Clean Power 2030

Annex 2: Networks, connections and network access analysis

NESO
National Energy System Operator

1. Introduction

Great Britain's electricity network was designed in the 1960s and 1970s to transfer electricity from large coal-fired power stations and nuclear power stations to meet demand across the country. Today, it must transmit renewable energy from generation sites to areas of high demand. Delivery of the necessary network, understanding whole system impacts and what needs to connect will be fundamental to delivering clean power.

This section points to the following priorities for the clean power plan, as set out in our main report:

- Delivery of network plans in full and faster. Current plans for network expansion are sufficient but must overcome many barriers to deliver on time; some vital projects need to be accelerated to deliver by 2030. More than twice as much network expansion needs to be built in the coming six years than built in the previous ten.
- Central to our proposed connections reform is the creation of a direct link between the technology and capacity needed, by location, in the Government's Clean Power 2030 Action Plan and the connection offers that are made.
- Plan network access outages further ahead to accommodate the significant increase in work taking place and ensure that the power system remains secure and stable.

This section provides additional detail behind our networks and connections analysis, setting out methodology, where we are now, what is needed for clean power, the basis of our analysis, stakeholder feedback and enablers.

Further detail on our assumptions and the data outputs are in our assumptions log and data workbook respectively.

2. Delivering a clean power network

2.1 Where we are today

The electricity network today is around 500,000 miles of wires and cables transporting power around Great Britain. Electricity networks are investing around £30 billion over this price control period and embarking on the biggest programme of reforms in the history of the national grid.[1]

The recent increase in applications for network connections (trebling between 2019 and 2023)[2] has posed challenges for both customers and transmission and distribution network operators. This increase is due to a significant rise in large-scale generation and storage projects, leading to a queue for access to the transmission and distribution networks. The number of applications continues to grow rapidly.

The electricity transmission network accommodates around 62% of annual demand from clean power sources today. If Great Britain achieved a clean power generation and demand mix through 2030, this would still only deliver 92% clean power without further network investment.

To accommodate future growth of renewable generation, we have already implemented ambitious plans to expand the transmission network. Under the Pathway to 2030, we have outlined a network design aimed at connecting 50 GW of offshore wind power by 2030. Additionally, through Beyond 2030, we have developed a network design to achieve the Sixth Carbon Budget and connect approximately 85 GW of offshore wind power by the middle of the next decade.

The delivery of the 2030 transmission network is already underway, based on our existing network plans. In our Pathway to 2030 (July 2022), we recommended deployment of 94 transmission schemes by 2030 across Great Britain. Ofgem subsequently provided funding for 26 projects to the transmission owners (TOs) through the Accelerating Strategic Transmission Investment (ASTI) framework to prioritise development of key transmission schemes for 2030.

A full list of transmission projects and their status is provided in the data workbook.

Limited significant new build of electricity transmission has taken place in recent years outside of a new line to facilitate the connection of Hinkley Point C nuclear power station, the upgrade to the Beauly to Denny line in the Scottish Highlands and a new line in Yorkshire.

The offshore wind deployed to date has been connected back to shore by subsea cables. An HVDC link Hunterston in Scotland to Connah's Quay in Wales, known as the Western Link, is in operation.

1 How do the UK's energy networks work? - Energy Networks Association
2 How we're improving grid connections – Energy Networks Association (ENA)

2.2 The ambition for 2030

A clean power network must allow sufficient low carbon generation to be moved through, delivering clean power while minimising the impact of constraints on consumers. Accelerating transmission network investment will reduce system costs.

The transmission network build programme to 2030 requires up to £60 billion to deliver around 1,000 km of onshore and over 4,500 km of offshore network and enabling works. This would more than double the total built in the last 10 years. Alongside the 2030 network delivery, further expansion must proceed to support continued growth in demand and renewables in the 2030s.

The delivery of the 2030 transmission network is underway based on existing plans. In the Pathway to 2030 (July 2022), 94 transmission schemes were recommended across Great Britain. This has since been revised to 88 schemes after descoping by TOs and reassessment by NESO. Ofgem has funded 26 projects through the ASTI framework to prioritise key transmission schemes for 2030.

Different supply and demand mixes result in different pinch points on the network, where we see the highest unresolved constraints on key parts of the network. There are still constraints in southern Scotland in our Further Flex and Renewables pathway and Very High Renewables sensitivity, although this is helped by the deployment of long-duration storage, as well as in East Anglia due to interconnectors. In New Dispatchable gas, the constraints are the lowest; the dispatchable plant with CCUS is in one of the CCUS clusters and makes more efficient use of the planned electricity transmission network. The Very High Renewables sensitivity has the highest constraints due to the significant volume of renewable generation, particularly connected in Scotland and East Anglia.

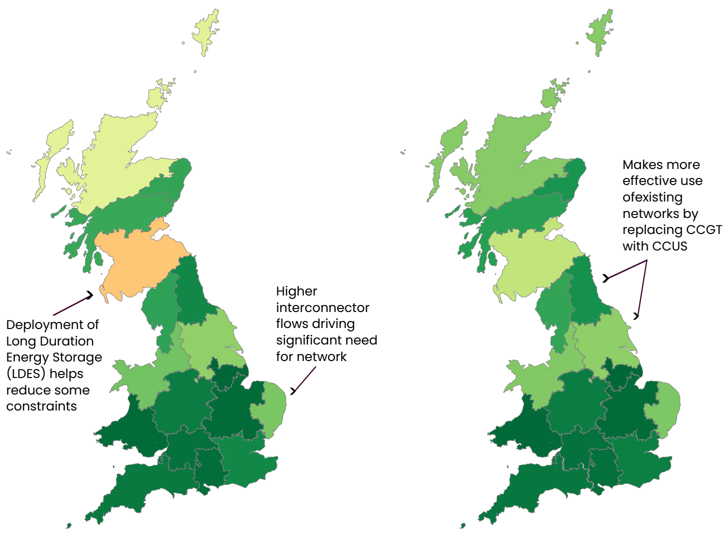


Figure 1: **Redispatch with the Clean Power Network, under each scenario – Further Flex and Renewables (left) and New dispatch (right)**

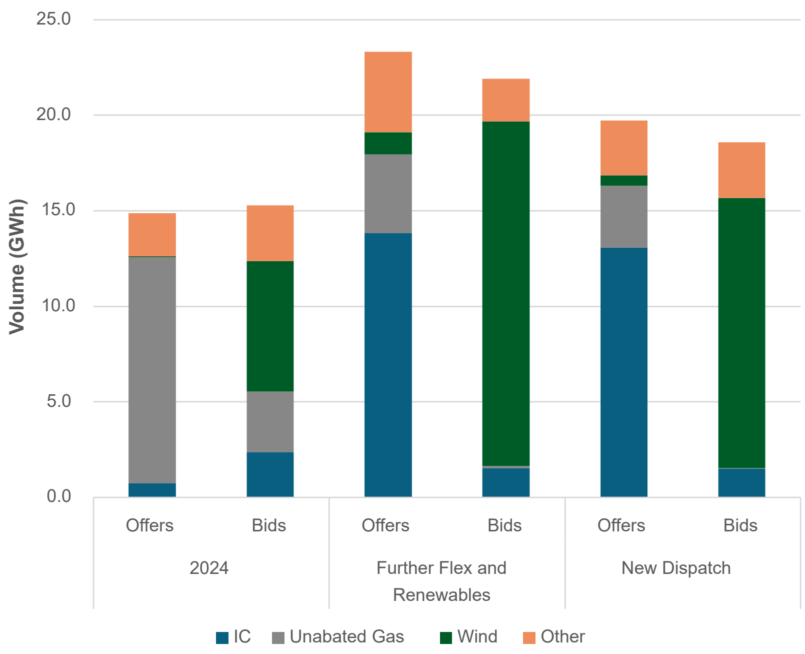


Figure 2: **Volume of generation redispatched under each pathway**

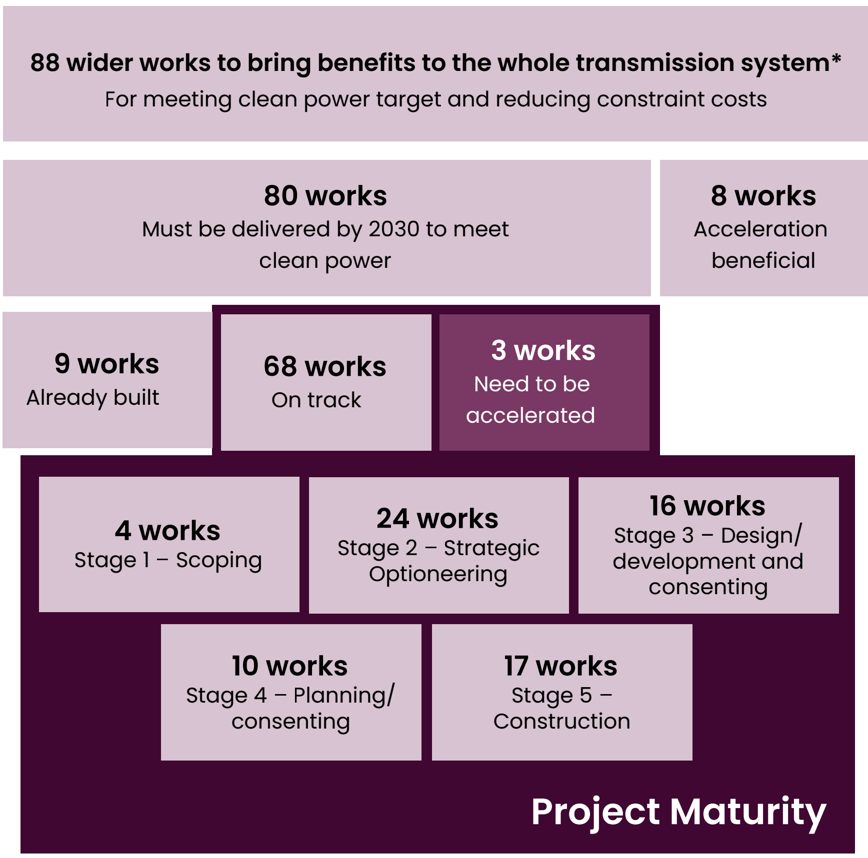
Most of the generation constrained in our analysis is from wind and is most frequently replaced by changing the position of interconnector flows. This is usually a reduction in exports; during high wind periods, prices in Great Britain are usually lower than in Europe, which leads to exports. At other times, this may be an increase in imports. When prices are higher in the connected markets, it is cheaper to run gas plants than to reduce exports or increase imports.

2.3 Delivering the 2030 network

Significant investment in transmission and distribution networks will be essential to connect generation, ensure system security and facilitate power transfer from generation sites to demand centres. The wider transmission network is crucial for clean power, but additional investment is necessary. Local works will be identified based on specific generation units through the reformed connection process.

To meet clean power in an efficient way in 2030, we recommend a total of existing 88 wider transmission schemes that deliver clean power and minimise constraints. 80 must be delivered by 2030 to deliver the clean power metric. 9 of these have already been built. Three projects have been identified as critical to delivering a network which supports the clean power pathways. At present, these three projects have delivery dates after 2030 and support is, therefore, needed to bring these projects forward for 2030 delivery. Moving delivery forward on a number of key projects would require drastically accelerating and fast-tracking Development Consent Order periods.

Of the 88 projects, 9 are built and 17 are under construction. 10 projects are in the planning and consenting processes, awaiting decisions. 44 projects are at an earlier stage of development, prior to planning and consenting. Of the 68 works that are on track for delivery, we have further identified those which will have the biggest impact on the clean power metric and constraint costs.



Breakdown of the wider required transmission works. The full list is available in the data workbook

**Only includes works for wider transmission benefit and does not include works such as connection enabling works, assets needed for operability*

Category	Key
New offshore network infrastructure	
New onshore network infrastructure	
Voltage increase on network	
Existing network upgrade	
Substation upgrade or new substation	
Existing Network	

*Amber dashed lines represent reinforcements required for this blueprint, but current delivery date estimates sit beyond this.

Note: all routes and options shown on this map are for illustrative purposes only.

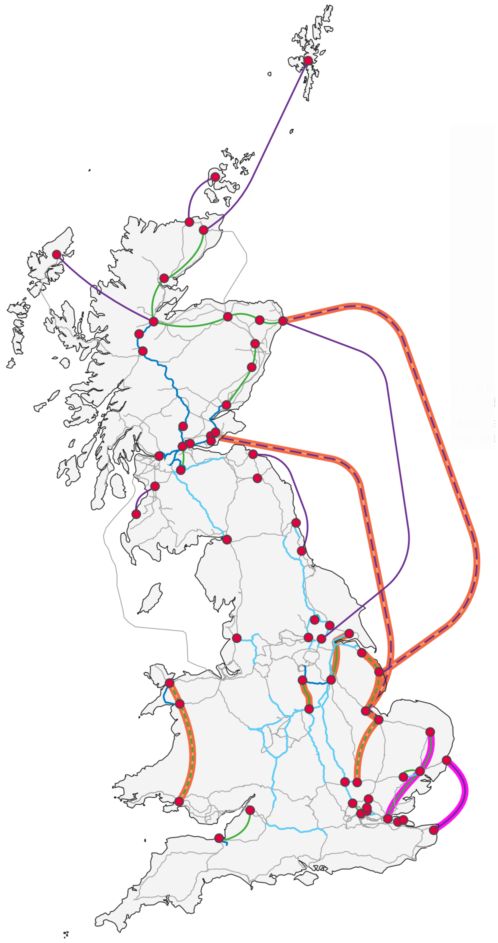


Figure 3: Map of the network recommended for clean power, showing schemes that must be supported back to 2030 (in purple) and schemes that are beneficial if accelerated to 2030 (in red).

2.4 Securing works for a 2030 delivery

There are three key schemes originally signalled as being delivered in 2030 in the Pathway to 2030, but where delivery will now be in 2031. The impact of these schemes is shown below. The percentages shown represent the difference in modelled percentage clean power generation across a typical year across the pathways.

Table 1: Impact of key projects for delivery in 2031 if not accelerated

Project	Connections / Support	Impact on Clean Power / Constraint Impact		Latest Status from TOs
		Further Flex and Renewables	New Dispatch	
Norwich to Tilbury (AENC and ATNC)	Delivers new substation connecting • North Falls OWF • Five Estuaries OWF • Tarchon Interconnector Facilitates transfer of clean power through and out of East Anglia	-1.04% +£2.8 billion constraints in 2030	-1.0% clean power +£2.7 billion constraints in 2030	Planned for 2031
Sealink HVDC from Suffolk to Kent (SCD1)	Facilitates transfer of clean power through and out of East Anglia Required for connection of Five Estuaries OWF and firm connection of Rampion Extension	-0.6% +£1.4 billion constraints in 2030	-0.25% +£1.1 billion constraints in 2030	Planned for 2031

There is a significant capacity of offshore wind planned to connect this decade into East Anglia, which is a key enabler for clean power. Without the significant network capacity provided by these schemes a significant proportion of the wind power generated off East Anglia, around 23 TWh (in the Further Flex and Renewables pathway) will not be able to reach demand, leading to increased balancing costs and a need to replace some 4 TWh (in the same pathway) of this generation with unabated gas.

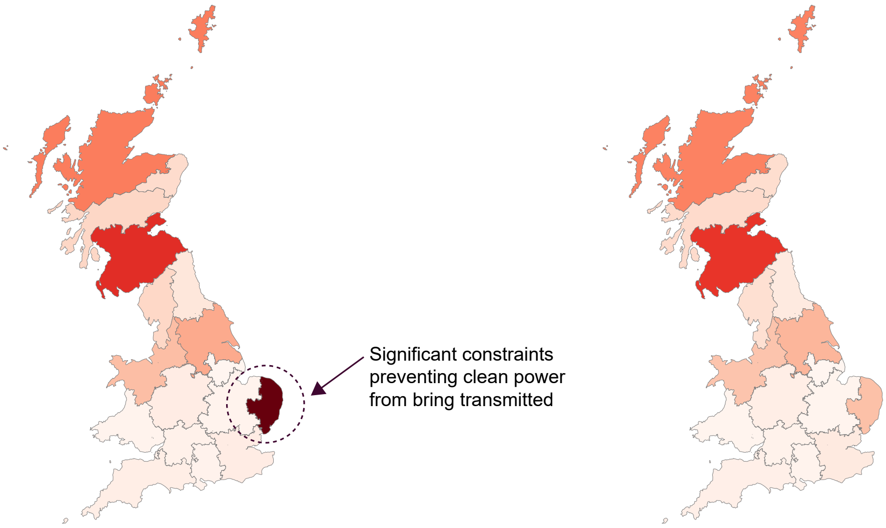


Figure 4: Constraints heat map if the schemes in East Anglia are not delivered (left) and if all projects are delivered in 2030 (right) in Further Flex and Renewables

2.4.1 Key projects have a significant impact if not delivered by 2030

The following projects are reported as on target for 2030, but they provide significant capacity across the country to deliver clean power. Whilst all 80 required works collectively allow Great Britain to meet the clean power metric, these are the schemes which have the highest impact on the country's ability to do so.

The four schemes in the table below provide significant additional capacity on the network to facilitate flow north to south.

Table 2: Impact of key projects for delivery by 2030

Project	Impact on Clean Power/ Constraint Impact		Latest status from TOs
	Further Flex and Renewables	New Dispatch	
Eastern Green Link 1 (E2DC), Torness to Hawthorn Pit subsea HVDC link	-0.4% +£877 million	-0.4% +£840 million	In construction; delivery in 2030
Eastern Green Link 2 (E4D3), Peterhead to Drax subsea HVDC link	-0.8% +£374 million	-0.7% +£248 million	In construction; delivery in 2029
Yorkshire GREEN (OPN2)	-0.4% +£1.0 billion	-0.5% +£1.05 billion	In construction; delivery in 2028
400 kV upgrade of Brinsworth to Chesterfield double circuit and Chesterfield to High Marnham double circuit (EDEU)	- 0.9% +£222 million	- 1.0% +£220 million	Planning application expected to be submitted in early 2025 for delivery in 2029

It is critical that this network is delivered to enable an affordable and secure clean power system, while recognising the scale of the investment required. In the Transmission Acceleration Action Plan (TAAP), a series of recommendations were made to speed up the delivery of transmission network. A number of these will be needed in the short term to help TOs secure the delivery of the network to 2030, as well as continued development of the post-2030 network.

The acceleration of these projects to 2030 is also being proposed amidst challenges across the global supply chain for building renewable infrastructure. Global competition and the shared urgency to decarbonise have put pressures on the UK procuring the necessary materials, equipment and skills for these key projects.

2.4.2 Reducing constraints

Overall, the proposed clean power network allows for enough clean power to be added to reduce unabated gas generation to under 5% in line with our clean power definition. The planned investment will enable clean power to be moved from where it is generated to where it is needed. However, the network that meets clean power still results in high constraint costs.

Table 3: Forecast constraint costs and clean power metric

Clean Power network	Further Flex and Renewables	New Dispatch
Forecast constraints cost in 2030	£3.6 billion	£2.8 billion
Clean power metric in 2030	>95%	>95%

This can be mitigated by bringing forward network development currently scheduled for delivery after 2030. These schemes will enable renewable energy, typically generated in the north of the country, and will reduce the need to run gas-fired generation plants, typically located in the south. This also further reduces the need for gas overall and reduces constraint costs to customers.

2.4.3 Delivering planned network reinforcement projects brings significant benefit in further reducing constraints in a clean power system

From Pathway to 2030 there are eight further projects, with delivery dates beyond 2030. Six of these projects, we understand from TOs, could be accelerated towards 2030 and any acceleration would bring reduced constraint costs. However, accelerating them to 2030 is likely to be extremely difficult. Two projects are at an earlier phase of development and, we understand from TOs, cannot be brought forward from their existing post-2035 delivery dates, although any acceleration will bring benefits.

These projects are summarised in the following tables:

Table 4: Projects due after 2030 with potential for acceleration

Network	Description	ASTI	Current delivery year based on stakeholder engagement
CGNC	New circuit between Creyke Beck and High Marnham	Yes	2031
E4L5	New offshore HVDC link between Peterhead and the East Coast of England (Eastern Green Link 3)	Yes	2033
EDN2	New circuit between Chesterfield and Ratcliffe-on-Soar	Yes	2031
GWNC	New circuit between North Lincolnshire and South Lincolnshire border	Yes	2033
SHNS	New substation in the South Humber area	Yes	2033
TGDC	New offshore HVDC link between east Scotland and the East of England (Eastern Green Link 4)	Yes	2034

Table 5: Projects at an earlier stage of development, which cannot be accelerated to 2030

Network	Description	ASTI	Current delivery year based on stakeholder engagement
PSNC	New circuit between North Wales and South Wales	Pre-construction funding	2037
LRN6	New transmission capacity between the South Lincolnshire, Cambridgeshire and northwest Norfolk boundary to Hertfordshire	Pre-construction funding	2034

Building these schemes has a different impact on constraint costs depending on the generation and demand mix. Deployment of low carbon dispatchable power in the right place can reduce constraint costs to a greater degree than in a high-renewable generation mix. Our analysis shows that constraint costs could reduce to around £1.9 billion in Further Flex and Renewables and to £1.1 billion in New Dispatch.

For comparison, constraint costs could be as high as £2.4 billion in a world with high demand and very high levels of renewables.

2.4.4 Stakeholder view

We have worked closely with organisations developing the network to understand what the status of their projects is and how likely they are to deliver key projects in line with the clean power 30 objective. This has underpinned the network analysis. One stakeholder told us that it's important to view the wider work analysis in the context of the wider delivery of accelerated strategic transmission investments (ASTIs) and the enabling and connection works these stakeholders are undertaking.

A great deal of feedback from stakeholders tells us that the development of the network is critical to support the clean power 2030 objective and failure to deliver will significantly undermine such objective. These stakeholders believe that there should be action to ensure that constraints are significantly reduced from the network. Concerns that remain for residual constraints in a 2030 clean power network should be resolved by further network build throughout the 2030s. A stakeholder has suggested that an ASTI-type framework may be required to ensure timely delivery of critical network currently scheduled to complete through the 2030s.

It is essential that the 94 transmission projects identified in the Holistic Network Design (HND) 'Pathway to 2030' report be delivered in full. Some of the projects identified as "essential for 2030" have service dates beyond 2030, with one extending to 2037. Urgent measures must be taken to bring these projects forward, possibly through an ASTI-type framework to ensure timely delivery.

A range of stakeholders have shared views that there is a need to develop networks in a way that represents value for money, is done in an environmentally considerate way, includes early engagement and facilitates some community benefit. Stakeholders emphasised the importance of regional connections and network build to enable national works. Stakeholders also reiterated the importance of the principles and proposals laid out by Nick Winser, the Electricity Network Commissioner, in 2023, in the context of the new clean power target.

Within stakeholder engagement forums, a key theme was ensuring communities are properly considered when developing the associated network. Support from communities is vital to ensure renewable energy projects and infrastructure are approved and delivered. A representative of coastal communities told us there is significant frustration around environmental impacts. These communities are on the frontline of climate change driven by the coastal erosion and it was felt they currently experience little direct benefit from hosting offshore energy infrastructure.

Stakeholders have suggested that a clear approach for community benefits across all technologies and sectors is essential so that such communities know what to expect. We've also heard many views on how to accelerate network build across bolstering associated workforce and skills, as well as reducing planning times.

2.5 What needs to happen

With the challenges and potential acceleration needed for the network projects we have identified, consideration should also be given for more action to support delivery of the network to 2030. This includes:

- Exploring how to expedite the development of these critical infrastructure projects and prioritisation in the planning and consenting process.
- Certainty and assurance that Great Britain can access the key network components that are needed, including HVDC cable, converter station equipment, substation equipment and transmission towers.
- Greater supply chain coordination between certain projects at transmission, distribution and generation levels that may require similar components and skills to deliver in time for 2030, with more centralised analysis that can quantify and identify equipment and materials across network and generation projects.
- Clarity on strategic planning and regulatory funding and incentive mechanisms, providing certainty of revenue to TOs and DNOs to make investments in projects.
- Greater coordination and focus to leverage the buying power and domestic manufacturing capability of the UK.
- Continuation of innovation projects and working on new opportunities to support delivery of network plans and data management, including DER Visibility and probabilistic modelling and Powering Wales Renewably (Beta).

Continued and significant investment is needed, at pace, in Great Britain's transmission network. Any barriers delaying delivery beyond earliest in service dates for network projects will have a significant effect on the deliverability of clean power by 2030. Greater certainty is needed on the market, policy and regulatory arrangements that will be needed to get to 2030 and beyond.

A clean power network can result in high constraint costs. This can be mitigated by bringing forward network development currently scheduled for post-2030 delivery. These schemes will enable renewable energy, typically generated in the north of the country, and will reduce the need to run gas-fired generation plants, typically located in the south. This further reduces the need for gas overall and reduces constraint costs to customers.

The development of transmission network infrastructure should be considered holistically with the needs at distribution and local levels for delivering a clean power system. Stakeholders identified the value in greater coordination between transmission and distribution leading to better outcomes and efficiencies around network reinforcements. Increasing this coordination, and coordination with other local planning bodies, would avoid progress and actions to achieve clean power from becoming disjointed and misaligned.

Consideration of planning rules and reform may also be important for overcoming certain barriers faced by DNOs. This includes whether planning thresholds are still set at the optimal level in the drive to clean power, including the 2 km threshold in the planning for overhead lines. Any changes or action around planning should be taken holistically, having regard to the whole system and local impacts of any decisions. Increased transparency and data sharing throughout the process could also help to foster trust between developers and statutory consultees.

Accelerating network infrastructure to 2030 will also require quick and consistent decisions from Ofgem, to unlock investment in vital network projects and set funding allowances for the projects identified in the plan for clean power. Clarity is needed on the policy and regulatory funding and incentive mechanisms calibrated for these projects to provide certainty of revenue and target dates across transmission and distribution sectors. Any actions taken on investment and funding mechanisms should be coordinated and should also acknowledge the analysis in the Clean Power Plan (where possible), so that a balance between the required certainty, risk/reward, investability and regulatory oversight can be achieved.

2.5.1 Enabling works from the Holistic Network Design.

To ensure the offshore windfarms within the pathways can connect and export their power on the transmission network, a number of enabling works must be delivered by 2030. These works are determined by technical studies that were previously undertaken following the Pathway to 2030: Holistic Network Design publication.

The table below provides a list of some of the major onshore enabling works, which are a subset of, including ASTI, schemes and options from within the Beyond 2030 analysis that needed to be delivered ahead of 2030. In addition, this list presents the current view of enabling work requirements and the works would be updated as offshore wind connections advance further in their development.

The projects required vary between our pathways, to reflect the different capacity of offshore wind required in the different options. For a full list of projects please see tab N1 in the data workbook.

Table 6: List of major enabling works

Code	Project Description	Further Flex and Renewables	New Dispatch
AENC	New circuit in northeast Anglia	✓	✓
ATNC	New circuit in southeast Anglia	✓	✓
BDUP	Upgrade the existing network to a higher voltage between Beauly and Denny	✓	✓
BLN4	New circuit between Carnaig (Loch Buidhe) and Beauly	✓	✓
BPNC	New circuit between Coachford (Blackhillock 2) and Peterhead	✓	
BTNO	New circuit between Bramford and Twinstead	✓	✓
CGNC	New circuit between Creyke Beck and High Marnham	✓	✓
CWPC	Power control device along Cottam to West Burton	✓	✓
E2DC	New offshore HVDC link between Torness and Hawthorn Pit (Eastern Green Link 1)	✓	✓
E4D3	New offshore HVDC link between Peterhead and Drax (Eastern Green Link 2)	✓	✓
E4L5	New offshore HVDC link between Peterhead and the East Coast of England (Eastern Green Link 3)	✓	
EDEU	Upgrade the existing network to a higher voltage between Brinsworth and Chesterfield and Chesterfield and High Marnham. Develop new High Marnham and Chesterfield high voltage substations	✓	✓
ETRE	Upgrade the existing circuits between Eggborough and Thorpe Marsh to allow for more capacity	✓	✓

Code	Project Description	Further Flex and Renewables	New Dispatch
FHRE	Replace the conductors on the existing circuit between Feckenham and Hams Hall with higher capacity conductors	✓	✓
FMR2	Replace the conductors on the existing circuit between Feckenham and Minety with higher capacity conductors	✓	✓
HNRE	Replace the conductors on the existing circuits between Hawthorn Pit and Norton with higher capacity conductors	✓	✓
HWUP	Upgrade the existing network to a higher voltage between Waltham Cross to Hackney	✓	
IFR1	Replace the conductors on the existing circuit between Feckenham and Ironbridge with higher capacity conductors	✓	✓
KCEU	Carry out thermal upgrading of the existing circuits between Creyke Beck, Keadby and Killingholme	✓	✓
KCRE	Replace the conductors on the existing circuit between Cottam and Keadby with higher capacity conductors	✓	✓
KWP2	Increase rating of power control devices installed on the existing circuit between Keadby and West Burton	✓	✓
NNNC	New circuit between New Deer and Greens	✓	
NOR6	Replace the conductors on the existing circuit between Norton and Osbaldwick with higher capacity conductors	✓	✓
OPN2	New circuit between Osbaldwick and Poppleton	✓	✓
OTHW	Carry out thermal upgrading on the existing circuit between Osbaldwick and Thornton	✓	✓
PCR1	Replace the conductors on the existing circuits between Carrington and Penwortham and Penwortham and Padiham with higher capacity conductors	✓	✓
PKUP	Upgrade and/or rebuild the circuits and equipment between Longside (Peterhead 2), Peterhead, Persley, Kintore, Fetteresso, Alyth and Kincardine	✓	
PSDC	New offshore circuit between Banniskirk (Spittal) and Longside (Peterhead 2)	✓	✓
PTC1	Pentir to Trawsfynydd cable replacement	✓	✓

Code	Project Description	Further Flex and Renewables	New Dispatch
PTNO	A second transmission circuit on the existing Pentir to Trawsfynydd route	✓	✓
SCD1	New offshore circuit between Suffolk and Kent	✓	✓
SLU4	New circuit between Banniskirk (Spittal) and Carnaig (Loch Buidhe)	✓	✓
TKUP	New circuit from Kintore to Emmock (Tealing) and upgrade elements of the existing Emmock to Westfield and Alyth to Emmock circuits	✓	
WRRE	Replace the conductors on the existing circuit between West Burton and Ratcliffe-on-Soar with higher capacity conductors	✓	✓

3. The gas network

3.1 Great Britain today

Gas-fired generation provides a critical service for the electricity system and is crucial for security of supply. The gas networks are therefore critical to providing that security in a flexible way.

When a gas-fired power station starts up, the physical impact on the gas system is to lower pressure and reduce the amount of gas in the network (linepack) within the region it is located in. When multiple gas-fired power stations start at the same time, pressure and linepack levels are impacted throughout the gas network. Linepack is moved around the gas network by controlling the flows of gas within it, utilising assets such as compressors. Ultimately, this is made up with additional gas supplies to the network provided by shippers via the gas market.

In order to respond to the requirements of these gas-fired power stations, and not materially impact on other users of the network, it is therefore essential that there be sufficient compression reliably available.

3.1.1 Great Britain in 2030

Gas-fired generators continue to be of vital importance to the operation of the energy system because of their ability to bring large volumes of flexibility through fast start-ups and shut-downs.

3.1.2 The basis of our analysis

Our gas network analysis shows that the gas transmission network can absorb the impact of the gas-fired generation fleet's start-up behaviour for both summer and winter conditions. We have used a hydraulic model of the National Transmission System (NTS) owned and operated by National Gas Transmission (NGT).

Most of our analysis has assumed that all compressors in NGT's fleet are operationally available and reliable. However, the availability of compressors can be compromised by unplanned outages, so we have considered a lowered level of reliability (described as 'resilience' below) for the winter condition. The availability of compressors can also be compromised by planned outages and it is expected that NGT's maintenance programme moving forward may reduce availability at some times of the year.

In addition to this, we have assumed that the market is able to respond rapidly to ensure gas supply matches the demand of the power generation fleet. We note that the ability of the market to respond to increase supplies to the gas network can be impacted at certain times due to availability of flexibility of LNG and EU interconnector supplies.

The analysis we have done replaces ramping behaviours of the gas-fired generation fleet that are ordinarily assumed for gas network planning purposes (baseline), with the more severe behaviours observed in the electricity network analysis (enhanced). Electricity network redispatch analysis has generated operational profiles and ramp rates for gas-fired generation. These have been analysed over 1-, 2- and 4-hour periods to identify the national worst-case situations. The individual gas-fired generation offtake profiles are then applied to network analysis models, replacing the baseline behaviours. Other underlying assumptions, such as entry flow profiles, physical constraints such as safe operating pressures and unaffected GDN offtake profiles remain unchanged and therefore reflect the standard gas network analysis approaches outlined in NGT's Transmission Planning Code. Individual gas network components' operational settings are adjusted where necessary to ensure that the gas network remains within safe operational limits. Analysis has been carried out under a range of demand conditions, including an average years' peak day, a shoulder period and a typical summer's day. Analysis focused on the expected most sensitive areas: the South East and the South West.

The network analysis across the range of scenarios and ramp-rate studies will be shared with and further developed with NGT to ensure that the gas network remains within safe operational limits.

South East sensitivities highlighted that, in some situations where compression is unavailable, a higher operational opening linepack position would be required to ensure the gas network remains within safe operational limits and contractual obligations are achieved during the most severe 1-hour ramp rate period. The results of this analysis are depicted in the diagram below, which shows a repeated 24-hour period, with the 'high resilience' lines representing the situation without key compression being available.

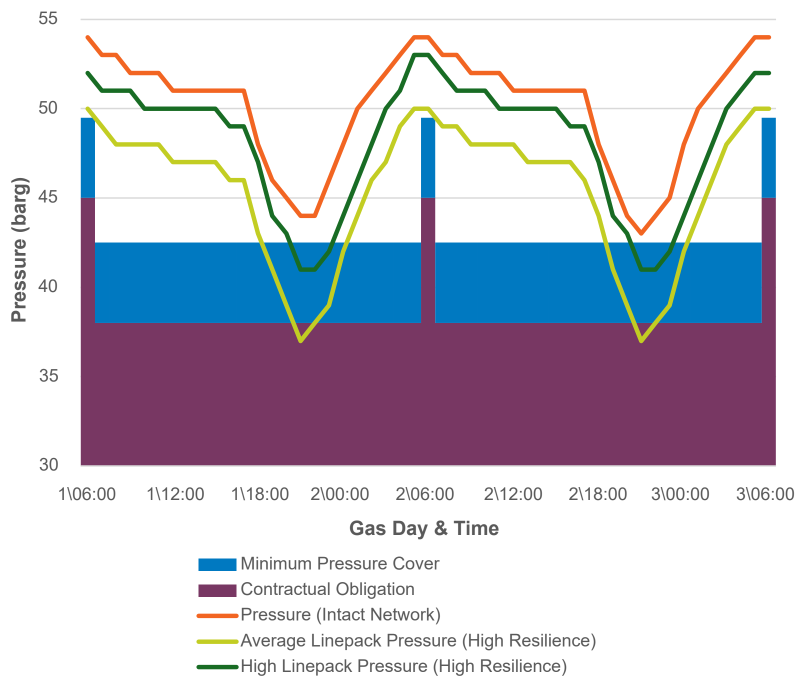


Figure 5: **NTS South East Pressure (1 Hour Ramp Rate)**

Table 7: National Transmission System (NTS) South East pressure

Pathway description	National Data			Zonal Data			Operational Changes to Support Power Profile	
	Total Linepack (Average) (Mil Nm_3)	Total Demand (mcm/d)	Linepack Swing (Mil Nm_3)	Zone	Linepack Swing (Mil Nm_3)	Power Demand (mscm)	Compression	Flow Control
South East sensitivity (Intact Network)	359.6	370.0	32.3	SE	4.8	3.9	Additional use of South East compression utilised to support loss of compressor station	Additional use of South East FCVs to manager pressure boundary
South East Min Supply sensitivity (High resilience average linepack)	349.7	370.0	32.3	SE	5.0	3.9	Additional use of South East compression utilised to support loss of compressor station	Additional use of South East FCVs to manager pressure boundary
South East min supply sensitivity (high resilience, high linepack)	359.4	370.0	32.4	SE	5.0	3.9	Additional use of South East compression utilised to support loss of compressor station	Additional use of South East FCVs to manager pressure boundary

Analysis of the South West region, presented in the diagram below, reveals that there are no physical concerns with meeting contractual obligations associated with the 1-, 2- and 4-hour ramp-rate changes that we have studied. Similarly, this diagram covers a repeated 24-hour period.

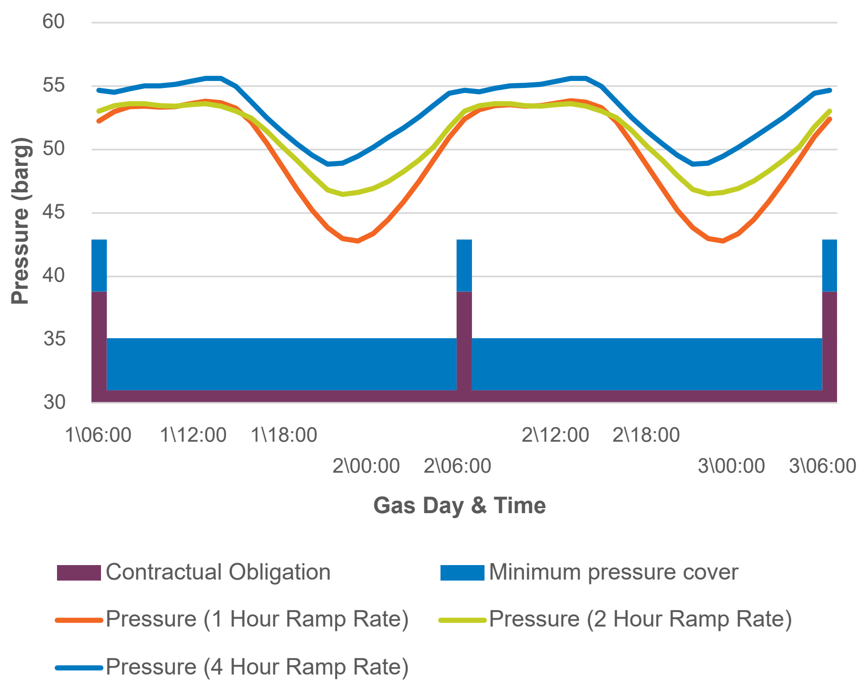


Figure 6: NTS South West Pressure

Table 8: NTS South West pressure

Pathway Description	National Data			Zonal Data			Operational Changes to Support Power Profile	
	Total Linepack (Average) (Mil Nm_3)	Total Demand (mcm/d)	Linepack Swing (Mil Nm_3)	Zone	Linepack Swing (Mil Nm_3)	Power Demand (mscm)	Compression	Flow Control
South West (1 Hour Ramp Rate)	344.3	269.1	22.5	SW	1.0	2.9	No changes required	No changes required
South West (2 Hour Ramp Rate)	353.0	379.2	31.0	SW	3.6	4.0	No changes required	No changes required
South West (4 Hour Ramp Rate)	347.2	282.8	22.3	SW	2.3	5.8	Additional use of South East compression to support increase in power demand	No changes required

3.1.3 Stakeholder views

Stakeholders stressed that additional requirement of gas generation would require the cancelling or postponing of asset outages (compressor stations etc). They stated that operating NTS with a relatively high opening linepack in the summer, to mitigate unexpected unavailability, may require more facilities to be operationally available and potentially impact the availability of outage windows. They noted that there is likely an increasing need for outages as the assets of the gas network age and they need to be more resilient. There could also be an impact on combustion plant directive derogations of current compressor units within future regulatory arrangements. We expect that these may trigger discussions with Ofgem regarding asset intervention strategies and their funding and may trigger changes to operational practices.

Stakeholders highlighted that the detailed implications for gas network operation needed further exploration and that the gas market may change or evolve over the intervening period. One stakeholder noted that the operational forecasts carry significant levels of uncertainty and that information, such as nominations from shippers and CCGTs, are only required very late in the gas day, and wondered whether earlier and more accurate information provision might improve this forecasting.

One stakeholder commented that additional investment would be required to repurpose the gas network to achieve the 2030 ambition.

3.1.4 What needs to happen

Continuation of work to improve the availability and/or resilience of the gas network into RIIO-3, alongside RIIO-3 reopener opportunities, to enable any additional investment that might be required to reach clean power by 2030.

3.2 Hydrogen transport and storage networks

3.2.1 Great Britain today

There currently are no major hydrogen transportation (transmission and distribution) pipelines in operation in Great Britain. However, projects linked to Track 1 industrial clusters are in development.

3.2.2 Great Britain in 2030

There is some optionality across the CCUS and hydrogen to power pipeline, but both rely on the delivery of critical infrastructure.

3.2.3 The basis of our analysis

By 2030, we expect there to be limited hydrogen infrastructure within Great Britain, which will be within the industrial clusters. Programmes will be underway to deliver wider infrastructure after 2030.

When considering the extent for the need of a larger hydrogen network, it is important to consider future generation and demand locations. It might be the case that generation is not located close to or produced at the same time as demand, therefore pipelines and storage would be needed to assure that supply can meet demand.

Work is currently being carried out by NGT, aiming to demonstrate how to transport hydrogen safely around the current natural gas NTS.[3] Outcomes from this will feed into the design and development of NGT's "Project Union" development. This project will be developed in phases with an aim of repurposing and newly building pipelines.[4] Our 2030 hydrogen to power use does not require completion of Project Union or any similar national-scale hydrogen pipeline infrastructure by 2030.

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3 nationalgas.com/future-energy/futuregrid
4 nationalgas.com/future-energy/hydrogen/project-union

As hydrogen can be stored over time and the production and consumption may not always align, there will be a need for hydrogen storage to help smooth out these differences across different timescales. Salt caverns and existing oil and gas fields present options for storing hydrogen. However, salt deposits in Great Britain are restricted geographically to East Yorkshire, Cheshire and Wessex and gas fields also have specific locations. Pipelines would therefore be needed in order to transport hydrogen from production to storage and then to demand.

3.2.4 Stakeholder views

Stakeholders have told us that developing storage caverns is a major challenge and is a significant blocker for the development of the hydrogen network out to 2030. This is because the lead time on a storage cavern is typically 7 - 10 years. Stakeholders have also flagged that specialist pipework needed for hydrogen will take time to procure, which is an example of wider supply chain challenges in developing these projects.

Stakeholders have suggested that we could import renewably sourced ammonia from abroad. They have suggested that this could be a feedstock that takes far less energy from which to remove the hydrogen. This approach could function as a stop gap ahead of a wider penetration of hydrolysers coming online in Great Britain.

Stakeholders have told us that the success of developing these projects is getting Government funding, signalling and policy to develop the projects that will facilitate more private investment and have highlighted that these challenges could be similar to challenges faced by other technologies, such as offshore wind. Stakeholders are telling us that they are still working through viable business models for hydrogen and this work will need to progress swiftly to ensure the development of these types of projects.

3.2.5 What is the impact

Failure to deliver on the required hydrogen transport and storage infrastructure within the industrial clusters limits the optionality on low carbon dispatchable power and would require an increase in gas CCS projects to provide the same level of flexibility and security of energy supply through 2030. This would also have a significant impact on the progress of other sectors, such as heavy industry, meaning that emission targets would likely be missed.

3.3 CO_2 transport and storage

3.3.1 Great Britain today

There currently are no major hydrogen transportation (transmission and distribution) pipelines in operation in Great Britain. However, projects linked to Track 1 industrial clusters are in development.

3.3.2 Great Britain in 2030

Timely development of CO_2 transport and storage infrastructure is critical for the deployment of low carbon dispatchable power by 2030. Our analysis assumes that transport and storage infrastructure within Track 1, Track 1 expansion and Track 2 of the Industrial cluster programme is deliverable by 2030.

The ability to safely capture and store CO_2 will help achieve clean power as it allows for low carbon dispatchable generation to be deployed, making sure the supply can meet demand.

3.3.3 The basis for our analysis

On 4 of October 2024, the Government announced funding for the first carbon capture sites in Teeside and Merseyside. There is up to £21.7 billion worth of funding over 25 years.[5]

5 gov.uk/government/news/government-reignites-industrial-heartlands-10-days-out-from-the-international-investment-summit

Storage of CO_2 will occur in depleted oil and gas fields in the East Irish Sea (EIS) and the North Sea. To date, the North Sea Transition authority (NSTA) have had 21 accepted licences for storage in depleted oil and gas fields. These fields could store up to 30 million tons of CO_2 per year by 2030.[6] The NSTA is able to hold further licences for CO_2 storage, building on the licences issued in the first round in 2022.[7]

3.3.4 Stakeholder views

Similarly, regarding the development of the hydrogen network, stakeholders have told us that developing storage caverns is a major challenge, also needing a 7 - 10 year lead time. CO_2 also relies on specialist pipework, which will take time to procure. A network organisation felt that the technologies are very similar to those used in the gas industry and lead times could be turned around far quicker with the right support and investment.

Other bodies highlighted to NESO that prioritisation should be given to the CO_2 network (and associated cluster decisions).

Key to the success of developing these projects is getting the Government funding and continued policy support to develop the projects that will facilitate more private investment (i.e. Track 2 projects and beyond). Business models for CCS are established, with the Track 1 clusters close to taking final investment decisions, providing a clear signal that projects are investable on this basis.

3.3.5 What needs to happen

Ensure sufficient capacity of transport and storage infrastructure for the required power CCS.

Overcome risks associated with First of a Kind (FOAK) projects.

3.3.6 What is the impact

Failure to deliver on the required CO_2 transport and storage infrastructure limits the optionality on low carbon dispatchable power and would require an increase in hydrogen projects to provide the same level of flexibility and security of energy supply through 2030. This would also have a significant impact on the progress of other sectors, such as heavy industry, meaning that emission targets would likely be missed.

6 nstauthority.co.uk/news-publications/net-zero-boost-as-carbon-storage-licences-accepted/
7 nstauthority.co.uk/news-publications/huge-net-zero-boost-as-20-carbon-storage-licences-offered-for-award/

3.4 Connections

3.4.1 Great Britain today

New projects have been entering the connections process at an ever-increasing pace. To meet decarbonisation targets and economic growth efficiently, the connection queue needs to contain the right mix of projects. Connections reform, along with greater network investment, will be critical.

3.4.2 Great Britain in 2030

Projects that are ready and aligned with the Government's clean power action plan must be able to connect at pace

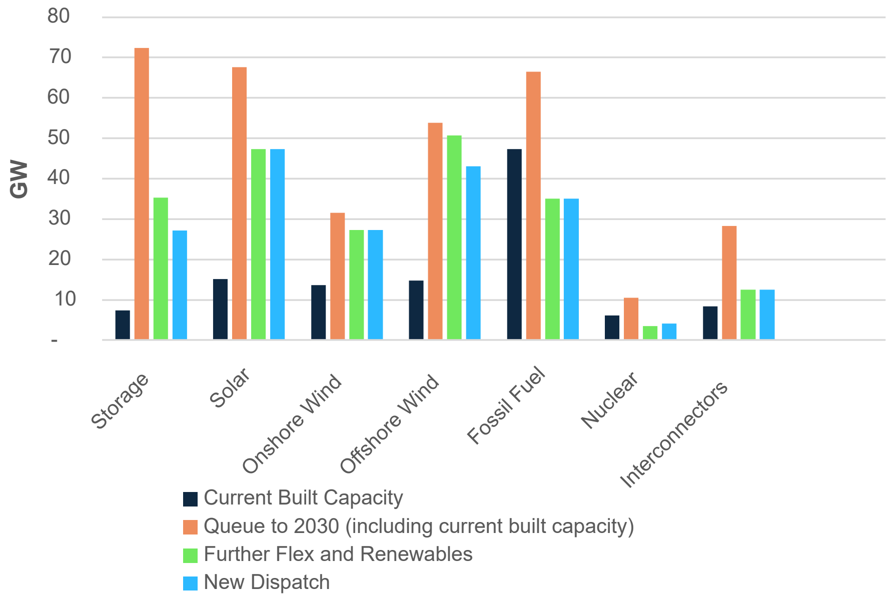

Figure 7: **The current unreformed queue, broken down by technology and year out to 2030 alongside each pathway and where the queue stands relative to the requirements of each pathway in 2030**

Connections reform needs to cover both transmission and distribution networks and the enabling works required. Priority should be given to connecting projects that are both ready and aligned to strategic energy plans. This may mean, for example, connecting renewable generation ahead of storage, if that storage is not (yet) required. Storage can, instead, be collocated to help the connection of renewables and flex assets.

The current queue for both transmission and distribution connections includes projects that may not be ready to progress and/or are not likely to be aligned with the Government's plan for clean power by 2030, based on our analysis. Connecting only those projects which are ready and aligned to the strategic energy plans can enable renewable projects with a current connection date beyond 2030 to be brought forward if their development can be accelerated. Delivering net zero will require connecting new capacity and new types of customers more quickly than at any time since the current process was established.

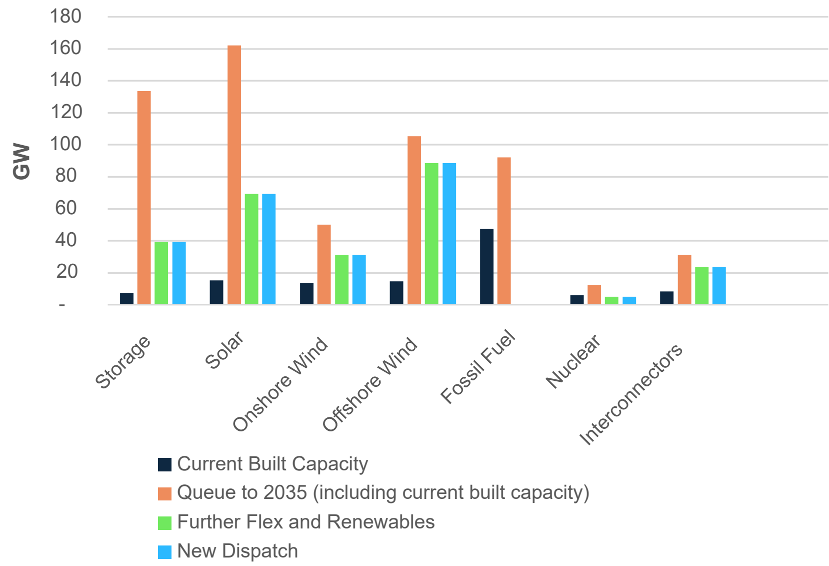

Figure 8: Transmission and distribution queue to 2035 alongside clean power pathways

Incorporating this new generation and demand will give rise to an increasing volume of connections, as well as significant shifts in the nature of connecting customers and their needs.

Figure 7 and Figure 8 show the combined transmission and distribution connection queues compared to what each of our pathways says that might be required in 2030 and 2035 at a national level. These figures show that, for some technologies, there is a clear gap between the current queue and what is needed in the future.

The amount of generation capacity currently contracted to connect between now and 2035 significantly exceeds the upper end of our pathway analysis. Up to c285 GW of generation, interconnection and storage capacity would be needed by 2035, according to the Holistic Transition pathway in Future Energy Scenarios 2024.

Central to our proposed connections reforms is the creation of a direct link between the technology and capacity needed, by location, in the Government's clean power action plan, and the connection offers that are made.

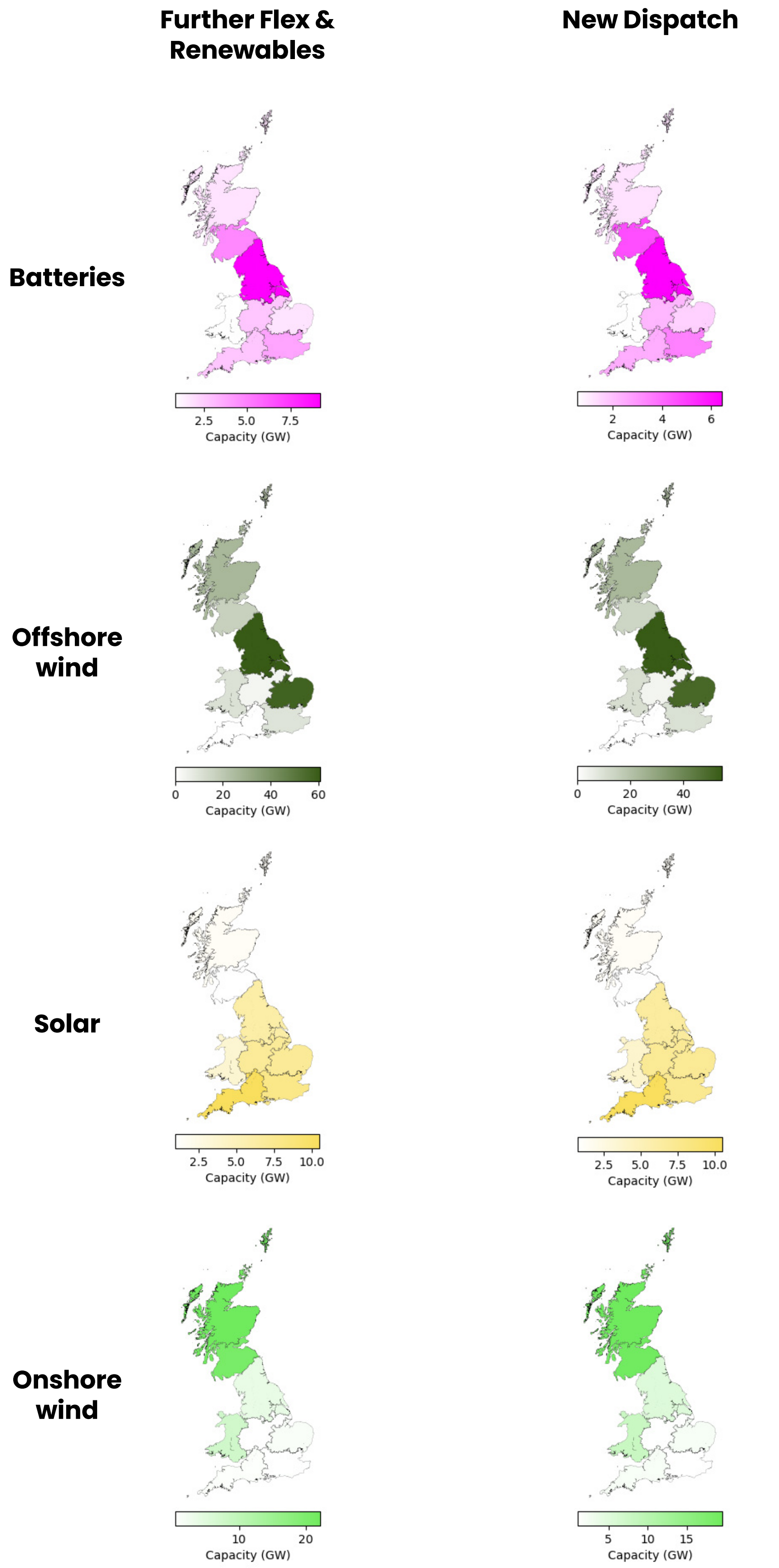

Figure 9: Spacial capacity maps

3.4.3 Stakeholder views

NESO has been engaging with stakeholders on grid connections reform for some time through various channels. We have mixed views across industry on our grid connection proposals, with some project developers highly supportive of more strategic intervention and other developers more cautious or concerned about the impact of aligning to strategic energy plans. Network companies in general have been highly supportive of recent proposals to align the connections process and reformed connections queue with strategic energy plans.

Project developers are keen to understand the detail (notably on whether they are "needed") as soon as possible, otherwise this could create investment uncertainty. To mitigate against this investment uncertainty, some stakeholders are keen that we prioritise projects that are further developed (i.e. projects that have obtained planning consent would be prioritised higher than projects that have just secured land rights).

Engagement with societal delivery partners on grid connections have said that reforms need to lead to developers having pre-application conversations with local authorities (LAs): they need early sight of proposals to build in their areas to help guide. Frustration that the first time LAs were using grid connection applications was in the Transmission Entry Capacity (TEC) queue owing to lack of early developer engagement.

3.4.4 What needs to happen

The connections process needs to enable those projects that are both ready and aligned to strategic energy plans to connect. The scope of these proposals includes all projects connecting at transmission level, as well as any generation and storage projects connecting to the distribution networks that impact upon the transmission system. Consideration will also be given to the treatment of demand connections with regards to the queue and the interaction with the generation connections.

NESO has previously set out proposals intended to ensure those projects that are ready can connect to the system and have been considering how to align the connections process with strategic energy planning. The Government's action plan for clean power and the request that we consider criteria that could support connections reform has accelerated our thinking.

As such we have also published today, for consultation, details on how we propose to align the reformed connections process with strategic energy plans (initially Government's Clean Power 2030 Action Plan, and then the first Strategic Spatial Energy Plan, SSEP).

We set out in that consultation our view that the connections process and reformed connections queue should align with the technology, capacity and regional requirements for clean power as set out within Government's clean power plan (at both a transmission and distribution level), and then with subsequent strategic plans like the SSEP. The Government's clean power plan can help ensure the efficiency of the new connections queue and that 'ready'[8] and strategically aligned projects are connected efficiently to achieve clean power. This could be achieved through including capacity requirements for different technologies connecting at transmission and distribution networks, and that the pathways within the clean power plan clearly separate the proposed mix of transmission and distribution technologies, by capacity and location.

8 By 'ready' we mean projects that meet the new criteria we propose to apply to the current connections queue and future applications, that would require projects to demonstrate that they have secured appropriate land rights in order to receive a confirmed connection offer and a place in the reformed connections queue.

However, the transition to net zero emissions across the economy by 2050 does not stop with achieving clean power in 2030. Projects needed beyond 2030 are in development now and require clarity on their connection agreements too. This could be achieved through the government's clean power plan providing clarity on the pathway upon which connection offers can be based for the period 2031-35.[9] Including this 2031-35 pathway in the clean power plan will provide a 10-year time planning horizon for the reformed connections queue, thereby providing longer-term investment clarity that will help ensure an efficient transition towards net zero targets beyond 2030 (including the Sixth Carbon Budget targets), while also facilitating an efficient transition to the first SSEP.

Once the reformed queue is established, it is important to continue to monitor and manage progress of projects through queue management milestones and financial commitments. Additional ready projects could enter the queue if they are aligned with strategic energy plans.

Connections reform is at both transmission and distribution level and collaboration across the whole network is required. The Electricity Networks Association (ENA) is leading on the distribution network connection reform and how that aligns to the reforms of connections to and use of the transmission system. The ENA have also been working with their members, Ofgem, Government and NESO to deliver these six steps:

1. **Strengthen and tighten the application process.** Some customers submit speculative applications due to a lack of information and a perception that having a connection offer is in itself valuable. This has driven exponential growth in application volumes (nearly trebling since 2019), although it is recognised that the majority of these will not go on to become viable projects. To address this, network operators will take steps to make the application process more discerning, providing more information to the market, requesting more data from applicants and standardising pre-application engagement. These actions will contribute towards ensuring fewer but higher quality projects apply, addressing today's rapid queue growth and lowering attrition within the queue.
2. **Release up to 90 GW of capacity by cleaning up the queue and actively managing a "first ready, first connected" process.** To address the challenge that many projects with a connection offer will not ultimately be completed by the customer (up to 60% attrition rate at transmission level) and that customers are not ready to connect in the order that they apply, network operators are cleaning up the queue and transitioning to a first ready, first connected process. This will release up to 90 GW of capacity through customer exits and accelerate remaining applications.
3. **Accelerate up to 70 GW of applications by allowing some applicants to connect faster before network reinforcements are completed.** Historically, customers could not be connected until network reinforcements had been completed, which led to later connection dates in some cases; 31% (167 GW) have connection dates more than 10 years away. To accelerate connections of up to 70 GW of applications, network operators are providing flexible contracts for generation and storage customers through solutions at distribution and transmission levels. These will allow customers to receive earlier connection dates and to connect ahead of enabling works, although they may be instructed to reduce their output/consumption when needed.
4. **Release nearly 3 GW of capacity by treating storage differently.** Applications for storage projects are increasing faster than any other technology (5,930% from 2019-2023) and are a significant contributor to network capacity constraints. This volume (158 GW, 29% of the queue) is driven in part by the historical treatment of storage. Network operators are changing the modelling and assumptions for storage projects at both transmission and distribution level, to better align with actual usage patterns. This will directly release nearly 3 GW of capacity and will also contribute to the impact and benefits delivered through action 5, making network planning more coordinated and realistic.

9 We are proposing that the 2031 to 2035 pathway for connection offers should be based on the Holistic Transition scenario within our Future Energy Scenarios 2024 (FES24) to 2035.

5. **Release 46 GW of capacity by making network planning processes more coordinated and realistic.** Network operators are reforming connections and network planning processes to better coordinate capacity and reinforcement decisions with actual requirements. Improved construction planning assumptions, and the strategic reform of the transmission connections framework, will allow for a more efficient process that is not hindered by high application volumes and customer attrition from the queue. We estimate this will release up to 46 GW of capacity and accelerate future customer applications.
6. **Further improve coordination between transmission and distribution operators.** Given the increasing interdependence between connections at distribution and transmission levels, network operators are developing a new solution to improve coordination between distribution network operators and transmission operators, including reviewing the threshold at which impacts on the transmission network are assessed, improving transmission and distribution data exchanges and reforming how distribution customers are charged for triggering transmission network reinforcements. These actions will create a more streamlined and equitable customer experience for distribution customers whose projects impact transmission.

3.4.5 The impact of delivery and beyond 2030

The transition to net zero emissions across the UK economy by 2050 does not stop with achieving clean power in 2030; there is significant further action required across all sectors to achieve it.

Looking beyond 2030, we will publish our first SSEP by the end of 2026. It will build on the Government's Clean Power 2030 Action Plan to support the energy transition efficiently and securely, provide greater clarity on the nation's future energy requirements and achieve the UK's net zero ambitions in line with the Government targets.

Using this report as the starting point, the first SSEP will be a UK-wide plan to identify a pathway for the optimal mix of electricity and hydrogen generation and storage technologies that meet net zero by 2050 and delivers security of supply. Future iterations could include other energy vectors.

Zonal locations, capacities and timings of large supply sources will be set out in the SSEP. These will be cooptimised with large demand sources and high-level network needs, as well as environmental and community interests. The specific projects that deliver will result from market signals and subsequent processes.

The development of the SSEP will be an iterative, comprehensive process that models and assesses options for meeting future demand scenarios in line with the Government's objectives. This will involve analysing different energy system configurations across Great Britain.

The viability of these options will be evaluated for technical feasibility, environmental impact, cost-effectiveness and societal considerations to develop proposed pathway options for the Energy Secretary, whose decision will form the basis of our public consultation on the draft SSEP. Feedback received will be used to improve first and future versions of the plan.

Ultimately, the SSEP will provide the Government and Ofgem with a plan they can endorse and use to develop policy, and which has status in planning regimes. This will in turn accelerate subsequent consenting and approvals for specific network solutions, aligned with NESO's Centralised Strategic Network Plan (CSNP) and regional energy plans.

Once the first SSEP is in place, we will then use it to prioritise future connection offers aligned to the SSEP.

There is a strong focus on ensuring that, beyond 2030, we continue the trajectory set by this report and maintain critical alignment between Great Britain's strategic energy planning and an efficient and transparent approach to managing connections.

3.5 Network access

Network access involves the planning of outages of electrical assets and equipment (e.g. circuits and breakers) on the power system to carry out maintenance and improvement works. The delivery of projects and connections to deliver clean power by 2030 will require a significant increase in the work taking place on the transmission system. The planning of economic and efficient network access will be a key consideration in ensuring deliverability of the Government's Clean Power 2030 Action Plan.

3.5.1 Where we are today

The transmission system outage plan is built through close collaboration between NESO, transmission owners (TOs), system users, distribution network operators (DNOs), directly connected customers (Network Rail, Steelworks, Chemical works, etc.) and generators. The principles that govern the outage management process are set out in the Grid Code and System Operator-Transmission Owner Code.

There is a physical limit to the number of outages that can take place at any one time due to the impact on system security and consumers. Any increase in work taking place must be carefully managed to ensure that the power system remains secure and stable. There are also outages in regions of the network that can cause system constraints as they reduce the amount of generation capacity that can be transferred from one area of the network to another. To manage this, and ensure the power system remains secure, NESO operates within a market to reduce or increase generation in one area and then balance that action in another.

3.5.2 The ambition for 2030

Outages on electricity network assets must be planned and coordinated effectively to ensure new connections and equipment are delivered in an optimised way to accelerate as many projects as possible, whilst minimising constraints.

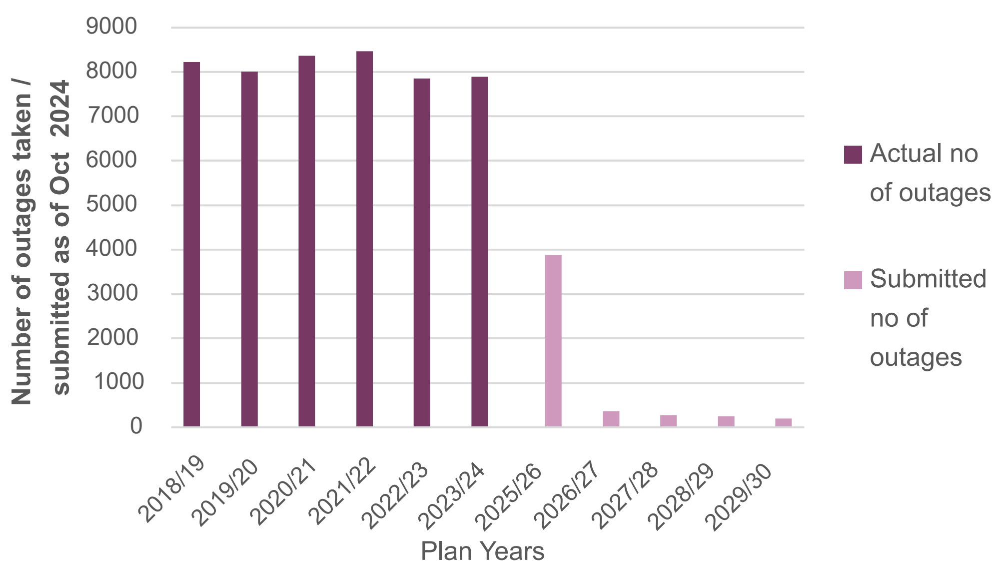

Figure 10: Number of outage taken or requested across years

Approximately 8,000 outages take place on the electricity transmission system each year. Typically, 40% of these will have been agreed 12 months ahead of delivery with the remainder mostly requested and agreed in the year that the outage takes place. On average 15% of the outages at year ahead are visible 3 - 6 months ahead. The outage plans agreed and planned from 2 - 10 years ahead of delivery are significantly lower in magnitude, on average 15% of the outages at year ahead are visible in the 3 to 6 year space.

There are also outages in regions of the network that can cause system constraints through reducing the amount of generation capacity that can be transferred from one area to another. Analysis on key constraint boundaries out to 2030 shows the potential capacity available and how much is currently committed.

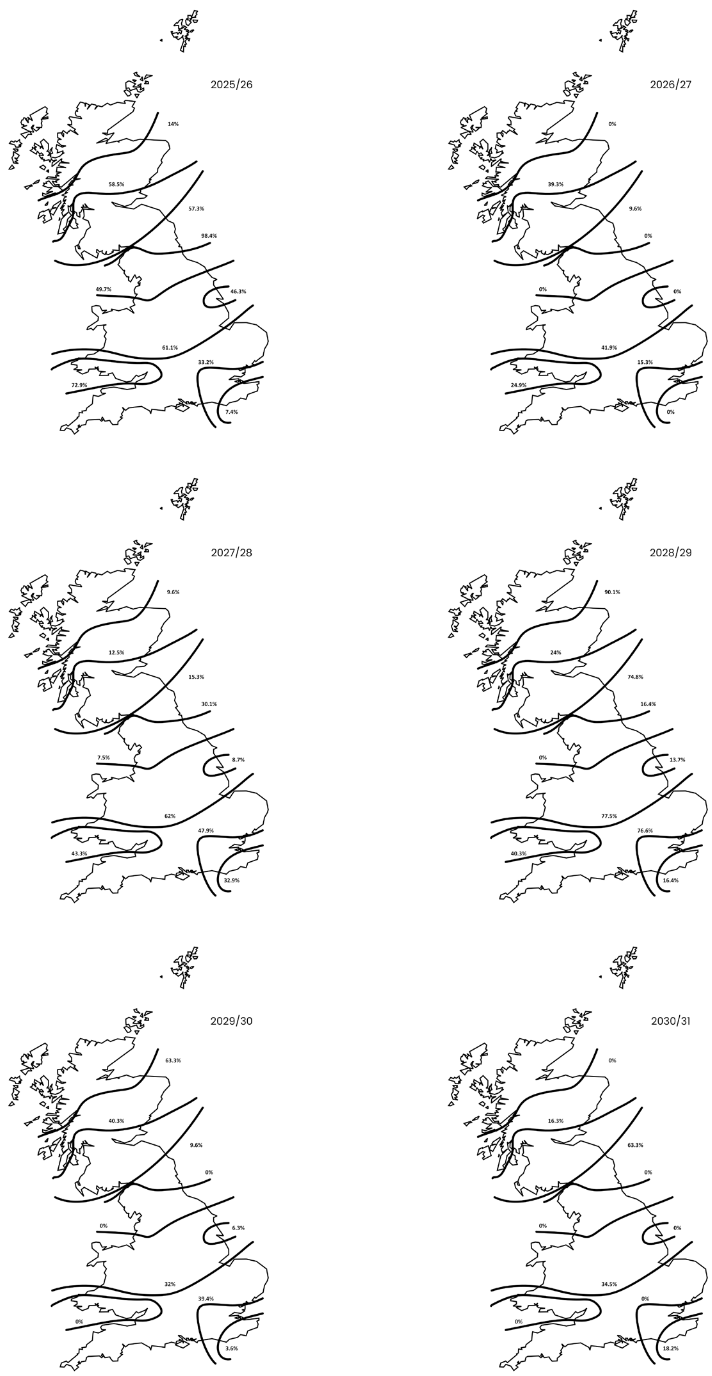

Figure 11: **Capacity of system access boundaries**

3.5.3 Key challenges need to be addressed:

- **Short-term industry focus.** Network Access plans are currently built over 2 years. 60% of outages are requested in the year of delivery and 40% are requested in the year ahead phase. The number of outages requested further out in time is negligible in comparison. This short-term planning can lead to less sight of future options that can be taken to manage network access.
- **Managing outage delays.** The system access plan is tightly congested and delays to one outage can impact on many others due to a ripple effect.
- **Reactive compensation equipment availability.** Reactive compensation equipment is essential in supporting the voltage security of the network and is essential in providing system security. System access can cause challenges to managing voltage on the system and improved availability of reactive compensation across the network will be essential in allowing an increased number of outages to proceed.
- **Asset ratings and capabilities.** The assessment of system access is made against the ratings and capabilities of the assets on the system. Across the industry, there is an inconsistent approach to deriving the ratings and capabilities across industry and differences between organisations.
- **Constraint optimisation.** Outages can cause constraints on the network and can carry associated constraint costs as action needs to be taken in the balancing mechanism to manage. It is crucial that the phasing of outages on the system is optimised to ensure that the associated constraint costs are minimised.
- **Generation reserve capacity management.** Constraints reduce the amount of energy that can be transferred from one area of the network to another, which also means that the amount of generation reserve capacity that can be accessed behind a constraint is reduced. This can also lead to subsequent difficulties in the redispatch of generation.
- **Unplanned outages.** Unplanned outages take place when immediate asset interventions are required on the network. The level of unplanned system access will impact on the delivery of the increase to planned system access that is required for system reinforcement and connections. It also increases constraint costs as it leads to sub-optimal phasing of system access. Current levels sit between 15% and 25% of all outage unavailability being unplanned.
- **SQSS review.** The Security and Quality of Supply Standard (SQSS) sets out the criteria and methodology for planning and operating the Electricity Transmission System. Currently, there are occasions where system access cannot be granted within the rules of SQSS and are needed in exceptional circumstances, but this separate process can take time to work.
- **Increased outage liaison.** With the increased volumes of connections and new customers/users on the network, communication and liaison in regard to planning network access becomes more challenging to balance the needs to more parties.
- **Wider project risks.** Potential impacts of wider delivery issues such as procurement, logistics, resources, capabilities, etc. can cause delays to future and current plans and diminish certainty on delivery.

3.5.4 Stakeholder views

One stakeholder reflected that the level of operations and management of the system is very significant and carries a high level of risk, suggesting that a risk-averse approach should be taken. Big users, new technologies coming on to the system often have delays. There is a need to ensure that NESO is developing its tools to be able to plan outages competently in this ever more complex environment.

3.5.5 What needs to happen

The challenge to deliver more work and more system access than before will need greater long-term strategic focus across years, particularly in the 1-year ahead to 6-year ahead timescales. This will be required to provide the assurance necessary around the deliverability of the accelerated projects and connections. The 1-year ahead to 6-year ahead system access plans will need to be more strategic and consider all foreseeable outage requirements, including system reinforcement, connections and maintenance.

A more strategic approach across industry will be required to provide assurance around the deliverability of clean power by 2030 and to address the network access challenges in timescales where there are a greater number of options available to minimise costs. This will also help to:

- Provide greater assurance around deliverability of net zero projects.
- Facilitate greater efficiency in outage days per circuit, i.e. include as much foreseeable work in one outage rather than several outages of the same equipment in the same year or across years.
- Deliver a more cohesive optimal system access plan across years which will allow more work to be completed and constraint cost management to be optimised across years.
- Ensure that blockers and challenges to the provision of system access are highlighted further out in time for solutions to be identified in timescales where there are more options available, such as changes to project design, procurement, enhanced services, etc.

It is also essential that the outages on electricity network assets are planned and coordinated effectively to ensure new connections and equipment are delivered in an optimised way that allows as many projects to be accelerated and delivered as possible, whilst minimising the associated constraint costs. Less intrusive ways of working, such as off-line build and temporary circuits, should also be considered to maximise the amount of work that can be progressed and consideration of the processes laid out in the SQSS.

Measuring and improving adherence to planned start and end times of outages would also allow more system access to be achieved overall and minimise the increased cost to consumers due to less optimal phasing of outages. A cross-industry focus on improving the approach to unplanned asset outages would also support the requirement for increased planned system access.

A more strategic approach taken to the planning of network access, with plans built across years, will be key in ensuring that each outage contains the maximum amount of work that can be delivered, as well as finding the most economic phasing of the outages that need to be taken.

Networks are fundamental in the biggest reform of our electricity system since the 1950s. Therefore, the price controls within which they operate must be designed to ensure that networks have access to the funding they need to deliver energy at least cost to consumers and meet net zero and clean power targets. They must be able to have the funds to invest and remain attractive to their shareholders, whilst not unduly increasing consumer bills.

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