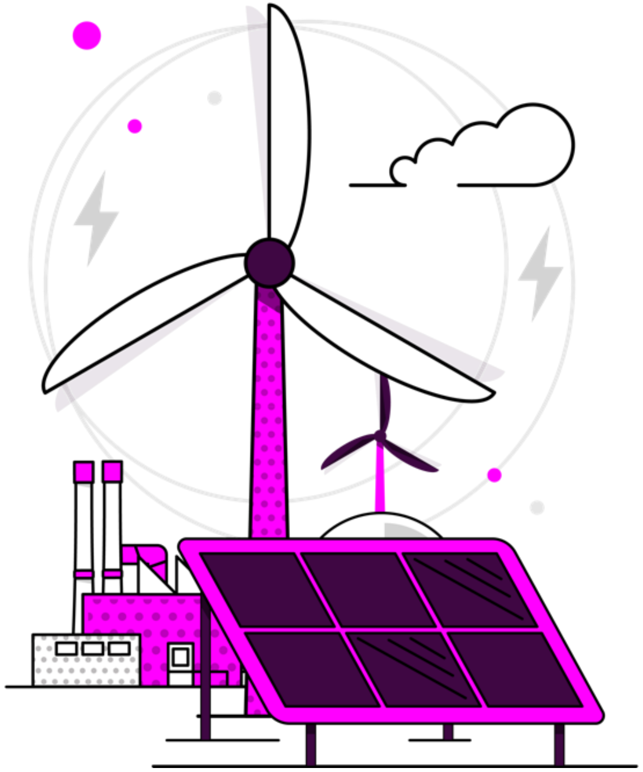
Electricity Ten Year Statement

ETYS 2025

NESO
National Energy System Operator

Contents



Foreword

Foreword

Welcome to the 2025 Electricity Ten Year Statement (ETYS). This ETYS sets out our view of GB's future transmission needs and system capability over the next decade.

The ETYS assesses how the network is expected to perform under our Future Energy Scenarios (FES). It identifies the investment and development required to keep the system reliable, while supporting the transition to a clean, affordable energy system.

This year's analysis highlights ongoing thermal and voltage challenges in parts of the network. It also shows the need to accelerate reinforcement to reduce constraint costs for consumers as the system transitions to clean power.

Electricity demand in GB is expected to increase significantly, with demand projected to nearly double by 2040. This growth reflects greater electrification of heat and transport, alongside the UK Government's ambition for clean power by 2030.

We are taking a more coordinated approach to network planning. Through the Strategic Spatial Energy Plan (SSEP) and the Centralised Strategic Network Plan (CSNP), we will bring together electricity, gas and hydrogen planning. This will support system resilience, enable new technologies, and provide clearer signals for investment—helping deliver a reliable, clean and affordable system.

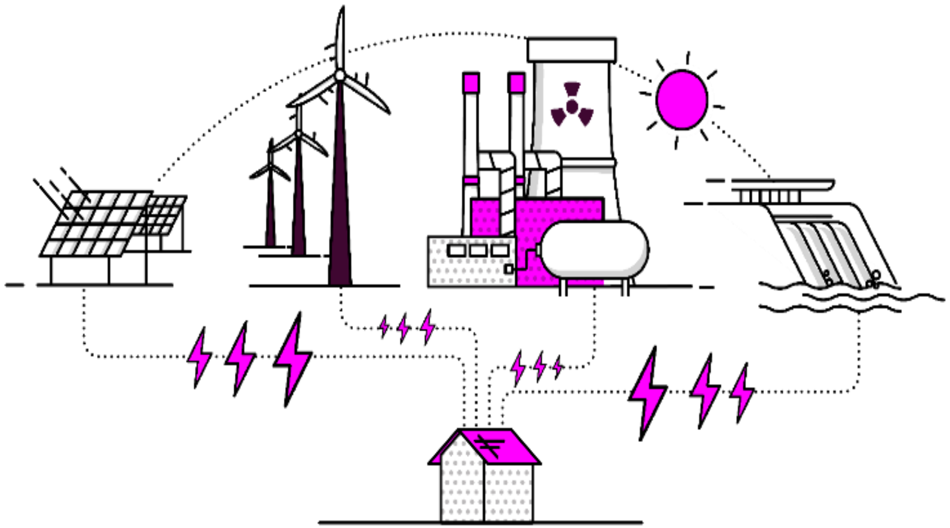
The Beyond 2030 - Electricity Transmission Update reflects the changes in policy and the energy system since Beyond 2030 and provides clarity on the network investment required to meet GB's future transmission needs.

ETYS analysis

Introduction

The Electricity Ten Year Statement is a view of future transmission requirements and the capability of GB's National Electricity Transmission System over the next 10 years.

The 2025 Future Energy Scenarios (FES 2025)[1] set out credible pathways to decarbonise GB's energy system and reach net zero. The Electricity Ten Year Statement (ETYS) draws on these pathways to show how system requirements will change over time. This helps us identify where the national electricity transmission system needs investment and development, so we can continue to deliver a reliable electricity supply while supporting a clean and affordable energy system for GB.



About the ETYS

The Electricity Ten Year Statement (ETYS) is a well-established network development report that sets out a forward-looking view of the capability and future requirements of GB's National Electricity Transmission System over the next 10 years. Drawing on FES, the ETYS analyses how electricity demand, generation, and network flows are expected to evolve, enabling identification of where additional transfer capacity or reinforcement is needed to maintain a secure and reliable system while supporting the transition to a low-carbon energy future. It sits at the core of the network planning process by informing stakeholders of emerging system needs and inviting solutions to meet them.

[1] NESO, neso.energy/publications/future-energy-scenarios-fes

National Electricity Transmission System (NETS)

As NESO, we are responsible for the system operation of the electricity transmission networks in England, Wales, Scotland and in the surrounding offshore waters.

The National Electricity Transmission System (NETS) spans GB and is comprised of overhead lines as well as underground and subsea cables, at 132 kV, 275 kV and 400 kV voltage levels.

These are all linked together via substations across GB which connect separately owned generators, interconnectors, large demands, and distribution systems. Electricity Distribution comprises of network below 275 kV in England and Wales and below 132 kV in Scotland respectively. It transports electricity from transmission "highways" to the end consumer.

GB has three onshore transmission owners that separately own the network, as shown in figure 1. These are:

1. Scottish & Southern Energy Networks Transmission - owning the network in the north of Scotland.
2. Scottish Power Electricity Networks - owning the network in the south of Scotland.
3. National Grid Electricity Transmission – owning the transmission network in England and Wales.

There are also 28 licenced offshore transmission owners (OFTOs) appointed through Ofgem's competitive tendering process. They own the assets that connect operational offshore wind farms to the transmission or distribution network.

Together with the transmission owners, we regularly assess and model network behaviour under different conditions to test its resilience. We assess where the transmission, network may be under strain for various reasons and this analysis accumulates into the ETYS. This ensures we portray an accurate representation of the current transmission capabilities and identify future requirements.

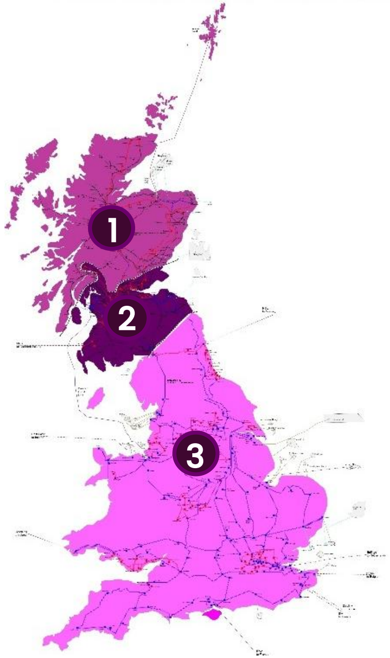


Figure 1: GB Transmission Owners

What is a boundary?

A boundary splits the system into two parts, crossing critical circuit paths that carry power between the areas where power flow limitations may be encountered. Figure 2 shows all GB network boundaries.

Defining the boundaries has evolved over many years of planning and operating the transmission system. When significant changes occur, new boundaries may be defined and some boundaries either removed or amended, and we communicate any changes with our stakeholders.

We do not study all boundaries, specifically those where no significant changes are identified in the FES generation and demand data compared to previous years. We assume the same capability as the previous year for these boundaries.

The boundaries used by ETYS can be split into two different types:

Local boundaries

Small areas of the NETS with a high concentration of generation. These small power export areas can have a high probability of overloading the local transmission network due to too much generation operating simultaneously.

Wider boundaries

Large areas containing significant amounts of both generation and demand. The System Security and Quality of Supply Standard (SQSS) boundary scaling methodologies assess the capability of the wider boundaries. These consider both the geographical and technological effects of generation, allowing for a consistent capability and requirements assessment.

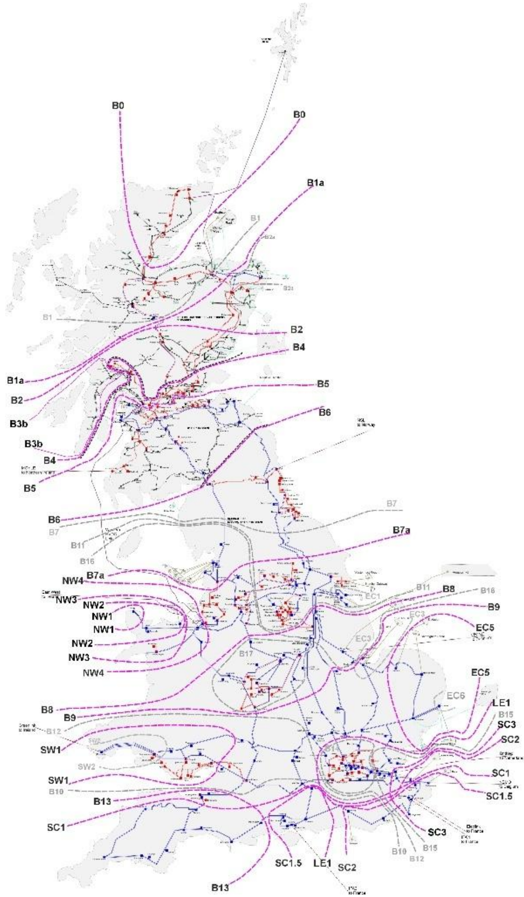
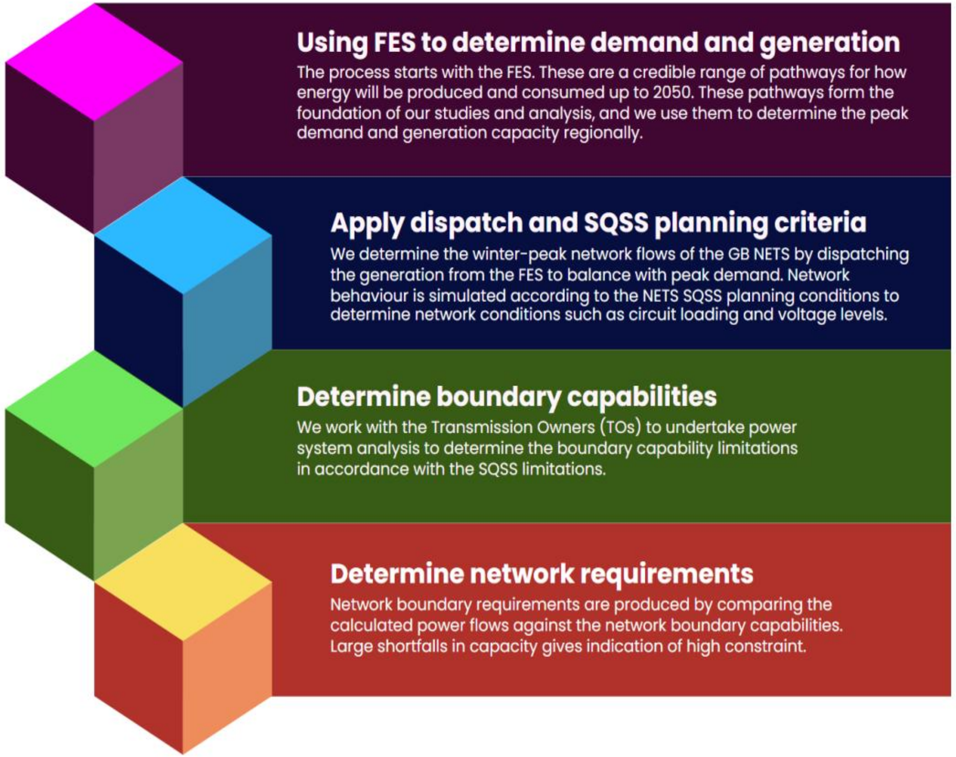


Figure 2: GB network boundaries

How we assess the network

To identify the future transmission requirements of the GB NETS there are several inputs that are fed into the planning process and at various stages.

You can find more details on our FES 2025 Pathways on the FES webpages and the FES 2025 report[2].



[2] NESO, neso.energy/publications/future-energy-scenarios-fes

Determining boundary capability

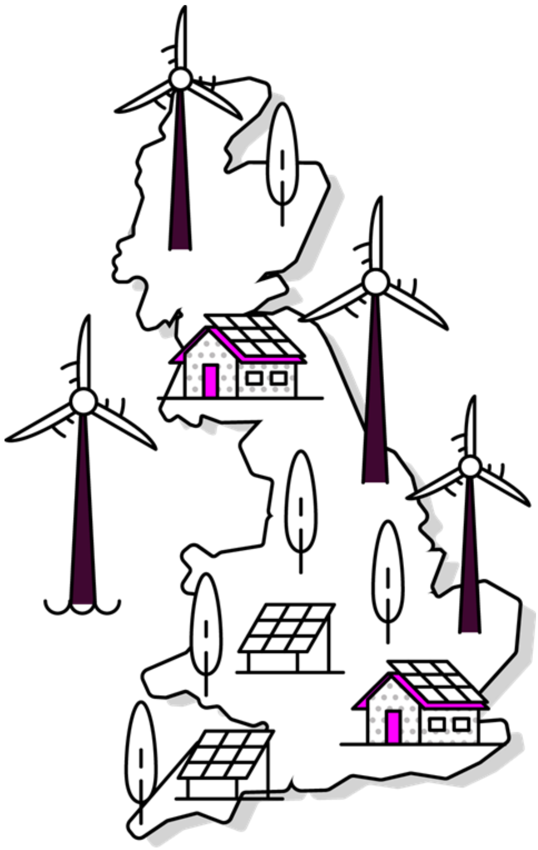
Boundary capability is the maximum power flow that can be securely transferred across the boundary while meeting GB's Security and Quality of Supply Standards.

The SQSS has fixed rules for planning and operating the Main Interconnected Transmission System (MITS). The MITS must be kept secure against credible events such as network faults and loss of generation, while making sure circuits are not overloaded, voltages and frequency are kept within SQSS planning limits.

For each boundary, we work with the transmission owners to undertake power system analysis, determining the boundary capability. Limiting factors on transmission capacity include:

- thermal circuit rating
- voltage constraints
- dynamic stability

For the ETYS network assessment, contingencies are applied, and the most severe SQSS limitation is used to determine the network boundary capability. The base capability of each boundary can be seen in the Electricity Transmission Network Requirements section.



Operability overview

Operation of the NETS is becoming increasingly complex as the system is transitioning from predominantly synchronous plant to a higher proportion of inverter-based and intermittent resources. Our latest Operability Strategy Report[3], published in March, sets out the principal operability challenge, including the methodology used to assess voltage and stability requirements and how this methodology may evolve in the future. Going forward, we will publish operability requirements as part of CSNP process.

[3] NESO, neso.energy/document/379601/download

Electricity Transmission Network Requirements

Introduction

GB's National Electricity Transmission System (NETS) must continue to adapt and be developed so power can be transported from source to demand, reliably and efficiently.

In this chapter, we:

- Describe the thermal and voltage characteristics of the NETS – on a regional basis
- Discuss the thermal characteristics of the NETS boundaries
- Provide analysis to show how and when, the NETS could potentially face growing future network needs in several regions

This chapter is broken into regions, as shown on Figure 3, each with distinct electrical network characteristics and generation and demand backgrounds.

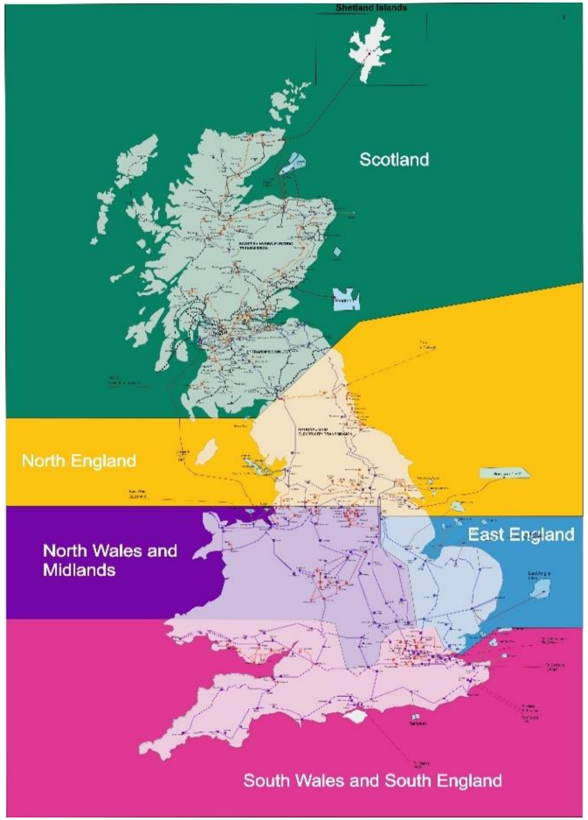


Figure 3: GB Regions

Communicating our thermal needs

Each FES pathway indicates differing levels of generation and demand across the NETS which project boundary power flow expectations, communicated through our boundary charts.

From applying the methodology in the NETS SQSS for wider boundary planning requirements, we determine the following for each pathway:

- Economy required transfer - solid coloured line
- Security required transfer - dashed coloured line
- Current and future capability (where available) - solid red line

The purpose and modelling conditions of the economy and security criteria are detailed in the NETS SQSS[4] appendices E & C, respectively.

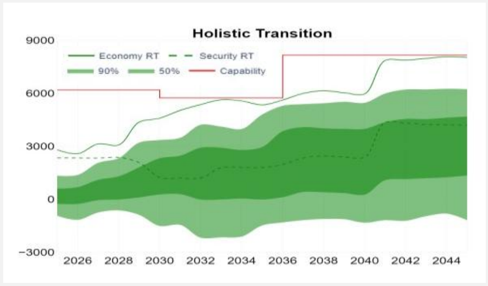
We also determine the annual boundary flows based on unconstrained market operation, meaning network restrictions are not applied, which reflects the minimum cost generation output profile. On each boundary chart:

- The darker area describes the range of boundary flows for 50% of the year
- The lighter area describes the range of boundary flows for 90% of the year

The capability line (red line) is based on the recommendations from our Beyond 2030 - Electricity Transmission Update report. Where the Beyond 2030 capability is not available, there is a red line that provides the most recent available boundary capability. The 50%, 90%, Economy required transfer (RT) and Security RT are calculated from the 2025 FES and ETYS processes.

A reverse boundary capability, identified under scenarios where boundaries is importing power from the rest of GB, has also been provided for certain boundaries which are expected to import power for significant periods of time either now or in the future. This is shown by a red line with a negative value.

From the boundary charts, we show how often the power flows are within capability. If flows exceed capability, then reinforcement may be required; if capability is sufficiently higher than the unconstrained flows then it is likely that no reinforcement is required currently.



We publish our view of requirements for three FES Pathways:

- Holistic Transition - A balanced, lowest-cost pathway that relies on a mix of renewables, electrification and industrial hydrogen utilisation.
- Electric Engagement - A highly electrified system relying heavily on nuclear, renewables, CCS, and bioenergy to support a high peak demand.
- Hydrogen Evolution - A hydrogen-led pathway driven by hydrogen networks, storage, and widespread use in industry, transport, and heating.

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[4] NESO, neso.energy/industry-information/codes/security-and-quality-supply-standard-sqss/sqss-code-documents

Scotland

The onshore transmission network in Scotland is owned by SSEN Transmission and SP Transmission.

The Scottish NETS is divided into seven boundaries:

- B0 – Upper North SSEN Transmission
- B1a – North West SSEN Transmission
- B2 – North to South SSEN Transmission
- B3b – Kintyre and Argyll SSEN Transmission
- B4 – SSEN Transmission to SP Transmission boundary (shared by SSEN Transmission and SP Transmission)
- B5 – North to South SP Transmission
- B6 – SP Transmission to NGET (shared by SP Transmission and National Grid Electricity Transmission)

Figure 4 shows the general pattern of power flow directions expected to occur most of the time in the years to come up to 2036, i.e. power will generally flow from north to south. The arrows in the diagram illustrate power flow directions and are approximately scaled relative to the winter peak flows.

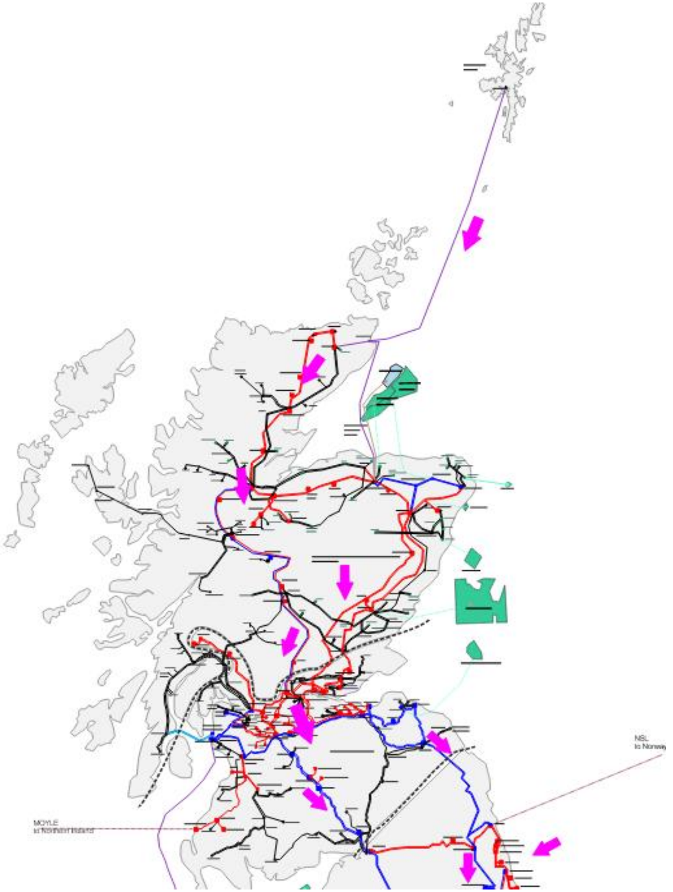


Figure 4: Scotland winter peak flows directions

Scotland Regional Drivers

Offshore wind is the main driver of rapid growth in renewable generation across Scotland, significantly increasing north–south transfer requirements and network reinforcement needed over the next decade. Scotland is expected to remain a net exporter due to high generation capacity relative to gross demand (38 GW vs ~6 GW by 2030 under Holistic Transition), as seen in Figure 5 & Figure *6*.

Increasing boundary flows (B0–B6), reduced synchronous generation capacity, and the prevalence of long transmission lines across Scotland increase instability and high-voltage risks, particularly in Central Scotland under light load conditions. In the past year, NESO has sought inertia and short-circuit level services, through the Long Term 2029 Tender[5], to address future network stability concerns within Scotland and across GB.

We are developing the Scottish Constraint Management Intertrip Service (CMIS), a non-build solution that contracts with generators to provide post-fault intertrip facilities which can manage constraints more cost-effectively than the balancing mechanism, with delivery from Q4 2027.

Following the Constraints Collaboration Project, we are seeking to incentivise flexible demand located near network constraints via the Demand for Constraints[6] service—to reduce curtailment and constraint costs.

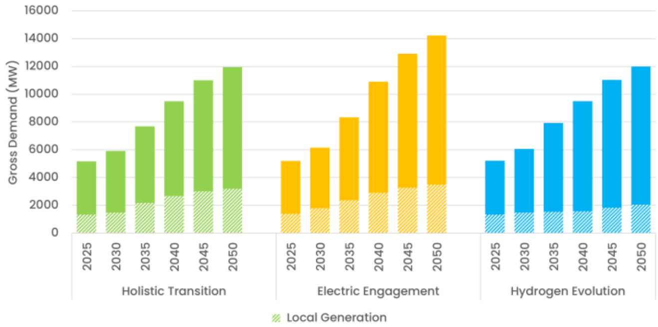


Figure 5: Scotland peak gross demand and embedded generation output

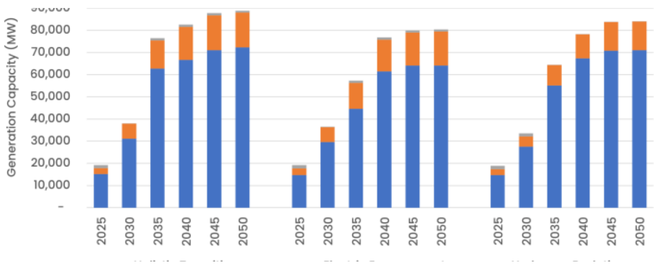
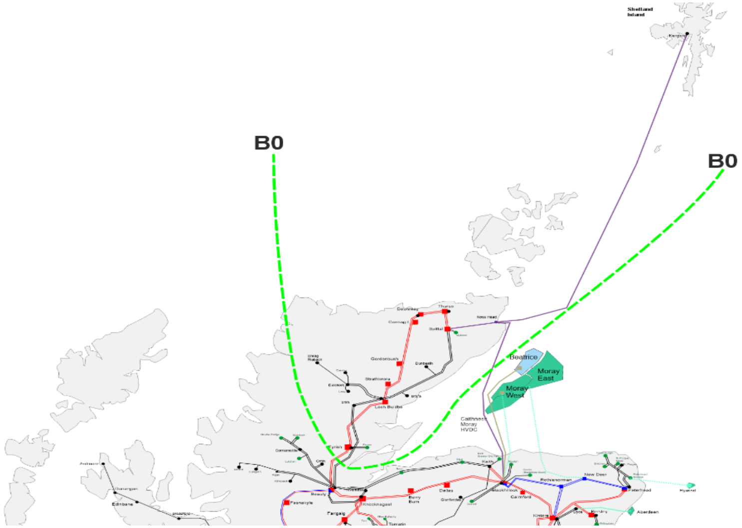


Figure 6: Scotland installed generation capacities per fuel type

[5] NESO, neso.energy/industry-information/balancing-services/stability-market/long-term-2029-tender

[6] NESO, neso.energy/document/377856/download

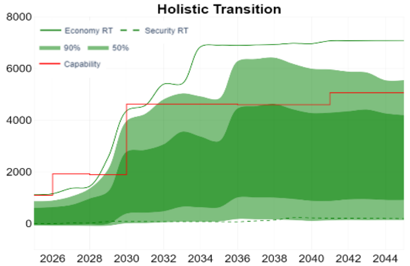
Boundary B0 – Upper North SSEN Transmission

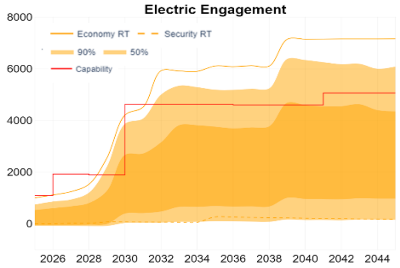


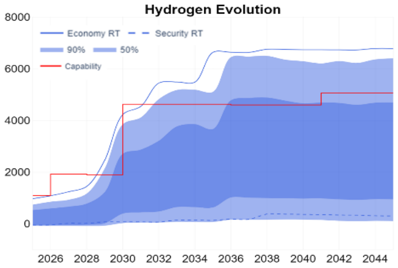
As with previous years ETYS projections, future power transfer over this boundary will gradually increase due to growth of renewable generation north of the boundary, mainly onshore and offshore wind in the Orkney and Pentland Firth waters.

SSEN Transmission projects will develop and reinforce the network in the north of Scotland which will increase the capacity of transferring power from north to south of the GB system.

Beyond 2035, we see a decrease in expected transfers in the Holistic Transition and Hydrogen Evolution pathways. This is due to increasing demand in the north of Scotland whilst generation capacity remains relatively flat post-2035.



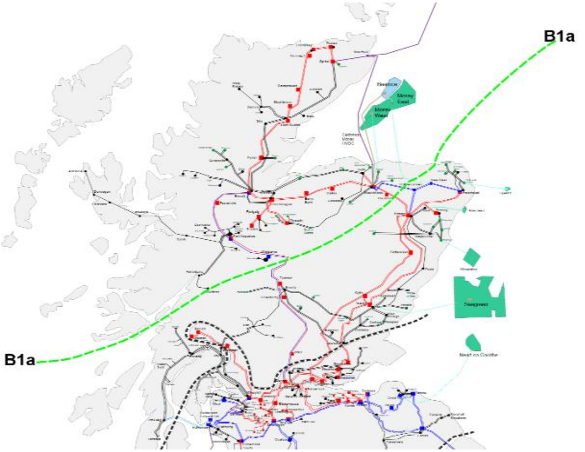




Click here for Boundary Chart Data and click here for detailed Boundary Charts

B0 boundary capability is limited to **1.1 GW** by a thermal constraint on the **Shin – Beauly 132kV circuit**

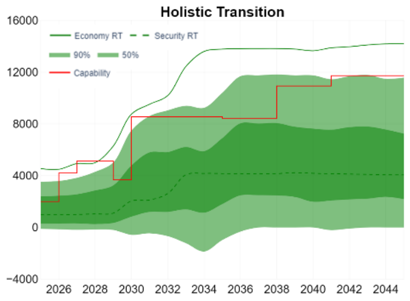
Boundary B1a – North West Transmission

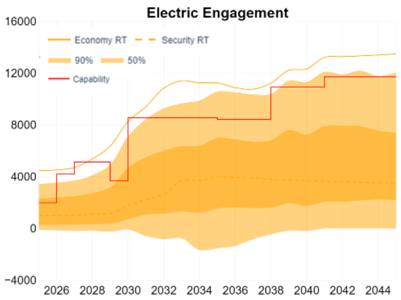


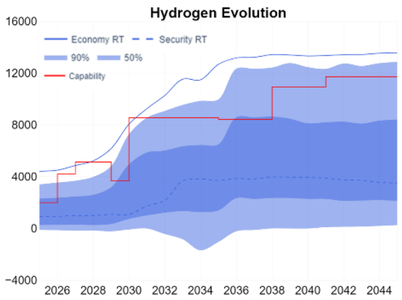
New renewable generation connections north of the boundary are expected to result in a significant increase in export requirements across the boundary, especially along the Beauly – Denny and East coast circuits.

In all FES pathways, there is an increase in the power transfer through B1a due to the large volume of renewable generation connecting north of this boundary. Contracted generation behind boundary B1a includes the renewable generation on the Western Isles, Orkney and the Shetland Isles with a considerable volume of large and small wind developments both onshore and offshore. Future connection of new pumped storage assets in the North-West of the country are planned

Beyond 2035, we see a decrease in expected transfers in the Holistic Transition and Hydrogen Evolution pathways. This is due to increasing demand in the north of Scotland whilst generation capacity remains relatively flat post-2035.



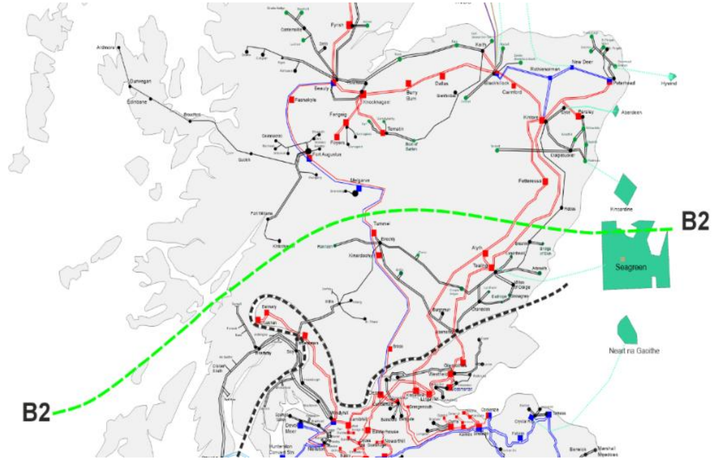




Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **2 GW** due to thermal constraint on the **Kintore - Tealing 275kV circuit.**

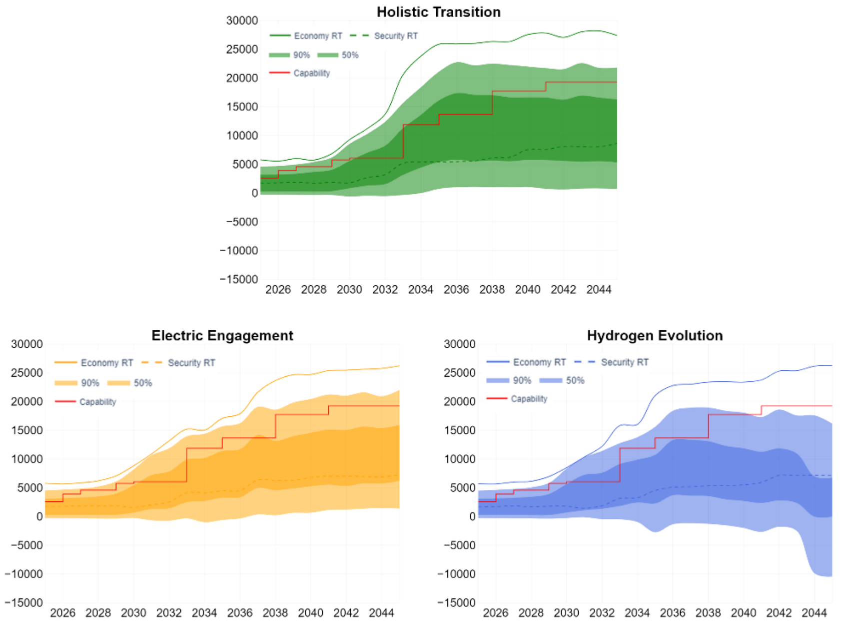
B2 – North to South SSEN Transmission



The generation behind boundary B2 includes both onshore and offshore wind, with the potential for additional pumped storage. Thermal generation lies between boundaries B1a and B2, as do several offshore windfarms.

The potential future boundary transfers for boundary B2 are increasing at a significant rate because of the high volume of renewable generation to be connected to the north of the boundary. This increased generation capacity will drive increasing power flows down the east coast 275kV circuits.

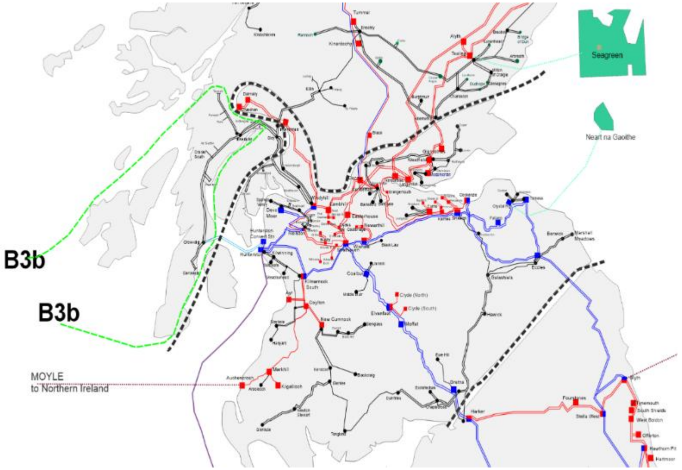
The increase in the required transfer capability for this boundary across all the FES, with expected flows being above capability, indicates the strong potential need to reinforce the transmission system.



Click here for Boundary Chart Data and click here for detailed Boundary Charts

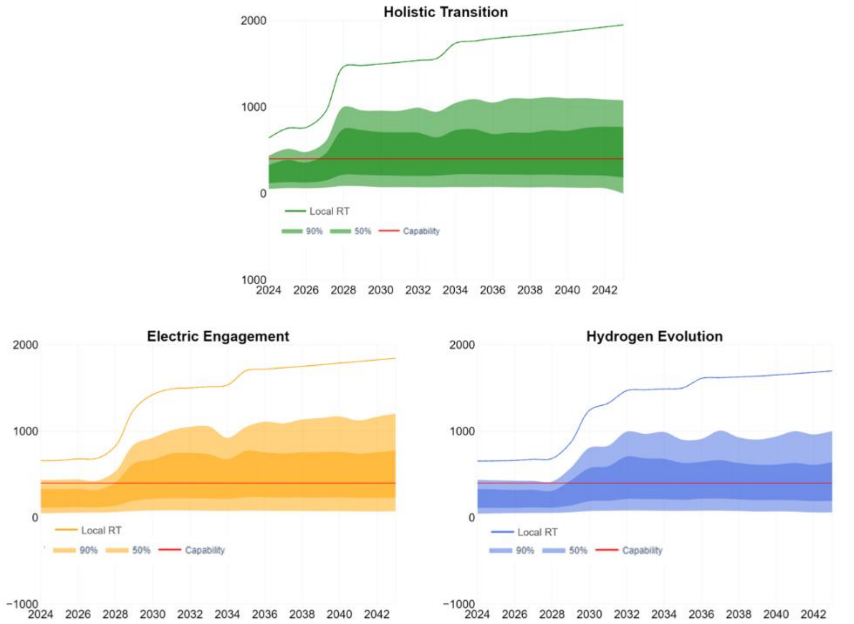
The boundary capability is limited to **2.8 GW** due to thermal constraint on the **Killin - Errochty 132kV circuit.**

Boundary B3b – Kintyre and Argyll SSEN Transmission



For future years, starting with 2028, there is a significant increase in renewable generation expected to connect within the area covered by B3b boundary (the Argyll and Kintyre peninsula), mostly offshore wind, marine and tidal.
Enabling works for customer connections lead to increased network export capability for this boundary.

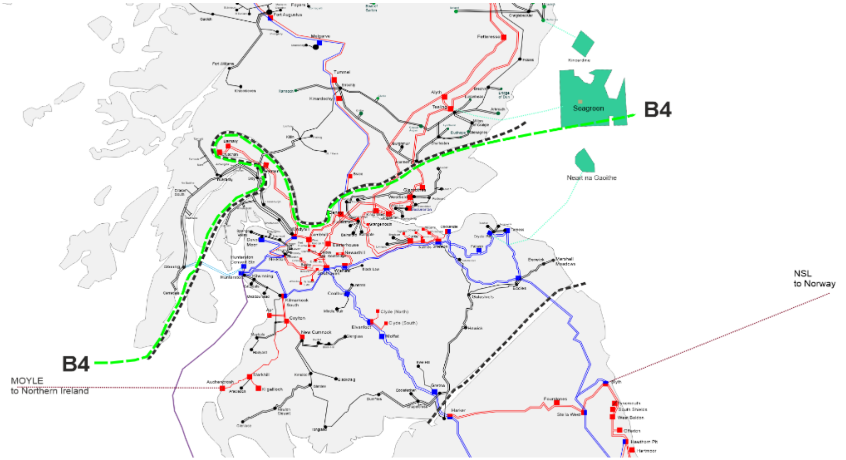
The B3b boundary was not studied for the Beyond 2030 – Electricity Transmission Update and subsequently the 50% and 90% flows data has not been calculated for the FES25 backgrounds, the boundary chart data still uses FES24 backgrounds for the 50% and 90% data.



Click here for Boundary Chart Data and click here for detailed Boundary Charts

B3b boundary capability is limited to **0.45 GW** by a thermal constraint on the 1st **Inverary – Sloy 132kV circuit.**

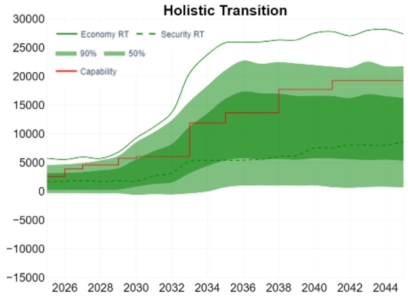
Boundary B4 – SSEN Transmission to SP Transmission

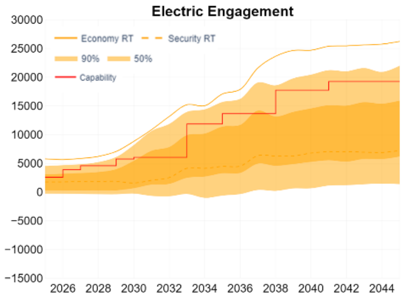


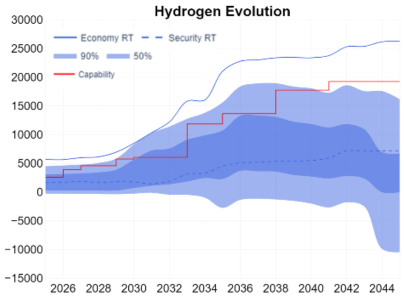
With increasing generation, the SSEN Transmission area for all scenarios, the required transfer across boundary B4 is expected to increase significantly over the next decade.

Across all FES pathways, power transfer through B4 boundary increases due to significant generation connecting north of the boundary, including all generation above boundaries B0, B1a, B2, and B3b. This is primarily onshore and offshore wind generation, with the prospect of significant further offshore wind and storage being connected in the longer term.

Boundary B4 has a range of planned reinforcements as recommended by Beyond 2030 which will increase boundary capability; significant constraint costs may be incurred due to ongoing asset outages as some of these works take place.



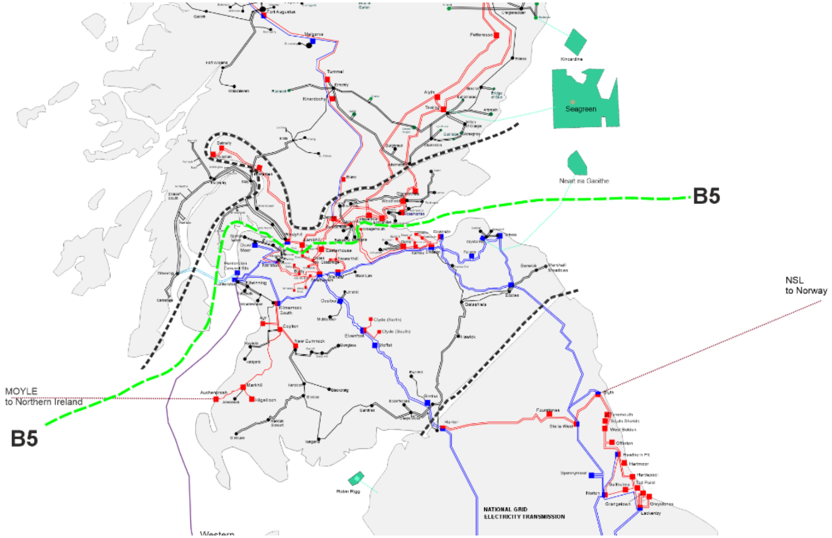




Click here for Boundary Chart Data and click here for detailed Boundary Charts

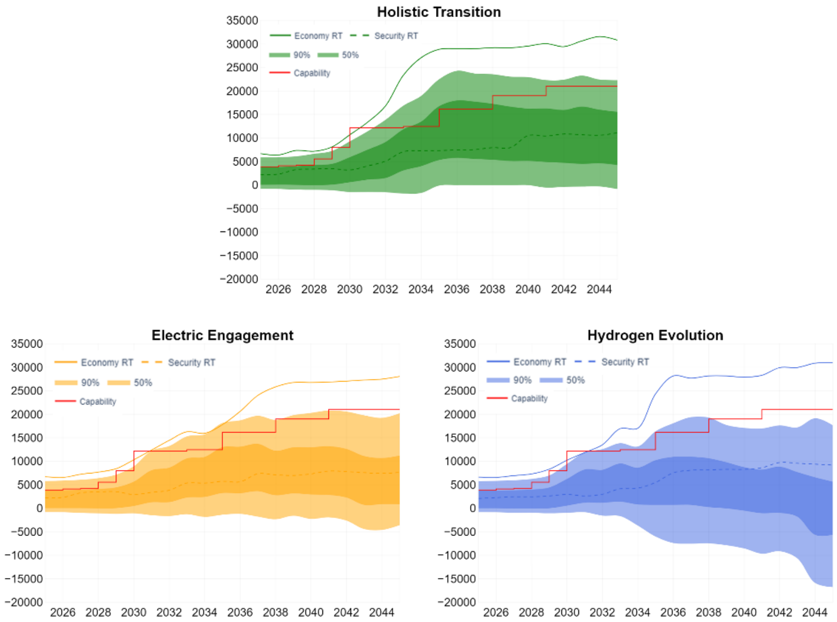
The boundary capability is limited to **4 GW** due to thermal constraint on the **Tealing - Westfield 275kV circuit**

Boundary B5 – North to South SP Transmission



Across all FES pathways, the power transfer through boundary B5 increases because of the significant volumes of generation connecting north of the boundary, including all generation above boundaries B0, B1a, B2 and B4. This is primarily onshore and offshore wind generation.

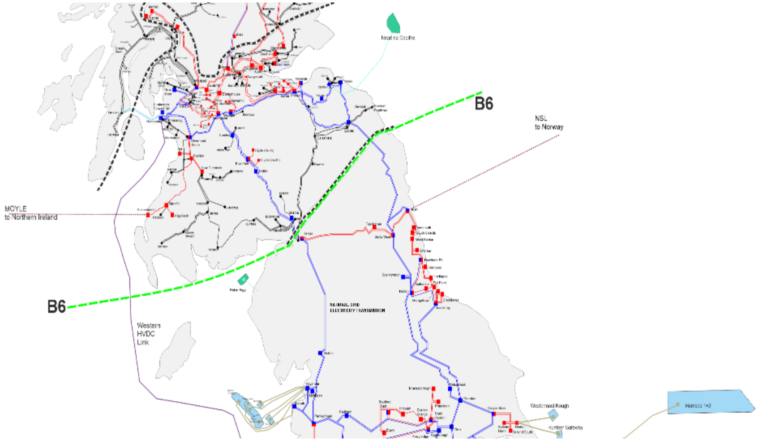
B5 has a range of reinforcements recommended by Beyond 2030 which will enhance its capability.



Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **3.9 GW** due to thermal constraint on the **Denny North-Lambhill 275kV circuit**

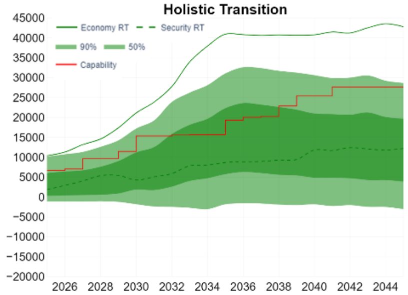
Boundary B6 – SP Transmission to NGET

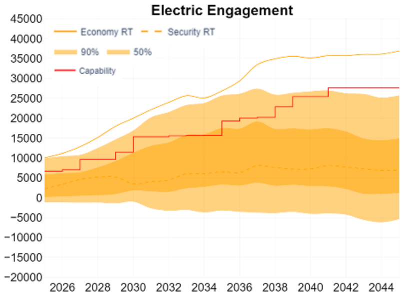


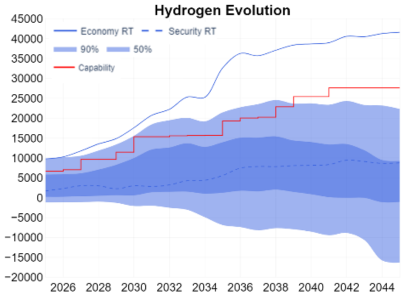
Across all FES pathways there is an increase in the power transfer requirements from Scotland to England due to the connection of additional generation in Scotland, primarily onshore and offshore wind.

With the FES including many wind farms in Scotland, the range of boundary power flows is very wide due to the variable nature of wind generation. During periods of low generation output in Scotland, it is credible to have power flowing from south to north feeding Scottish demand.

The magnitude of the south to north power flows is low compared to those in the opposite direction so network capability is sufficient to support those conditions. While the south to north transfer capability is enough to meet demand in Scotland, it is still necessary for synchronous plant capability to remain in service in Scotland to maintain year-round secure system operation.







Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **6.7 GW** due to thermal constraint on the **Harker-Moffat 400kV circuit.**

North of England

The North of England transmission region includes the network between the Scottish border and the North Midlands.

- Boundaries B7a and B8 are in this region.

Figure 7 shows the general pattern of power flow directions expected to occur most of the time in the years to come up to 2036. Power will generally flow from north to south. The arrows in the diagram illustrate power flow directions and are approximately scaled relative to the winter peak flows.

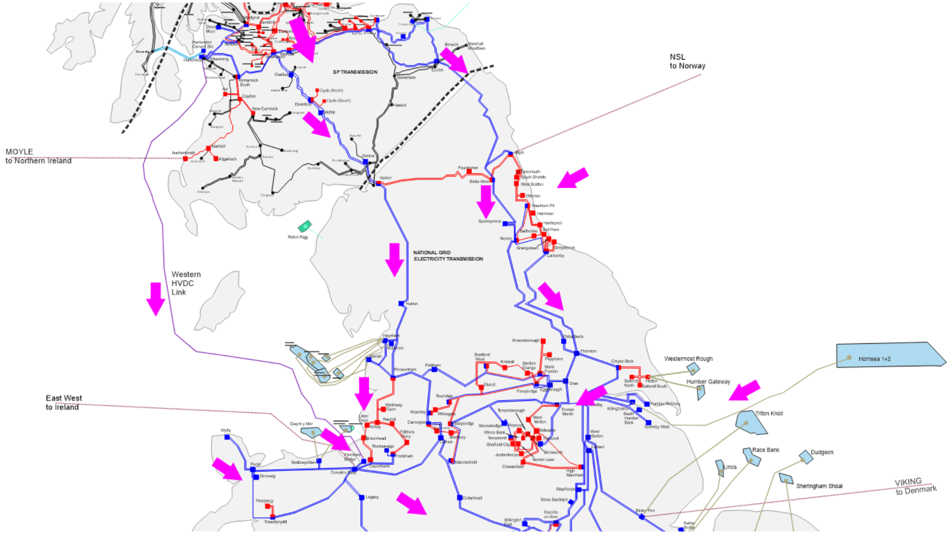


Figure 7: North of England winter peak flows directions

North of England Regional Drivers

The North of England is a major exporting region, where generation significantly exceeds demand. Alongside power inflows from Scotland this can result in strong north–south power flows, particularly during high wind conditions.

High output across the North of England and Scotland can lead to network congestion, with outages on north to south routes increasing constraint risks. New network reinforcements are planned to create new transmission routes and to upgrade existing network in order to support these future power flows.

Low carbon and renewable generation is expected to grow across all pathways, mainly offshore wind and in later years CCS-equipped gas and biomass. Fossil fuel capacity is expected to decline more gradually with a continuing need to support security of supply in the region and keep synchronous generating capacity available on the network.

By 2030, generation capacity is projected to reach 32 GW, with gross demand rising to 10 GW. The North of England is expected to have significant local generation capacities which will reduce net demand and increase transfers to the Midlands and South, driving additional transmission requirements.

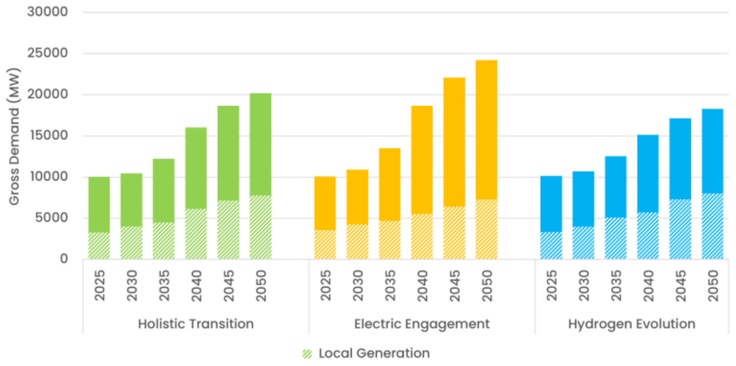


Figure 8: North of England gross peak demand and embedded generation output

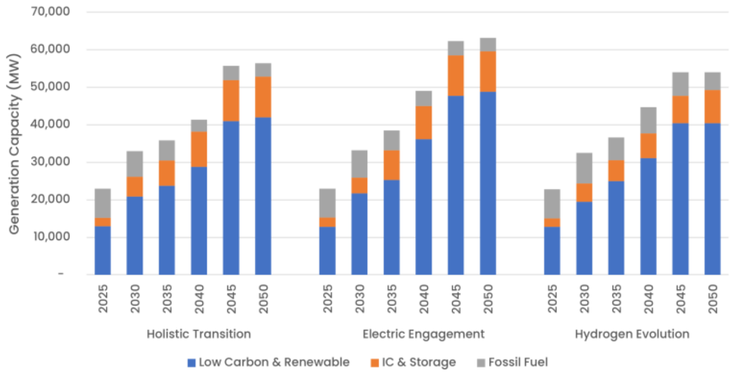
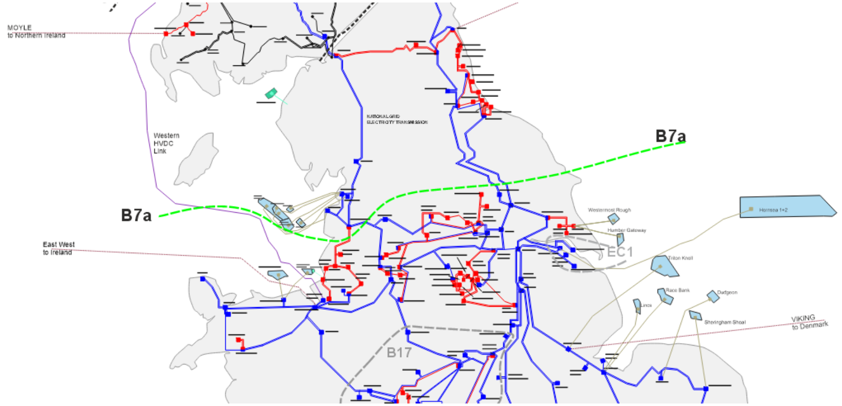


Figure 9: North of England installed generation capacities per fuel type

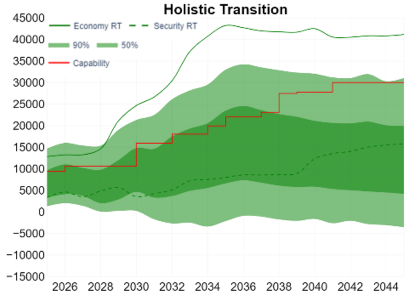
Boundary B7a – Upper North of England

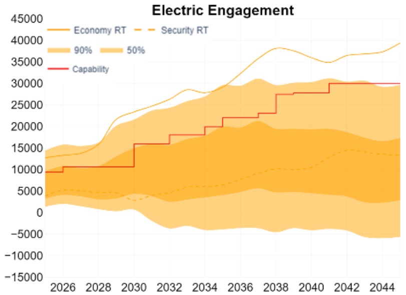


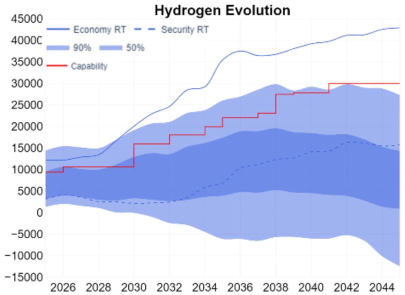
Across all FES pathways the economy required transfer and expected power flows are already beyond the present boundary capability. This suggests a strong need for network development to manage the increasing power flows.

The FES show a lot of variable renewable generation in the north of boundary, meaning the spread of boundary power flows is very wide. During periods with low northern generation output it is credible to have power flowing from south to north feeding northern demand.

Offshore wind contributes heavily to the increase in flows across B7a, multiple offshore developments are expected to connect onshore in Northern England - above B7a.



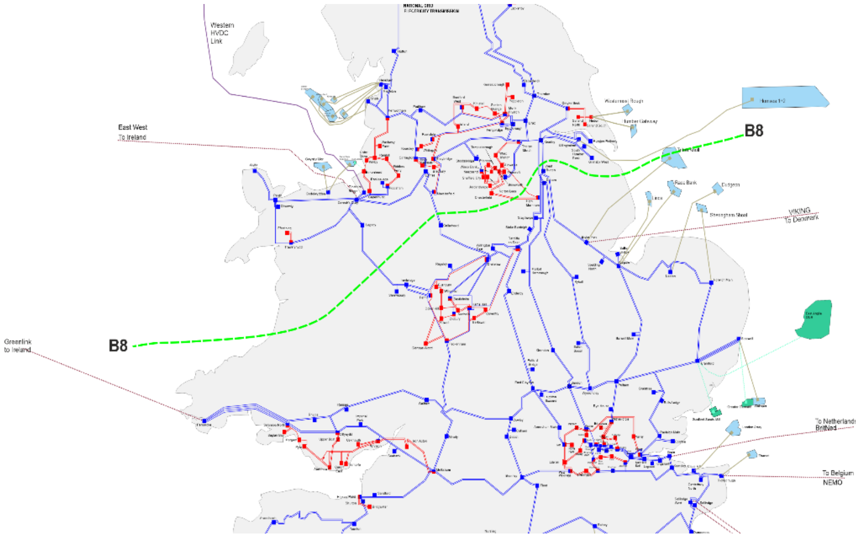




Click here for Boundary Chart Data and click here for detailed Boundary Charts

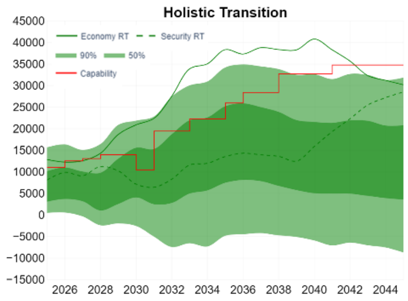
The boundary capability is limited to **9.4 GW** due to thermal constraint on the **Penwortham – Washway Farm 275kV circuit.**

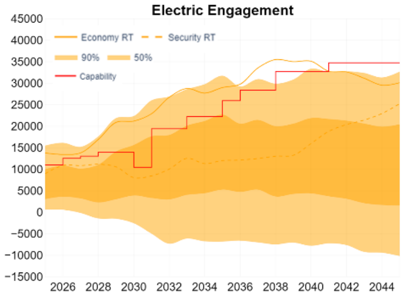
Boundary B8 – North of England to Midlands

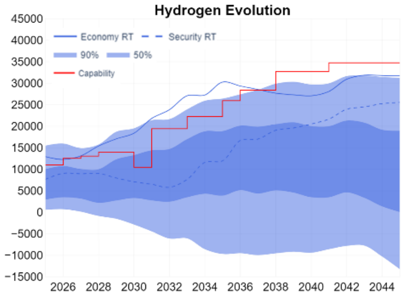


Across all FES pathways, both the SQSS economic transfer requirement and expected power flows grow significantly over time, surpassing the existing boundary capability. This suggests a strong need for network development to manage the increasing power flows.

Unconstrained flows do outstrip expected boundary capability until the late 2030s, suggesting the potential for constraints across this boundary in future years. Timely delivery of recommended reinforcements across B8 will be key to mitigating future constraint costs and innovative solutions for managing constraints may be required in this region.







Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **11 GW** due to thermal constraint on the **Keadby – West Burton 400kV circuit.**

North Wales & Midlands

The Western transmission region includes boundaries in the Midlands and the north of Wales.

This includes the lower midlands boundary B9 and the north Wales boundaries NW1, NW2 and NW3.

Figure 10 shows the general pattern of power flow directions expected to occur most of the time in the years to come up to 2036, i.e. power will generally flow from north to south. The arrows in the diagram illustrate power flow directions and are approximately scaled relative to the winter peak flows.

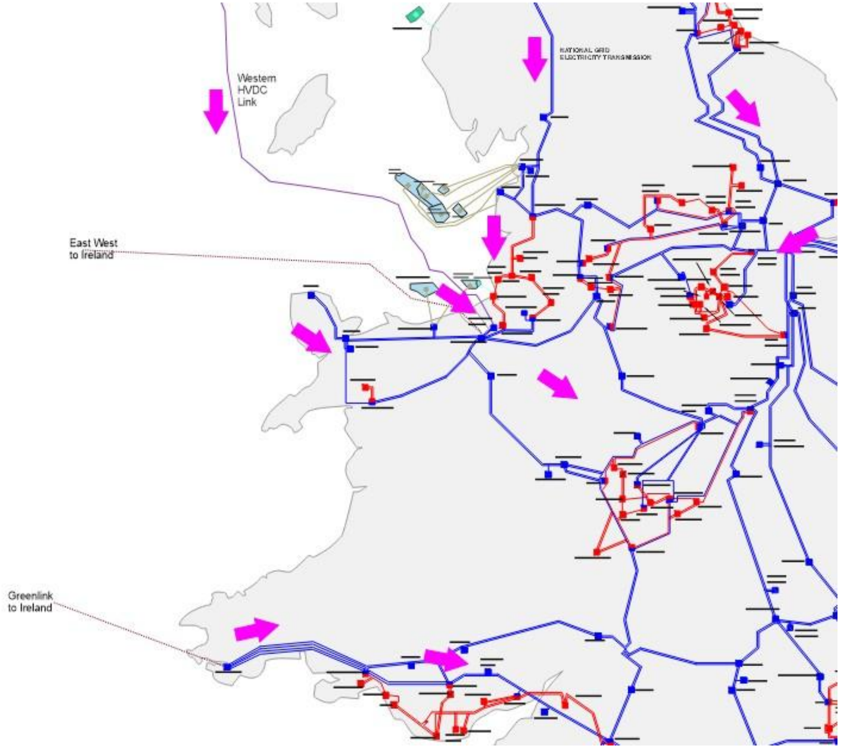


Figure 10: North of Wales and Midlands England winter peak flows directions

North Wales & Midlands – Regional Drivers

Today, this region has a high proportion of fossil fuel generation, which declines across all FES pathways by 2035 and is only fully phased out by 2050 under Holistic Transition. Generation and demand grow at broadly similar rates, with the region moving between net exports and imports under differing network conditions.

Transmission-connected capacity increases to 27-30 GW by 2030 (from 18 GW today), driven by growth in low carbon generation, alongside modest expansion of interconnectors and storage. Demand increases significantly across all scenarios after 2030, potentially reaching 50-60GW by 2050, and driven in large part by rising industrial and commercial demand.

Rising transfer volumes and reduced synchronous generation increase low-voltage risks, particularly across the B9 boundary, where additional local solutions may be required to manage low voltage issues during high-flow conditions.

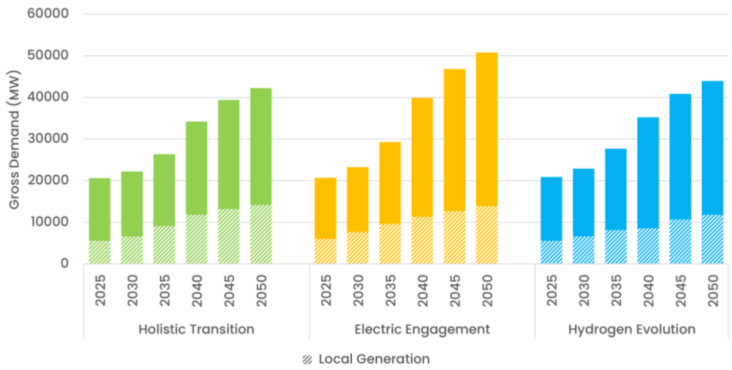


Figure 11: North Wales & Midlands gross peak demand and embedded generation output

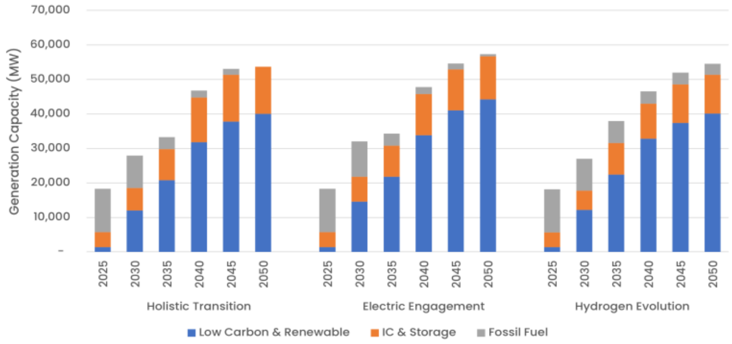
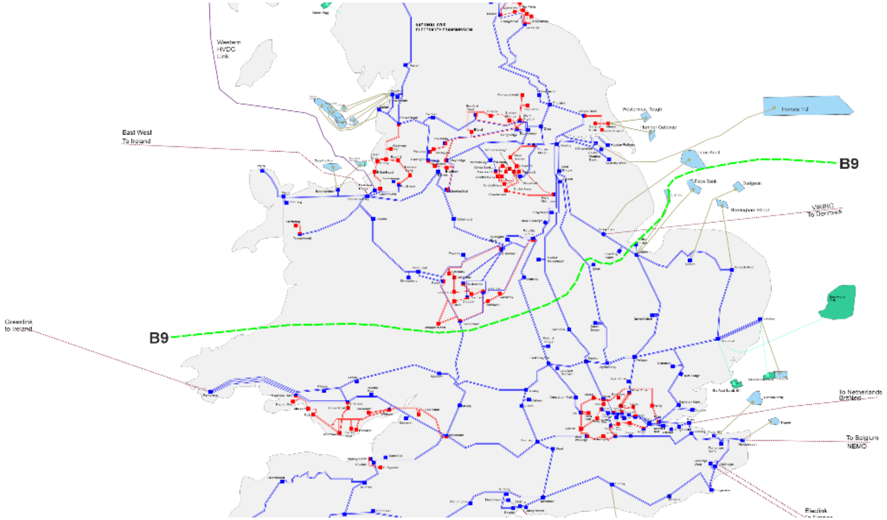


Figure 12: North Wales & Midlands installed generation capacities per fuel type

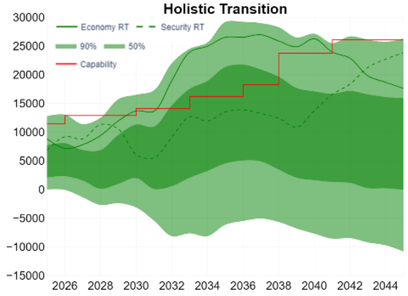
Boundary B9 – Midlands to South of England

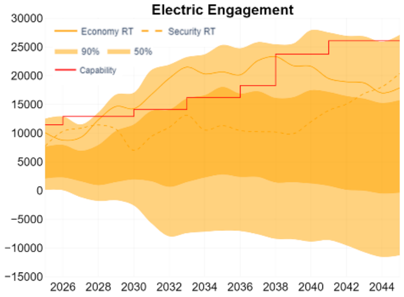


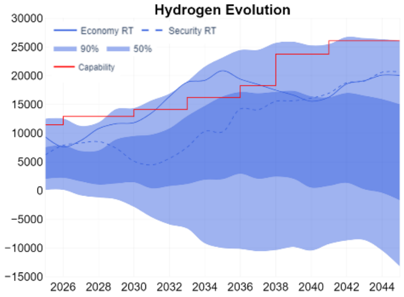
Developments in the east coast and the East Anglia regions, such as the locations of offshore wind generation connection and the network infrastructure requirements, will affect the transfer requirements and capability of boundary B9.

In all FES Pathways the expected flows increase to above the boundary capability for B9 after 2030. Expected flows have increased for Holistic Transmission and Electric Engagement scenarios but reduced slightly for HE compared to ETYS 24.

The FES show a lot of variable renewable generation in the north of boundary, meaning the spread of boundary power flows is very wide. During periods with low northern generation output it is credible to have power flowing from south to north feeding northern demand.







Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **11.5 GW** due to a voltage constraint for a fault on the **Spalding North – Walpole – Bicker Fen** 400kV circuits.

North Wales

The onshore network in North Wales comprises a 400kV circuit ring that connects Pentir, Connah's Quay and Trawsfynydd substations.

A 400kV double-circuit spur crossing the Menai Strait and running the length of Ynys Mon connects the now decommissioned nuclear power station at Wylfa to Pentir. A short 400kV double-circuit cable spur from Pentir connects Dinorwig pumped storage power station. In addition, a 275kV spur traverses north of Trawsfynydd to Ffestiniog pumped storage power station.

Most of these circuits are of double-circuit tower construction. However, Pentir and Trawsfynydd within the Eryri National Park are connected by a single 400kV circuit, which is the main factor limiting capacity in this area. The area is studied by analysing the local boundaries NW (North Wales) 1 to 3.

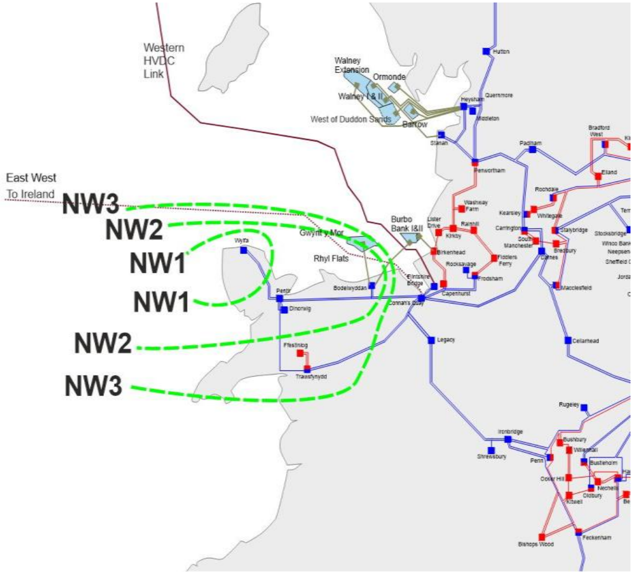
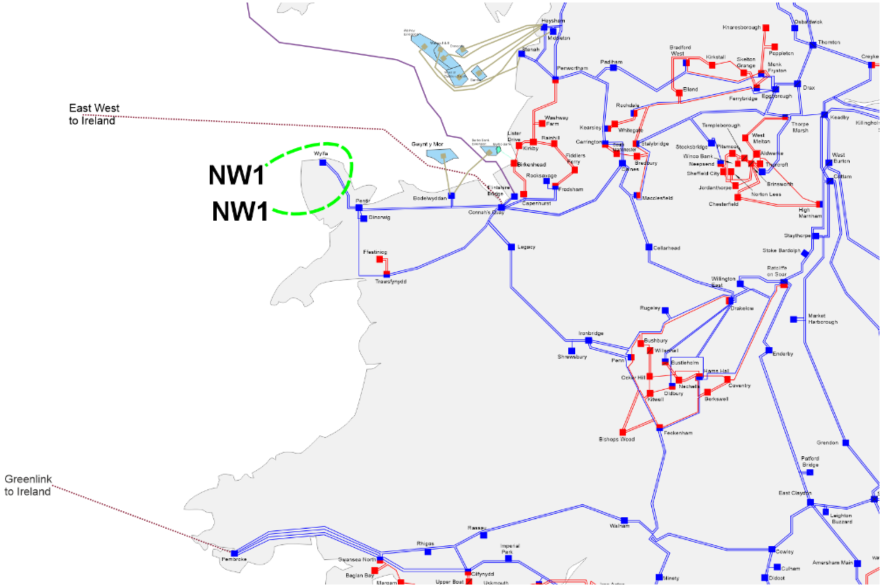
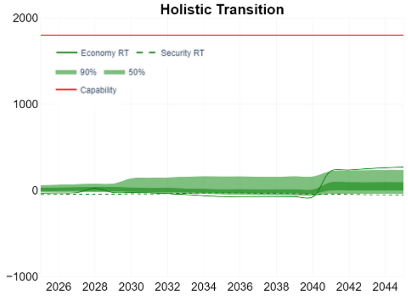


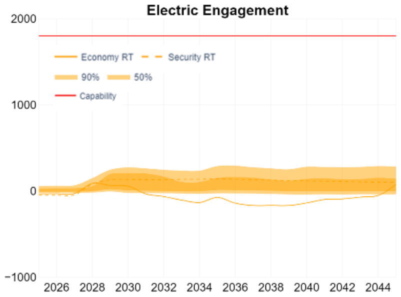
Figure 13: North of Wales boundaries

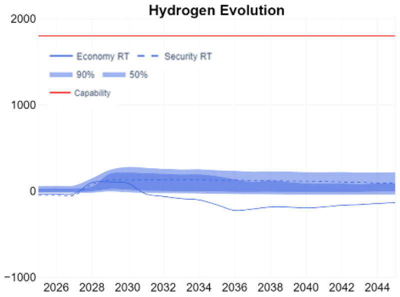
Boundary NW1 – Ynys Mon



There is currently very low amounts of transmission-connected generation behind NW1 following the closure of Wylfa power station in 2015. However, there is some renewable and storage plant. Due to this low generation behind the boundary - it is expected within the later years for NW1 to become predominantly importing.



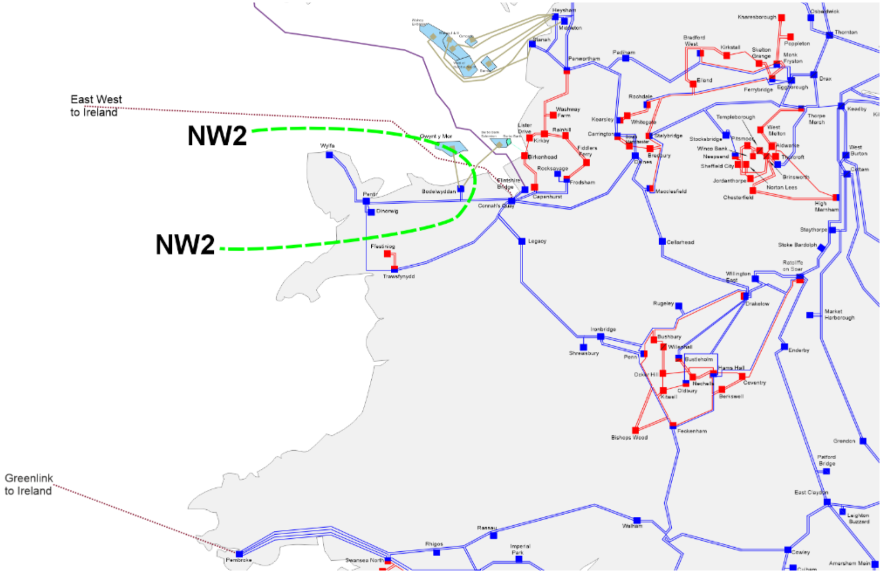


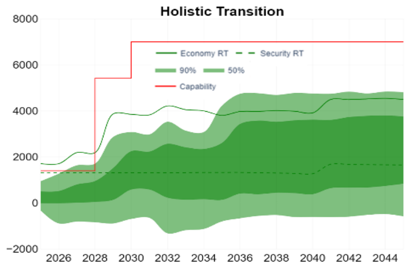


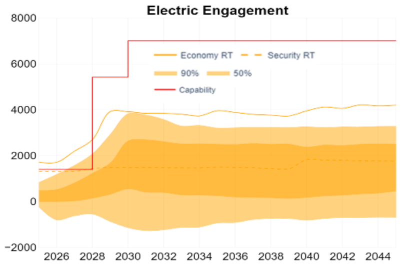
Click here for Boundary Chart Data and click here for detailed Boundary Charts

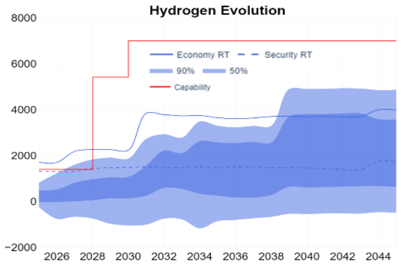
The boundary capability is limited by the infrequent infeed loss risk criterion set in the SQSS, currently **1.8GW.**

Boundary NW2 – Ynys Mon and Caernarvonshire









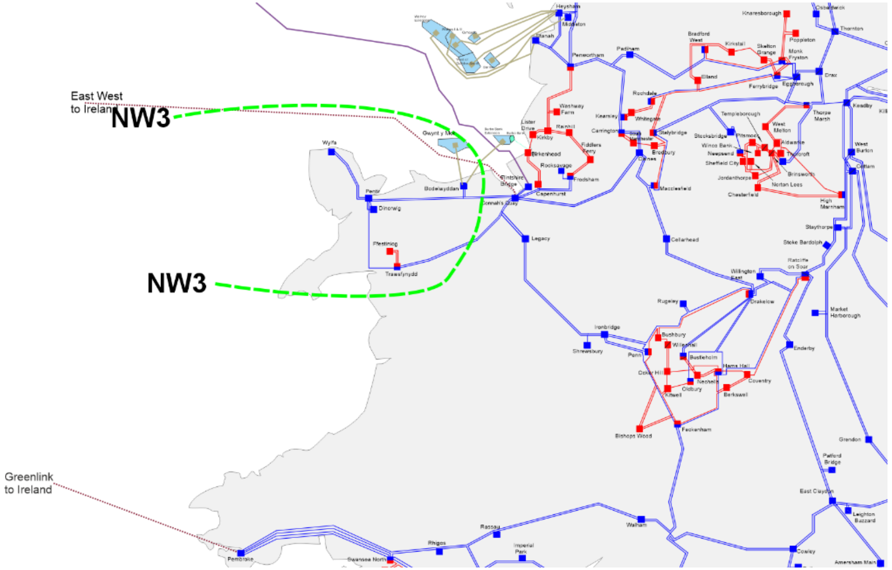
Click here for Boundary Chart Data and click here for detailed Boundary Charts

Currently, there is not a significant amount of generation behind NW2, mainly pumped storage and offshore wind projects.

Expected transfers across NW2 after 2028 will rise due to the additional offshore wind generation projects landing within the boundary, planned reinforcements in the area will facilitate this new generation capacity.

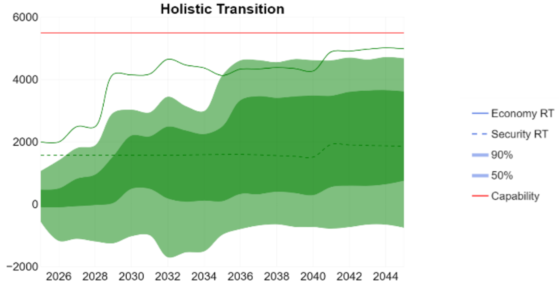
The boundary capability is limited to **2.0GW** due to a thermal constraint on the **Pentir – Trawsfynydd** 400kV circuit.

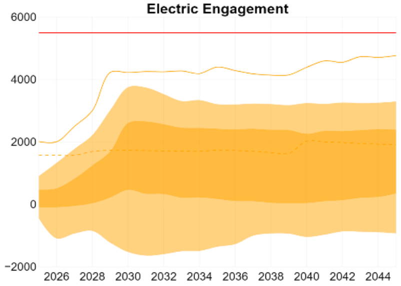
NW3 – Ynys Mon, Caernarvonshire and Meirionnydd

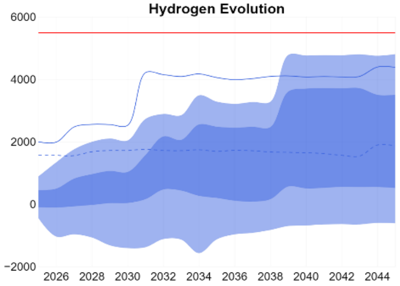


The profile of NW3 is largely similar to that of NW2.

Expected transfers across NW3 after 2028 will rise due to the additional offshore wind generation projects landing within the boundary, planned reinforcements in the area will facilitate this new generation capacity.



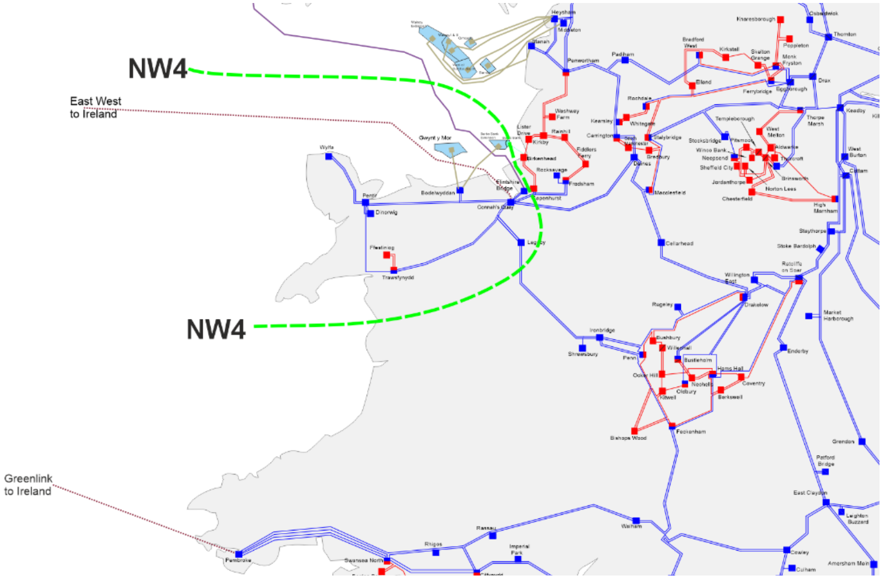




Click here for Boundary Chart Data and click here for detailed Boundary Charts

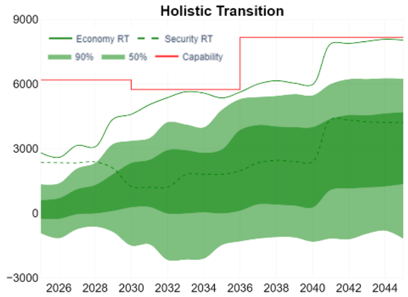
The boundary capability is limited to **4.5 GW** due to a thermal constraint for on the **Legacy - Shrewsbury** 400kV circuit .

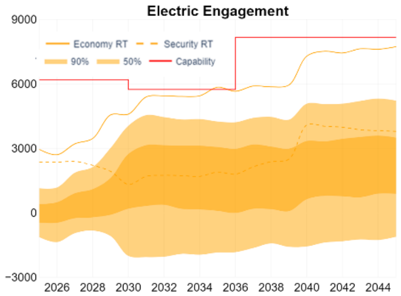
NW4 – Ynys Mon, Caernarvonshire and Meirionnydd

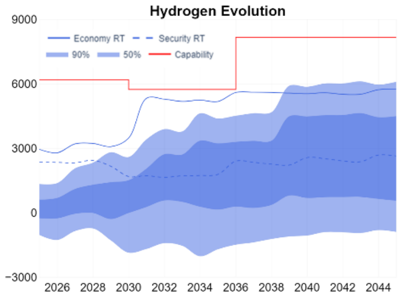


The profile of NW4 is largely similar to that of NW3.

Expected transfers across NW4 post-2028 will rise due to the additional offshore wind generation projects landing within the boundary, planned reinforcements in the area will facilitate this new generation capacity.







Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **6.2GW** due to a voltage constraint for fault on the **Connah's Quay - Daines** 400kV circuits.

East of England

The East of England region includes the counties of Norfolk and Suffolk.

EC5 is the only boundary within this region.

Figure 14 shows the general pattern of power flow directions expected to occur most of the time in the years to come up to 2036. Power will generally flow from north to south down through Lincolnshire and east to west out of East Anglia. The arrows in the diagram illustrate power flow directions and are approximately scaled relative to the winter peak flows.

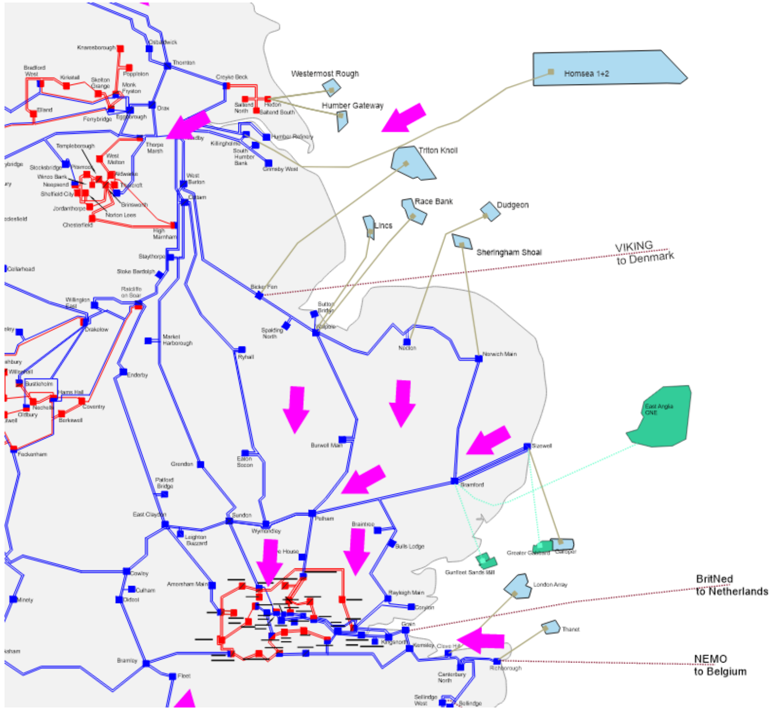


Figure 14: East of England winter peak flows directions

East of England – Regional Drivers

Over the next decade, this region could see growth in renewable and low carbon generation, primarily from offshore wind which will slow by 2040. From 2030, further interconnector and storage connections are expected in this region which will help to mitigate local constraints under high-wind conditions.

Demand is steady in the short term with growth expected from 2030 out to 2050. Already a net-export region, the growth in generation capacity far exceeds the growth in demand meaning that this region will become a significant exporter during high-wind periods.

There is work ongoing to coordinate the network infrastructure in this region to facilitate greater coordination of offshore generation and interconnectors connecting into this region. This follows the 2024 publication of our East Anglia Network Study[7] which reviewed the upcoming generation connections and network reinforcement planned in the area.

The EC5 Constraint Management Intertrip Service[8] is now in place and contracting with generators in the region to provide a more economical method of managing constraints than actions through the Balancing Mechanism.

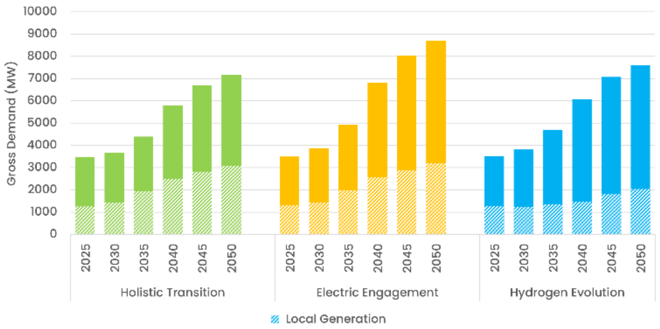


Figure 15: East of England gross peak demand and embedded generation output

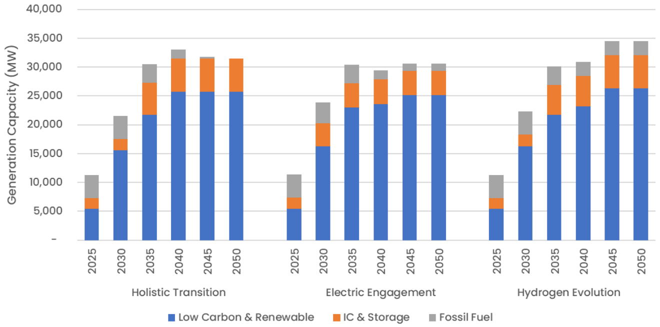
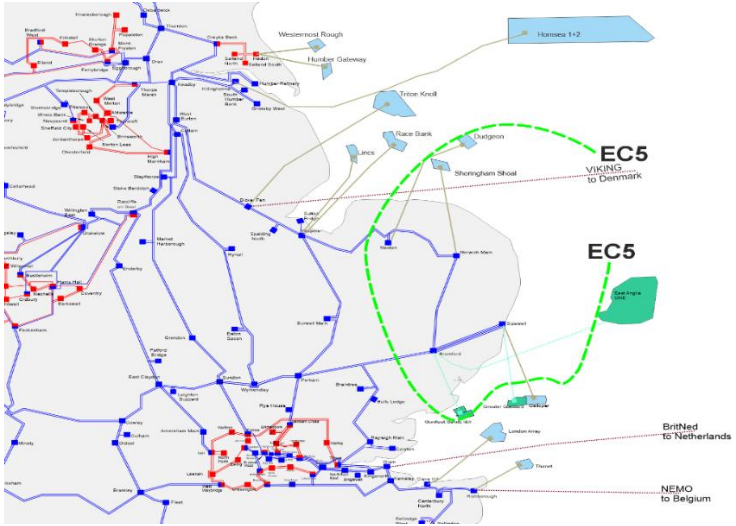


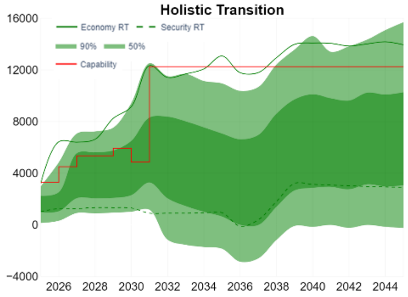
Figure 16: East of England installed generation capacities per fuel type

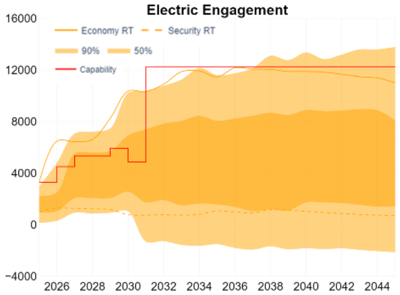
7 NESO, neso.energy/document/304496/download

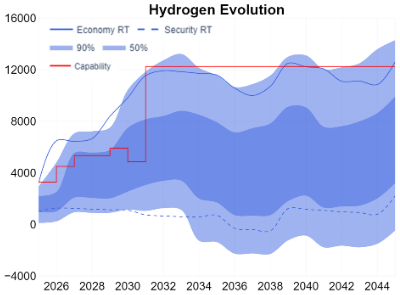
8 NESO, neso.energy/industry-information/balancing-services/network-services/constraint-management-intertrip-service

Boundary EC5 – East Anglia









Click here for Boundary Chart Data and click here for detailed Boundary Charts

There are several offshore wind projects connecting into the region.
The growth in low carbon and renewable generation connecting behind this boundary greatly increase the power transfer requirements. The present boundary capability is sufficient for today's needs but could be significantly short of the future capability requirements pre-2030.

Work is ongoing to coordinate the network infrastructure in this region to facilitate greater coordination of generation connecting into this region.

The boundary capability is limited to **2.3 GW** due to a voltage constraint for a fault on the **Pelham-Bramford-Braintree** 400kV circuits.

South Wales & South of England

The region includes the high demand area of London, generation around the Thames estuary and the long set of circuits that run around the south coast and South Wales.

Interconnection to Central Europe is connected along the southeast coast and this interconnection has significant influence on power flows in the region by being able to both import and export power with Europe.

The South of England transmission region includes boundaries B13, B14, LE1, SC1, SC1.5, SC2, SC3 and SW1.

Figure 17 shows the general pattern of power flow directions expected to occur most of the time in the years to come up to 2034. Power will generally flow from north to south. The arrows in the diagram illustrate power flow directions and are approximately scaled relative to the winter peak flows.

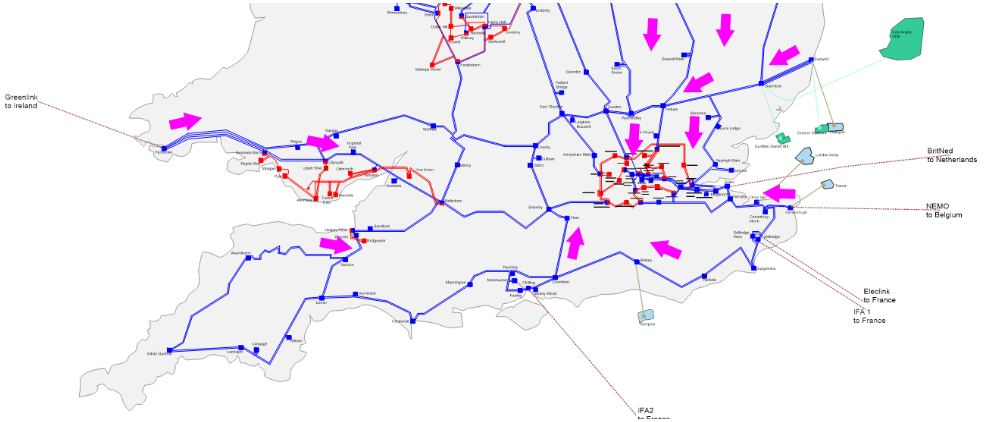


Figure 17: South Wales and South of England winter peak flows directions

South Wales & South of England – Regional Drivers

The southern transmission network is densely meshed in and around the London (LE1) but becomes more radial and dispersed in the southwest. Most interconnectors are due to connect south of boundary SC1, the impact of these will be discussed later in the chapter in the south coast boundary sections.

Interconnector and storage capacity is expected to reach 10–12 GW by 2030 (from 7.5 GW), operating bidirectionally and creating up to 12 GW of demand or power injection.

As new interconnectors come online, boundaries SC1, SC1.5, SC2, SC3, LE1 and B13 must accommodate large bidirectional flows. Limited local generation increases reliance on imports from outside the boundary, and without reinforcement, operating with all interconnectors importing or exporting heavily will be challenging.

High voltages in London arises from the high reactive power gain from the numerous cable circuits, particularly overnight when demand is low. Low-voltage issues are expected to become more prevalent around the south coast during high-flow periods, especially when the south-coast interconnectors are exporting power. The NESO's Long Term 2029 Tender[5] is seeking to procure services in this region to manage both high- and low-voltage issues in future.

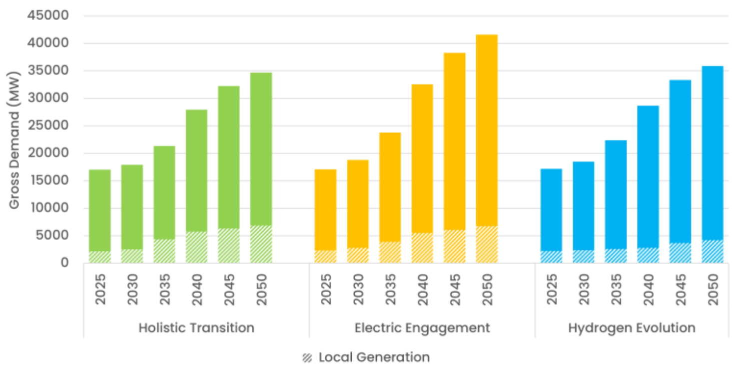


Figure 18: Southern E&W gross peak demand and embedded generation output

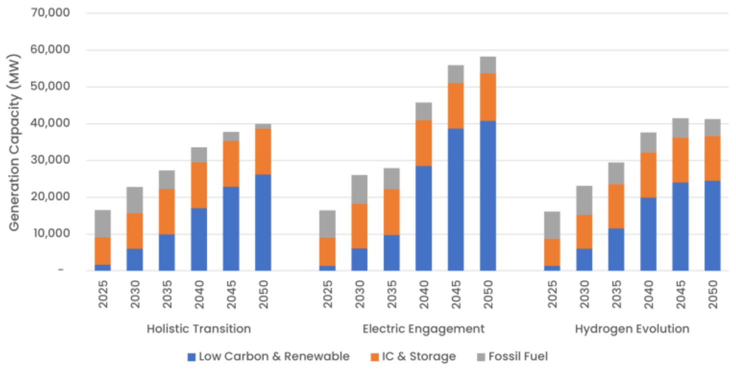
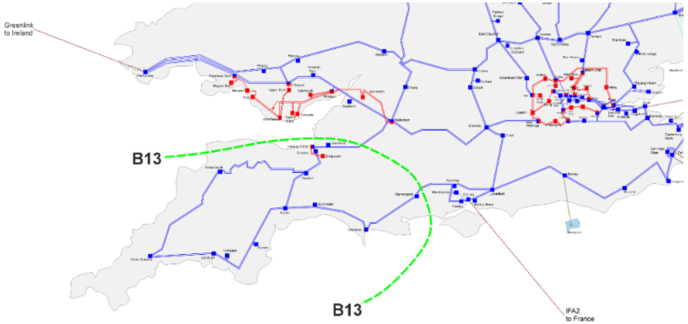


Figure 19: Southern E&W installed generation capacities per fuel type

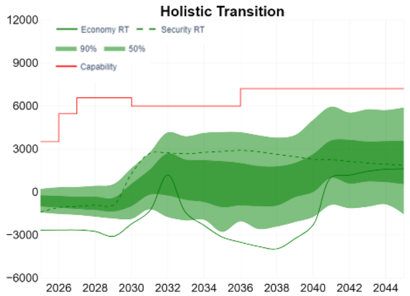
Boundary B13 – South West

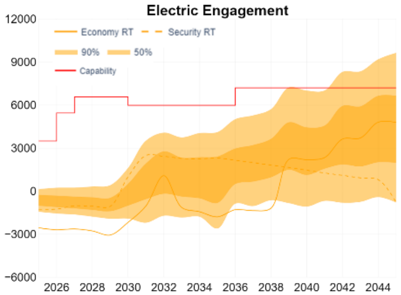


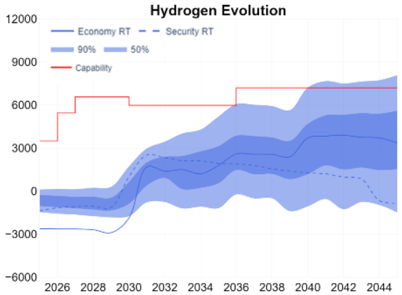
The southwest peninsula is a region with a high level of localised generation and demand. Until new generation or interconnectors connect there is very little variation in boundary requirements for B13, and the current importing boundary capability is sufficient to meet the short-term needs.

The volume of generation capacity expected to connect behind B13 mean the boundary is likely to trend more towards net exports. Further reinforcements may be required after 2030, following the connection of offshore wind projects in the South West. There is also an expected increase in embedded solar generation, with some nuclear and interconnector capacity coming in the early 2030s and continued battery growth.

Compared to ETYS 2024, ETYS 2025 shows a reduction in Required Transfer across all FES pathways. This reflects updated assumptions that increase the role of flexibility, storage, and demand-side response, improving local balancing and reducing extreme flows between regions.



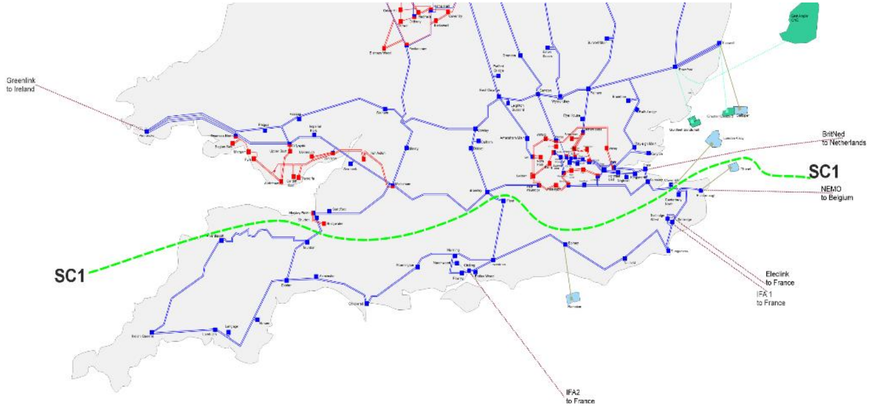




Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **2.9 GW** due to a voltage constraint for a fault on the **Hinckley Point – Shurton** 400kV double circuit.

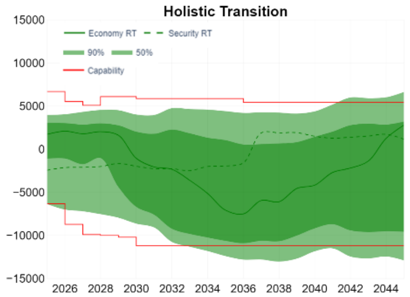
Boundary SC1 – South Coast

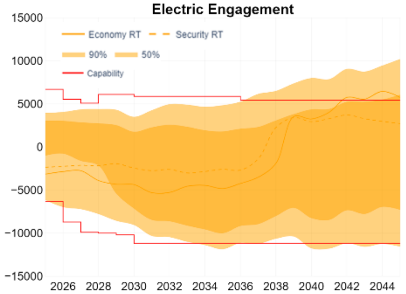


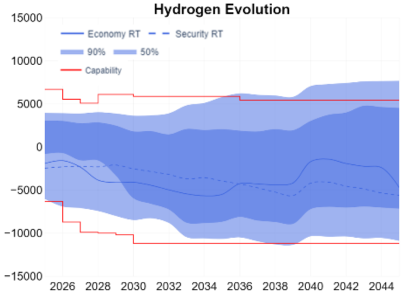
During winter peak demand, the power typically flows from north to south across the boundary due to the low volumes of local generation on the south coast.

Interconnector activity significantly influences this boundary power flow. There are currently four interconnectors to the continent landing along the south coast and the most significant driver for future requirements across SC1 will continue to be the connection of new continental interconnectors. These interconnectors can, at times, complicate the management of network flows and constraints in real-time. For instance, a 2GW interconnector like IFA can cause a 4GW difference on the boundary, switching from full export to full import mode or vice versa.

Across all FES pathways the expected flows move further into the importing region over future years. Capability is expected to be sufficient for both importing and exporting cases.



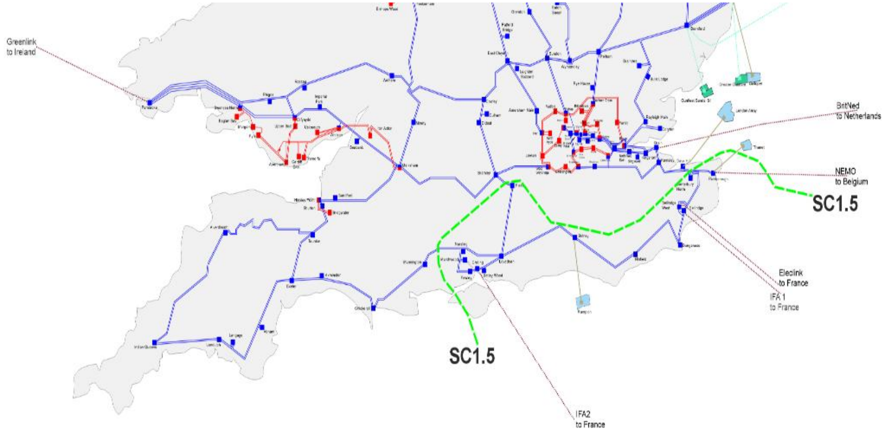




Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **6.4GW** due to thermal constraints on the **Bramley – Fleet** 400kV circuit 1.

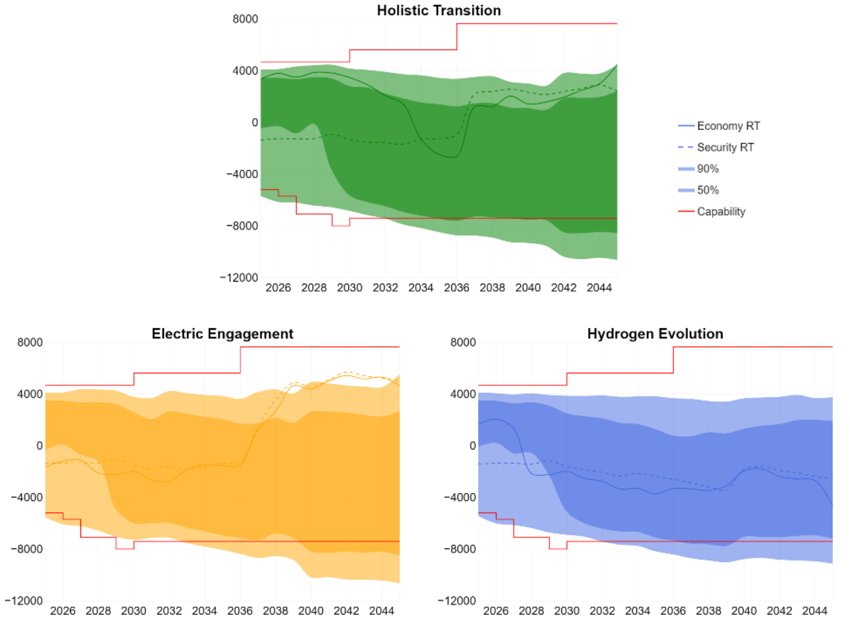
Boundary SC1.5 – South Coast



During peak winter demand in, power typically flows from north to south across the boundary due to the low volumes of local generation on the south coast.

The volatility of interconnector activity can be seen in the wide spread of expected boundary flows depicted by the shaded areas on the boundary charts.

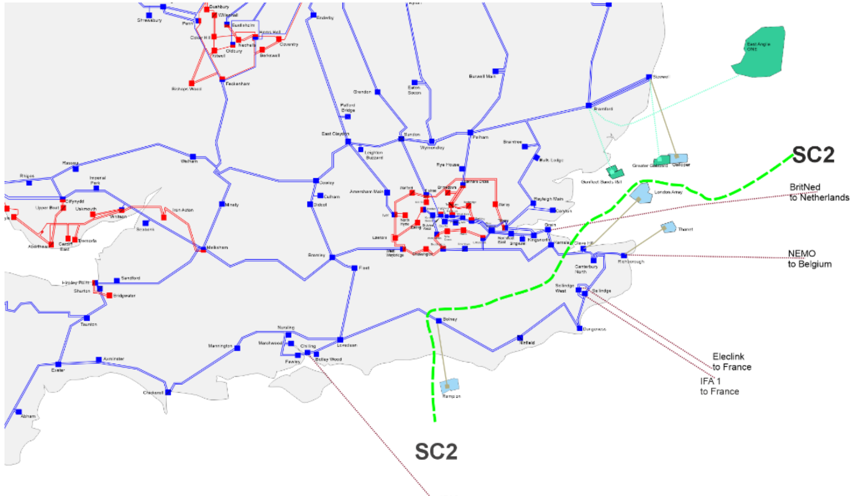
Across all FES pathways the expected flows move slightly more toward importing on average, over future years. Capability is expected to be sufficient for both importing and exporting cases.



Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **5.3GW** due to a thermal constraint on the **Bramley - Fleet** 400kV circuit 1.

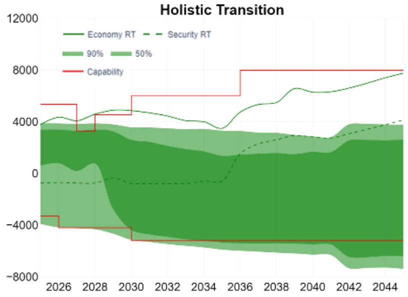
Boundary SC2 – South Coast

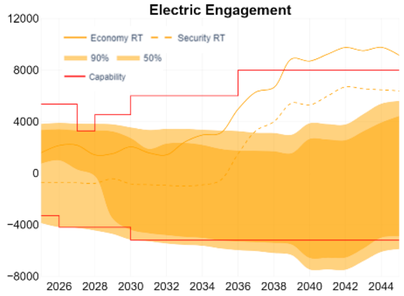


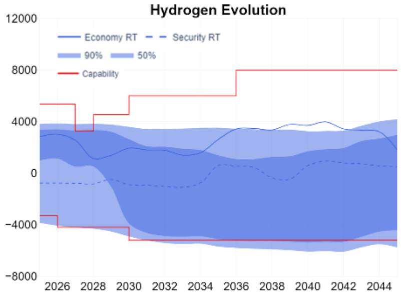
The 400kV route between Kemsley and Lovedean is relatively long and serves significant demand while connecting large generators and interconnections to Europe. A fault at either end can turn it into a long radial feeder, placing all the load on the remaining two circuits.

Additional generation and interconnectors contracted for connection below SC2 could lead to some constraints when windy periods occur in combination with outages around the southeast coast.

Across all FES pathways expected flows are projected to shift slightly more towards importing on average over the coming years. However, the capability is expected to be sufficient for both importing and exporting cases.



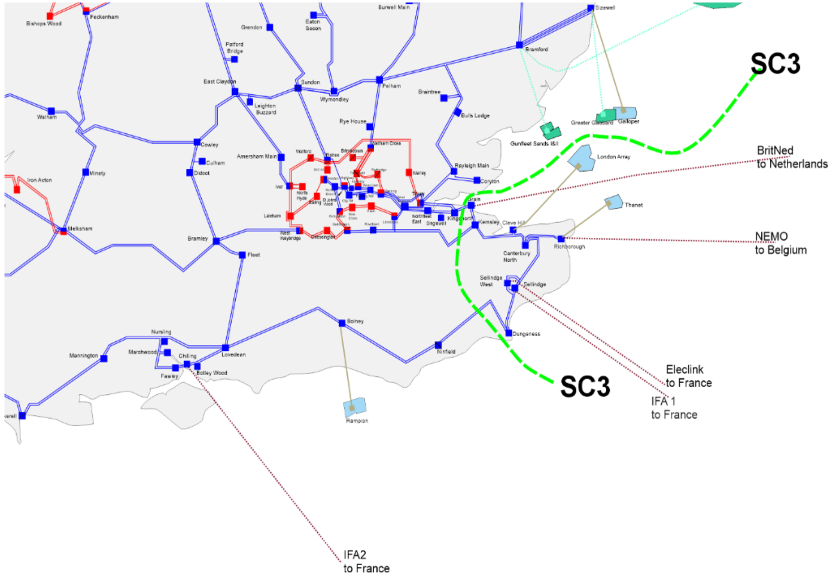




Click here for Boundary Chart Data and click here for detailed Boundary Charts

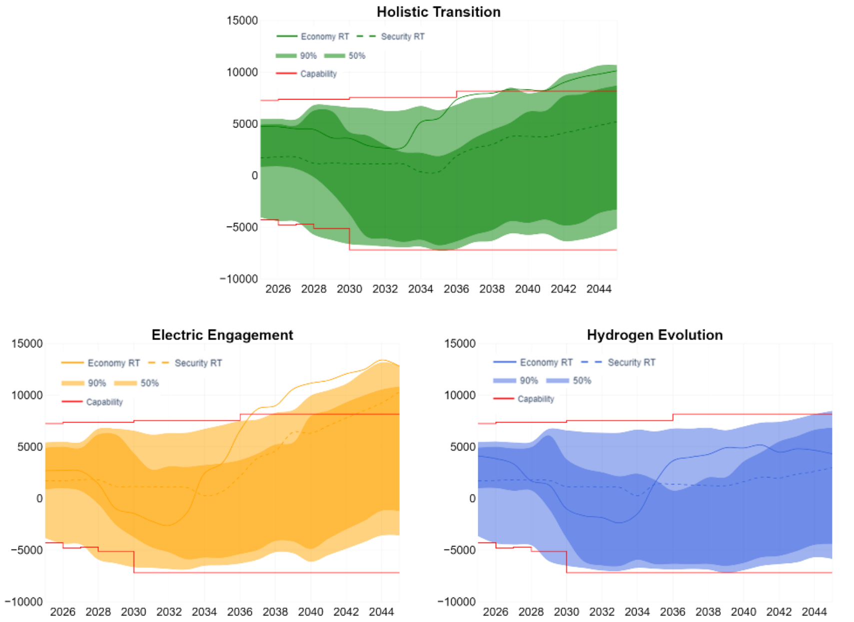
The boundary capability is limited to **3.3GW** due to a thermal constraint on the **Bramley – Fleet** 400kV circuit 2.

Boundary SC3 – South Coast



The current and future interconnectors to Europe have a significant impact on the power transfers across SC3. The current interconnectors to France, the Netherlands and Belgium connect at Sellindge, Grain and Richborough respectively.

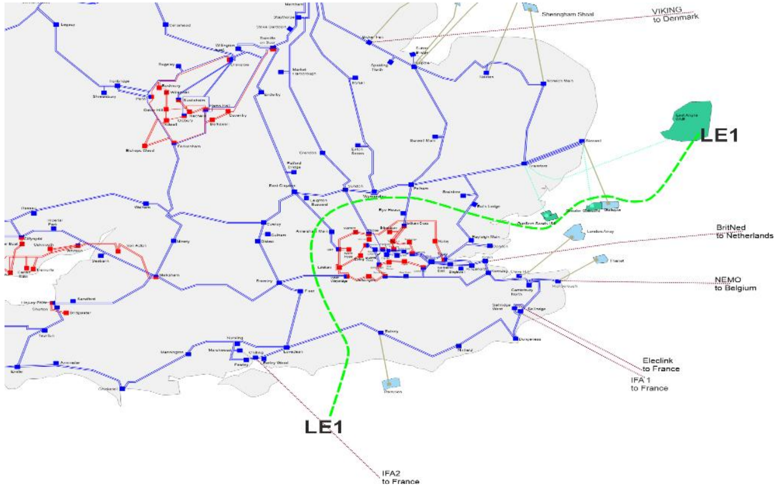
Across all FES pathways the expected flows move slightly more toward importing on average, whilst still expected to regularly export power for limited periods, in future years. Capability is expected to be sufficient for both importing and exporting cases.

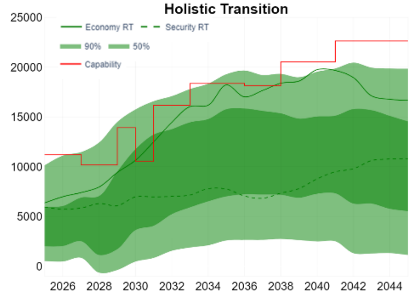


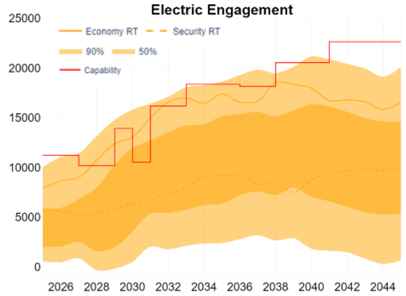
Click here for Boundary Chart Data and click here for detailed Boundary Charts

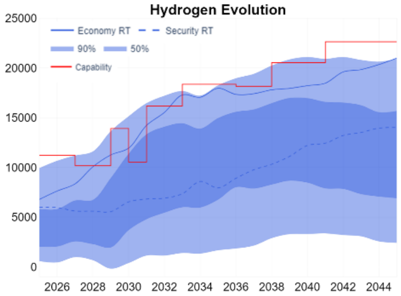
The boundary capability is limited to **7 GW** due to a thermal constraint on the **Grain-Tilbury** circuit.

Boundary LE1 – South Coast









Click here for Boundary Chart Data and click here for detailed Boundary Charts

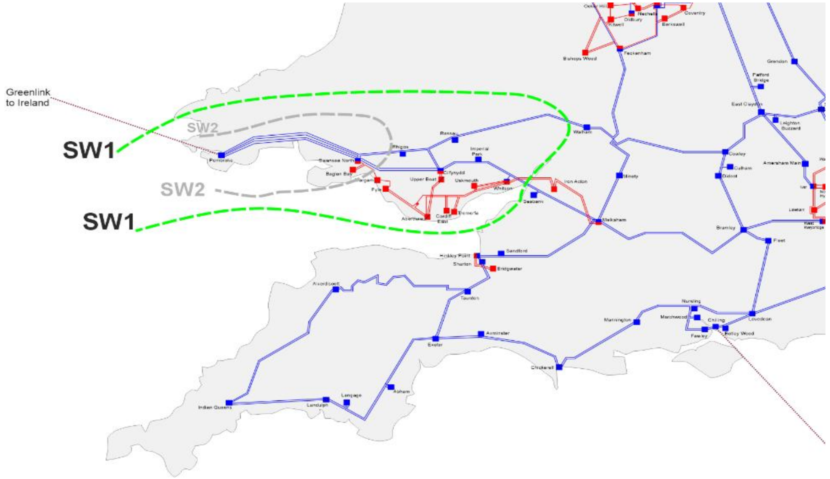
LE1 is characterised by two distinct areas. Within London, there is high local demand and little generation. The remainder of the area contains both high demand and high levels of generation.

LE1 almost exclusively imports power from the north and west into the south-east, and the purpose of the boundary is to monitor flows in this direction. Due to this and for ease of reading, LE1 is defined in the reverse manner, positive flows on the boundary charts indicate power flowing into LE1 (importing).

Increasing interconnector exports to Europe drive an increase in power flows and a need for network reinforcements in the area over the coming years. Expected flows have increased compared to ETYS24.

The boundary capability is limited to **10 GW** due to a voltage constraint for a fault on the **Pelham-Bramford-Braintree** 400kV circuits.

Boundary SW1– South Coast

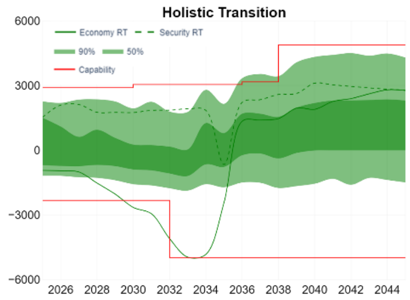


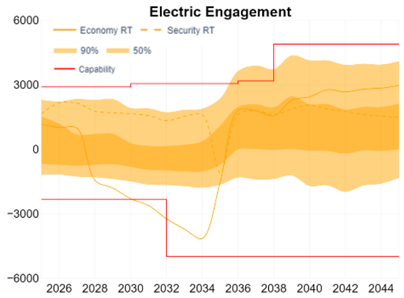
Contained within the boundary is a mixture of generation types including renewable generation and fossil fuel generation which are expected to close.

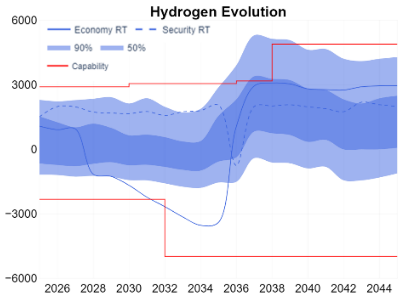
South Wales includes demand consumptions from the major cities, including Swansea and Cardiff, and the surrounding industry.

The boundary requirements are within the boundary's present capability, and we expect this to remain the case for the foreseeable future, as seen in the boundary chart.

The NESO's final recommended design for the Celtic Sea offshore sees up to 3GW of floating offshore wind connecting into South Wales, behind SW1, by 2035.







Click here for Boundary Chart Data and click here for detailed Boundary Charts

The boundary capability is limited to **3.8 GW** due to a thermal constraint on the **Cowley-Walham** 400 kV circuit.

Further Information

Further Information

Supporting Parties

Producing the ETYS relies on contributions and support from a wide range of stakeholders and internal teams. Key parties that provide the information and insight needed to support this work include:

- The GB electricity transmission owners
- NESO's Energy Insights team, which develops the Future Energy Scenarios (FES)
- Our customers and wider industry stakeholders

We welcome feedback on the ETYS. If you have any comments or suggestions, please contact us at: transmission.etys@neso.energy.

Ways to connect and contact us

Keep an eye out for any surveys, energy articles and engagement opportunities on our NESO website: www.neso.energy

You can also contact us through our ETYS email address at transmission.etys@neso.energy and one of our team members will be in touch.

Access our current and past ETYS documents, data, and media at the ETYS archive.

Electricity Networks (EN)

In addition to producing the ETYS, we work collaboratively with the transmission licence holders to develop a holistic strategy for the National Electricity Transmission System (NETS). This includes the following key activities:

- Managing and implementing the Options Assessment process to determine the need for, and progression of, wider transmission network reinforcements.
- Developing and publishing recommendations on preferred investment options for the NETS.

Our latest network investment recommendations are set out in the Beyond 2030 - Electricity Transmission Update report.

Write to us at

Electricity Networks
National Energy System Operator
Faraday House
Warwick Technology Park
Warwick CV34 6DA

Glossary

Acronym	Phrase
ACS	Average cold spell
ASTI	Accelerated Strategic Transmission Investment
CBA	Cost-benefit analysis
CCS	Carbon capture and storage
CCGT	Combined cycle gas turbine
CHP	Combined heat and power
CMIS	Constraint Management Intertrip Service
CSNP	Centralised Strategic Network Plan
DC	Direct current
DSR	Demand side response
DNO	Distribution Network Operator
ENCC	Electricity National Control Centre

ENTSO-E	European Network of Transmission System Operators
ETYS	Electricity Ten Year Statement
EU	European Union
FACTS	Flexible alternating current transmission system
FES	Future energy scenarios
GEP	Grid entry point
GSP	Grid supply point
GW	Gigawatt
GWh	Gigawatt hour
GB	Great Britain
HND	Holistic Network Design
HT	Holistic Transition
HVAC	High voltage alternating current
HVDC	High voltage direct current
IBR	Inverter-Based Resource

LCPD	Large Combustion Plant Directive
MW	Megawatt
MWh	Megawatt hour
MITS	Main Interconnected Transmission System
NETS	National Electricity Transmission System
NGET	National Grid Electricity Transmission plc
NOA	Network Options Assessment
OFGEM	Office of Gas and Electricity Markets
OCGT	Open cycle gas turbine
PA	Per annum
PV	Photovoltaic
QB	Quadrature booster
SCADA	Supervisory control and data acquisition
SGT	Supergrid transformer
SOF	System Operability Framework

SQSS	Security and Quality of Supply Standard
SSEN	Scottish and Southern Electricity Networks
SSEP	Spatial Strategic Energy Plan
SPEN	Scottish Power Electricity Networks
STATCOM	Static Synchronous Compensator
TEC	Transmission entry capacity
TO	Transmission Owners
TSO	Transmission System Operators
VSC	Voltage Source Converter

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