. **Community benefits are only likely to become payable after the commissioning into service of infrastructure: so all the uncertainty of the planning process and disruption during construction will be felt before any benefits accrue.**

147. *We recommend that Ministers assess the merits of providing that a proportion of community benefit be delivered earlier in the process, for instance from the date of grant of planning consent.*



## 4 Governance, policy and regulatory reform to support the future grid

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### Electricity system governance

148. The transformation of the energy system entailed in the wholesale electrification of the economy will have far-reaching implications for the way that the GB electricity grid, and the supply into and outputs from it, are managed. Significant changes to the governance of this system were introduced in the Energy Act 2023 and are beginning to take effect. We have examined the features of the emerging system of electricity system governance and have examined what the implications are for effective and democratic management of a vital national resource.

#### *The role of the Government*

149. The Government is responsible for setting the policy and strategy for the energy sector and proposing any changes to the statutory framework which establishes organisations such as Ofgem and the National Energy System Operator. It is also responsible for shaping markets to drive investment in important areas such as renewable energy generation by providing funding frameworks such as Contracts for Difference.

#### *The role of Ofgem*

150. Ofgem, a non-ministerial Government department, is Great Britain's independent energy regulator, tasked with ensuring consumers are treated fairly by energy market players. Ofgem is responsible for regulating monopoly networks and system operators, enabling competition and innovation, stopping bad practice in the industry and, as of recently, delivering a net zero energy system at the lowest cost to consumers.<sup>177</sup>

#### *The role of the ESO and NESO*

151. The Electricity System Operator (ESO) is responsible for moving electricity around Great Britain and ensuring that the supply always meets demand, keeping the system in balance. ESO does not own network infrastructure assets: though it was formerly part of the National Grid, which does own infrastructure.

152. In April 2019 ESO was established as a legally separate entity within National Grid plc, a move undertaken to provide more transparency and independence. The ESO was identified as the best organisation to provide whole system planning for Great Britain: it was considered inappropriate for it to reside within the National Grid corporate structure.

153. In April 2022, the Government announced its decision to bring the ESO into public ownership<sup>178</sup> and in March 2024 the ESO announced that it would transition to become the National Energy System Operator (NESO), a public corporation that will be

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177 Ofgem, [Our role and responsibilities](#) (last accessed 12 May 2024)

178 Department for Business, Energy and Industrial Strategy news story, "[Government future proofs Britain's energy system with launch of new body to boost energy resilience](#)", 6 April 2022

independent from other commercial energy interests as well as from operational control of government.<sup>179</sup> The NESO is expected to be fully independent and publicly owned by the summer of 2024.<sup>180</sup>

154. The NESO will be responsible for system planning, taking responsibility across electricity, gas and hydrogen and ensuring that there is investment ahead of need.<sup>181</sup> As provided for in the Energy Act 2023, NESO will be required to carry out its functions in the way that it considers is best calculated to promote the objective of ensuring security of gas and electricity supply, meeting the Government’s statutory decarbonisation targets and promoting coordinated, efficient and economical systems for the conveyance of electricity and gas.<sup>182</sup>

### **Sub-national energy planning and system governance**

155. A number of local authorities are actively engaged in local energy planning. Local Area Energy Plans (LAEP) translate national net zero targets into local energy system action. Preparation of these plans is led by local authorities and they are developed collaboratively with stakeholders.<sup>183</sup> The Energy Systems Catapult describes the outcome of these processes as “a fully costed, spatial plan that identifies the change needed to the local energy system and built environment, detailing ‘what, where and when and by whom’”.<sup>184</sup>

156. LAEPs set out the total costs, changes in energy use and emissions, and sets these out over incremental time periods to meet the 2030 target of a 68% reduction in emissions, and the 2035 target of a 78% reduction in emissions, and net zero by 2050.<sup>185</sup> The NESO is developing a new Regional Energy System Planning (RESP) function to advise on more local network developments.<sup>186</sup> The exact nature of this planning function and its interaction with other elements of the energy planning system, including LAEPs, is currently unclear.

### **Implementing the new governance arrangements**

157. The governance relationship between the Government, Ofgem and the NESO is complex. Ofgem’s functions are set out in legislation, as are some of the functions of the NESO: the Department for Energy Security and Net Zero is the Government department responsible for implementing these legislative provisions. Ofgem will be responsible for regulating the income of the NESO and setting performance requirements.<sup>187</sup> The NESO will have the task of advising government and Ofgem on investment.<sup>188</sup> The Government

179 Department for Energy Security & Net Zero, [Draft strategy and policy statement for energy policy in Great Britain](#), 21 February 2024

180 Electricity System Operator news story, “[ESO announces the name of the forthcoming Future System Operator](#)”, 22 January 2024, accessed April 2024

181 Department for Energy Security & Net Zero, [Draft strategy and policy statement for energy policy in Great Britain](#), 21 February 2024

182 Energy Act 2023, [ss. 163 to 165](#)

183 Energy Systems Catapult briefing, [Local Area Energy Planning](#) (last accessed 12 May 2024)

184 *Ibid.*

185 *Ibid.*

186 Ofgem, [Decision on the framework for the Future System Operator’s Centralised Strategic Network Plan](#), 13 December 2023

187 Department for Energy Security & Net Zero, [Statutory consultation on National Energy System Operator licences and other impacted licences](#), March 2024

188 *Ibid.*



owns the NESO, and the Secretary of State for Energy Security and Net Zero appoints its Chair. In recognition of the desirability of Parliamentary involvement in major public appointments, the Secretary of State invited the Energy Security and Net Zero Committee to undertake a pre-appointment hearing with the Government's preferred candidate to be the first Chair of NESO, Dr Paul Golby: that Committee held its hearing on 24 April 2024 and subsequently issued a report on the candidate's suitability for appointment.<sup>189</sup>

### *Our view*

158. We support the principle of an independent planning function established to support the development and operation of the UK energy system as it decarbonises. Nevertheless the current model, which is still effectively under development, is novel and complex. NESO will be the UK's gas and electricity system operator and an independent advisor on energy to the government—in effect, an energy agency. There are likely to be benefits to this approach, which has not previously been tested in the UK context, but the development of the relationships in the new system will need careful monitoring.

159. The interaction between the national system planning function in NESO and local electricity planning arrangements needs clarification as it is yet to be fully established.

**160. The electrification of the economy will lead to a more distributed energy system and will require local government engagement. While some efforts are underway to understand the potential for governance reform between national policy making and local policy making, the optimal governance structure involving national government, regulator, FSO and local authorities is currently unclear.**

**161. The National Energy System Operator (NESO), an organisation currently under development, is consolidating a number of existing functions while also taking on a number of new responsibilities, such as giving advice to the Government and working with local authorities through a new regional energy system planning process. The NESO will be a powerful and influential body: it will be expected to carry out many tasks that in other national energy systems would fall to an energy agency or other independent technical body.**

***162. We recommend that Ministers establish appropriate arrangements for review of the role and performance of the NESO against the benefits it is expected to deliver to the GB energy system, including good value for money and high performance. It is essential that, from the outset, this significant new body has robust corporate governance arrangements, including a functioning and independent board.***

***163. The incipient role of the NESO in local energy planning ought to be subject to periodic review to ensure that its engagement is appropriate. We recommend that the NESO seek regular independent appraisal of its role in regional energy system planning to ensure that it is adding value to regional network development.***

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<sup>189</sup> Energy Security and Net Zero Committee, [Pre-appointment hearing for the Chair of the National Energy Systems Operator](#) First Report of Session 2023–24, HC 573, 26 April 2024

### Ensuring energy security and system resilience

164. The Russian invasion of Ukraine in March 2022 sent shockwaves through the UK energy market and concentrated political attention on national energy security. In its Powering Up Britain energy security plan issued in March 2023 the Government asserted that that “energy security necessarily entails the smooth transition to abundant, low-carbon energy” and “if we do not decarbonise, we will be less energy secure.”<sup>190</sup> The National Infrastructure Commission has concurred with this view, indicating that a transition to low-carbon energy sources will not only improve energy security, but will also provide cheaper, less volatile energy in the long term.<sup>191</sup>

165. The NESO is to be responsible for “cross-vector energy resilience”, readiness and assessing security of supply—in effect taking a system-wide approach to energy security and resilience issues. It expects to undertake modelling to assess risks and potential mitigations: by the 2030s it expects to produce seasonal outlook reports and assessments of resource adequacy.<sup>192</sup>

166. The Energy Act 2023 places a statutory net zero duty on Ofgem, in practice restating Ofgem’s principal objective to protect the interests of existing and future energy consumers and adding a specific mandate to achieve this objective by supporting the Government to meet its statutory obligation to get to net zero by 2050.<sup>193</sup>

167. The Secretary of State for Energy Security and Net Zero is ultimately responsible for ensuring energy security in the UK. It is not year clear how this responsibility is to be discharged on a practical day-to-day basis in a distributed energy system reliant on several short-term and long-term forms of energy storage. The Government has set a target to decarbonise the power system by 2035, subject to security of supply. In April 2023, the Business, Energy and Industrial Strategy Committee called on the Government to define the ‘subject to security of supply’ condition in its 2035 target.<sup>194</sup> The Government response to the Committee’s report was silent on this point: the proviso to the Government’s decarbonisation target therefore remains unclear.<sup>195</sup>

168. The Government has confirmed that the NESO will undertake security and resilience functions from its first day of operation. In addition to the production of annual reports on system security and resilience, these functions are to include carrying out season-ahead assessments of system readiness and advising the Department and industry on the state of emergency processes.<sup>196</sup>

169. In its December 2023 report on *Government resilience: extreme weather* the National Audit Office found that while the resilience of the GB power grid had held up thus far, there were risks on the horizon.<sup>197</sup> Ofgem does not have a statutory remit to require climate

190 Department for Energy Security & Net Zero, [Powering Up Britain—Energy Security Plan](#), March 2023

191 National Infrastructure Commission, [The Second National Infrastructure Assessment](#), October 2023

192 Energy System Operator, [Introduction to Resilience and Security Roles](#), February 2024

193 Ofgem news story, [Ofgem welcomes Energy Act getting Royal Assent](#), 26 October 2023

194 Business, Energy and Industrial Strategy Committee, [Decarbonisation of the power sector](#), Eleventh Report of Session 2022–23, HC 283, 28 April 2023

195 Business and Trade Committee, [Decarbonisation of the power sector: Government response to the BEIS Committee’s Eleventh Report of Session 2022–23](#), Eleventh Special Report of Session 2022–23, HC 1698, 14 July 2023

196 Department for Energy Security & Net Zero, [Statutory consultation on National Energy System Operator licences and other impacted licences](#), March 2024

197 National Audit Office, [Government resilience: extreme weather](#), HC 314, 6 December 2023

resilience in the electricity network; and while the energy sector has set standards on recovering power after extreme weather, resilience against floods and incident recovery, most of these standards do not set a measurable level for resilience against climate change. The Government has committed to establish new standards for resilience by 2030. Regulation and standards are important tools to support the development of resilience to extreme weather events, but the Government's use of these tools is currently limited.<sup>198</sup>

170. The main issues identified by the NAO were that, in common with other critical national infrastructure assets, including the strategic road and rail networks and data centres, the GB power grid has not been designed to withstand extreme weather events, particularly high temperatures and heatwaves; and that emergency response arrangements to extreme weather events in communities tend to focus on the risk of flooding, often not extending to other climate hazards.<sup>199</sup>

### *Our view*

**171. Energy security is vital to the UK's national interest: responsibility within Government for promoting and ensuring energy security ought to be crystal clear. In a rapidly changing governance structure which includes new responsibilities for Ofgem and the new NESO body, it is unclear to us who holds ultimate responsibility for ensuring energy security and resilience while also driving forward progress on decarbonisation.**

*172. We recommend that Government and Ofgem should maintain clear indicators of progress on decarbonisation and energy security to allow simple public progress tracking of the proportion of renewable electricity on the system compared to expected needs, the security of supply and the progress on connections.*

173. While there are a number of different models for the necessary energy storage capacity, as previously set out, it is as yet unclear what level of energy storage at any given point is expected and who will decide on a day-to-day basis whether excess energy generation should move into short-term or long-term energy storage.

**174. Renewable energy generation paired with sufficient energy storage will allow the UK to become more self-reliant, secure national energy supplies and provide a buffer against energy price hikes. This is a future that the UK should embrace, and that the Government must support actively.**

*175. We recommend that the Government take steps to ensure that decarbonisation, alongside energy security, is at the forefront of all energy discussions. Decarbonisation of the energy system must be established as strategic Government priority, informing clear and unambiguous direction to the industry. The British Energy Security Strategy should be revisited to provide this direction as well as reinforce the intertwined nature of decarbonisation and energy security.*

**176. We support recommendation 2 of the April 2023 report of the Business, Energy and Industrial Strategy Committee, on Decarbonising the power sector, proposing that the**

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<sup>198</sup> *Ibid.*

<sup>199</sup> *Ibid.*

*Government define the proviso 'subject to security of supply' condition in its 2035 target. Since this term is yet to be defined, we recommend that the Government provide a clear definition in its response to this report.*

# Conclusions and recommendations

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## Energy generation, storage and flexibility

1. The Government has set stretching overall ambitions for the generating capacity required to supply the GB electricity grid with decarbonised energy by 2035. To meet these, current capacity will have to increase by 250% in a little over a decade. Planning for this wholesale electrification of the economy ought to be well under way to ensure that the 2035 deadline is met. (Paragraph 19)
2. While we welcome the commissioning of a Centralised Strategic Network Plan and a Strategic Spatial Energy Plan, the relationship between the two is unclear: unless they are developed in tandem, in an environment where the relationship between the two is actively nurtured, there is an evident risk that the two plans will deliver suboptimal outcomes. We are struck by the current lack of evidence of a unified overall approach to delivery planning for the energy system in a way which explicitly facilitates the joint development of interim net zero energy targets, network system planning and requirements for public and private investment in setting out a path to 2035. (Paragraph 20)
3. *We recommend that the Government, together with Ofgem and the National Energy System Operator, establish a multidisciplinary planning cell tasked with the development of a detailed pathway to the decarbonised grid. This unit ought to be commissioned to produce a delivery plan that sets out the necessary investment and rollout of electricity infrastructure required to deliver the Government's current ambitions for low carbon electricity generation. The cell should be established as soon as possible, with a view to producing initial pathways and plans by the end of 2024 at the latest.* (Paragraph 21)
4. Currently the UK relies on mostly imported gas for electricity system balancing needs. Low carbon long-term energy storage has the potential to reduce the UK's carbon impact whilst maintaining or improving its levels of energy security. (Paragraph 43)
5. While short-term energy storage has some market drivers, the development of long-term, inter-seasonal storage at the scale expected to be required faces market, policy and regulatory barriers. The UK economy will require a significant level of low carbon energy storage of this type in order to achieve the Government's net zero energy goals while maintaining energy security and avoiding energy shortfalls. (Paragraph 44)
6. The form that this energy storage should take has not been made clear by the Government. It is by no means clear to us that Ministers have grasped the scale of the storage facilities likely to be required, nor the Government action likely to be necessary either in providing long-term storage or establishing the conditions for it to be developed. The sector therefore lacks strategic direction, inhibiting private investment and delaying the future rollout of grid-scale energy storage. (Paragraph 45)

7. *The Government must address as a matter of urgency the barriers to long term energy storage for the UK to ensure it can provide its citizens with clean and reliable energy during periods of limited renewable generation. This can be delivered through direct Government intervention and investment in infrastructure, as well as through regulatory and policy reforms, such as cap and floor mechanisms or a reformed capacity mechanism, that signal to the market the value of long-term energy storage. (Paragraph 46)*
8. *By the end of 2025 at the latest, the Government must publish an energy storage strategy, underpinned by robust analysis, that indicates to the market the capacity and type of both short-term and long-term energy storage which will be required in a net zero energy system, and the measures that Ministers plan to take to ensure that sufficient capacity is in place to meet the system's needs in 2035 and in 2050. (Paragraph 47)*
9. The benefits to the energy sector of developing grid flexibility are substantial. These benefits are underpinned and sustained by increased usage of decarbonised consumer technologies such as smart meters, heat pumps and electric vehicles in ways which make best use of the energy supply. (Paragraph 63)
10. We are nevertheless concerned that recent Government adjustments to the incentives for take-up of these technologies by consumers may affect the capacity of the grid to deliver the benefits of flexibility in the short- to-medium-term: this in turn may affect the willingness of investors to commit to leading and supporting grid development initiatives. It is desirable that, as far as possible, Ministers should publish the rationale behind all decisions on changes to energy transition policies, including the underlying analysis: communication of such decisions should be informed by an assessment of their likely impact on achieving relevant net zero targets. (Paragraph 64)
11. The flexibility in the GB energy system provided by the development of demand-side response and energy storage capacity can provide significant cost savings to consumers. But the current slow rate of rollout and take-up of flexible technologies which can benefit from demand-side response is delaying the realisation of these benefits. The Government's 2035 targets of 600,000 heat pump installations a year and 100% of new cars being zero emission both face real challenges. (Paragraph 65)
12. *We recommend that the Government support an accelerated rollout of flexible energy technologies to homes and businesses, at a minimum through the enhanced policy support envisaged under the Clean Heat Market Mechanism, by the end of 2025 at the latest. This rollout must be accompanied by clear and effective communication about the financial benefits that these technologies can provide to electricity consumers. (Paragraph 66)*
13. *We further recommend that Ofgem expedite its programme to deliver market-wide half-hourly settlement. We expect Ofgem to provide a progress report in response to this recommendation, setting out current barriers to delivery of this objective, identifying measures to overcome them, and indicating a target date for final delivery. (Paragraph 67)*



## Developing an electricity grid ready for net zero

14. Ofgem and the Energy System Operator have sought to improve grid connection timeframes through reforming grid queue procedures and introducing milestones. Early evidence suggests that the reforms introduced to date appear not to have yet had the immediate and radical effect on reducing grid connection times which they were designed to deliver: two months after the introduction of milestones, the queue had markedly lengthened, a development likely to have been due to a significant increase in applications. (Paragraph 87)
15. Overall visibility of the grid connections queue is limited, and it is possible that the immediate effect of the reforms introduced has been to lengthen the connections queue as developers react to the new regime. While we welcome the Ofgem project milestone reforms which took effect in November 2023, the measures entailed in the Connections Action Plan may take longer to have a positive effect on the queue. (Paragraph 88)
16. Delivery of renewable energy projects at pace, and securing their connection to the transmission network, is essential to achieving the generation capacity required under the Government's strategy for energy security. The connection of generation capacity to the grid is being held up by delays to the 'critical path' of grid readiness. Delays in project connections are unlikely to improve the confidence of investors in electrification projects. While the connection reforms brought in by Ofgem and the commencement of implementation of the Connection Action Plan measures are welcome, further work is likely to be required to reduce the time taken to connect generation projects to the transmission grid. (Paragraph 89)
17. Sustained and consistent action by Government and the regulator will be required to manage the grid connections queue down so that commissioned renewable generation projects are able to deliver outputs to the grid without unreasonable delays. (Paragraph 90)
18. *We recommend that the Department for Energy Security and Net Zero and Ofgem actively monitor the progress of connection reform initiatives and the delivery of the transmission capacity required to facilitate new grid connections, and, where appropriate, streamline the measures already introduced. In particular, we recommend that Ofgem review its milestone queue reforms with a view to advancing projects which are demonstrably ready to connect to the grid to the front of the queue.* (Paragraph 91)
19. *We recommend that, in the interests of transparency, Ofgem monitor and publicly report on the status of the queue and its progress in managing it on a monthly basis.* (Paragraph 92)
20. *The Government and Ofgem must implement in full the changes proposed in the Connections Action Plan. This must entail, for example, the prioritisation of short-term grid requirements, so as to incentivise network operators to prioritise renewable energy connections. The connection of grid inputs from solar and wind, generation, and outputs serving decarbonised applications such as heat pumps and electric vehicle charging, must be prioritised in parallel with connections for larger nuclear and carbon-emitting technologies.* (Paragraph 93)

21. We recognise the rationale for the current restrictions on the commissioning and construction of connections to regional substations. The GB electricity network must be constructed to certain minimum standards which ensure coherence, reliability and interoperability, under arrangements which provide long-term certainty over responsibility for maintenance. Nevertheless, we consider that there is in principle scope to accelerate grid expansion by authorising experienced third parties to build connections which meet approved standards. (Paragraph 94)
22. *We recommend that Ofgem work with the NESO, the Department for Energy Security and Net Zero and the Energy Networks Association to ensure that developers can call on the fullest possible range of providers when seeking to connect their generation facilities to the grid.* (Paragraph 95)
23. We consider that the current model of Ofgem electricity network regulation, based around lengthy multi-year business plans, risks not being responsive enough to an energy system which is in rapid flux. The present regulatory model locks in market controls over many years: in the current climate, this risks slowing down innovation and restricting network development. (Paragraph 97)
24. *We recommend that the Government examine the operation of the current ED2 (distribution) and T2 (transmission) price control periods to establish whether the measures are driving the necessary connections and increases in capacity. If not, these price control periods should be re-opened or modified so as to incentivise immediate network reform. Future network regulatory reviews should be geared to respond as rapidly as possible to the potential for further innovations to decarbonise the economy.* (Paragraph 98)
25. A general focus by Ofgem on ‘just in time’ network investment means that limited current network capacity can be a barrier to new connections. *We recommend that the Government and Ofgem work together to encourage anticipatory investment where it is apparent that new demands on the system are likely. This should be done through clear direction based on the Centralised Strategic Network Plan, as well as through targeted market incentives and reform of the network price control review process.* (Paragraph 99)
26. Energy infrastructure supply chains are often very fragile and are affected by fierce global competition. The shoring up of these supply chains serving the UK’s electrification requirements will require urgent and significant anticipatory investment to ensure that the rollout of infrastructure can take place at reasonable value for money. (Paragraph 105)
27. *We recommend that, alongside managing investor confidence through market certainty, the Government work with businesses in the sector to create an electrification supply chain roadmap, setting out how the Government will seek to ensure that the energy sector supply chain is resilient in the short term and is insulated as far as possible against possible future price volatility on international markets. This electrification supply chain roadmap should be published within three months of the State Opening of the next Parliament.* (Paragraph 106)

28. Moving essential elements of the energy infrastructure supply chain into the UK is likely to strengthen the supply chain while creating jobs, improving the UK economy and protecting existing skills. (Paragraph 107)
29. *We recommend that the Government work with industry to provide incentives, including financial support, to ensure that essential elements of the electricity infrastructure supply chain are based in the UK, so as to counter competitive incentives from other countries racing to develop their domestic electricity grids. Government policy in this area should prioritise the maintenance and development of the clean UK steel industry as well as driving the UK technology sector.* (Paragraph 108)
30. The UK workforce is currently deficient in many of the skills relevant to several aspects of energy decarbonisation. At present the information available on the scale of the problem is insufficiently detailed to inform good policy making. (Paragraph 112)
31. *Ministers must communicate clearly to industry their expectations on the rollout of energy and electrification infrastructure to meet Government policy objectives in a timely fashion. In tandem with this, we recommend that the Government conduct a nationwide electrification skills needs assessment across all relevant sectors, so as to inform a comprehensive plan which ought to include robust policies for addressing skills gaps. The Government should also take an active role, through promotion and funding and deployment of development and training programmes, the promotion of electrical education colleges in each region and the delivery of clear career pathways for skilled roles.* (Paragraph 113)
32. Despite recognising the electrification skills shortage in the UK, the Government has delayed the publication of its green skills plan. *We reinforce the recommendation from our 2021 report that the Government sets out how it will measure progress towards its green jobs target, including a definition of 'green jobs' and how it will measure the number, type and location of these over the 2020s, for the purpose of monitoring and evaluating the impact of its policies.* (Paragraph 114)

### Planning, community engagement and community benefit

33. Local authorities generally do not have the resources or in-house knowledge to manage the effective determination of the significant number of planning applications required for the rapid growth of clean energy infrastructure. (Paragraph 128)
34. *We urge the Government to ensure that the planning authorities have adequate resources to obtain and develop the skills and capacity necessary to prevent the planning system being a bottleneck to the rollout of energy infrastructure. The increase in planning fees is a justifiable measure to provide more adequate resources to planning authorities: but additional funding should be provided, and finances should be ring-fenced for local authorities.* (Paragraph 129)
35. *We recommend that the Government develop a plan to ensure that planning authorities, are sufficiently well resourced, in terms of personnel and expertise, to support the timely determination of planning applications for energy infrastructure and facilities.*

*Ministers should expedite the delivery of a training programme designed to provide the necessary skills which will support well-considered and timely consideration of planning applications for electricity infrastructure. (Paragraph 130)*

36. Despite recent reforms to the Nationally Significant Infrastructure Projects regime in respect of energy infrastructure and to the National Planning Policy Framework, we are not convinced that the current design of the planning system is adequate to balance local concerns and interests against the need for rapid rollout of electricity infrastructure. (Paragraph 131)
37. *The Government should further review the application of planning regulations to electricity infrastructure so as to bring the relevant provisions of the Nationally Significant Infrastructure Projects regime and the National Planning Policy Framework into full alignment. We recommend that the review address the impact of the planning consenting system on the timely deployment of renewable energy generation and energy infrastructure, including the particular conditions which currently apply to applications for onshore wind development. It should further support measures prioritising rooftop solar installations, and mandate the delivery of appropriate solar generation capacity in all suitable new-build properties, both domestic and commercial, subject to suitable connections being available. (Paragraph 132)*
38. Early, well-run community engagement is an essential aspect of successful rollout of energy infrastructure. Communities who are engaged and invested, and who can have input into their local infrastructure, are more likely to accept a greater level of infrastructure and support the energy transition more broadly. (Paragraph 137)
39. *We recommend that the Government develop a major public engagement strategy to communicate the need for further electrification of the economy, its likely benefits and the infrastructure development it will entail. (Paragraph 138)*
40. *The Government must also require meaningful developer-led community engagement at the outset of major electricity infrastructure projects. We recommend that Ministers also develop guidance for operators and local authorities on best practice in community engagement. (Paragraph 139)*
41. Engaging early and fully with local communities to explain why renewable energy infrastructure through their area is necessary and of benefit to them is essential to ensure positive public participation and acceptance. Badly-designed community benefits, or those forced upon communities without adequate consultation, can create tension and objection to new infrastructure while adding costs to consumer bills nationwide. Approaches to engagement and consultation which are poorly thought out or ineptly executed will not help to speed up infrastructure development and will be likely to cause more resistance to its deployment overall. (Paragraph 144)
42. *We recommend that the Government expedite the implementation of its current proposals for community benefits to be considered as part of community engagement in the delivery of certain transmission projects. A toolkit of illustrative community benefits and potential levels of support should be developed in order to inform communities what options are available to them as well as providing incentives to developers to mitigate visual or community impacts as far as possible. Progress in implementing*

*community benefit measures should be monitored following deployment, and the effectiveness of the overall approach should be reviewed at least every three years. (Paragraph 145)*

43. Community benefits are only likely to become payable after the commissioning into service of infrastructure: so all the uncertainty of the planning process and disruption during construction will be felt before any benefits accrue. (Paragraph 146)
44. *We recommend that Ministers assess the merits of providing that a proportion of community benefit be delivered earlier in the process, for instance from the date of grant of planning consent. (Paragraph 147)*

### Governance, policy and regulatory reform to support the future grid

45. The electrification of the economy will lead to a more distributed energy system and will require local government engagement. While some efforts are underway to understand the potential for governance reform between national policy making and local policy making, the optimal governance structure involving national government, regulator, FSO and local authorities is currently unclear. (Paragraph 160)
46. The National Energy System Operator (NESO), an organisation currently under development, is consolidating a number of existing functions while also taking on a number of new responsibilities, such as giving advice to the Government and working with local authorities through a new regional energy system planning process. The NESO will be a powerful and influential body: it will be expected to carry out many tasks that in other national energy systems would fall to an energy agency or other independent technical body. (Paragraph 161)
47. *We recommend that Ministers establish appropriate arrangements for review of the role and performance of the NESO against the benefits it is expected to deliver to the GB energy system, including good value for money and high performance. It is essential that, from the outset, this significant new body has robust corporate governance arrangements, including a functioning and independent board. (Paragraph 162)*
48. *The incipient role of the NESO in local energy planning ought to be subject to periodic review to ensure that its engagement is appropriate. We recommend that the NESO seek regular independent appraisal of its role in regional energy system planning to ensure that it is adding value to regional network development. (Paragraph 163)*
49. Energy security is vital to the UK's national interest: responsibility within Government for promoting and ensuring energy security ought to be crystal clear. In a rapidly changing governance structure which includes new responsibilities for Ofgem and the new NESO body, it is unclear to us who holds ultimate responsibility for ensuring energy security and resilience while also driving forward progress on decarbonisation. (Paragraph 171)
50. *We recommend that Government and Ofgem should maintain clear indicators of progress on decarbonisation and energy security to allow simple public progress tracking of the proportion of renewable electricity on the system compared to expected needs, the security of supply and the progress on connections. (Paragraph 172)*



51. Renewable energy generation paired with sufficient energy storage will allow the UK to become more self-reliant, secure national energy supplies and provide a buffer against energy price hikes. This is a future that the UK should embrace, and that the Government must support actively. (Paragraph 174)
52. *We recommend that the Government take steps to ensure that decarbonisation, alongside energy security, is at the forefront of all energy discussions. Decarbonisation of the energy system must be established as strategic Government priority, informing clear and unambiguous direction to the industry. The British Energy Security Strategy should be revisited to provide this direction as well as reinforce the intertwined nature of decarbonisation and energy security.* (Paragraph 175)
53. *We support recommendation 2 of the April 2023 report of the Business, Energy and Industrial Strategy Committee, on Decarbonising the power sector, proposing that the Government define the proviso 'subject to security of supply' condition in its 2035 target. Since this term is yet to be defined, we recommend that the Government provide a clear definition in its response to this report* (Paragraph 176)



# Formal minutes

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**Wednesday 22 May 2024**

## **Members present**

Philip Dunne, in the Chair

Duncan Baker

Chris Grayling

Cherilyn Mackrory

Jerome Mayhew

Dr Matthew Offord

## **Enabling sustainable electrification of the economy**

[ ... ]

The Committee deliberated.

Draft Report (*Enabling sustainable electrification of the economy*), proposed by the Chair, brought up and read.

Paragraphs 1 to 176 read and agreed to.

Summary agreed to.

*Resolved*, That the Report be the Sixth Report of the Committee to the House.

*Ordered*, That the Chair make the Report to the House.

*Ordered*, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

## **Adjournment**

Adjourned till Thursday 23 May 2024 at 11.00 am.

## Witnesses

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The following witnesses gave evidence. Transcripts can be viewed on the [inquiry publications page](#) of the Committee's website.

### Monday 19 June 2023

**Nick Winser CBE**, Commissioner, National Infrastructure Commission; **Joanna Campbell**, Assistant Director, National Infrastructure Commission [Q1–44](#)

### Wednesday 15 November 2023

**Akshay Kaul**, Director General of Infrastructure, Ofgem; **Eleanor Warburton**, Director of Energy Systems Management and Security, Ofgem; **Claire Dykta**, Director of Markets, National Grid Electricity System Operator (ESO); **Craig Dyke**, Director of National Control, National Grid Electricity System Operator (ESO) [Q45–104](#)

**Susana Neves e Brookes**, Head of Connections, Policy and Performance, Scottish and Southern Electricity Networks (SSEN) Distribution; **Roisin Quinn**, Director of Asset Operations, National Grid Electricity Transmission; **Gareth Hislop**, Head of Market Development and Commercial, Scottish Power Energy Networks [Q105–138](#)

### Wednesday 17 January 2024

**Rachel Fletcher**, Director for Regulations and Economics, Octopus Energy; **Tom Glover**, UK Country Chair, RWE; **Craig Dolan**, Chair, Heat Pump Association [Q139–169](#)

**Councillor Bridget Smith**, Vice Chair, District Councils Network, Leader, South Cambridgeshire District Council; **Barbara Hammond MBE**, CEO and Executive Director, Low Carbon Hub IPS Ltd; **Dan Stone**, Senior Planner, Centre for Sustainable Energy; **Dr Rebecca Windemer**, Planning and communities lead, Regen [Q170–205](#)

### Wednesday 07 February 2024

**Chris Hewett**, Chief Executive, Solar Energy UK; **Peter McCrory**, Policy Manager - Networks and Charging, RenewableUK; **Susie Elks**, Senior Policy Advisor, E3G; **Olivia Powis**, UK Director, Carbon Capture and Storage Association [Q206–243](#)

**Ed Porter**, Director of Revenue, Modo Energy; **Kate Gilmartin**, Chief Executive, British Hydropower Association; **Professor Sir Chris Llewellyn Smith**, Emeritus Professor of Physics, University of Oxford [Q244–266](#)

### Tuesday 12 March 2024

**Rt Hon Graham Stuart MP**, Minister of State (Minister for Energy Security and Net Zero), Department for Energy Security and Net Zero; **Emily Bourne**, Director for Energy Systems and Networks, Department for Energy Security and Net Zero; **Eleanor Warburton**, Director, Energy Systems Management and Security, Ofgem [Q267–332](#)

## Published written evidence

The following written evidence was received and can be viewed on the [inquiry publications page](#) of the Committee's website.

ESE numbers are generated by the evidence processing system and so may not be complete.

- 1 Anonymised ([ESE0010](#))
- 2 Aston, Professor Sir John (Harding Professor of Statistics in Public Life, University of Cambridge); Rigas, Dr Georgios (Senior Lecturer, Faculty of Engineering, Imperial College London); Borovykh, Dr Anastasia (Assistant Professor, Dept of Mathematics, Imperial College London); Laizet, Professor Sylvain (Professor, Faculty of Engineering, Imperial College London); Magri, Dr Luca (Reader and Fellow, Imperial College London and the Alan Turing Institute); Weiland, Professor Michèle (Director of Research and Met Office Joint Chair, EPCC, University of Edinburgh); Vogiatzaki, Professor Konstantina (Associate Professor of Engineering Science, University of Oxford); and Shah, Aarushi (Research Assistant, Department of Pure Maths and Mathematical Statistics, University of Cambridge) ([ESE0017](#))
- 3 BCP Council ([ESE0038](#))
- 4 Bauman, Charles (Research Analyst, London Politica) ([ESE0006](#))
- 5 Bluefield Partners LLP ([ESE0029](#))
- 6 British Hydropower Association ([ESE0009](#))
- 7 Carbon Tracker Initiative ([ESE0037](#))
- 8 Carbon Trust ([ESE0060](#))
- 9 Cornwall and Isles of Scilly Local Enterprise Partnership ([ESE0002](#))
- 10 Coventry City Council ([ESE0035](#))
- 11 Department for Energy Security and Net Zero ([ESE0058](#), [ESE0075](#))
- 12 Dorset Council ([ESE0032](#))
- 13 Dorset Local Enterprise Partnership ([ESE0052](#))
- 14 E.ON ([ESE0030](#))
- 15 EDF ([ESE0031](#))
- 16 Eaton ([ESE0046](#))
- 17 Electricity System Operator (ESO) ([ESE0021](#))
- 18 EnBW Generation UK Ltd ([ESE0054](#))
- 19 Energy Networks Association ([ESE0045](#))
- 20 Energy Systems Catapult ([ESE0012](#))
- 21 Energy Utilities Alliance ([ESE0014](#))
- 22 Enertechos ([ESE0023](#))
- 23 Fender, Dr Thomas (Energy Systems Policy Research Fellow, University of Birmingham); Harrison, Christopher (Energy Systems Policy Research Fellow, University of Birmingham); Duncan, Laurie (PhD Researcher in Local Energy Policy, University of Birmingham); and Radcliffe, Dr Jonathan (Reader in Energy Systems, Policy and Innovation, University of Birmingham) ([ESE0033](#))
- 24 Field ([ESE0034](#))
- 25 Future Oxfordshire Partnership ([ESE0059](#))

- 26 Garvey, Professor Seamus (Professor of Dynamics, University of Nottingham) ([ESE0001](#))
- 27 Gordon-Brown, Ollie (Research Director, London Politica); Mpofo, Caroline (Comms Associate, London Politica); and Tandon, Raadhika (Research Analyst, London Politica) ([ESE0007](#))
- 28 Gordon-Brown, Ollie (Research Director, London Politica); Zalenski, Ekaterine (Research Analyst, London Politica); Starrt, Ella (Research Analyst, London Politica); and Deva, Jasmine (Research Analyst, London Politica) ([ESE0005](#))
- 29 Green Biofuels Ltd. ([ESE0028](#))
- 30 Heathrow Airport ([ESE0020](#))
- 31 Hitachi Energy ([ESE0041](#))
- 32 Independent Networks Association ([ESE0049](#))
- 33 Indra Renewable Technologies Ltd. ([ESE0018](#))
- 34 Institution of Engineering and Technology (IET) ([ESE0066](#))
- 35 InterGen ([ESE0016](#))
- 36 Kensa Group ([ESE0065](#))
- 37 Knauf Insulation ([ESE0067](#))
- 38 Low Carbon ([ESE0024](#), [ESE0072](#))
- 39 Marine Energy Council ([ESE0027](#))
- 40 Mineral Products Association ([ESE0042](#))
- 41 National Grid ([ESE0063](#))
- 42 NextEnergy Capital ([ESE0036](#))
- 43 North West Bucks Agricultural Association ([ESE0004](#))
- 44 Octopus Energy ([ESE0051](#), [ESE0071](#))
- 45 Ofgem ([ESE0070](#))
- 46 Openshaw, David (Director, Millhouse Power Limited); and Botting, Duncan (Managing Director, Global Smart Transformation Limited) ([ESE0015](#))
- 47 Photovolt Development Partners ([ESE0069](#))
- 48 RSPB ([ESE0043](#))
- 49 RWE ([ESE0057](#))
- 50 Regen ([ESE0026](#))
- 51 Renewable Power Capital ([ESE0019](#))
- 52 SSE plc ([ESE0055](#))
- 53 Say No to Sunnica Action Group Ltd ([ESE0053](#))
- 54 ScottishPower ([ESE0056](#))
- 55 Sharmina, Dr Maria (Reader in Energy and Sustainability, Tyndall Centre for Climate Change Research, University of Manchester) ([ESE0048](#))
- 56 Siemens Energy ([ESE0068](#))
- 57 Sizewell C ([ESE0040](#))
- 58 Smith, Cllr Bridget (Vice Chair, District Councils' Network; and Leader, South Cambridgeshire District Council) ([ESE0073](#))

- 59 Smith, Professor Sir Chris Llewellyn (Emeritus Professor of Physics, University of Oxford) ([ESE0074](#))
- 60 So Energy ([ESE0039](#))
- 61 Solar Securities Ltd ([ESE0062](#))
- 62 The Royal Society ([ESE0064](#))
- 63 The Society of Motor Manufacturers and Traders ([ESE0050](#))
- 64 UK Green Building Council ([ESE0047](#))
- 65 Waller, Dr Alexander (Visiting Professor, American University of Sovereign Nations) ([ESE0013](#))
- 66 Zero Carbon Shropshire ([ESE0025](#))
- 67 myenergi LTD ([ESE0022](#))

## List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the [publications page](#) of the Committee's website.

### Session 2023–24

Number	Title	Reference
1st	The financial sector and the UK's net zero transition	HC 277
2nd	Environmental change and food security	HC 312
3rd	Net zero and the UK aviation sector	HC 404
4th	The UK's contribution to tackling global deforestation	HC 405
5th	Heat resilience and sustainable cooling	HC 279
1st Special Report	Seeing the wood for the trees: the contribution of the forestry and timber sectors to biodiversity and net zero goals: Government Response to the Committee's Fifth Report of Session 2022–23	HC 406
2nd Special Report	The UK and the Arctic Environment: Government Response to the Committee's Sixth Report of Session 2022–23	HC 431
3rd Special Report	The financial sector and the UK's net zero transition: Government Response to the Committee's First Report	HC 550
4th Special Report	Environmental change and food security: Government Response to the Committee's Second Report	HC 646
5th Special Report	The UK's contribution to tackling global deforestation: Government Response to the Committee's Fourth Report	HC 669
6th Special Report	Net zero and the UK aviation sector: Government Response to the Committee's Third Report	HC 622
7th Special Report	Heat resilience and sustainable cooling: Government Response to the Committee's Fifth Report	HC 697

### Session 2022–23

Number	Title	Reference
1st	Building to net zero: costing carbon in construction	HC 103
2nd	Pre-appointment hearing: Chair of the Environment Agency (Pre-appointment hearing)	HC 546
3rd	Recommendations on the Government's draft environmental principles policy statement	HC 380



4th	Accelerating the transition from fossil fuels and securing energy supplies	HC 109
5th	Seeing the wood for the trees: the contribution of the forestry and timber sectors to biodiversity and net zero goals	HC 637
6th	The UK and the Arctic Environment	HC 1141
1st Special Report	Water quality in rivers: Government Response to the Committee's Fourth Report of Session 2021–22	HC 164
2nd Special Report	Greening imports: a UK carbon border approach: Government Response to the Committee's Fifth Report of Session 2021–22	HC 371
3rd Special Report	Building to net zero: costing carbon in construction: Government Response to the Committee's First Report	HC 643
4th Special Report	Accelerating the transition from fossil fuels and securing energy supplies: Government and Regulator Response to the Committee's Fourth Report	HC 1221

### Session 2021–22

Number	Title	Reference
1st	Biodiversity in the UK: bloom or bust?	HC 136
2nd	The UK's footprint on global biodiversity	HC 674
3rd	Green Jobs	HC 75
4th	Water quality in rivers	HC 74
5th	Greening imports: a UK carbon border approach	HC 737
1st Special Report	Energy efficiency of existing homes: Government Response to the Committee's Fourth Report of Session 2019–21	HC 135
2nd Special Report	Growing back better: putting nature and net zero at the heart of the economic recovery: Government and Bank of England Responses to the Committee's Third Report of Session 2019–21	HC 327
3rd Special Report	Biodiversity in the UK: bloom or bust?: Government Response to the Committee's First Report	HC 727
4th Special Report	Green Jobs: Government Response to the Committee's Third Report	HC 1010
5th Special Report	The UK's footprint on global biodiversity: Government Response to the Committee's Second Report	HC 1060

**Session 2019–21**

<b>Number</b>	<b>Title</b>	<b>Reference</b>
1st	Electronic Waste and the Circular Economy	HC 220
2nd	Pre-appointment hearing for the Chair-Designate of the Office for Environmental Protection (OEP)	HC 1042
3rd	Growing back better: putting nature and net zero at the heart of the economic recovery	HC 347
4th	Energy Efficiency of Existing Homes	HC 346
1st Special Report	Invasive species: Government Response to the Committee's First Report of Session 2019	HC 332
2nd Special Report	Our Planet, Our Health: Government Response to the Committee's Twenty-First Report of Session 2017–19	HC 467
3rd Special Report	Electronic Waste and the Circular Economy: Government Response to the Committee's First Report	HC 1268