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REPORT JULY 2024

CHEAP, CLEAN ELECTRICITY FOR GREAT BRITAIN BY 2030

A FRAMEWORK TO LOWER BILLS AND PROTECT THE ECONOMY

SUSANNA ELKS, JULIET PHILLIPS & SIMON SKILLINGS

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About E3G

E3G is an independent climate change think tank with a global outlook. We work on the frontier of the climate landscape, tackling the barriers and advancing the solutions to a safe climate. Our goal is to translate climate politics, economics and policies into action.

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SUMMARY

To protect the economy and permanently lower bills, Great Britain needs to get off gas and rapidly build a low-cost, clean electricity system. This report sets out a framework for how this can be achieved, using the Labour Government's 2030 clean power target as the guiding star.

Great Britain is highly dependent on gas for electricity generation – which presents a major risk for households and national finances. The recent gas crisis pushed inflation sky-high and millions into fuel poverty, with the Treasury forced to subsidise energy bills by over £94 billion.[1,2,3] Remaining dependent on gas imports means Great Britain[4] could be hit by these crises again. This would be disastrous. Recurring price spikes could cost the economy double the cost of net zero, with none of the economic and environmental benefits.[5]

In contrast, a renewables-based electricity system could make bills lower than they were pre-gas crisis and shield us from future price spikes.[6] Great Britain must transition rapidly to a clean electricity system or else it will be forced to build more expensive gas power stations by default. This new system should be underpinned by wind and solar power and managed with flexible demand and storage. These technologies can all lower bills. Alongside this, new low-carbon hydrogen power stations and green hydrogen storage should be rapidly built. This is a strategic future technology for Great Britain needed to decarbonise and protect our energy security. This is an area where we should prioritise using this valuable fuel.

To effectively lower bills, the next stage of the clean electricity transition must be well-designed and successfully managed. This is essential as significant sums must be spent to transform Great Britain's electricity system.[7] This price will be

[1] UK government, March 2024, **Spring Budget 2024**

[2] National Energy Action, 2024, **Timeline of the energy crisis**

[3] ONS, March 2024, **Contributions to the 12-month rate of CPI(H) by import intensity**

[4] Note: Electricity policy for Northern Ireland is devolved. Therefore, for simplicity we discuss Great Britain throughout this report. However, a lot of the topics discussed within this paper also hold true for all the UK.

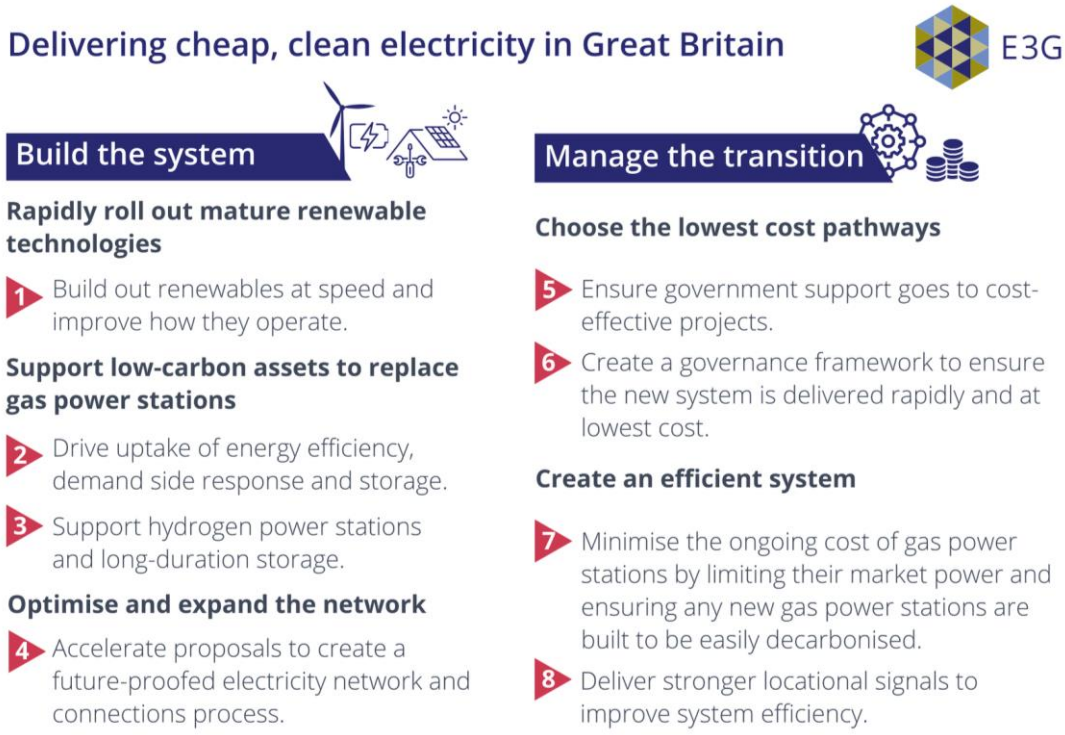
[5] Office for Budget Responsibility, July 2023, **Fiscal risks and sustainability**

[6] National Infrastructure Commission, October 2023, **The Second National Infrastructure Assessment**

[7] Resolution Foundation, April 2024, **Electric Dreams**

much greater if the transition is managed poorly, wiping out the potential to permanently lower bills. The government will need to stand up to vested interests to secure the lowest cost transition pathway. Policies and strong, independent governance mechanisms can ensure that rapid investment is put into the right assets in the right place, at a good price. They must ensure that once built, these assets are operated to meet the needs at the lowest cost.

We highlight the specific interventions below to transition Great Britain to a low-cost, clean electricity system by 2030.



Moving away from gas cannot be done instantly, so bills may remain high for some time. Targeted groups of consumers can be supported during this transition by:[8]

> Introducing targeted energy bill support, guaranteeing affordable energy for vulnerable households (i.e. a social tariff).

> Boosting rates of home decarbonisation with energy efficiency, heat pumps and heat networks.

> Removing policy levies from electric heating to lower bills and kick start the heat pump market.

[8] More detail on these actions is set out in the supporting note **"Targeted near-term actions to bring down UK electricity bills"**, available from E3G, July 2024.

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INTRODUCTION

Renewables and low-carbon flexible assets are the most cost-effective investment for Great Britain's electricity system.[9,10] A gas-based system risks Great Britain's economy and household finances on the hope that gas prices stay low in perpetuity. We took this bet in the past. This is why bills rose more in Great Britain during the gas crisis than in almost any other European country.[11] Inflation peaked at 11% during the energy crisis (with 70% directly due to energy)[12] even though the Treasury spent £39.3bn to subsidise bills over just 6 months.[13]

We cannot take this bet again. The Office for Budget Responsibility (OBR) found that if we stay dependent on gas, recurring price spikes could cost the economy double the cost of getting to net zero, with none of the financial benefits.[14] A renewables-based system shields Great Britain from this risk, while boosting the green economy. It can make bills permanently and consistently lower in the 2030s than they were pre-crisis.[15]

Exactly how much this transition will reduce bills depends almost entirely on how well it is managed by the government. The transition is a huge opportunity. However, Great Britain will not fully capture the benefits if we build the wrong projects in the wrong places and do not get a good deal for consumers. Therefore, it is essential both that assets are deployed rapidly, and that the government has a laser focus on good management.

In this report we show how the government can do just that. Chapter 1 first introduces and compares some of the key technologies available for building a clean, low-cost electricity system. Chapter 2 then details the specific interventions that would allow Great Britain to both build the system and manage the transition.

[9] National Infrastructure Commission, August 2020, **Renewables, recovery, and reaching net zero**

[10] UK government, November 2023, **Electricity Generation Costs 2023**

[11] Household Energy Price Index, May 2024, **Monthly update**

[12] Resolution Foundation, April 2024, **Electric Dreams**

[13] UK government, June 2023, **News Story: £40 billion spent protecting families and businesses from energy costs**

[14] Office for Budget Responsibility, July 2023, **Fiscal risks and sustainability**

[15] National Infrastructure Commission, October 2023, **The Second National Infrastructure Assessment**

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CHAPTER 1
TECHNOLOGY STOCKTAKE

Great Britain needs to build a new low-cost electricity system not dependent on gas. This will require a wide mix of technologies fulfilling different roles:

> **Producing the bulk of our electricity with low-cost assets.** Building out low-cost renewables such as wind and solar and investing in home decarbonisation as fast as possible.

> **Balancing the system with the cheapest low carbon assets, rather than gas power stations**, including demand side flexibility, interconnectors, batteries and long duration storage.

> **Getting the right mix for when renewables are not available.** The right mix will reduce the use of gas, develop new technologies for tomorrow – such as hydrogen power stations – and maintain an ever-decreasing reserve of gas power stations to operate a small amount of the time.

Below we explore these technology options in more detail. The cost-effectiveness of electricity decarbonisation – and how much it impacts bills – will depend on which options are chosen.

Producing the bulk of our electricity with low-cost assets

Mature renewable technologies – namely onshore wind, offshore wind and solar – can produce electricity at a lower price than gas power stations.[16,17] Rapidly building these can reduce bills for consumers, and shield households from future gas price spikes. We discuss the barriers to deployment and how to resolve these in Recommendations 1 and 4.

It is difficult to exactly estimate how much these technologies lower bills. The cost saving from building out renewables reduces if they are excessively "curtailed", because there is more electricity in a region than can be used or

[16] House of Commons Library, 14 September 2023, **Why is cheap renewable electricity so expensive?**

[17] Laura Sandys and Frontier Economics, 2021, **Re-costing Energy: powering for the future**

exported. This puts up prices as the system operator must pay to switch off renewables in remote regions with overloaded network and turn on gas power stations nearer the electricity users. Building storage, flexible demand and a range of renewable technologies in a range of places can reduce the amount of curtailment, helping to reduce energy bills.

Like renewables, energy efficiency measures consistently reduce the need for gas power stations. They also reduce the amount of expensive "peaking plant" needed. Cost-effective measures to make homes energy efficient could reduce energy demand from households by 25%, equivalent to the output from six nuclear power stations.[18]

Balancing the system with the cheapest low carbon assets, rather than gas power stations

Great Britain mainly uses expensive gas power stations to balance the electricity system. These fill in when renewables cannot supply enough electricity, particularly during times of peak usage. Storage and flexible demand can take this role instead. They can reduce bills for consumers by billions of pounds per year – providing wide-ranging benefits.[19,20]

Storage and flexible demand help reduce curtailment discussed above, helping renewables to further lower bills. They reduce the need to build expensive peaking power stations and network. They reduce the number of expensive gas power stations that are needed to run every day to balance the system and can help eventually eliminate the need for them. Long-duration storage, such as pumped hydro, can also reduce the need for gas power stations to be kept online as backup capacity.

Electricity storage

The main type of storage being deployed today is industrial scale batteries. For now, these amount to relatively low capacity, but they are expanding rapidly and have potential to provide a large source of low-cost flexibility. GB also has some large legacy pumped hydro sites which store electricity by pumping water uphill

[18] UKERC/CEID, September 2017, **Unlocking Britain's First Fuel: The potential for energy savings in UK housing**

[19] UK government, July 2021, **Smart Systems and Flexibility Plan**

[20] UK government, LCP and Regen, January 2024, **Scenario deployment analysis for long-duration electricity storage**

and storing it. These can play a different role to batteries as they can supply electricity for a longer time. There are plans to build new pumped hydro sites in the UK. A government study found that pumped hydro could lower system costs by £24bn from 2030-2050.[21]

Demand Side Response

Demand side response (DSR) refers to consumers reducing their bills or being paid to use electricity at different times. In reward a consumer has lower bills. DSR is an exciting proposition for households with heat pumps and electric vehicles. They can shift the electricity use of these assets, using less when demand is high and making the most of cheap renewables when they are plentiful. Without this, it will be difficult to decarbonise electricity and electrify the economy affordably as electric vehicles and heat pumps will add a huge demand at peak times.

DSR can reduce system costs by £14bn/year by 2040 by reducing the need to build and use expensive flexible assets, reducing the need for new network and increasing the usage of renewables.[22] It also reduces individual household bills. Current electric vehicle tariffs can save consumers £700/year[23] and solar and battery tariffs can reduce bills by 85%.[24] Further intervention is needed from government to ensure DSR becomes the norm for all EV drivers and the potential from heat pumps is used fully.

We discuss how to accelerate the installation of storage and DSR in Recommendations 2 and 3.

Getting the right mix for when renewables are not available

Renewables and flexibility solutions can provide electricity most of the time, but not all the time.[25] Assets that provide back-up will be essential to energy security, although will run rarely. Great Britain will need a mix of several technology options each running a different amount of the year. Some assets will

[21] UK government, 5 March 2024, **Long duration electricity storage consultation**

[22] Cornwall Insight, August 2023, **The power of flex: Rewarding smarter energy usage**

[23] Octopus, February 2024, **Intelligent Octopus Go**

[24] Octopus, February 2024, **Get Solar & Battery Power**

[25] CCC, March 2023, **Delivering a reliable decarbonised power system - Charts and data** and Ember, September 2022, **Data annex - Ember UK gas phaseout - Model outputs**

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run purely as backup, e.g. 2% of the year, whereas others will run more regularly to balance the system, as well as operating as backup. Striking the right balance across these assets will significantly reduce system costs. We discuss how we might strike this balance in Recommendation 5.

Gas power stations

Great Britain has 36 GW of unabated gas power stations.[26] Some of these could be kept online to run at very low load factors, e.g. for 2% of the year. This could be a relatively low-cost way to provide backup supply in the shorter term. Deploying technologies to replace these gas power stations can ensure this reserve of gas power stations runs rarely and is ever decreasing.

Gas power stations with CCS

One option for decarbonisation is to retrofit existing gas power stations with carbon capture and storage (CCS) or build new gas power stations with CCS. We propose the government builds those power stations with CCS that are already planned within the current CCS clusters. Any further support for CCS for power should be limited because:

> It keeps Great Britain dependent on price-spiking gas.

> Power stations with CCS can have relatively high emissions due to leaks.

> CCS should be prioritised for sectors without other decarbonisation routes.[27]

> To justify the money for the CCS equipment, these assets would need to run a reasonable amount. This means longer term it is not the best source of balancing or backup to sit alongside renewables.

Hydrogen

Modelling suggests that retrofitting existing power stations to run on hydrogen, or building new hydrogen power stations, is the best long-term option to sit alongside renewables and replace gas power stations.[28] Hydrogen can be produced from excess renewable electricity, increasing the use of these assets. It can then replace natural gas as a store of energy.

To operate, the power stations will require hydrogen producers, pipelines, and storage. There will be a limited supply of hydrogen from excess renewable

[26] National Grid ESO, July 2023, **Future energy scenarios data workbook**

[27] E3G, July 2023, **Carbon Capture and Storage Ladder**

[28] The Royal Society, September 2023, **Large-scale electricity storage**

electricity for the next five years. However, as this is a strategic future technology, Great Britain needs to get the first projects off the ground, so that it can scale in the future. We discuss how to do this in Recommendation 3.

Nuclear

New nuclear projects cannot be built quickly, are high cost and consistently see large cost increases during construction. For example, the cost estimate for Hinkley Point C has risen from £18bn to over £30bn (in 2015 prices).[29] The price is significantly higher than that of renewables, and a recent Royal Society study suggests that hydrogen power stations with hydrogen storage may be a cheaper way of providing backup than nuclear.[30]

Overall

The table on the next page qualitatively summarises the main technologies which can reduce system costs and how quickly they can be built. It shows some additional technologies that are not discussed in detail in the text above. It shows that the technologies that can reduce bills are those most integral to decarbonisation.

[29] Reuters, January 2024, **EDF's UK Hinkley Point nuclear plant start date delayed again, costs mount**

[30] Royal Society, September 2023, **Large-scale electricity storage**

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	Technology	Can it reduce bills by 2030?	Can it reduce bills by 2040?	Potentially zero carbon aligned?
Producing the bulk of our electricity with low-cost assets	Energy efficiency	**High certainty**	**High certainty**	**High certainty**
	Offshore wind, onshore wind and solar	**High certainty**	**High certainty**	**High certainty**
	Nascent renewables – tidal, wave, geothermal	**Unlikely**	**Potentially**	**High certainty**
Balancing the system with the cheapest low carbon assets, rather than gas power stations	Demand side response	**High certainty**	**High certainty**	**High certainty**
	Batteries	**High certainty**	**High certainty**	**High certainty**
	Pumped hydro	**Potentially by 2032**	**High certainty**	**High certainty**
	Interconnectors	**High certainty**	**High certainty**	**Depends on imports**
Getting the right mix for when renewables are not available	Nascent long duration storage	**Unlikely**	**Potentially**	**High certainty**
	Hydrogen storage and power stations	**Unlikely**	**High certainty**	**High certainty – if green hydrogen**
	Power-CCS	**Unlikely**	**Potentially**	**Valid concerns about carbon intensity**
	Biomass-CCS	**Not with current biomass sustainability**	**Not with current biomass sustainability**	**Major concerns about sustainability of biomass. Can have negative climate and ecological impacts.**
	Nuclear	**No, due to speed of construction**	**Potentially**	**High certainty**

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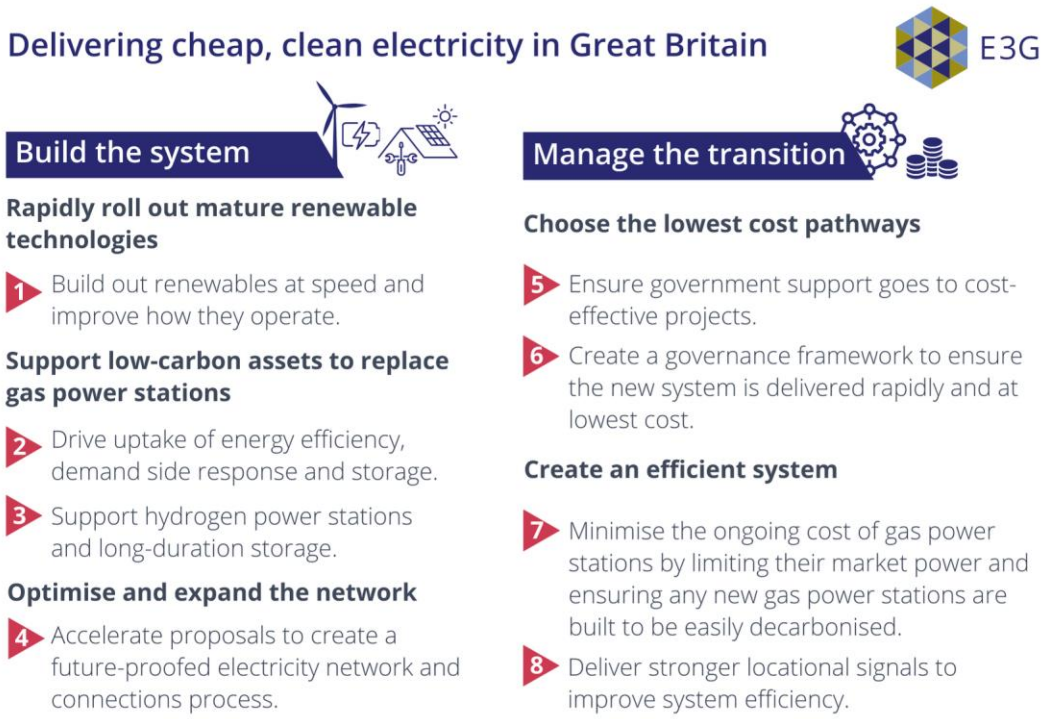
CHAPTER 2
DELIVERING LOW-COST, CLEAN ELECTRICITY FOR ALL

Building a system to produce cheap, clean electricity rapidly and efficiently will be challenging. In this chapter we highlight eight specific interventions to do this successfully and thereby structurally lower bills for all. These are summarised in the diagram below before each is expanded in detail.



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A. Rapidly roll out mature renewable technologies

Recommendation 1 – Build out "no regrets" renewables at speed and improve how they operate

Great Britain must procure a huge capacity of renewables to transition away from gas and lower bills. In Great Britain these assets are funded through the renewables support scheme, Contracts for Difference (CfDs).[31]

Offshore wind is of particular importance because it is affordable, can be deployed rapidly in a large area – but has experienced challenges in recent years. In 2023, the government failed to procure new offshore wind through CfDs. Therefore, to hit the target of 55 GW by 2030, the government will need to procure roughly 30 GW of offshore wind over the next few years. This is not currently set to happen. Industry estimates that the next auction will only contract 3–5 GW of offshore wind if the budget is not increased.[32] It appears that to achieve this target, the government may need to procure all available offshore wind projects. This is challenging with the current way that CfD contracts are allocated as an auction by its nature cannot procure all assets which bid in.

To ensure these new assets reduce system costs as much as possible, reforms to CfDs are being considered by government under the Review of Electricity Market Arrangements (REMA). The reforms need to derisk investment in renewables while incentivising the assets to operate at their best.

Recommended actions

> Immediately remove planning barriers to new onshore wind developments in England. Onshore wind is the cheapest form of renewables, but none has been built in England since planning restrictions were introduced in 2015. Set up an Onshore Wind Taskforce to ensure that lifting these restrictions leads to new projects being developed and constructed.

> Increase the number of offshore wind projects in the pipeline, working with industry to find the pinch points and remove them.

> Explore whether reforms are needed to how CfDs are allocated, to ensure large amounts of renewables can come through quickly. CfDs should be

[31] For more info see: UK government, November 2023, **Contracts for Difference**

[32] Energy UK, March 2024, **Energy UK explains: how much renewable energy can we expect from Allocation Round 6?**

designed so that all projects that can help lower bills can be procured. This may require looking at alternatives to auctions. The government could explore the proposal of a "hurdle rate" CfD. Under this, all projects can receive a contract when they are ready to proceed, provided they are happy with the price the Government has set the contracts at. There may be other forms of non-competitive allocation that can potentially be introduced quicker. If this is taken forward, the government should add a profit-sharing mechanism so that if the price is set too high, companies do not get excessive profits.

> The government can reform CfDs so that they incentivise generators to operate more efficiently, as proposed in the Review of Electricity Market Arrangements (REMA). The proposal of evolving a CfD to a Deemed CfD could keep down capital costs and boost incentives to operate well i.e. shutting down for maintenance when demand is low. These reforms likely cannot be introduced before Auction Round 8; it is essential that they are progressed as a priority.

B. Support low-carbon assets to replace gas power stations

Recommendation 2 – Drive uptake of demand side response, storage and home energy saving technologies

Energy efficiency, heat pumps, demand side response (DSR) and short-duration storage (batteries) can make the electricity system more efficient and reduce the use of expensive gas. E3G has considered options to rapidly scale up energy efficiency and heat pumps in other papers.[33]

DSR is expanding in households, driven by smart tariffs that reduce bills if, for example, people charge electric vehicles off-peak. More is needed for DSR to become the norm for all electric vehicle drivers, as well as within businesses and industrial processes.

Grid-scale batteries are being deployed rapidly, but for now only at low capacities. There is 3.5 GW in operation, with a further 3.5 GW under

[33] For example, see **Creating a Mass Market for Heat Pumps in the UK** and **A New Deal for Locally Led Home Upgrades**

construction.[34] Battery storage makes money through the Capacity Market, balancing the system for National Grid and shifting renewable electricity to times of high demand. There are ongoing reforms that need to be delivered to ensure these technologies become a more major part of the electricity system.

Recommended actions

> Deliver the ongoing reforms from the Smart Systems and Flexibility Plan to support DSR and batteries.[35] For a full list of additional actions on DSR, see Annex A.

> Ofgem should accelerate the rollout of Distribution System Operator (DSO) level flexibility markets and ensure these are standardised. DSO flexibility markets pay consumers to shift their demand as a way of avoiding expensive network upgrades or managing network until it can be expanded. They lower bills for the consumers providing the service and for everyone else in the area by reducing the money spent on new network. These markets would ideally use a single market operator that enables innovative companies to provide different offers to consumers in the area. These local flexibility markets also need to align with decisions on national markets.

> Introduce innovation funding for flexible heat pump trials; and in the future, consider that heat pumps funded through government schemes are smart as standard. Continue to work towards complete smart meter coverage, and nation-wide half hourly settlement.

> Increase engagement and awareness-raising so that all new electric vehicle and heat pump owners are informed about DSR. For example, when an electric vehicle is installed, the owner should be offered a smart meter installation and informed of the potential savings through DSR.

> Evolve the Capacity Market to value low carbon assets above high carbon assets. This can be done by introducing an Optimised Capacity Market as proposed by the government within REMA. This should boost the procured capacity of DSR and batteries.

> Introduce a target for low-carbon flexibility capacity by 2030, to provide a clear aim for ministers, the civil service and industry. The National Infrastructure Commission suggested a target of 60 GW of short-duration flexibility and 30 TWh of persistent flexible generation by 2035.

[34] RenewableUK, December 2023, **Pipeline of UK energy storage projects grows by two-thirds over last 12 months**

[35] UK government, July 2021, **Smart Systems and Flexibility Plan**

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Recommendation 3 – Support hydrogen power stations and long-duration storage to ensure a route to market

In the long term, hydrogen power stations and long-duration storage are likely to be the cheapest ways to provide low-carbon backup for the electricity system. Investing in them will reduce gas use instantly and create a pathway to getting off gas completely. It will also make Great Britain a leader in major new technologies.

Unlike renewable generators, hydrogen power stations and long-duration storage have not had support mechanisms for the last 20 years. The most developed form of long-duration storage, pumped hydro, has not been built at scale in Great Britain for a long time.

These technologies will not be built without support mechanisms to reduce risk as they are large, long-lived projects. Government is aiming to set up support mechanisms before the end of 2024.[36,37]

Recommended action

> Quickly establish funding mechanisms for hydrogen power stations, hydrogen storage and hydrogen pipelines to rapidly scale up the strategic use of hydrogen. As the need for hydrogen power stations is set to substantially grow and the industry is very nascent, it is likely that the best approach in the starting years will be to build almost all available projects. For hydrogen storage, aim to build over 3 TWh of storage by 2030.[38] Public funding should only be put towards "green hydrogen" produced from low-carbon electricity – as "blue hydrogen" produced by natural gas can have high upstream emissions and locks in further dependence on gas.

> Quickly establish the Long Duration Electricity Storage support mechanism outlined in the government consultation[39]. Use this to fund pumped hydro projects and innovative new long-duration storage technologies.

[36] UK government, 22 February 2024, **Hydrogen to power: Consultation on the Need, and Design, for a Hydrogen to Power Market Intervention**

[37] UK government, 5 March 2024, **Long duration electricity storage consultation**

[38] UK government, December 2023, **Hydrogen transport and storage networks pathway**

[39] UK government, March 2024, **Long duration electricity storage consultation**

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> Ensure these support mechanisms do not distort the incentives for hydrogen power stations and long duration storage to turn on. Hydrogen power stations and long duration storage should not turn on before other lower cost low-carbon assets just because of subsidies from support mechanisms.

> GB Energy, the UK Infrastructure Bank and the National Wealth Fund should also invest in these technologies to further reduce financing costs.

C. Optimise and expand the electricity network

Recommendation 4 – Accelerate and effectively deliver proposals to create a future-proofed electricity network and connections process

A lack of available network capacity is the biggest challenge for the renewable energy and low carbon flexibility sectors today. This must be sorted if we are to rapidly build these assets. New projects in some areas can only connect in 10 years' time or are limited on when they can produce electricity. Over 600 GW of new projects are currently stuck in the "connection queue". This is roughly five times Great Britain's current total capacity.[40] The government has created a plan to start solving this problem.[41,42] It will accelerate the building of new networks and start to clear the connections queue, but at the current pace will likely not be able to quickly solve these problems.

A lack of network is also leading to renewable generators being curtailed. This costs £1.8bn/year, paying renewable generators to turn off, and gas power stations to turn on. This could rise to £8bn/year in the late 2020s if reforms are not introduced and network build is delayed.[43]

The quickest way to build additional network capacity is to focus on speeding up the delivery of existing projects. Policy interventions need to focus on ensuring these projects are delivered to time and even delivered earlier if possible.

[40] UK government, November 2023, **Connections Action Plan**

[41] ibid

[42] UK government, November 2023, **Transmission Acceleration Action Plan**

[43] UK government, March 2024, **Review of Electricity Market Arrangements - Second Consultation Document**

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Recommended action

> Deliver planned reforms to network policy as quickly as possible – the Transmission Acceleration Action Plan and the Connections Action Plan – focusing on reforms that can accelerate existing network projects.

> Fund planning and regulatory institutions so that they have enough capacity to quickly process network projects.

> Ensure that Ofgem is working to accelerate network build. Ofgem needs to sign off on network projects quickly, fast-tracking them through processes. Ofgem could aim to incentivise transmission owners to not let projects be delayed, with delays to projects causing heftier penalties.

> National Grid to discourage new speculative applications for grid connections, freeing up capacity for projects that are ready to progress. The connection queue is still rapidly growing, as developers put speculative applications in to reserve network capacity. This needs to be discouraged so that only feasible projects are in the queue. This could be done through higher payments for staying in the connections queue or through higher fines for projects that do not promptly progress to the next stage of development.

> Ensure the new National Energy System Operator (NESO) rapidly delivers a robust Strategic Spatial Energy Plan and Central Strategic Network Plan. These will provide a longer-term plan of where new assets could be built and therefore where new networks will be needed. Community engagement and environmental assessments should be embedded throughout development, to avoid pushback when the plans are released in 2026.

D. Choose the lowest cost pathways

Recommendation 5 – Ensure government support goes to cost-effective projects

The government will need to leverage billions of pounds on new electricity assets – through a mix of public, private and blended capital. This should be focused on the lowest cost mix of assets. Currently, there are only limited processes for ensuring this happens.

Soon the government will be using numerous processes to procure low-carbon flexibility and back up assets – including separate processes for nuclear, interconnectors, renewables, hydrogen power stations and long-duration

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storage – with the Capacity Mechanism as a backstop for ensuring there is enough capacity overall. This approach risks building an expensive mix of assets. It also risks building new, unnecessary gas power stations. If the low-carbon asset support mechanisms do not receive enough funding, then the Capacity Market will be left to fund expensive gas power stations by default.

Recommended action

> The government must create a system, the Investment Efficiency Mechanism, for comparing all projects and allocating the correct funding to different support mechanisms. The process should ensure the government builds the best value mix of low-carbon projects, and builds low-carbon assets instead of new gas power stations. It should consider the pipeline and cost of projects in the Capacity Market and the support mechanisms for hydrogen power stations, power-CCS, interconnectors and long-duration storage.

  First NESO would estimate which mix of technologies will be best. Government would then allocate the correct funding to each mechanism, with confidence that any unnecessary, high-cost projects can be avoided. A similar process should be used for assessing new nuclear projects. It is vital that this process is undertaken independently as if this process is disrupted by vested interests, then a much higher-cost system will be built.

> After considerable time, once these technologies have developed, the specific support mechanisms should be removed and technologies should compete for funding in an Optimised Capacity Market which values low carbon assets.

> To keep the system secure, NESO needs to urgently reform the Capacity Market's "Reliability Standard" to ensure Great Britain has the right assets to operate during a prolonged low-wind event. No country has yet reformed their reliability standard to work for a renewables-based system. NESO should be commissioned to recommend a robust and innovative new standard.

Recommendation 6 – Create a governance framework to ensure the new system is delivered rapidly and at lowest cost

The success in decarbonising the electricity system will be determined by how well the transition is managed. Clear and thorough governance is essential to

ensure that delays, policy gaps and poorly designed policy do not increase costs for consumers.

To date, there has not been a body which looks across the transition and holds responsibility for steering it. The network crisis is a symptom of the lack of this oversight. This was avoidable but has become a major issue which has added to bills. To prevent this from happening again, we need to reform our governance structures.

The new government has announced that they will set up a "Mission Control" to be led by Chris Stark. The body should play an important role in taking responsibility for ensuring actions are delivered and highlighting and solving problems early.

A new governance body should leverage the expertise of the new NESO, which will be an evolution of National Grid ESO. NESO will be a new independent, public corporation responsible for planning Britain's electricity and gas networks and operating the electricity system. This body can help government highlight what needs to be done and give evidence on the best options. NESO alone cannot entirely manage the transition as they cannot create new policies, nor make political decisions.

Recommended action

> Establish a ministerial level board with overall responsibility for decarbonising the electricity system, and ensure the new Mission Control is set up in the right way to effectively deliver the mission. The ministerial level board should be chaired by the Secretary of State responsible for net zero delivery and attended by ministers from other key departments and the leaders of delivery bodies. The delivery coordination body must be set up to have influence across different departments. It should have a designated team to create KPIs for the transition, the expertise to quickly identify obstacles and the power to propose policy remedies. They should have input from government departments, NESO, Ofgem and the Climate Change Committee. The wider structure is shown in Figure 1. (Note that Mission Control takes the role of the "delivery coordination body".

> Create an annual Net Zero Investment Plan to ensure government is securing enough investment in each sector and at lowest cost. It could identify if there are areas where investment is falling behind and where policy interventions

could reduce project cost of capital. It would be a valuable tool to accelerate the transition and continually ensure it lowers bills.

> Release a Great British Clean Power Strategy so that all stakeholders can see the direction of travel and update the Strategy and Policy Statement to reflect the new strategy.

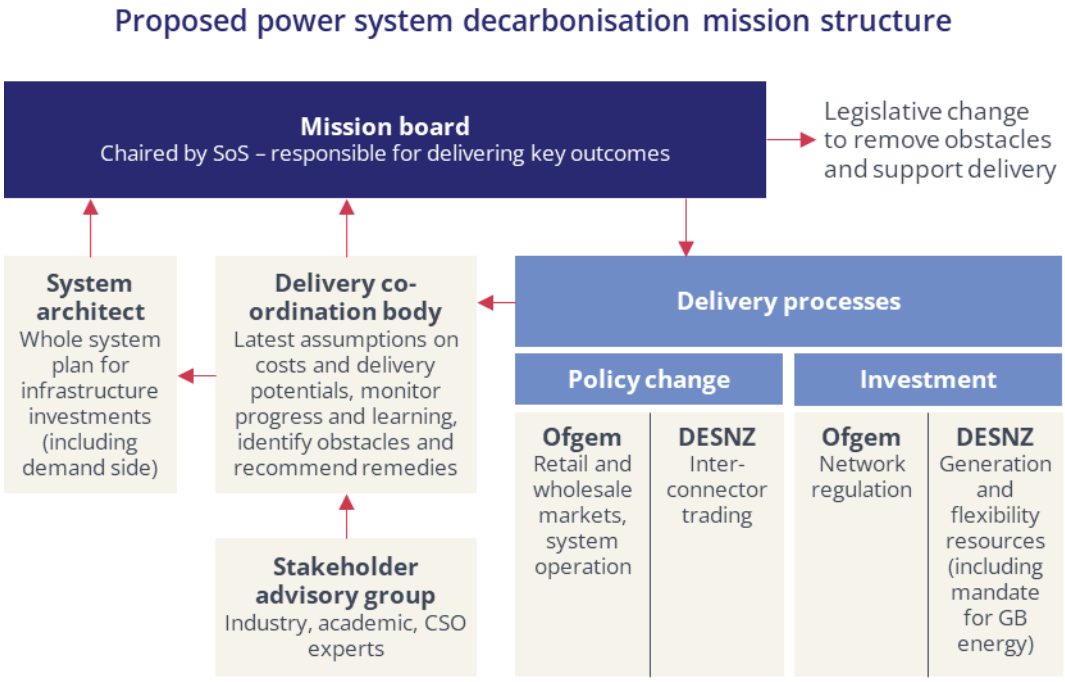

Figure 1: Proposed new governance structure for electricity decarbonisation. This includes a new mission board at ministerial level which would carry overall responsibility. The delivery coordination body would monitor progress, taking input from relevant stakeholders and feeding information and recommendations to the mission board.

E. Create an efficient system

Recommendation 7 – Minimise the ongoing cost of gas power stations

The future of gas power stations is uncertain. It would be difficult to rapidly build enough low-carbon flexibility to entirely replace gas power stations as backup by 2030. Therefore, there will likely continue to be a small role for gas for a limited time, although the government should aim to phase this out as fast as possible.

The costs of existing and new gas power stations could spiral if not managed well. With the way policies are currently designed these assets could push for high prices, as they are needed for security purposes so can bid high and still receive contracts, or could become expensive stranded assets. There is currently not a plan for managing the costs and market power of these backup power stations.

Great Britain also will likely need to build a small capacity of new gas power stations over the next few years. The government can minimise this new capacity by maximising the build of low-carbon flexibility and energy efficiency. For the remaining need, it is important the new gas power stations are built with routes to decarbonise.

Recommended action

> Ensure any new gas power stations are built so that they can be easily decarbonised in future. Government has developed "Decarbonisation Ready" requirements for new power stations, which should be tightened where possible and introduced. A cost–benefit analysis should be introduced at the point of the Capacity Market qualification to ensure that assets are being built to decarbonise by the lowest cost route, particularly if government is guaranteeing future revenue streams for gas power stations to decarbonise.

> Policies should be designed to keeps backup power stations online in a cost-effective manner. This could be done either by 1) a Strategic Reserve where government owns the assets, 2) a Strategic Reserve where the assets are given a low regulated rate of return or 3) the Capacity Market. A study is needed to compare the cost of these three options and to ensure costs do not spiral in the Capacity Market.

> Request that Ofgem investigate the bidding behaviour of gas power stations, take appropriate action to penalise breaking rules and report on how they will manage future risks. There is evidence gas power stations have unnecessarily raised their bid prices during the recent gas crisis.[44] An Ofgem investigation should discourage this in the future.

Recommendation 8 – Deliver stronger locational signals to improve system efficiency

[44] UCL, 16 May 2023, **Where does the money go?**

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Locational signals aim to reduce system costs. They look to ensure assets are built in the best places and act based on the needs of their area rather than the national average. For example, by incentivising batteries in Scotland to charge from excess renewables. Locational signals will become increasingly important as the country transitions to a renewables-based system, with a need for highly responsive flexible assets.

The government is assessing improving locational signals through REMA. There are two options under consideration – zonal pricing or strengthening signals within current arrangements.

This is a contentious topic, and it is hard to know which option is better before the solutions have been fully worked up. Most industry is strongly against zonal pricing, whereas Octopus and National Grid ESO are strongly in favour. Studies funded by Ofgem and government have found zonal pricing could save consumers £15bn–£31bn to 2040[45] and £25bn–£60bn from 2030 to 2050[46]. Another funded by industry found zonal pricing could save £4.6bn to 2050, or cost £9bn.[47] There is a lot of debate about these different studies.

There are concerns that locational pricing could create uncertainty for industry and that this might cause higher costs for capital and a drop in investment. To what degree this is a genuine risk is unclear as it is dependent on how zonal pricing is designed. For example, renewable generators could be partly shielded from the changes in pricing.

Alternatively, locational signals could be strengthened within current arrangements through reforming network charges and the Balancing Mechanism. It is unclear how well this could send locational operational signals which are key for efficient system operation. The government is now developing these options further within REMA.

Recommended action

> The energy transition requires sharper locational signals, and the most developed proposal is currently zonal pricing. If an alternative can be found, that can deliver high quality locational signals without major market disruption, then this should be pursued. Either way, stronger locational

[45] FTI, October 2023, **Assessment of locational wholesale electricity market design options in GB**

[46] LCP, 2023, **System Benefits from Efficient Locational Signals**

[47] Afry, August 2023, **Review of electricity market design in Great Britain**

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signals are a necessity if Great Britain is to have an efficient high-renewables system with lots of flexibility assets. The government should continue to assess how locational signals can best be introduced within REMA. This must be a time-limited enquiry and done in a way that does not hinder investment in renewables today.

> Guarantee the next wave of renewable projects will be shielded from zonal pricing if it is introduced. Locational pricing being considered should not halt investment in renewables. Shielding projects from future changes will ensure investment in renewables does not reduce while locational pricing is being considered and introduced. This should be a time-limited measure.

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ANNEX A
FURTHER POLICY INTERVENTIONS FOR DEMAND SIDE RESPONSE (DSR) AND STORAGE

In addition to the suggestions included in Recommendation 3, the following actions are needed to drive the deployment of DSR and short-duration storage:

> **Ofgem should accelerate the rollout of Distribution System Operator (DSO) level flexibility markets and ensure these are standardised.** DSO flexibility markets pay consumers to shift their demand as a way of avoiding expensive network upgrades or managing network until it can be expanded. They lower bills for the consumers providing the service and for everyone else in the area by reducing the money spent on new network. These markets would ideally use a single market operator that enables innovative companies to provide different offers to consumers in the area. These local flexibility markets also need to align with decisions on national markets.

> **Introduce innovation funding for flexible heat pump trials; and in the future, consider that heat pumps funded through government schemes are smart as standard**. Continue to work towards complete smart meter coverage, and nation-wide half hourly settlement. If heat pumps can operate flexibly this will considerably reduce both electricity system costs and heat pump running costs. There is a lack of data on how well this can be done or how it can be encouraged. A substantial innovation programme could help to fill this gap and provide evidence for how to unlock DSR in this area.

> **Evolve the Capacity Market to value low carbon assets above high carbon assets.** This can be done by introducing an Optimised Capacity Market as proposed by the government within REMA. This should boost the procured capacity of DSR and batteries.

> **Have NESO expand the Local Constraint Market so that consumers in England and Wales can be paid to turn down their demand to help manage a major network constraint.** The current Local Constraint Market only pays for demand to be turned up in Scotland (to increase the use of renewables in the region **that** would otherwise be curtailed). Paying for demand to be

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turned down in England and Wales would help grow the market for DSR and reduce the cost of managing constraints.

> **Ensure all consumers who buy an electric vehicle or heat pump are made aware of the potential bill savings from DSR**. DSR could substantially reduce bills for households with electric vehicles and may be able to reduce bills for households with heat pumps. A lot of these households are unaware of this option, and there are barriers for energy companies to introduce accurate tariffs (including low penetration of smart meters). The government should put measures in place so that every person who buys an EV or heat pump is made aware of the benefits of DSR and offered a smart meter. This would require the government to map the journey consumers go through when buying and installing these products. Government could introduce information on DSR at key touchpoints. For example, when someone looks at EVs at a car show room they could be shown the cost of charging it under different tariffs or, when an EV charge point is installed in a home the household could automatically be offered a smart meter.

> **Ensure price comparison websites compare smart tariffs alongside others.** A lot of consumers choose their energy tariff through price comparison websites. These do not enable consumers to compare DSR tariffs. The websites could add simple features to make consumers aware of these tariffs. They could enable a full comparison based on accessing a consumer's usage data and asking which smart appliances a consumer owns and their ability to shift usage. Government should ensure that the major sites have these capabilities.

> **Embed DSR across all business and public sector energy policy**, particularly the Public Sector Decarbonisation Scheme and standards for assessing company decarbonisation as outlined in the Smart Systems and Flexibility Plan. This should get every major energy user to assess its potential ability to reduce its bills through DSR.

> **Ensure that policy which funds the electrification of industry encourages DSR to be built into the designs.** If public support is allocated through a competitive process, then when assessing the bids, there should be a criterion for the projects' DSR potential.

> **Make DSR accessible for vulnerable consumers and ensure they are protected during the transition.** Project InvoLVe[48] is a valuable step towards understanding what is needed to enable low-income and vulnerable

[48] UK government, October 2020, **Participation of low income and vulnerable consumers: Project InvoLVe**

consumers to access DSR. The learnings from this project should turn into a programme of work to ensure DSR is accessible. Work should also be done to ensure vulnerable consumers are protected during this transition. This will be tied to government's work on market-wide half hourly settlement[49], future default tariffs[50] and regulating smart secure electricity systems.

> **Continue the ongoing work to improve consumer protection for DSR and assess the need for further interventions.** The government and industry need to ensure that, as smart tariffs develop, there are no gaps in consumer protection. For example, it must be clear who is responsible (i.e. the energy supplier or equipment manufacturer) for malfunctions that lead to high energy bills for consumers, and what paths for recourse consumers can take. Government should conduct a full review of how DSR will interact with existing consumer protections and where these need to be strengthened. The government could go further and require that all consumers can try smart tariffs for a trial month but can have a guarantee of returning to a standard tariff if they are not happy with the bill.

> **Introduce new de-rating factors in the Capacity Market (CM) for each type of DSR.** All DSR is currently treated equally in the CM. This is unfair as different consumers have very different reliability and capability – compare for example an automated industrial process to a domestic asset which a consumer can override. NG ESO should create a working group to gather evidence and decide these new de-rating factors. This could be supported by the Association for Decentralised Energy.

[49] Ofgem, **Electricity Settlement Reform**

[50] UK government, April 2024, **Future Default Tariffs – call for evidence**