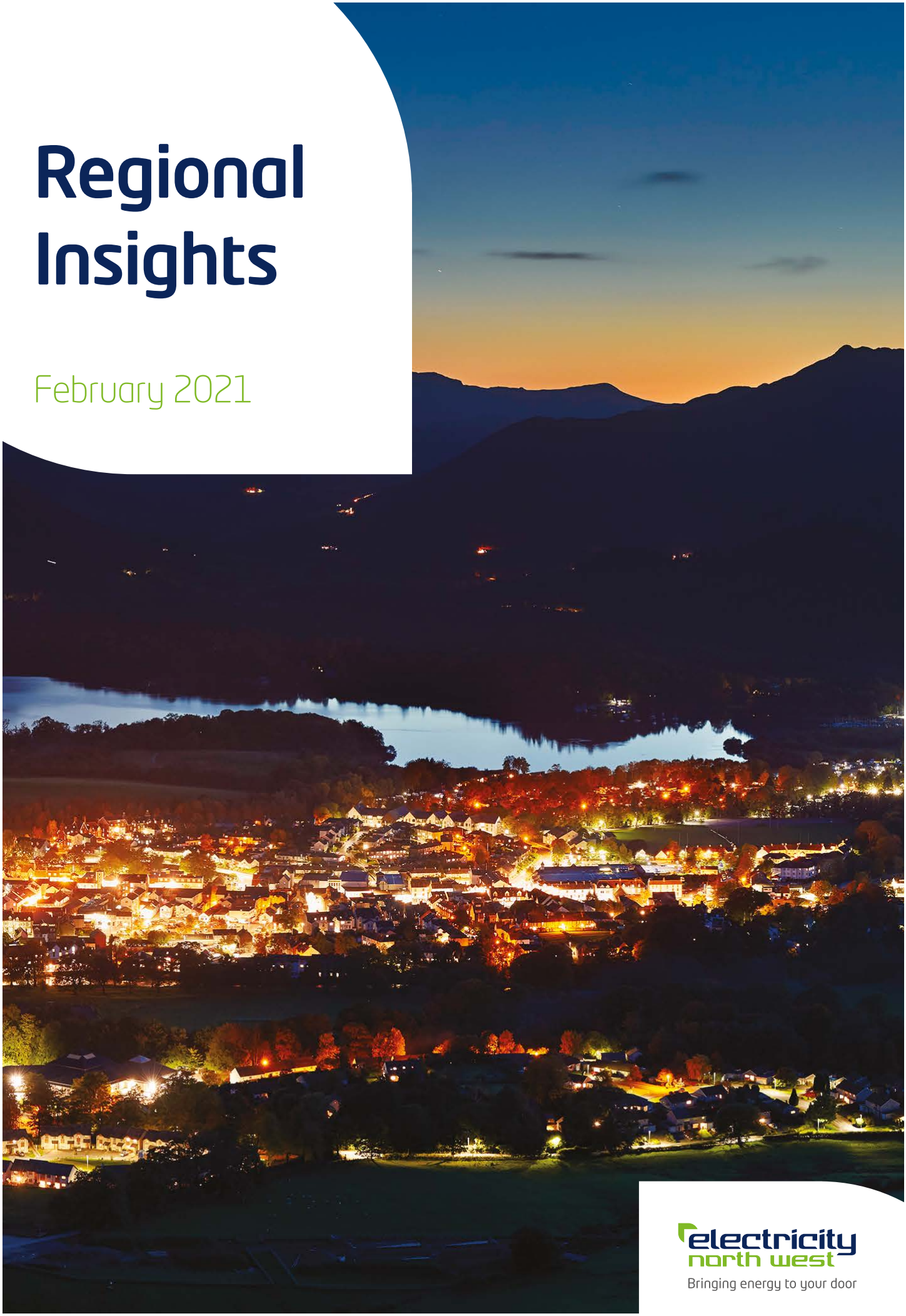
Regional Insights

February 2021



electricity north west

Bringing energy to your door

About us

Electricity North West is one of 14 electricity distribution network operators (DNOs) in Great Britain. We are responsible for maintaining and upgrading 56,000km of network and nearly 500 major substations across the region. We supply electricity to the diverse communities in the North West of England which extends from Macclesfield all the way up to Carlisle.

We are regulated by the Office of Gas and Electricity Markets (Ofgem) who provide DNOs with their licence to operate and decide what's fair for us to charge our customers for each price control period.

Our current price control began in 2015 and runs to 2023 and is referred to as RIIO-ED1. This stands for Revenue = Incentives + Innovation + Outputs, Electricity Distribution 1. Under this framework, the price we can charge our customers is fixed until the next price control, RIIO-ED2, which will run from 2023 until 2028.

Work is already underway to set the framework for RIIO-ED2, which will apply to all electricity distribution network companies. The framework will determine what RIIO-ED2, which begins on 1 April 2023, looks like.

RIIO-ED2 will see significant change in the way electricity is generated, consumed and stored, driving innovation across the whole energy system both now and into the future. This will include an important transition in our role, from DNO to distribution system operation (DSO).

The transition to DSO is not one activity but rather the delivery and co-ordination of a range of functions. Our DSO transition plan, which is currently in development, will cover the three broad roles of planning and network development, network operation and market development.

Contents

1 Welcome

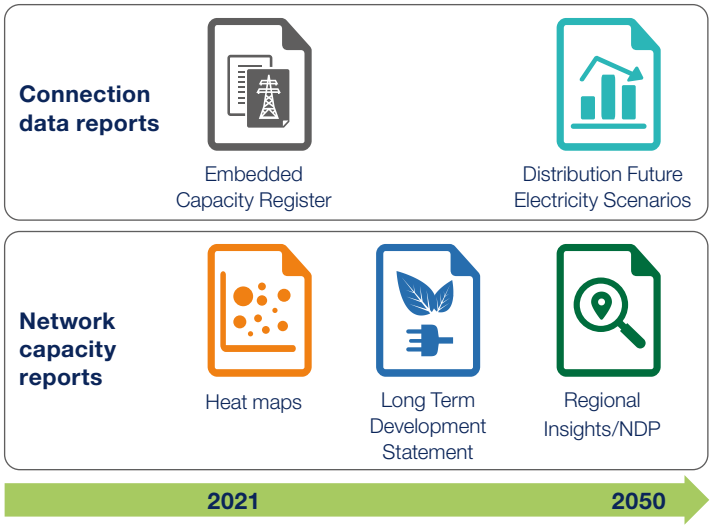
Welcome to our Regional Insights document, in which we report on the impact of our 2020 Distribution Future Electricity Scenarios (DFES) forecasts on our network in the near term, and share our view of the long-term future to 2050.

We are continuing to maintain a reliable supply of electricity during the ongoing global pandemic, which has brought widespread disruption for our customers and changed their electricity requirements. As the region's DNO, we will play an important role in helping our region to 'build back better', supporting government plans for a green recovery, while continuing to work even harder to support the communities we serve. One of the critical lessons learned in 2020 is that things can change. Uncertainty around the prospective scale and timings of changes in electricity use has been highlighted by societal step changes in working practices, the use of transport and the continuing transition to a net zero carbon future.

The alternative future forecasts presented in our recently published DFES report allow us to prepare for a range of eventualities and provide stakeholders with an overview of the electricity distribution roadmap to 2050. In the past, overall electricity demand did not change very quickly, so the studies underpinning the planning of our network were more assured. However, the significant growth of solar photovoltaics (PV) in the last decade and the large uptake of electric vehicles anticipated in the 2020s will lead to the use of more complex techniques and render the sharing of our network capacity assessments with stakeholders even more important.

In this Regional Insights document, we explain what the DFES demand and generation forecasts mean in terms of network capacity, and signpost where there could be future network constraints as the region strives to meet net zero carbon targets. We provide detailed analysis and a high-level commentary for the parts of the network supplied by each of our grid supply points which provide connections from our network to the transmission network. We also examine how the use of flexible services between now and 2030 could help ensure the evolution to net zero carbon is a smooth one. Our review then continues to 2050 and considers the ongoing impact of the transition.

REGIONAL INSIGHTS AND OTHER PLANNING DOCUMENTS



Our analysis shows that in many cases our existing infrastructure can accommodate our customers' long-term future requirements, even for net zero compliant scenarios. However, additional capacity will be required in some parts of the network to meet the challenge. By considering all DFES scenarios we will ensure that interventions are carried out timely and efficiently to satisfy our customers' needs.

This Regional Insights report is part of a suite of documents which provide data for a range of time periods to support our customers and stakeholders with their development plans. Our Heatmap Tool provides information about the ability to accommodate additional connections on the present network, including accepted connections. It is complemented by the Embedded Capacity Register which lists generation and storage resources (≥1MW) that are connected, or accepted to connect, to our distribution network. Our Long Term Development Statement (LTDS) provides more detailed ratings of network components and forecast loadings for the following five years. Our DFES provides forecasts up to 2050, which are considered in this Regional Insights document, although it focuses more on the next ten years. A new licence condition will see all DNOs publish a Network Development Plan in 2022 which will likely include some similar information to this report to highlight where there is network capacity and when network constraints may occur in the next five to ten years.

We hope you find this document to be a useful insight into the future operation of our network and our analysis, which is informing part of the network investments for our RIIO-ED2 business plan (2023-2028). If you have any comments or feedback, please contact us.

Steve Cox
Engineering and technical director

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Planning our future network

As the DNO for the North West of England, we are responsible for the affordable development of a safe and reliable electricity network which must continue to meet our customers' needs as they transition to a net zero carbon future.

We have a dual role to play in this transition. Firstly, we will act as a role model for our customers by reducing our own operational carbon footprint, having committed to a challenging company target. Our ambition is to drive down our emissions from heating and transport and become net zero by 2038.

Secondly, we have a responsibility to support the ambitions of our stakeholders such as the local authorities in our region who have committed to achieving net zero in advance of the 2050 national target.

Our network must evolve to meet the challenge as our customers' requirements change to meet their net zero ambitions.

One of the changes we are seeing as part of the transition to net zero carbon is the connection of more local embedded generation and flexibility, which are vital if we are to reduce our emissions. We are also accommodating more electric vehicles to decarbonise transport and more heat pumps to decarbonise heating in the UK. We have developed a range of scenarios to capture the uncertainty of how quickly these changes may occur.

The Regional Insights document presents the results of our review of what our 2020 DFES forecasts mean for our whole network, with focus on specific areas of the network where potential future issues have been identified.

We have carried out detailed analysis in accordance with our normal network evaluation practices and the results are summarised in a high-level commentary for the networks served by each grid supply point.

The ability of our existing networks to accommodate predicted new demand and generator connections is established for all the scenarios. Where we have identified that there may be inadequate capacity on our existing network, we have included details to summarise the requirement and potential action.

These could range from purchasing flexible demand and generation services to investing in new assets to ensure capacity is available until 2030 and beyond. Our forecasts for the uptake of low carbon technologies are an important input to our assessments as these inform well justified investments for inclusion in our RIIO-ED2 business plan which will be submitted to Ofgem in summer 2021.

This Regional Insights document provides valuable insight for local stakeholders by presenting our evaluations of the forecast growth of demand and generation in specific areas of our 132kV, 33kV and 11/6.6kV networks.

We indicate parts of the distribution system most likely to be suited to new connections in the future. We also highlight the parts of the network where reinforcement may be required to make new connections and where we are more likely to require flexible services or encourage energy efficiencies.

While this Regional Insights document intends to focus on the capabilities of our network to 2030 and beyond to 2050, it accompanies other publications on our website which summarise the capacity available today. Customers looking to make a connection in the area find our LTDS and Heatmap Tool useful sources of information in advance of making a connection application. The Heatmap Tool is updated monthly to provide the latest view of capacity in the area.

We have previously provided a long-term view of our network's capability to accommodate forecast demand and generation in the Regional Insights section of our first DFES in 2018. The update presented here is part of our commitment to share more information to empower our stakeholders. We will continue to improve and develop our publications, taking into account wider industry work, which is further shaping network capacity and investment reporting. We will publish our first Network Development Plan in 2022 and will look to develop the content of our LTDS following the outcome of Ofgem's review.

Document structure

This document comprises three further main sections:

- Section 3 outlines the methodology we use to evaluate future network capabilities and how we develop plans for our future network where the need for additional capacity has been identified.
- Section 4 introduces the individual GSP insights, including an overview of our network and the possibility of intervention latitude.
- Section 5 provides detailed analysis and a high level commentary for each of our grid supply points and the areas they serve. We also highlight the potential impact of the various scenarios up to 2050 to provide early warning of future network availability and potential constraints.

3 Methodology

NETWORK INTERVENTION PATHWAY

The way we plan and develop our network has evolved to meet our customers' changing needs and in response to their increasing ambitions. Distributed generation and the uptake of electric vehicles and heat pumps are expected to increase, but we cannot be sure of the rate of change. This uncertainty is factored into our planning by considering the impact of the range of forecasts from our DFES. We use detailed network studies to identify the network needs corresponding to each scenario and identify network development options. The optimum plan is then selected based on rigorous whole life cost-benefit analysis before implementation.

We continue to share more information on this process and our results to address the need for greater transparency across our industry. This data helps to empower our stakeholders and support their net zero carbon ambitions.

We consider alternative credible future pathways in our DFES scenarios to allow us to understand and address the evolving needs of our customers.

DFES

Forecasts are an essential first step on the journey to identifying network investment. Our 2020 DFES presents five scenarios, each driven by varying societal change and speed of decarbonisation. Each scenario describes an alternative roadmap and together they define uncertainty in the range of outcomes. Four of the scenarios meet the UK net zero carbon target whereas the Steady Progression scenario assumes only small-scale decarbonisation.

OUR DISTRIBUTION FUTURE ELECTRICITY SCENARIOS 2020

Steady Progression (SP)
Slow decarbonisation
Not meeting net zero targets
Limited efficiencies

System Transformation (ST)
Hydrogen helps to meet net zero beyond 2040
Limited efficiencies

Central Outlook (CO)
Average assumptions across the other scenarios

Consumer Transformation (CT)
Electrification of transport and heating help to meet net zero
High uptake of renewable distributed generation
High efficiencies

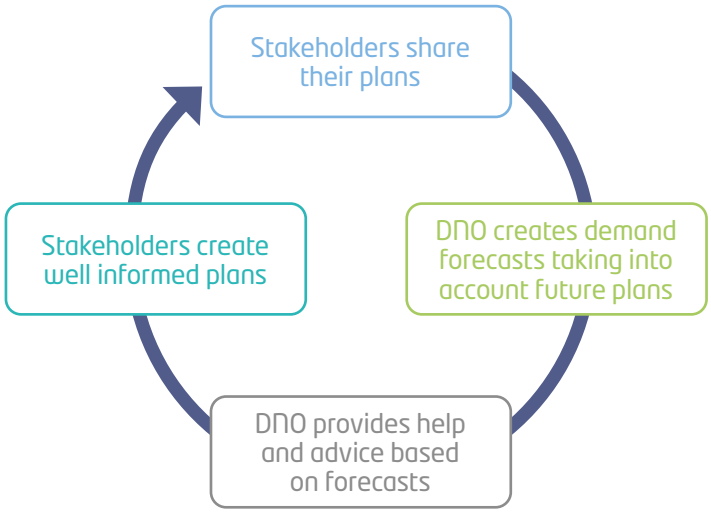
Leading the Way (LW)
Net zero before 2050
Early electrification of transport and heating

Our Steady Progression, System Transformation, Consumer Transformation and Leading the Way scenarios have been defined using the same high-level assumptions adopted by the rest of the industry to provide a consistent approach for our stakeholders. Central Outlook is an additional scenario that, as in our previous two DFES publications, considers central assumptions relevant to our region. Our DFES document explains how our scenarios are defined and what each of them means in terms of numbers of electric vehicles, heat pumps, distributed generation capacity and the associated demand for electricity.

Our scenarios utilise our unique bottom-up modelling methodology developed as part of our ATLAS project. We create very specific forecasts for the small areas corresponding to our distribution substations and combine them, taking into account the diversity between individual components to create the forecasts for the upstream substations that supply them. These well-informed forecasts for each of our bulk supply points and primary substations provide the detailed assessments which underpin our network development plans.

As explained in our DFES document, our continuous cycle of engagement with our stakeholders gives us tangible insights into their requirements which are incorporated into our forecasts to ensure our network investment is targeted at the right areas at the right time. Our use of regional energy master plans and stakeholder-informed forecasts help us to identify network limitations to determine a robust and well justified investment plan for tackling likely constraints.

OUR CYCLE OF ENGAGEMENT



Decarbonisation plans and other planned developments from local authorities and customers are often the anchor in an area earmarked for revitalisation and can trigger significant associated local redevelopment. We are more confident that plans will materialise when local government supports revitalisation plans based on economic and environmental benefits. Such justification means that we can reflect these needs in our forecasts and plan with greater confidence.

Our scenarios are tailored specifically to the North West by using regional data combined with extensive stakeholder engagement.

This continuous two-way process with stakeholders allows our Regional Insights work to be stakeholder-focused for the period up to 2030 and cover a longer range. This is in comparison to our LTDS and heatmaps which concentrate on a shorter period, and therefore come with a greater degree of certainty than the network capacity needs presented in this Regional Insights document.

As well as an increase in demand and generation, the uptake of low carbon technologies will lead to changes in the time of day and time of year when customers use electricity, creating more uncertainty in our forecasts. To meet these different challenges, we must plan our network to be agile and flexible, while continuing to be reliable.

Our forecasts are being used to help shape development plans for our ED2 submission to Ofgem which includes our reinforcement requirements for 2023-2028. The level of investment requested, and finally determined by Ofgem, will allow us to invest in a timely and efficient manner to meet our customers' needs and further facilitate the transition to net zero.

Assessment of network capacity

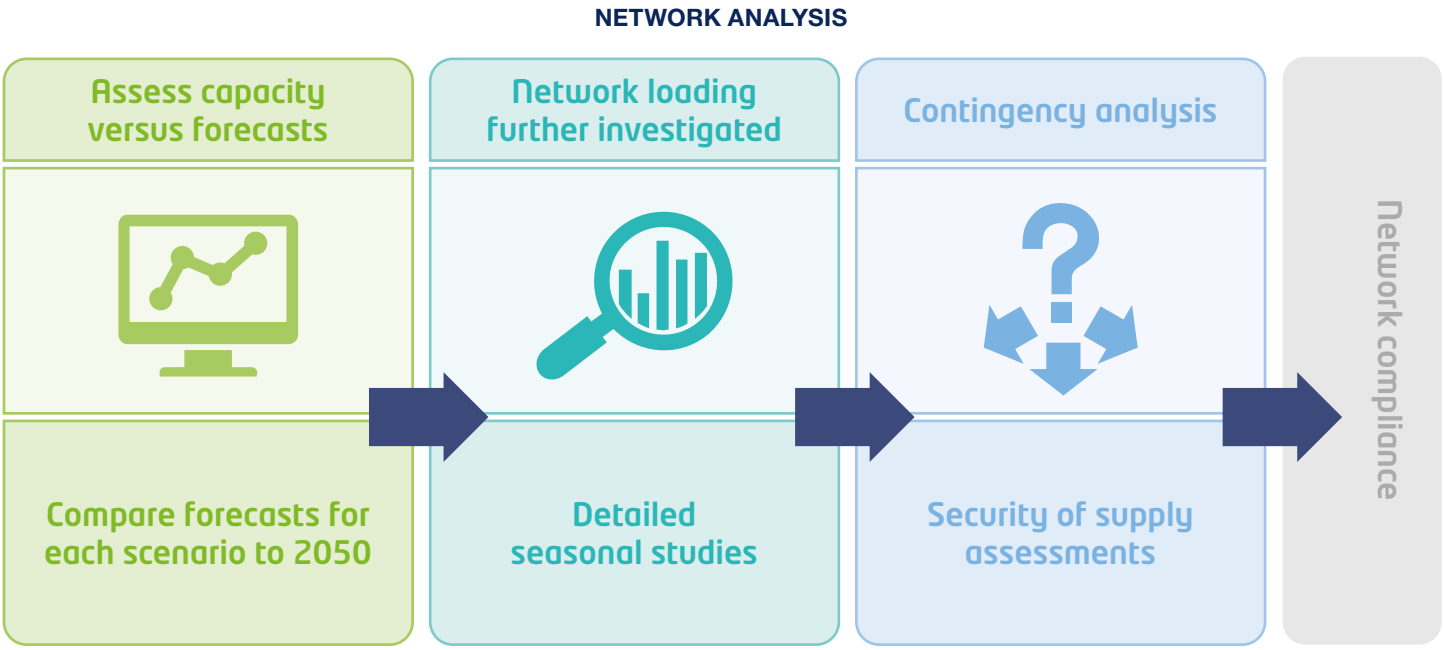
Our Central Outlook scenario aims to provide an average set of assumptions to minimise risk and to ensure that a measured and considered approach is taken to forecast future demand and generation. Initial views of our network's future capability are gained from investigations based on the Central Outlook scenario, while our understanding of sensitivities is gained from examining all net zero scenarios since our region has demonstrated strong commitment to this target.

The capabilities of our network are assessed using bespoke analysis of forecast active and reactive power flows applied to comprehensive models of our 132kV and 33kV networks, including representation of 33kV/HV substations. We also examine true demand forecasts to ensure that our network can continue to operate satisfactorily when local distributed generation is not exporting (when the wind is not blowing, or solar PV is not generating).

We ensure that all our assessments satisfy industry standards, are consistent, repeatable and auditable by complying with the rigorous policies that govern our network design. Studies include:

- Consideration of equipment capacity reflecting seasonal and cyclic variations
- Diversity of existing and new load components
- Planned work including assets being replaced due to health deterioration
- The flexibility to switch networks to transfer load.

Study results are reviewed to check that equipment is operating within its rating and that network parameters will remain within required limits for safe and stable network operation. We carry out further investigations when deficits are identified. Characteristics of the deviation are defined as a first step towards establishing appropriate interventions, including the extent and duration of flexible service solutions.



Our analysis looks to the long term to provide foresight of future needs so that we can plan efficiently. We need to plan proactively rather than react to issues when they occur because of the time required to construct new assets and arrange commercial solutions.

Our detailed analysis allows us to accommodate many of our customers' low carbon connections and maximise the use of our existing network.

Network analysis – demand

Our first step to meet the challenge of the expected increase in demand is to compare the forecasts created for each scenario up to 2050, with capacity values based on rating values for circuits, primary substations, bulk supply point transformers and substation equipment. We then explore any potential issues through detailed seasonal load flow studies. These studies allow us to check that power flows are within equipment thermal ratings, voltages are within statutory limits and that other parameters, such as voltage step changes, comply with standards. Contingency analysis is undertaken with single and double outages being reviewed in accordance with internal codes of practice and the security of supply Engineering Recommendation P2.

Although we estimate the capacity of grid supply point substations at the boundary of the distribution and transmission networks, detailed assessments are undertaken by the transmission network owner who considers the whole complexity of the network.

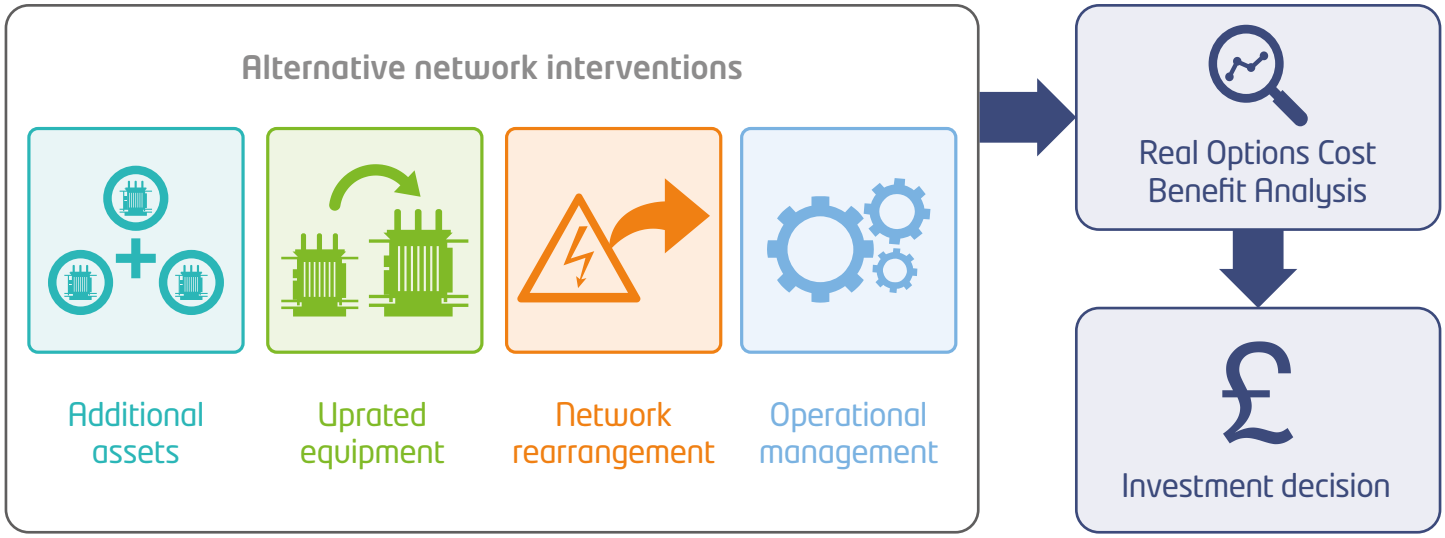
Network analysis – generation

Our Embedded Capacity Register shows a wide variety of technology types and over 2.5GW of generation already connected to our network with a further 1.9GW accepted to connect. We have seen the connection of tens of thousands of generators over the past ten years. This is partly due to several government incentives such as the feed-in tariff which encouraged the uptake of low carbon technologies by paying for electricity generated and exported back to the network. More recently, the need for balancing services to support National Grid has resulted in the significant uptake of storage facilities designed to address peak lopping, and generation shortfall or to provide a fast frequency response to maintain system stability.

Although renewable generation helps us to move away from large fossil-fuelled generators, its rapid growth is not without its challenges. We need to carry out comprehensive assessments to assess the growing impact of generation connections.

Increased demand from the decarbonisation of transport and heating will trigger reinforcement in several areas of our network, starting in ED2 and continuing beyond 2030.

INTERVENTION OPTIONEERING



The increase in generation connected to the network has also created the relatively new phenomenon of widespread reverse power flows. This occurs when generation exceeds local demand, for example during the night when demand is low. Our studies consider the terms of generator connection contracts since many are based on being connected only when the network is operating normally, with generation constrained when operating abnormally.

Voltage stability and short circuit studies are a key factor in our assessments of our network's ability to accommodate forecast generation. Future fault levels are simulated using assumptions for the different types of generation in our forecasts. The results are then judged by comparing calculated fault levels with switchgear, cable and overhead line circuit ratings. Where the increase in generation causes these levels to be exceeded, an intervention is triggered.

Working with National Grid ESO, we have implemented the Appendix G process at all grid supply points to give our customers a better indication of the transmission network's ability to accommodate additional generator connections to our distribution network. The Appendix G process provides a regularly updated view of the generation headroom available on the transmission network, speeds up checking for constraints and helps assess the impact of increased activity on the transmission network.

To increase generation on the network we are working with National Grid to develop regional development plans to facilitate further connections in areas already rich in generation.

Intervention optioneering

Options for accommodating additional customer requirements beyond our present extensive capabilities include making better use of our existing network, improving or extending it.

The traditional approach to increasing network capacity has been to deploy more equipment. Asset options typically include:

- Installing additional assets
- Replacing transformers and cables with larger types with greater ratings
- Transferring circuits from a constrained part of the network to somewhere with sufficient available capacity
- Operational management.

Network loads are effectively managed by switching which allows us to reconfigure the network and operate alternative supply arrangements. We develop this flexibility by considering the geographical locations of circuits. Overloads are addressed by interconnecting neighbouring networks, enabling us to share capacity.

Operational management to reconfigure a network before switching is a common way of avoiding the potential exceedance of switchgear short circuit ratings. A transformer may be switched out, or a bus section opened, to reduce fault level before a switch is closed.

Our innovation work and adoption of technology means that we now have a variety of solutions which maximise the use of our existing network to help overcome network constraints. We can now secure additional capacity and headroom for new connections by using active solutions that may offer greater value for money. Our new network management system provides localised control which enables us to increase our use of flexible services and manage our network better. Flexible services is the term used for paying a customer/provider to reduce their electricity consumption or increase generation on request, to resolve a network constraint. For example, we may ask service providers to reduce their demand at predictable times of maximum demand, to avoid overloading one of our circuits.

With the rollout of our new network management system, we will be in a strong position to offer a wide range of flexible services during the ED2 period and beyond.

Investment assessment and decision-making

Implementation is only planned when there is a well justified requirement.

We compare alternative investment strategies using economic assessments which reflect future uncertainty.

Our selection of the most appropriate option for efficient network development is assured by considering all scenarios in our Real Options Cost Benefit Analysis (ROCBA) tool which can carry out risk and cost assessments. This sophisticated decision-making process ensures that we roll-out targeted interventions, without over-investing or installing stranded assets. It also ensures that capacity is available for matching national and local policy ambitions for achieving net zero carbon.

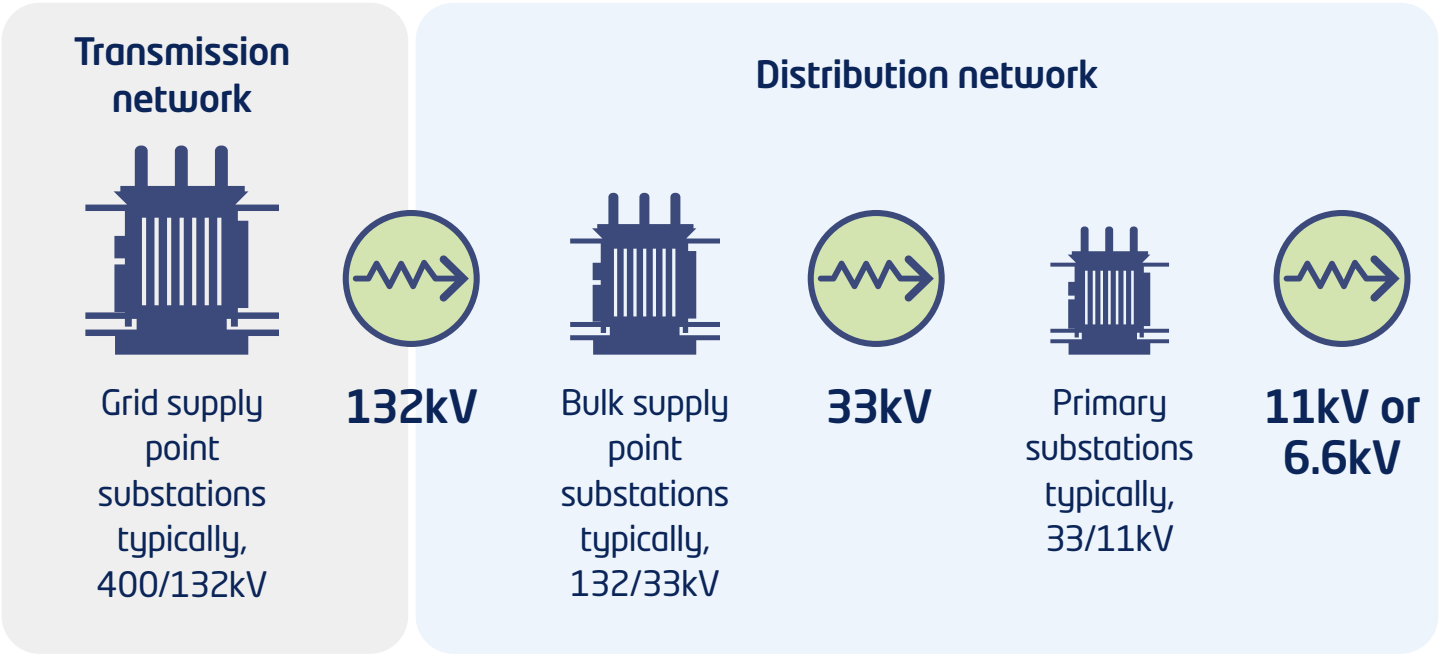
The use of ROCBA ensures that the solutions we implement give the best value for money for our customers by considering flexible solutions first and evaluating them against asset options. The output from ROCBA demonstrates which option is the best over the lifetime of the investment. For example, it may determine that it is more financially beneficial to:

- Purchase flexible services for two years then install a larger asset, or
- Install an asset that is larger than required now, rather than install a smaller asset and replace again it in ten years' time.

When options are developed to solve identified needs, they are often tested against our stakeholders' requirements. Feedback from regular stakeholder reviews is used to refine our proposals throughout the life of the project.

Grid supply point insights

EXAMPLE NETWORK



GRID SUPPLY POINT AND SUPPLY POINT LIST

Grid supply point	Voltage	Electricity North West network area	Page number
Bredbury	132kV	South Peak	13
Carrington	132kV	Manchester	15
Harker & Hutton	132kV	Cumbria	17
Heysham	132kV	Cumbria	20
Kearsley & Kearsley Local	132kV	Manchester/Lancashire	22 / 25
Macclesfield	275kV	South Peak	27
Padiham	132kV	Lancashire	29
Penwortham East and West	132kV	Lancashire	31 / 33
Rochdale	132kV	Lancashire	35
South Manchester	132kV	Manchester	37
Stalybridge	132kV	Manchester/South Peak	40
Stanah	132kV	Lancashire	33
Washway Farm & Kirkby	132kV	Lancashire	43
Whitegate	132kV	Manchester	45
Bold (bulk supply point)*	33kV	Lancashire/Manchester	47
Risley (primary substation)*	11kV	Lancashire	50

*Supplied from the SP Manweb network

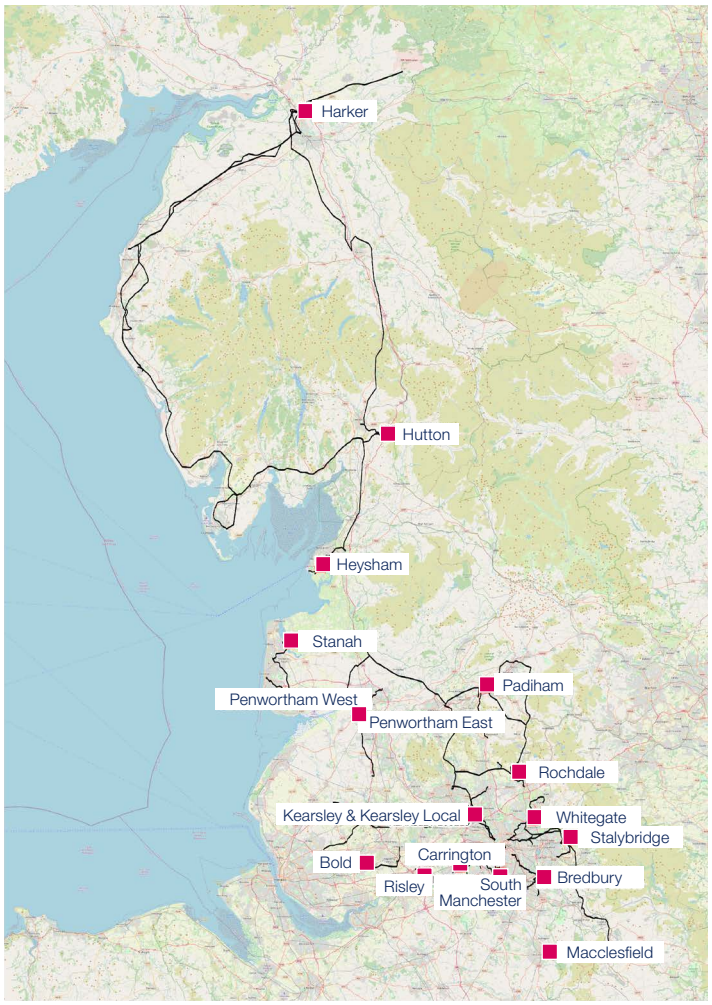
4 Regional insight results

Our network analysis results are presented in groups corresponding to the 14 grid supply point/groups where our distribution network interfaces with the transmission network. We have also included two further areas where supply reaches our network via the SP Manweb area. Splitting down the network in this way provides understanding on a local level. It allows the combined capability to be considered by grouping substations with capacities that may be shared most easily by creating interconnections or making transfers.

Results in the following sections are presented for bulk supply points, primary substations and associated networks as illustrated in the example network on the previous page.

The map below shows grid supply points, supply points and our 132kV network, which extends from Harker at Carlisle in the north to Bredbury in Stockport in the south.

ELECTRICITY NORTH WEST NETWORK SHOWING GRID SUPPLY POINTS



It should be kept in mind that although we are quite certain of the future need for capacity and the network development options presented in Section 5 of this document, there is some latitude on when network capacity interventions may be required.

In some areas one single solution may resolve the need for interventions at several sites. In other cases numerous issues at a single site may be resolved by just one intervention at that site.

The timing of triggers for investments may vary, depending on the rate of change in stakeholder requirements influenced by regional and national policies.

Intervention at a specific site may be required in a different year depending on the rate at which customers' needs change. A slower uptake of low carbon technologies driven by more relaxed policies could alter the timing of an intervention, which might be postponed for several years, or may not be triggered at all if uptakes are low, as predicted in the Steady Progression scenario.

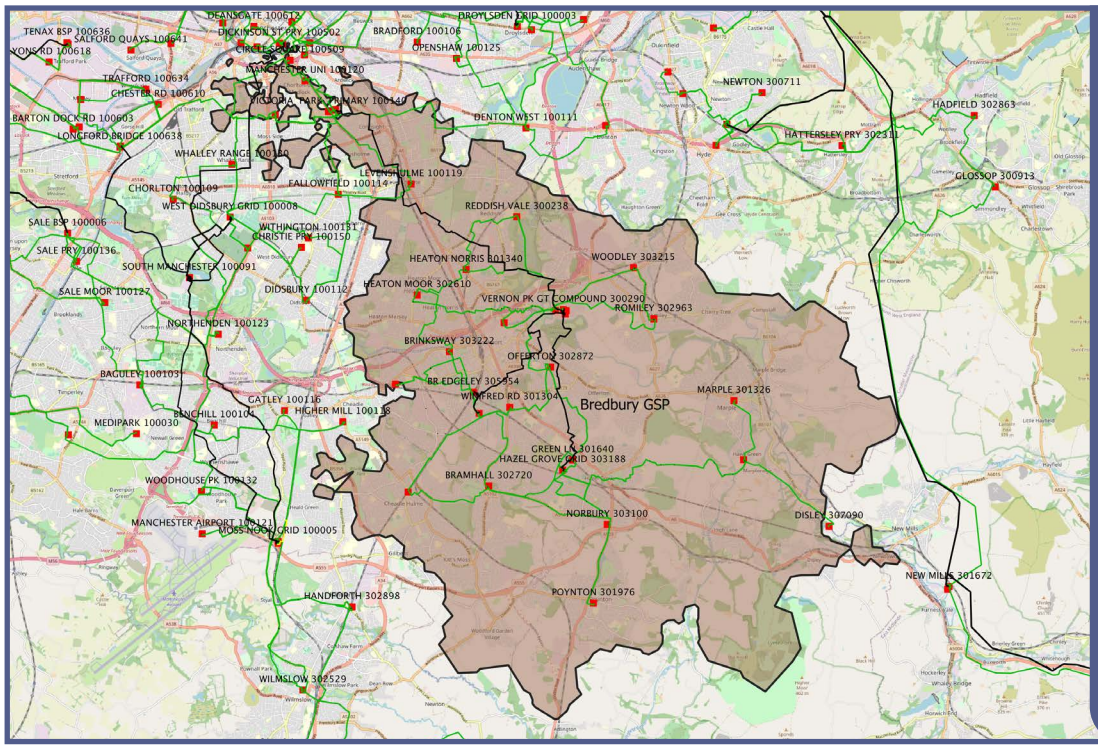
EXAMPLE OF THE IMPACT OF DIFFERENT SCENARIOS ON INTERVENTION REQUIREMENT

Intervention	2022	2024	2026	2028	2030
Steady Progression					
System Transformation				*	
Central Outlook		*			
Consumer Transformation			*		
Leading the Way		*			

The following pages cover asset-based interventions for each Electricity North West grid supply point in alphabetical order, at primary substation and bulk supply point level. These are covered in detail up to 2030, and then at a high level up to 2050. The interventions identified up to 2030 can be considered a worst case view; flexibility options will always be considered and explored as standard practice, to determine if they can meet the requirement before progressing with any asset-based proposal.

The graphs provided in the following section show peak demand and generation capacity requirements which are based on our detailed forecasting methodology. As with any forecast there are many factors which can change over time and influence these figures. Any intervention decision is made based on the observed network conditions and the connections pipeline in place at that time, which could change the forecast figures significantly.

Bredbury GSP



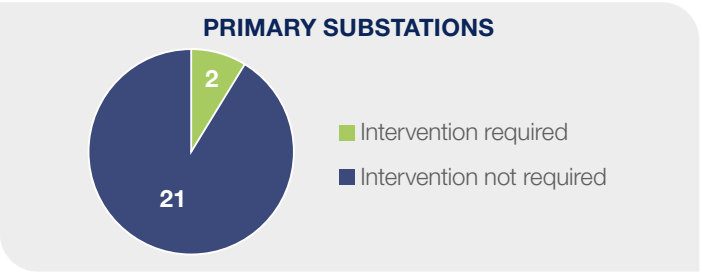
Summary

Bredbury grid supply point (GSP) is a 275/132kV substation which supplies approximately 178,000 customers across the south Peak and south Manchester region. The substation comprises three 240MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 273MVA, supplied via four bulk supply points (BSPs) and 23 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, the existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only two interventions may be required, both at primary substation level: one driven by generation and the second due to demand growth in Manchester.

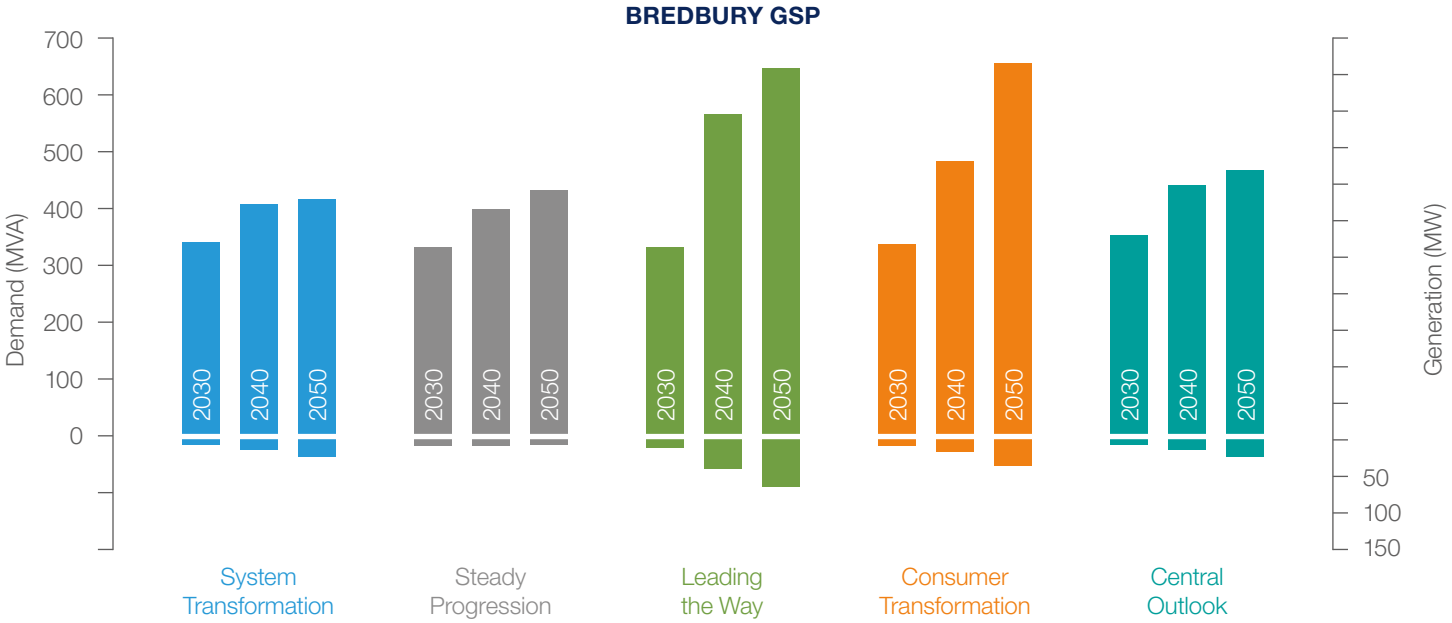


Site name	Description	2030 need	Asset-based solution
Primary substations			
Woodley	33/11kV substation Local 33kV switchboard 2 x 23MVA transformers 11 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Southern Gateway	New 33/6.6kV substation 2 x 23MVA transformers 6.6kV switchboard	New developments and capacity shortage at Moss Side and Victoria Park primary substations	Establish new primary substation to support high load growth south of Manchester city centre on the Oxford Road corridor and Manchester Science Park

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter-based and inverter-based generation increasing from 2030-2050, the exception being the Steady Progression scenario which shows only a small increase.

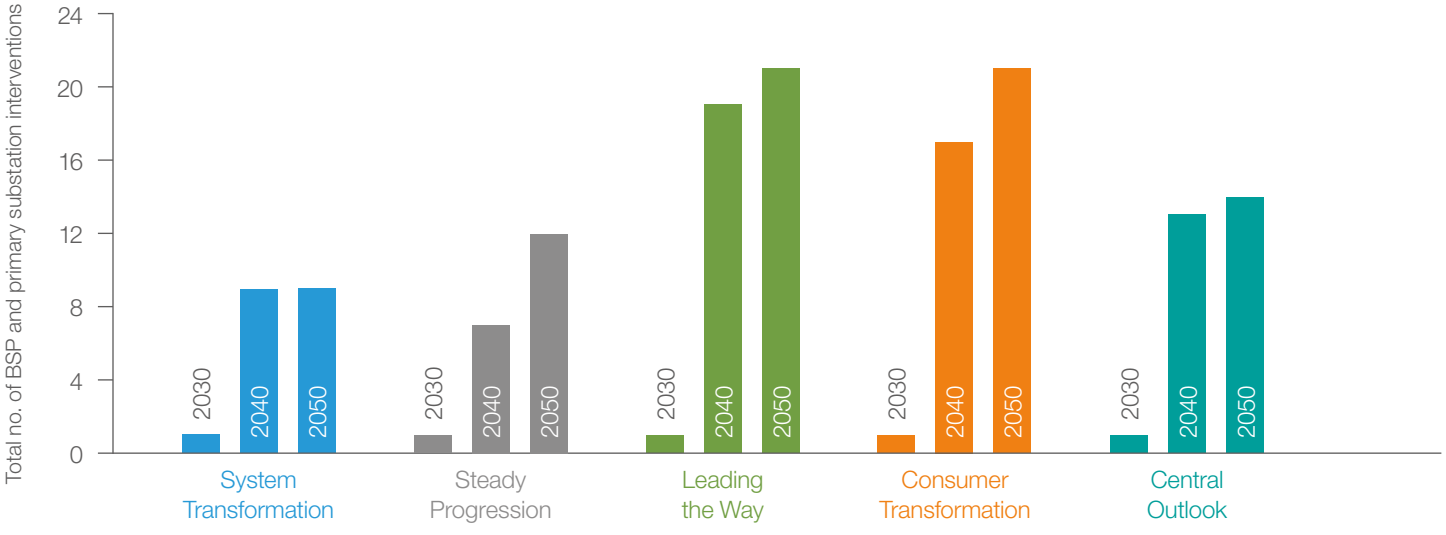


Load-based interventions by scenario (2030-2040-2050)

By 2050, the Central Outlook forecast indicates half the BSPs and primary substations will exceed existing capacity with an additional 70MVA of primary capacity required. Longsight and Vernon Park BSPs and associated primary substations such as Portwood, Heaton Moor, Levenshulme and Longsight are forecast to exceed existing capacity before 2040, driven by load growth in south east Manchester and Stockport.

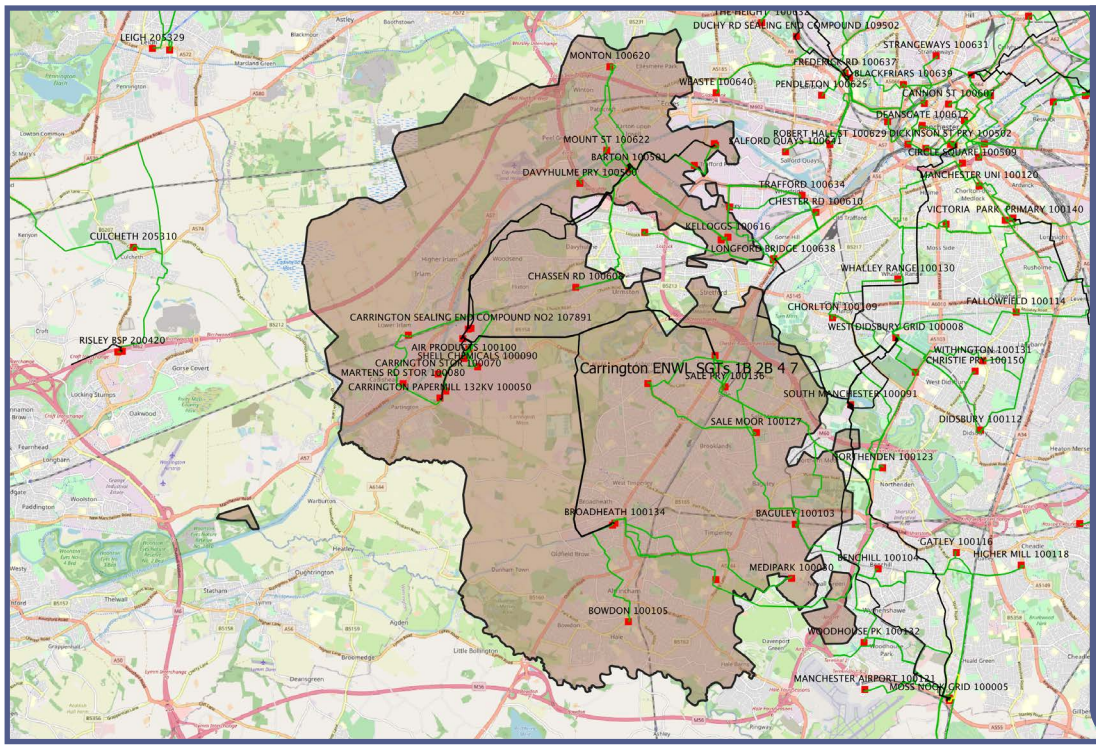
The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate 75% of the BSPs and 70% of the primary substations will be overloaded with an additional 200MVA of primary capacity required.

We see here, as we do for many other GSPs, that the number of interventions increases dramatically by 2040. indicating that there are tipping points between 2030 and 2040 for all scenarios. This means that the need for network capacity in the regulatory period commencing in 2028 will need to be carefully considered along with the deliverability of a large volume of network interventions.



electricity north west
Bringing energy to your door

Carrington GSP



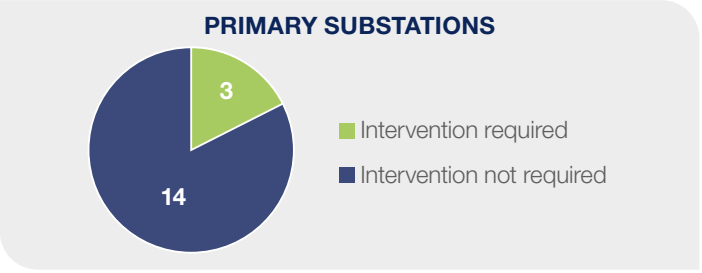
Summary

Carrington GSP is a 400/275/132kV substation shared with SP Manweb. The substation comprises a total of five super grid transformers (SGTs). SGTs 2B, 4 and 7 supply our network and SGTs 1B and 2A operate split, supplying SP Manweb. The Electricity North West section supplies approximately 110,000 customers across the west and south Manchester region and comprises two 180MVA transformers supplied from National Grid's 275kV network and one 240MVA SGT supplied from the 400kV network. Peak demand is currently 234MVA, supplied via four BSPs and 17 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, the existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Intervention may be required to accommodate the forecast demand and generation at three potential sites fed by Carrington GSP: one primary substation driven by demand and two driven by generation.

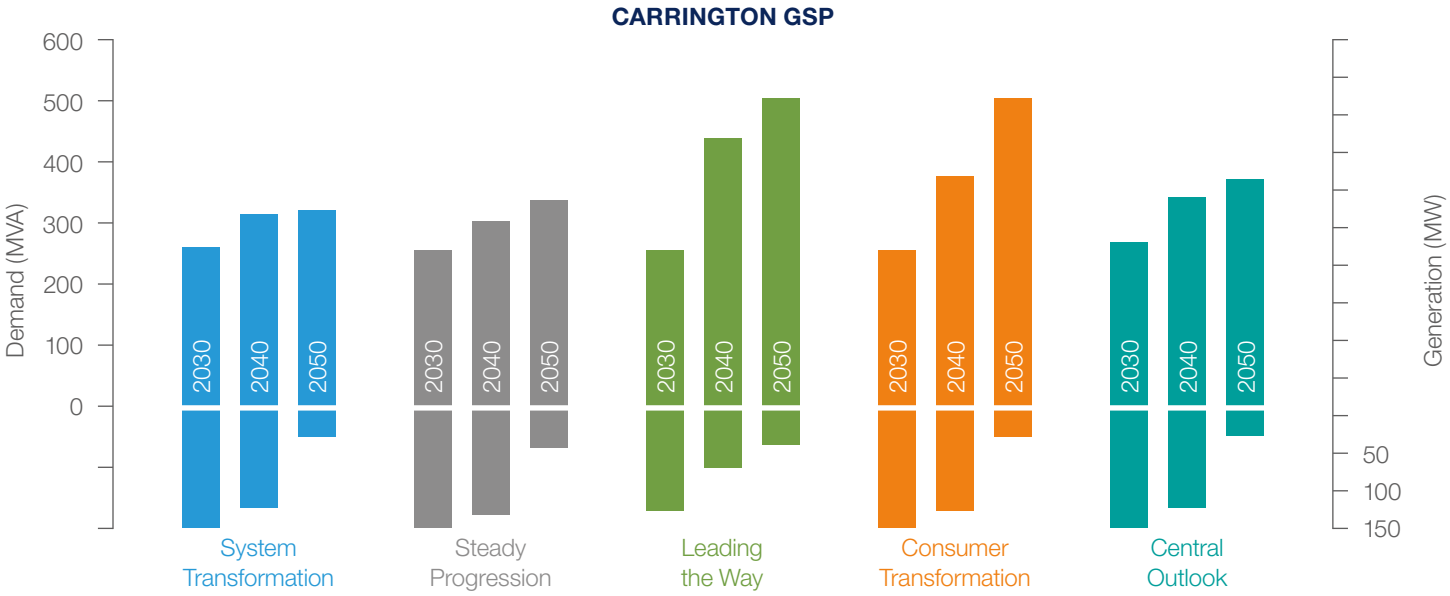


Site name	Description	2030 need	Asset-based solution
Primary substations			
Baguley	33/11kV substation 2 x 23MVA transformers, 11 panel, 11kV switchboard	Existing firm capacity forecast to be exceeded in 2027	Uprate existing transformers/ switchgear or network reconfiguration/innovation
Monton	33/6.6kV substation 2 x 23MVA transformers, 6 panel 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Trafford Park North	33/6.6kV substation 2 x 14MVA transformers, 11 panel 6.6kV switchboard	The existing operational approach for managing 6.6kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 6.6kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The high level of generation in 2030 for all the scenarios is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent decommissioning of this synchronous generation, which is expected to reach end of life by 2050, results in the forecast reduction in generation.

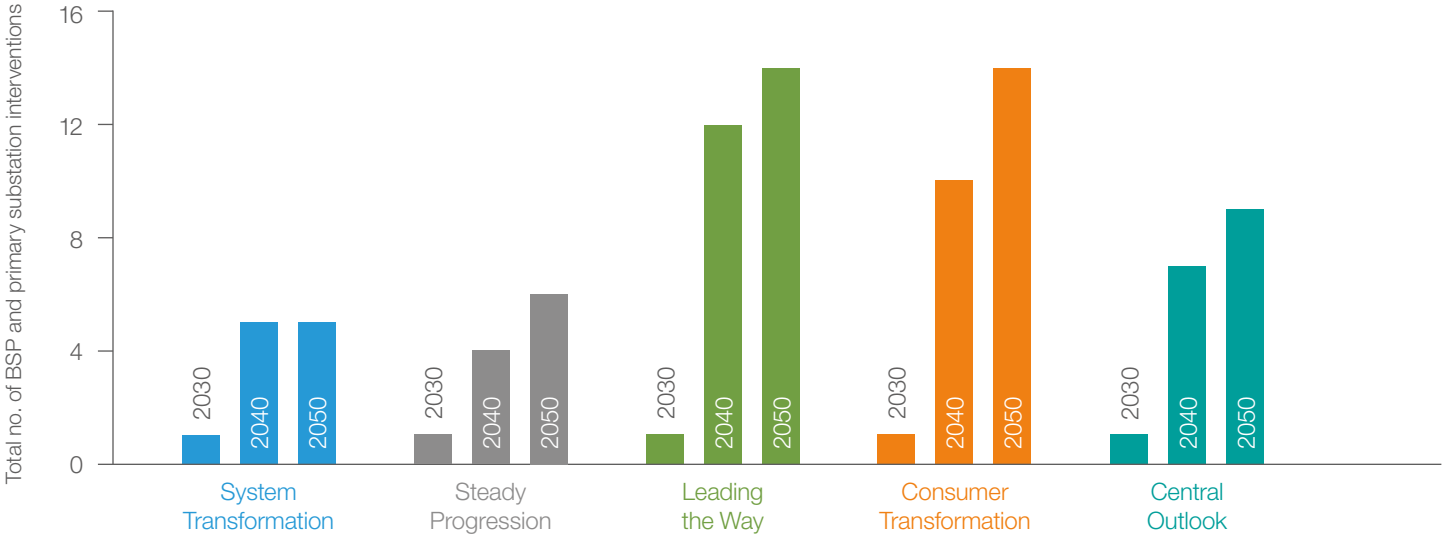


Load-based interventions by scenario (2030-2040-2050)

By 2050, the Central Outlook forecast indicates that 25% of the BSPs and 47% of the primary substations will exceed existing capacity with an additional 31MVA of primary capacity required. Sale BSP is the only one expected to exceed its existing firm capacity by 2040. Baguley primary substation is forecast to exceed its existing capacity first in 2028, followed by Sale Moor and Chassen Road in 2031.

Most of the primary substations supplied from Carrington GSP are forecast to exceed their existing firm capacity within the 2030-2040 period. This is to be expected as portions of the network are supplying large urban areas close to Manchester.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that 50% of the BSPs and 71% of the primary substations will be overloaded with an additional 138MVA of primary capacity required.



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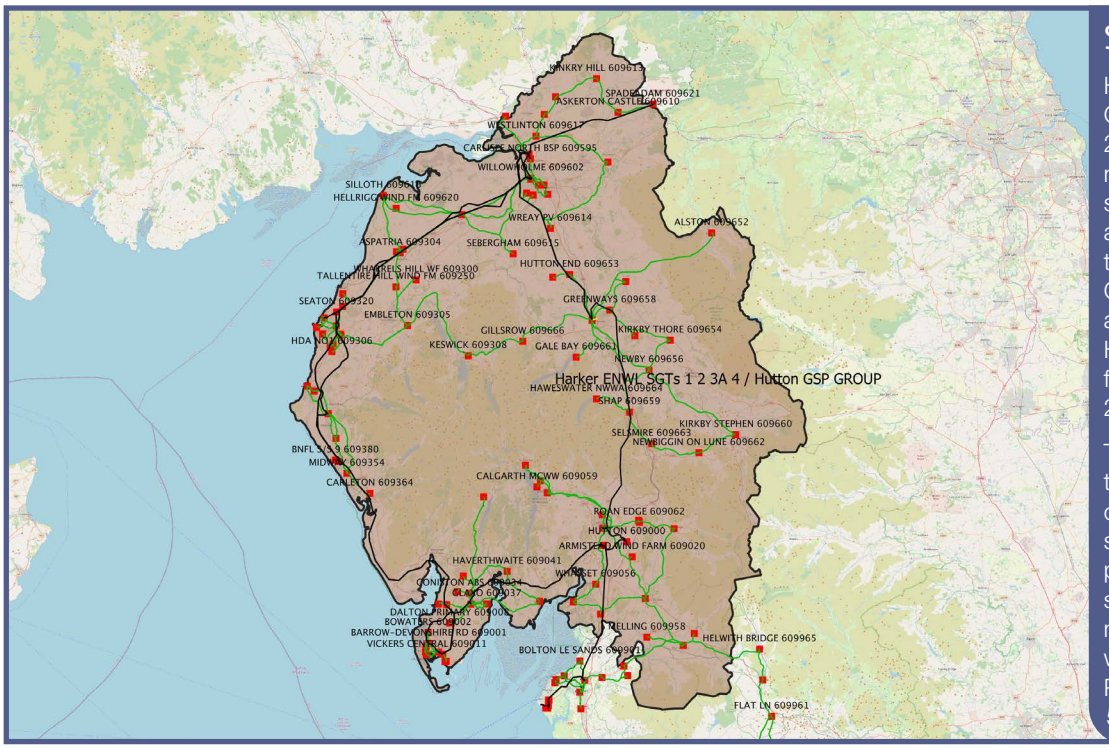
Harker and Hutton GSP



Summary

Harker SGTs 1, 2, 3A, 4/Hutton Group supplies approximately 235,000 customers across north and south Cumbria. The supply is taken from Harker and Hutton GSPs. Harker GSP takes its supply from National Grid via a 240MVA 275kV SGT and four 120MVA 275kV SGTs. Hutton GSP takes its supply from National Grid via two 240MVA 400kV SGTs.

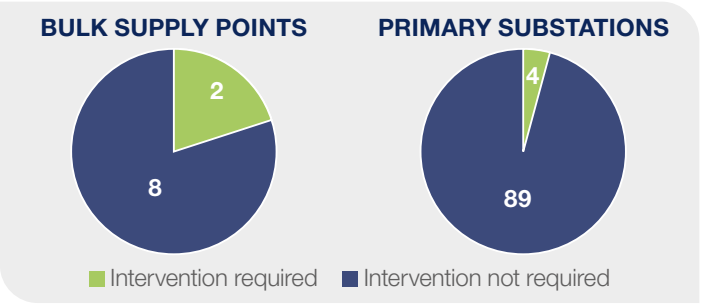
Together the GSPs supply the Cumbria ring consisting of two 132kV switching stations, ten BSPs and 93 primary substations. There is significant generation on the network including several large windfarms and CHP sites. Peak demand is currently 551MVA.

Due to the significant levels of generation in this area there is currently a National Grid scheme in flight to uprate the SGTs at Harker from 120MVA units to 240MVA units. Additionally, the 132kV switchboard is to be replaced as part of this scheme with an indoor GIS solution which is due to be completed in 2026.

Accommodating demand and generation forecasts up to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Intervention may be required to accommodate forecast demand and generation at six sites fed by Harker/Hutton GSP: two BSPs and four primary substations, all of which are driven by generation.



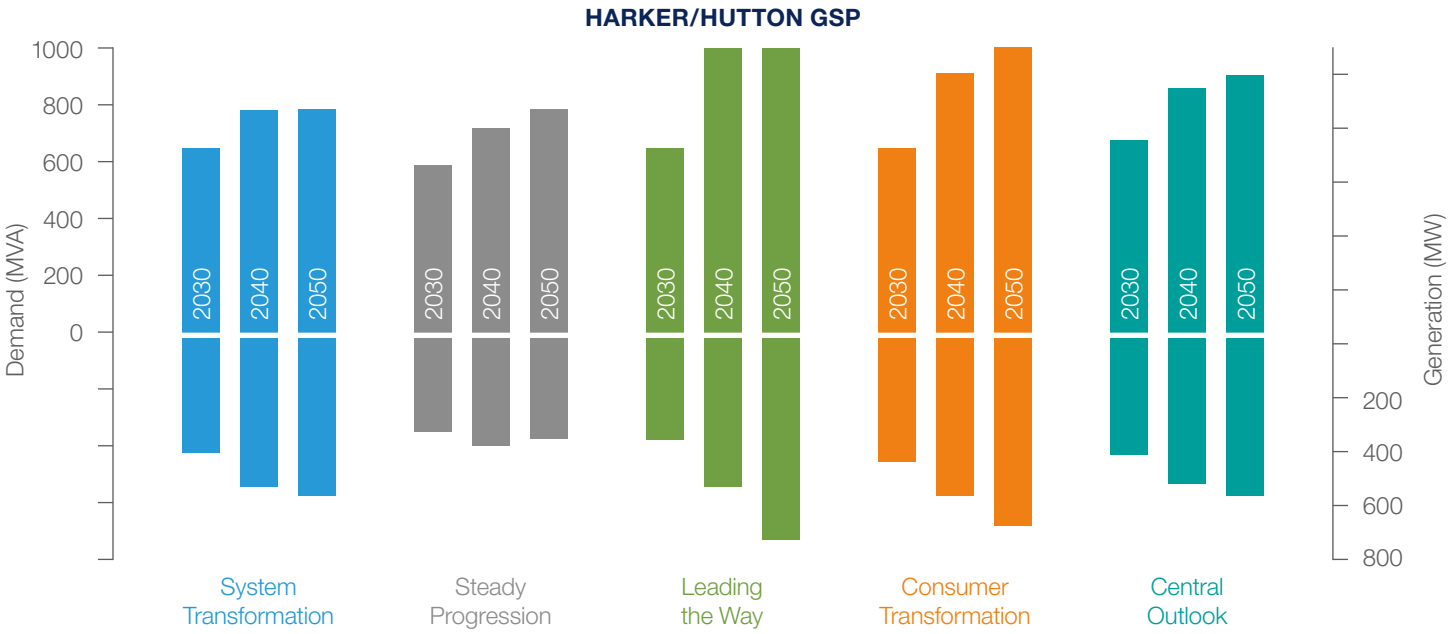
5 Grid supply point results

Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Carlisle	132/33kV substation 2 x 90MVA transformers, 21 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Stainburn	132/33kV substation 2 x 90MVA transformers, 14 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Bowaters	33/11kV substation 3 x 23MVA transformers, 10 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Fusehill	33/11kV substation 2 x 23MVA transformers, 5 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
HDA No 1	33/11kV substation 1 x 23MVA transformer, 8 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Leyland National	33/11kV substation 2 x 23MVA transformers, 9 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. Similarly, the generation forecast for the Leading the Way scenario in 2050 has the largest increase, driven by a large amount of both non-inverter based and inverter-based generation connecting to the network.

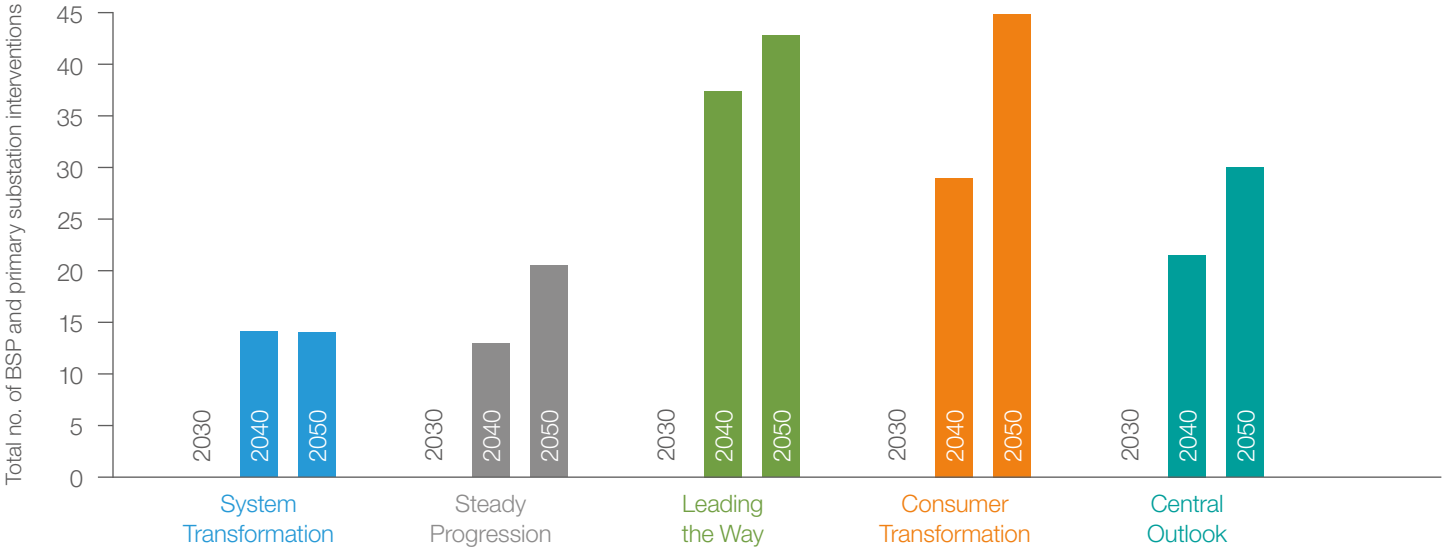


Load-based interventions by scenario (2030-2040-2050)

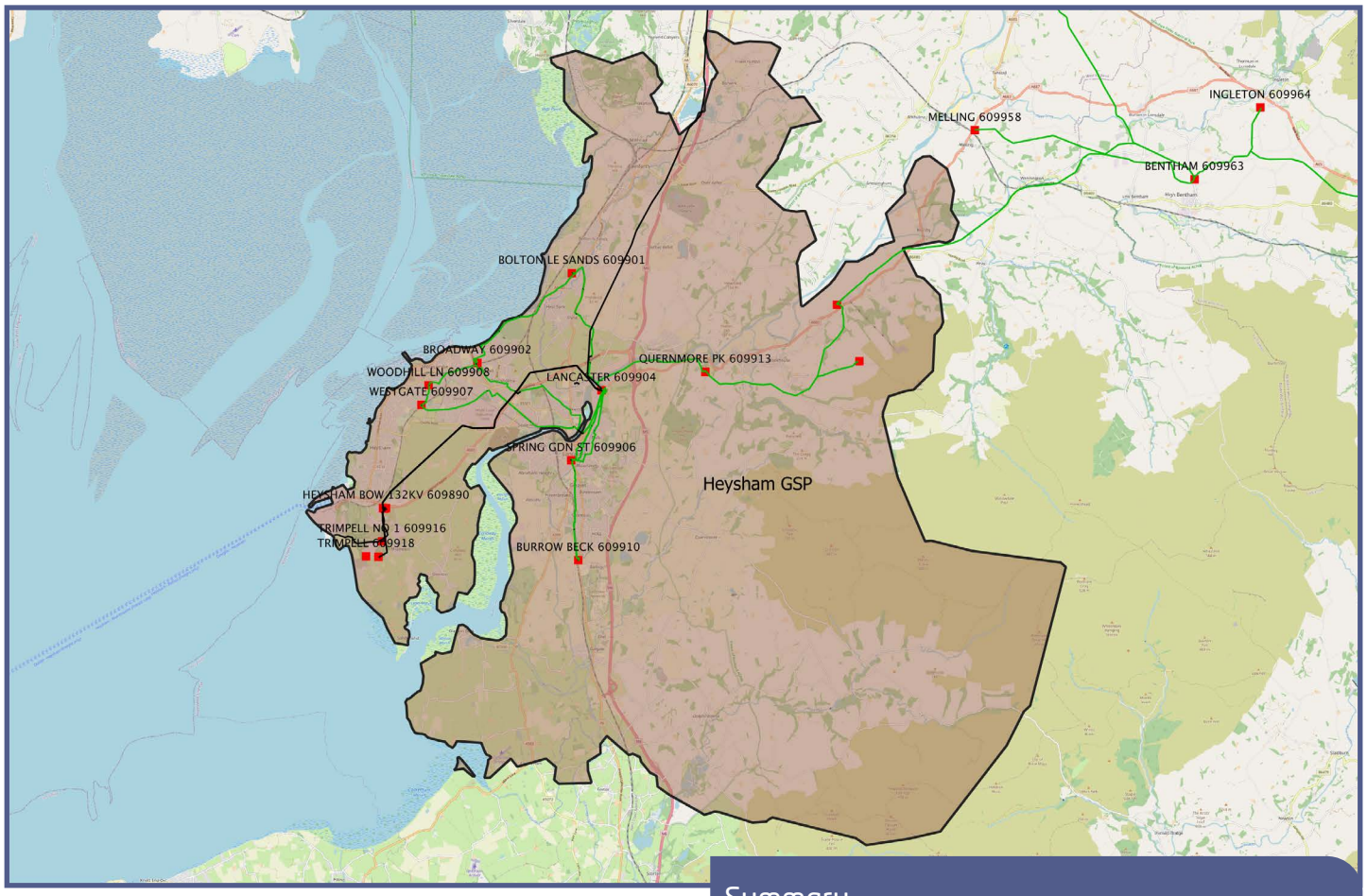
The number of load-based interventions up to 2050 is shown below. As time goes by the number of interventions increases. This is to be expected as demand on the network grows.

By 2050, the Central Outlook forecast indicates that 20% of the BSPs and 44% of the primary substations will exceed existing capacity with an additional 74MVA of primary capacity required. Carlisle and Kendal BSPs are expected to exceed their existing firm capacity between 2030 and 2040.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that 30% of the BSPs and 61% of the primary substations will be overloaded with an additional 253MVA of primary capacity required.



Heysham GSP



Accommodating demand and generation forecasts up to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth. No interventions are envisaged at primary or BSP level.

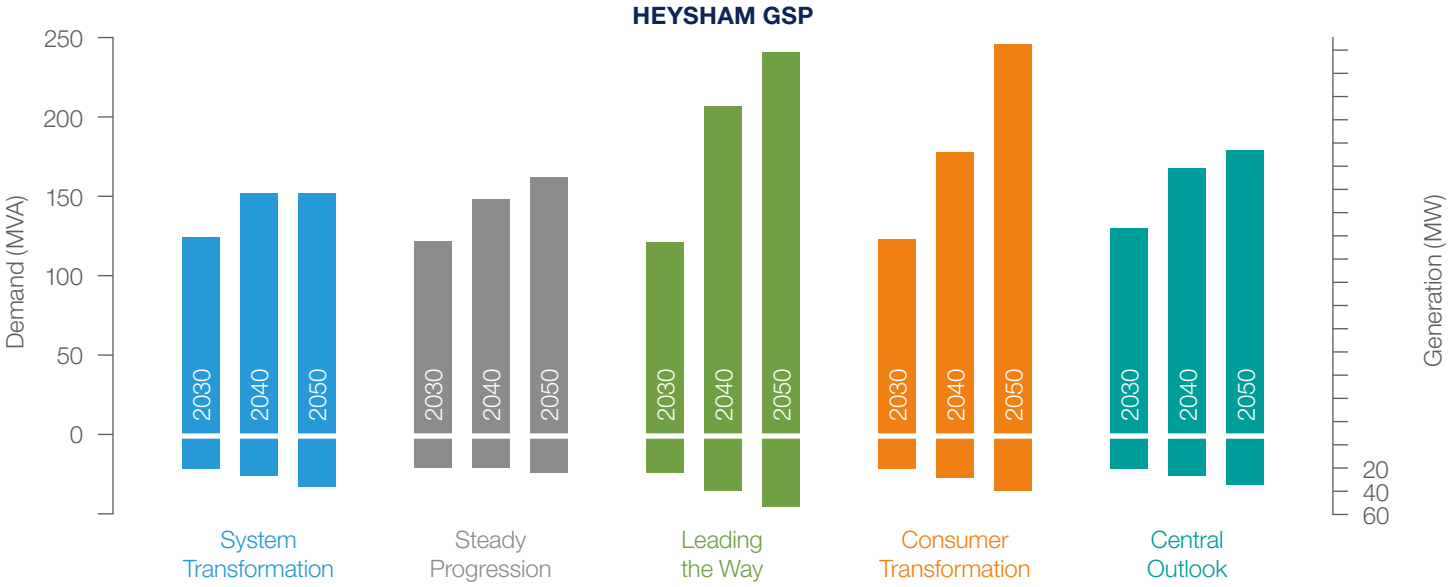
Summary

Heysham GSP is a 400/132kV substation which supplies approximately 50,000 customers across north Lancashire and south Cumbria. The substation comprises three 240MVA transformers supplied from National Grid's 400kV network. Peak demand on the GSP is currently only 113MVA supplied via two BSPs and nine primary substations. However, there are several large offshore windfarms connected at Heysham and therefore export is a greater constraint than import.

The significant levels of renewable energy sources already connected in this area have matched the available transmission capacity, meaning that intervention on the transmission network is necessary to accommodate additional generation on the distribution network. Working with National Grid ESO we have developed a regional development plan (RDP) to secure additional transmission capacity using existing assets, rather than build an additional SGT. This option aims to connect generation into the existing active network management system already in place at Heysham, and then constrain export from generators in the rare event of the loss of an SGT on the transmission network.

Demand and generation forecasts by scenario (2030-2040-2050)

Overall each scenario shows an increase in demand with the Consumer Transformation scenario showing the highest increase. Generation is highest in the Leading the Way scenario but overall there is only a relatively small increase in each of the scenarios.



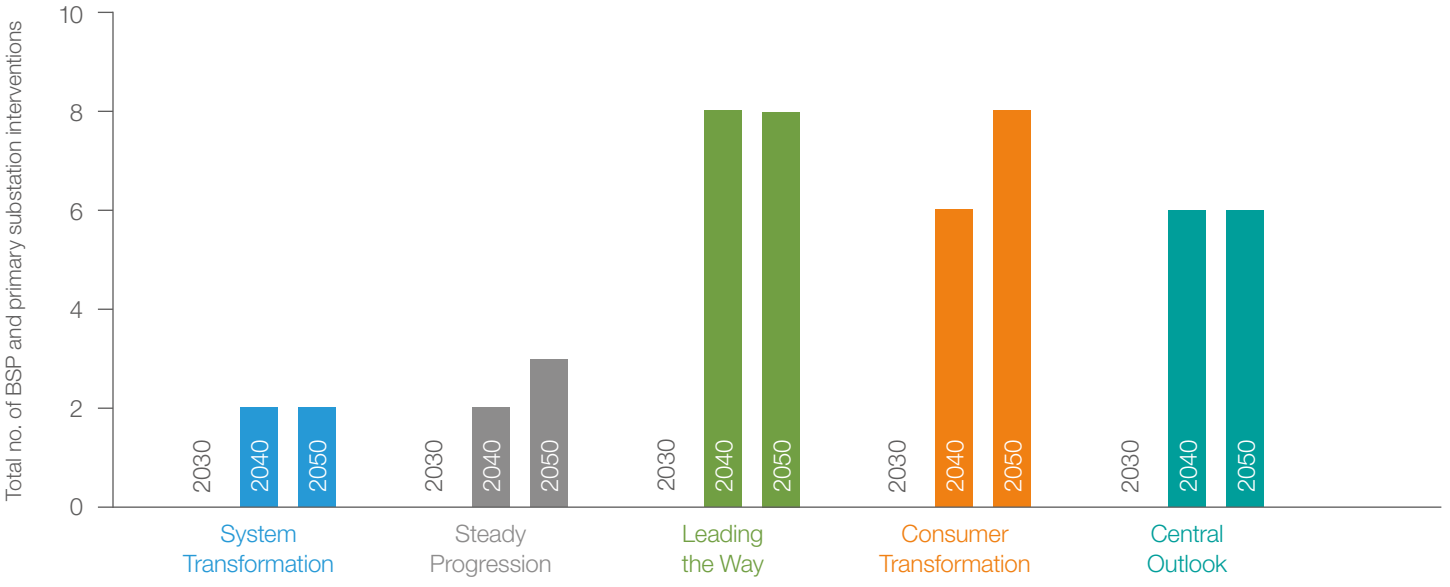
Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 is shown below. The forecasts predict that there is sufficient capacity available at all primary substations and BSPs in the area up to 2030, with interventions required only in the period 2030-2040.

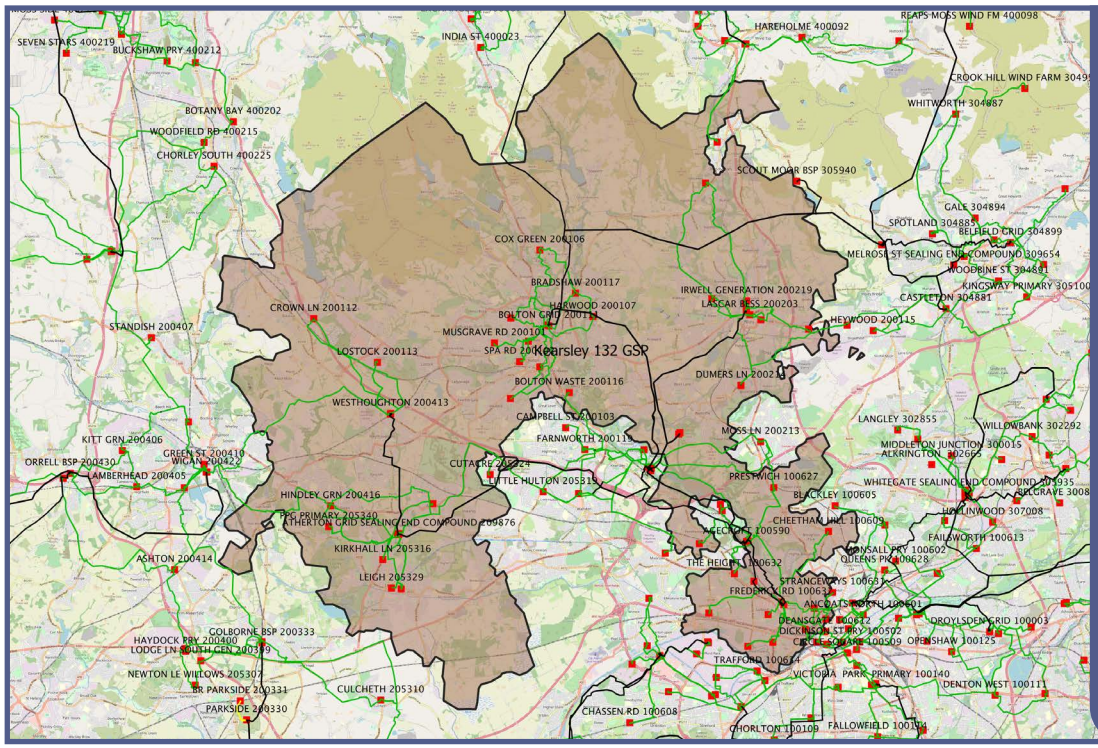
By 2050, the Central Outlook forecast indicates that half the BSPs and primary substations will exceed existing capacity with an additional 15MVA of primary capacity required. Lancaster BSP is forecast to exceed its existing firm capacity in 2037. From a primary perspective, Westgate is expected to exceed its existing firm capacity in 2033 followed by Bolton-le-Sands and Woodhill Lane in 2038.

Demand is most concentrated where the network supplies the large urban areas of Lancaster and Morecambe.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that 50% of the BSPs and 70% of the primary substations will be overloaded with an additional 56MVA of primary capacity required.



Kearsley GSP



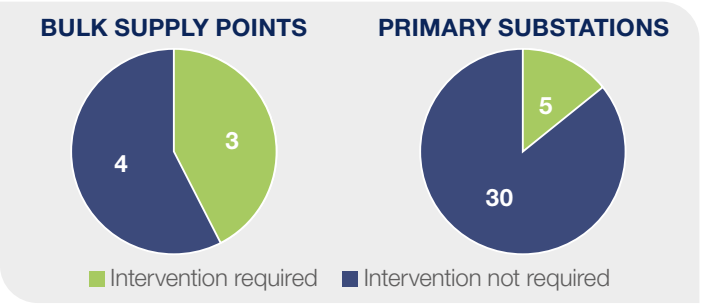
Summary

Kearsley GSP is a 275/132kV substation which supplies approximately 322,000 customers across south Lancashire and north Manchester. The substation comprises four 240MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 490MVA, supplied via seven BSPs and 35 primary substations.

Accommodating demand and generation forecasts up to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate the demand and generation growth at the majority of sites.

Intervention may be required to accommodate the forecast demand and generation at eight sites fed by Kearsley GSP: three BSPs, two of which are driven by generation and one by demand; and five primary substations, four of which are driven by generation and one by demand.



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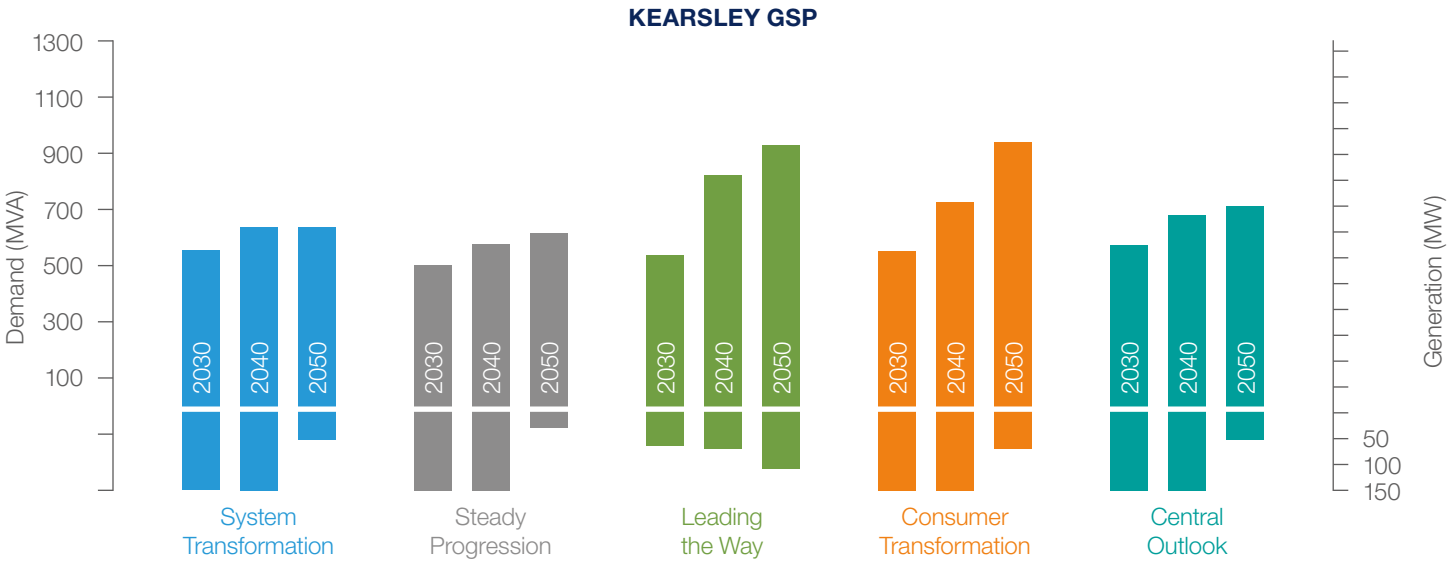
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Bolton	132/33kV substation 2 x 90MVA, 1 x 60MVA transformers, 23 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Bury	132/33kV substation 2 x 90MVA transformers, 12 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Frederick Road	132/33kV substation 3 x 60MVA transformers	Existing firm capacity forecast to be exceeded by 2024 due to large scale demand in Manchester	Replace existing transformers with 90MVA units and uprate approximately 9km of overhead line

Site name	Description	2030 need	Asset-based solution
Primary substations			
Blackfriars	33/6.6kV substation 2 x 23MVA transformers, 6 panel, 33kV switchboard	Existing firm capacity forecast to be exceeded by 2024 due to large scale demand in Manchester	Overlay existing 33kV supply cable between Frederick Road BSP and Blackfriars primary substation which is limiting the capacity
Heap Bridge	33/6.6kV substation 2 x 14MVA transformers, 6 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Trinity	33/6.6kV substation 3 x 23MVA transformers, 24 panel, 6.6kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Westhoughton	33/11kV substation 2 x 23MVA transformers, 6 panel, 33kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Woolfold	33/11kV substation 2 x 23MVA transformers, 13 panel, 11kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. Similarly, the generation forecast for the Leading the Way scenario in 2050 has the largest increase, driven by a large amount of inverter-based generation connecting to the network. The high level of generation in 2030 for all the scenarios, except Leading the Way, is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent de-commissioning of this generation results in the forecast reduction in generation by 2050.

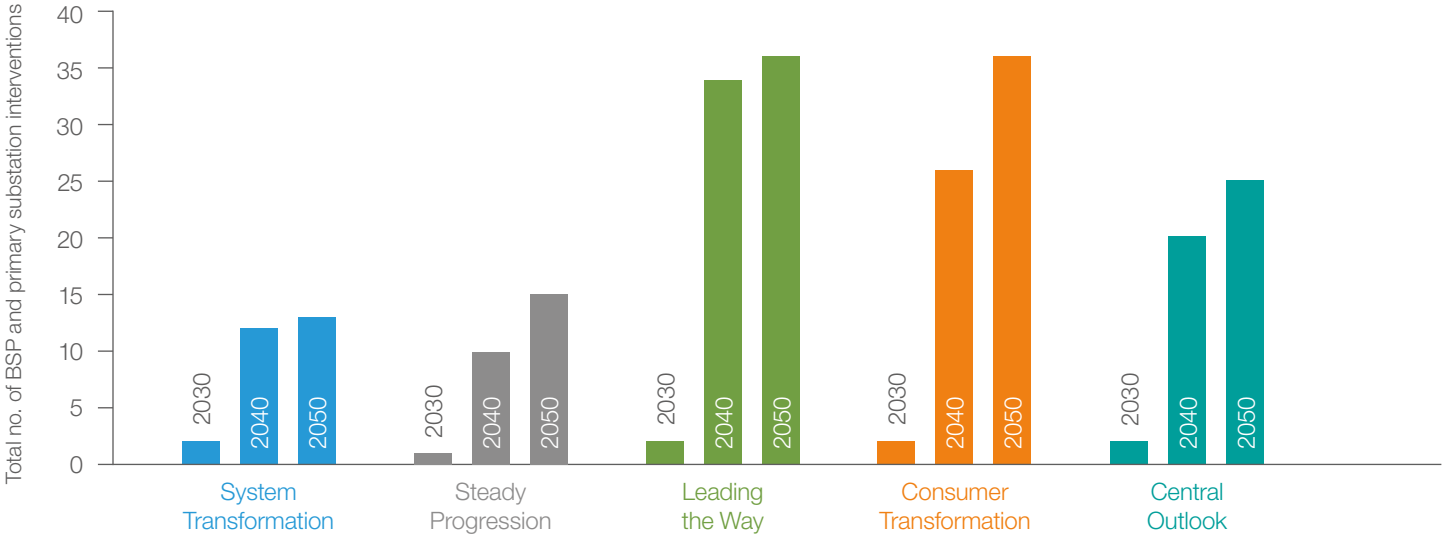


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates that 71% of the BSPs and 57% of the primary substations will exceed existing capacity with an additional 76MVA of primary capacity required. The demand on Atherton BSP is expected to exceed existing firm capacity in 2032 followed by Bolton BSP in 2033. At primary level Atherton Town Centre and Harwood are forecast to exceed existing capacity in 2031.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that all the BSPs and 83% of primary substations will be overloaded with an additional 350MVA of primary capacity required, driven by significant demand growth in the Greater Manchester area, from Salford out to Bolton and Atherton.



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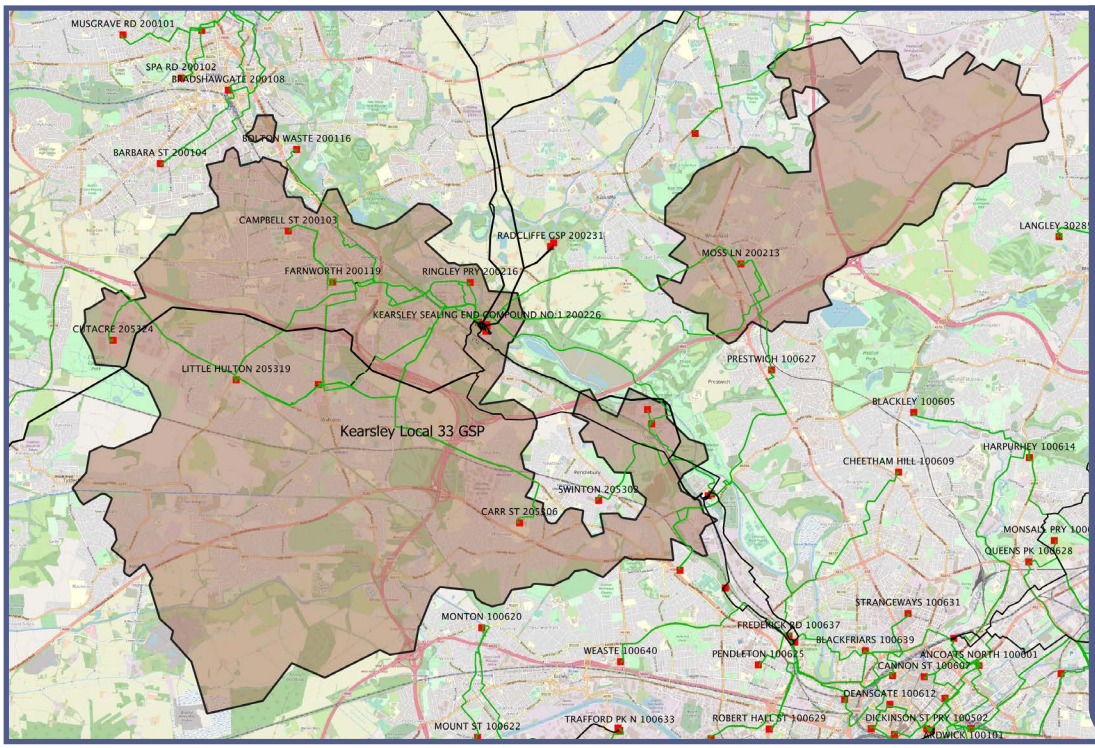
Kearsley Local GSP



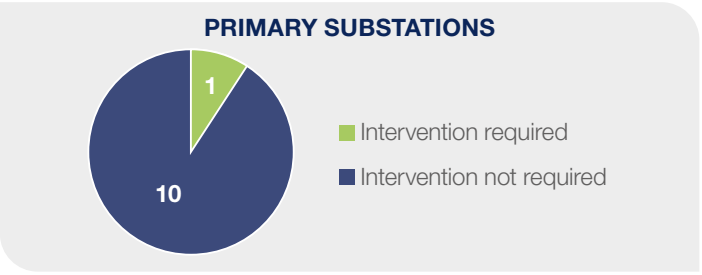
Summary

Kearsley Local GSP is a 275/33kV substation which supplies approximately 50,000 customers across south Lancashire. The substation comprises two 120MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 103MVA, supplied via 11 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only one intervention may be required at primary level, driven by demand in Little Hulton.

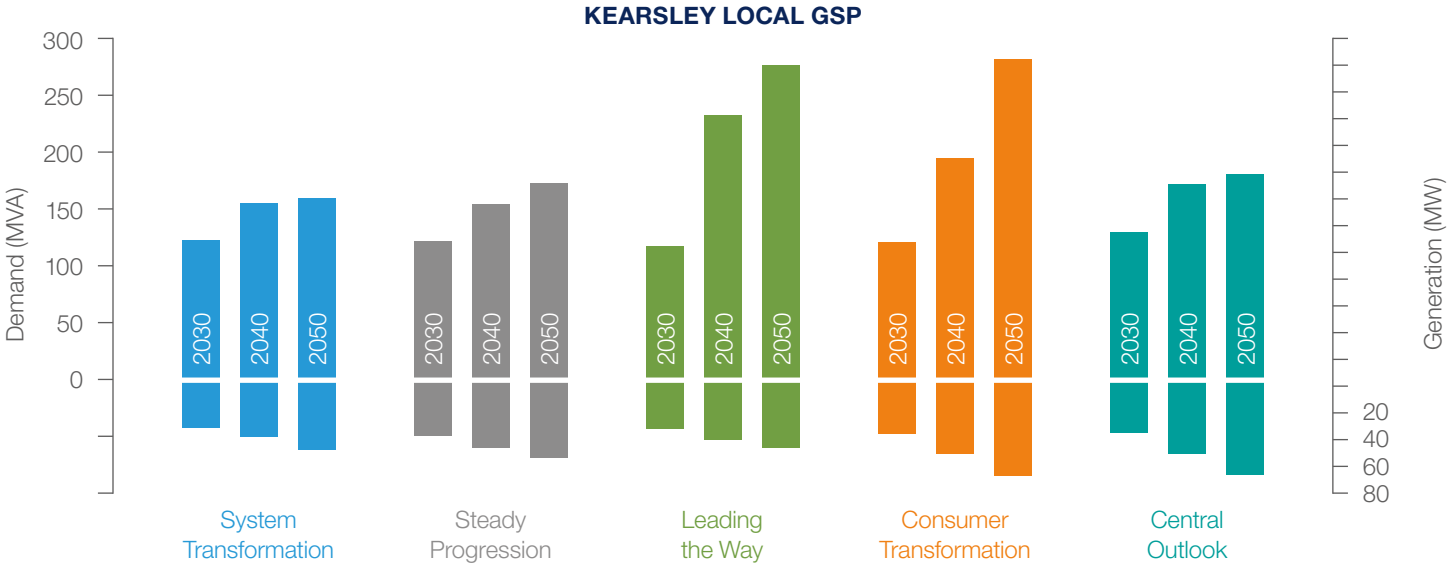


Site name	Description	2030 need	Asset-based solution
Primary substations			
Little Hulton	33/11kV substation 2 x 14MVA transformers, 11kV switchboard	Demand forecast to exceed existing firm capacity in 2027	Overlay approximately 5.5km of 33kV cable between Kearsley Local GSP and Little Hulton primary substation to increase firm capacity

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter based and inverter-based generation increasing from 2030-2050.

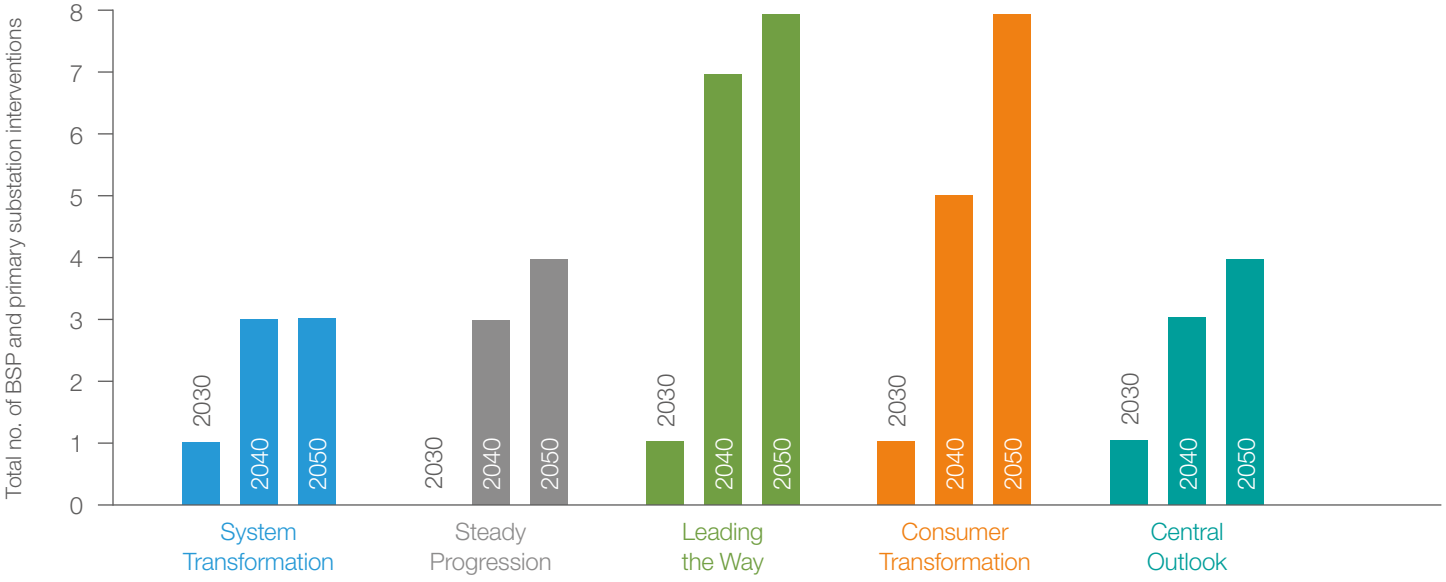


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 is shown below.

By 2050, the Central Outlook forecast indicates 40% of the primary substations will exceed existing capacity with an additional 25MVA of primary capacity required. The primary substations forecast to be overloaded will all be exceeded by 2041; these include Carr Street, Hill Top, Little Hulton and Moss Lane.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that 80% of the primary substations will be overloaded with an additional 93MVA of primary capacity required.



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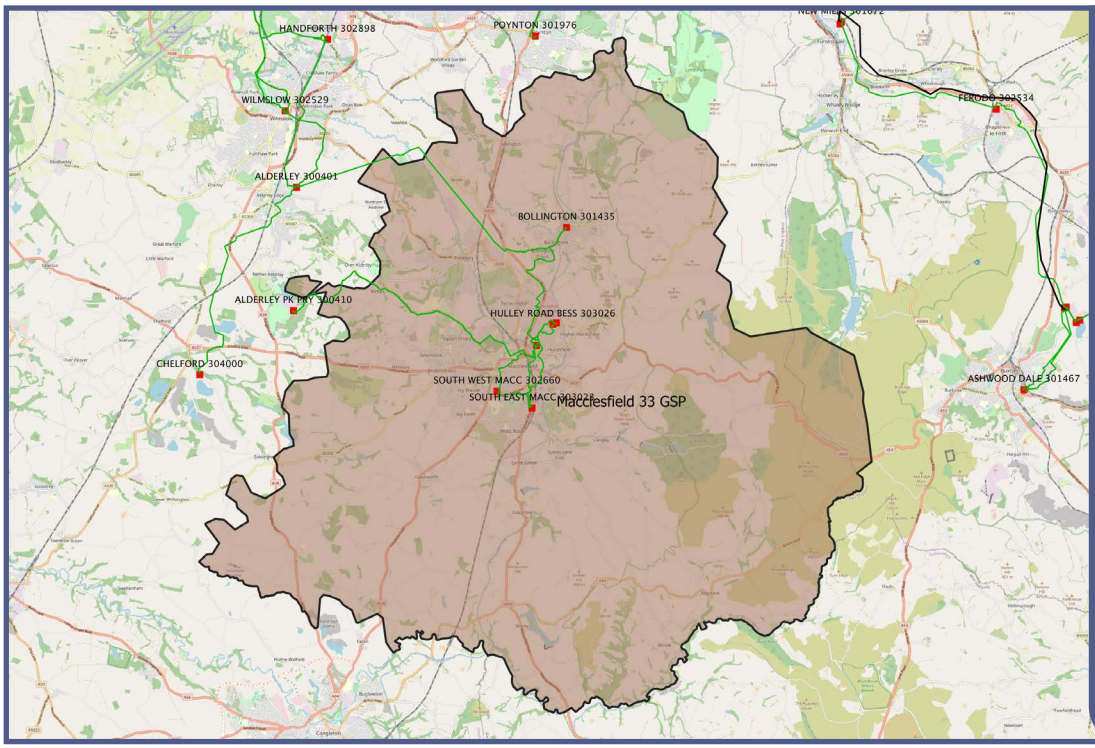
Macclesfield GSP



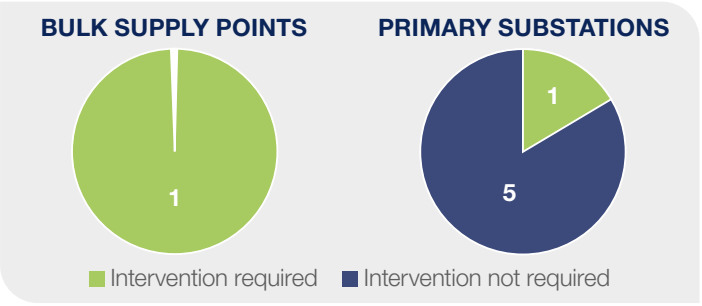
Summary

Macclesfield GSP is a 275/33kV substation which supplies approximately 36,000 customers across the south Peak region. The substation comprises two 100MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 81MVA, supplied via six primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only two interventions may be required: Macclesfield GSP 33kV switchboard and Withyfold Drive primary substation, both driven by generation.



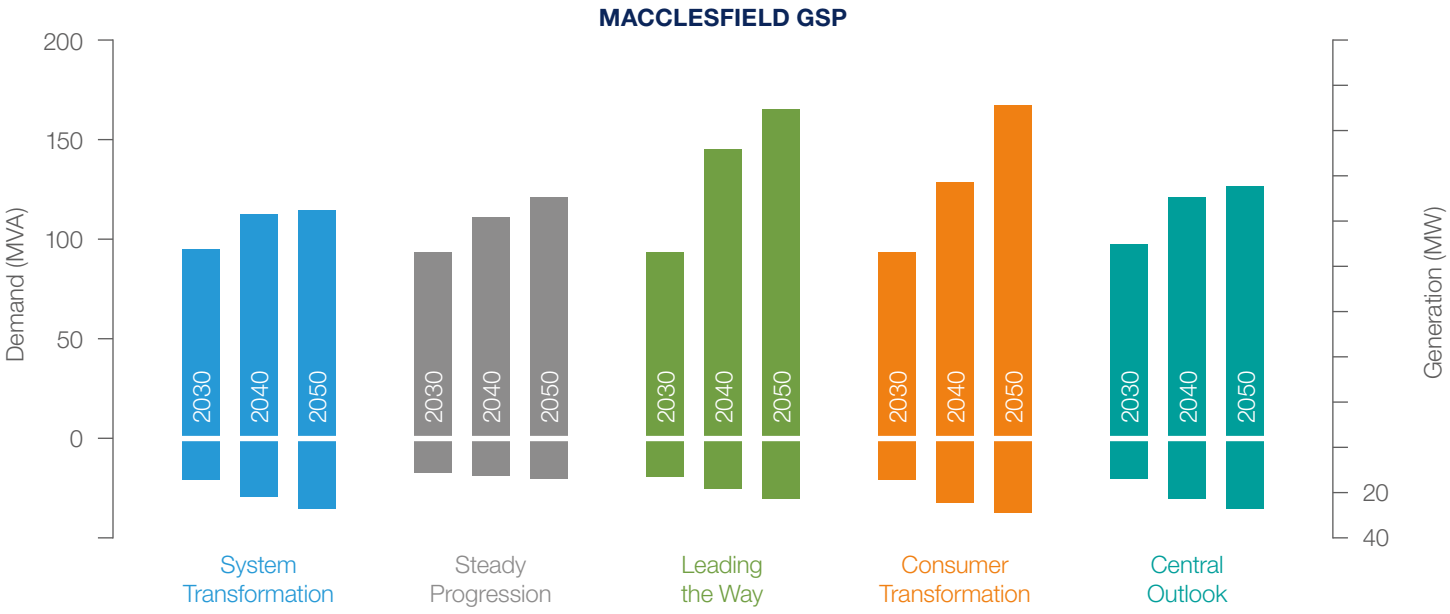
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Macclesfield	275/33kV substation 2 x 100MVA transformers 11 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Withyfold Drive	33/11kV substation 3 x 14MVA transformers 20 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter based and inverter-based generation increasing from 2030-2050. The Steady Progression scenario shows the least amount of generation coming onto the network.

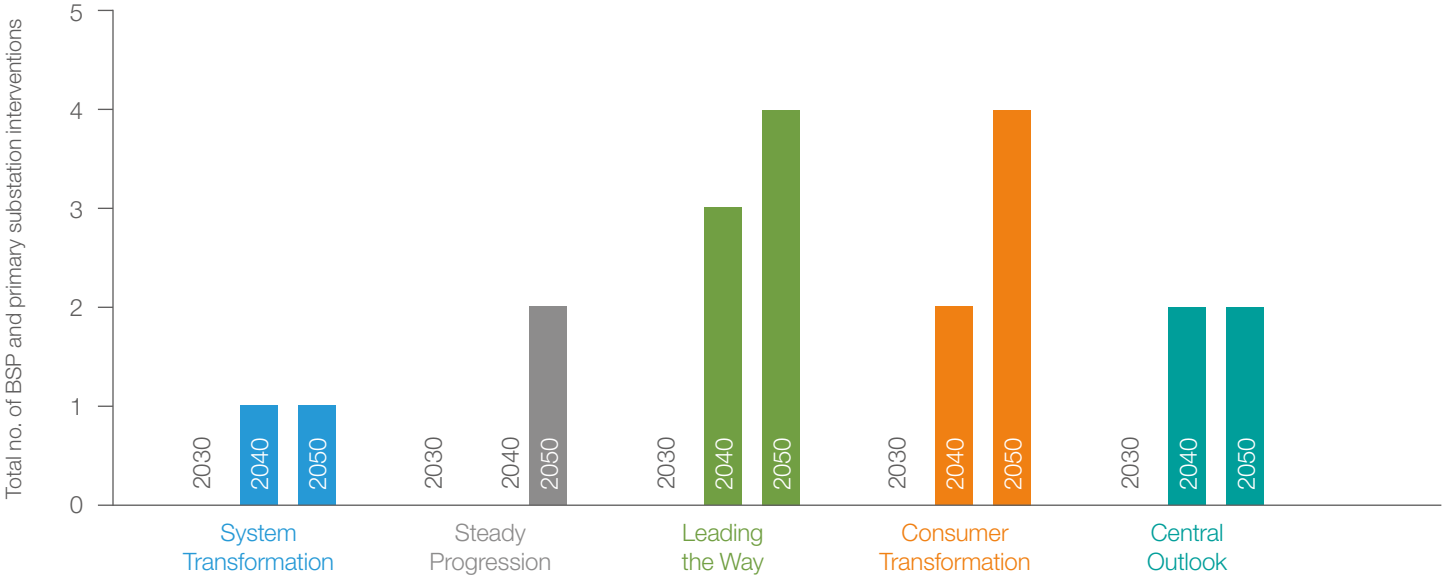


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates 50% of the primary substations will exceed existing capacity with an additional 5MVA of primary capacity required.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate all the primary substations will be overloaded with an additional 34MVA of primary capacity required.



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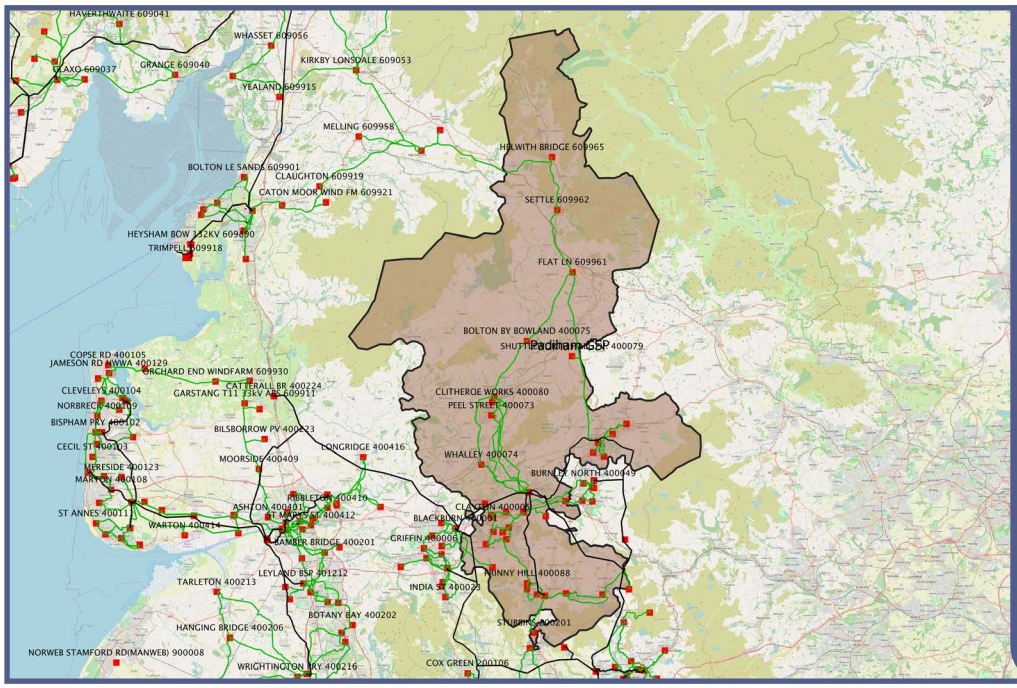
Padiham GSP



Summary

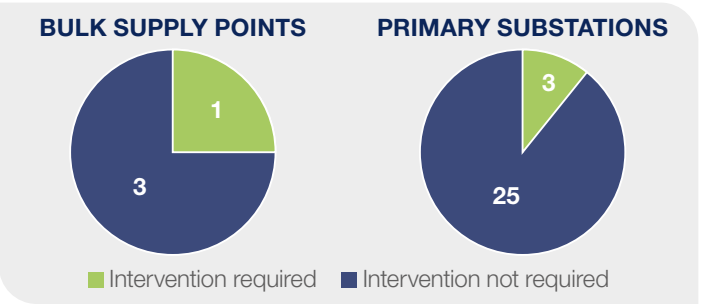
Padiham GSP is a 400/132kV substation which supplies approximately 130,000 customers across east Lancashire. The substation comprises two 240MVA transformers supplied from National Grid's 400kV network. Peak demand on the GSP is currently 245MVA, supplied via four BSPs and 28 primary substations.

The existing 132kV switchgear is currently an outdoor double busbar arrangement with main and reserve bars and ten feeder bays. Based on age and condition, the switchgear will be replaced with an indoor GIS solution which is due to be completed by March 2025.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Intervention may be required to accommodate the forecast demand and generation at four sites fed by Padiham GSP: one BSP and three primary substations all of which are driven by generation.



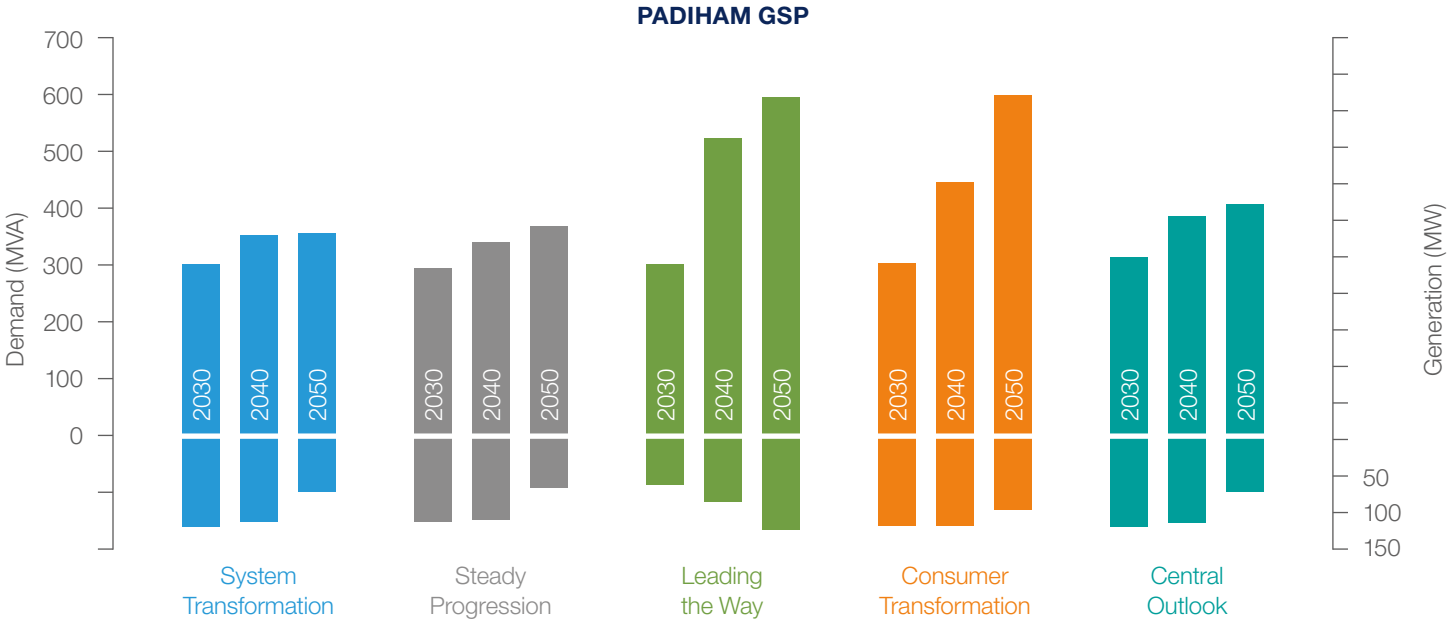
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Nelson	132/33kV substation 2 x 60MVA transformers 12 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Padiham	33/11kV substation 2 x 38MVA transformers 13 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Spring Cottage	33/6.6kV substation 2 x 23MVA transformers 6.6kV switchboard	6.6kV make and break fault level forecast to exceed switchgear rating	Replace 6.6kV switchboard or network reconfiguration/innovation
Strawberry Bank	33/6.6kV substation 2 x 23MVA transformers 6.6kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. Similarly, the generation forecast for the Leading the Way scenario in 2050 has the largest increase, driven by a large amount of inverter-based generation connecting to the network. The high level of generation in 2030 for all the scenarios, except Leading the Way, is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent decommissioning of this synchronous generation, which is expected to reach end of life by 2050, results in the forecast reduction in generation.

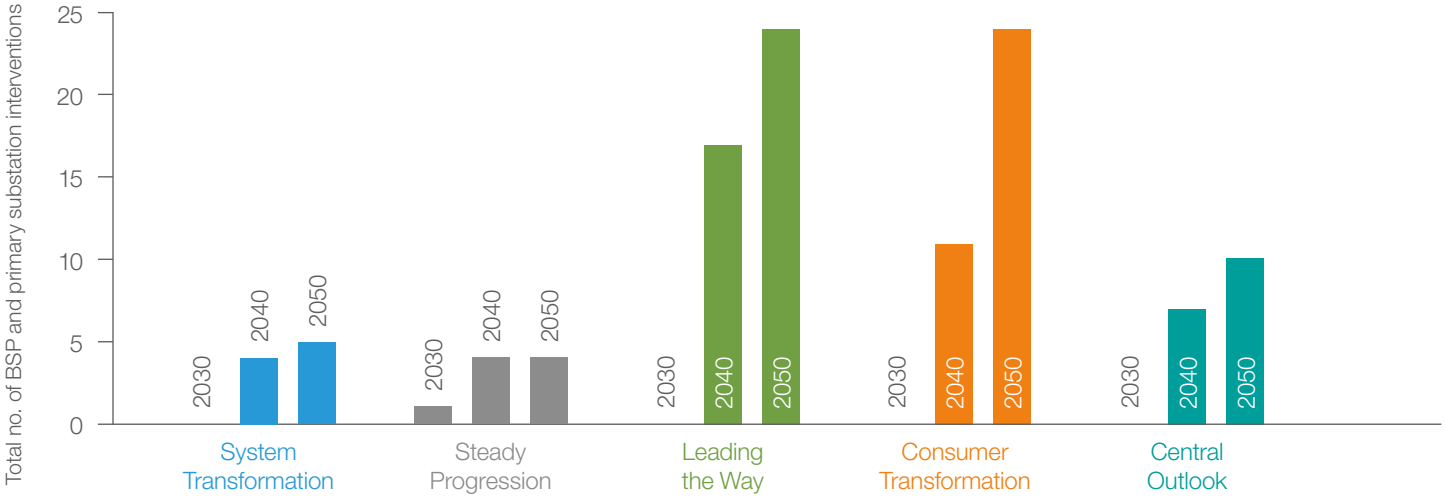


Load-based interventions by scenario (2030-2040-2050)

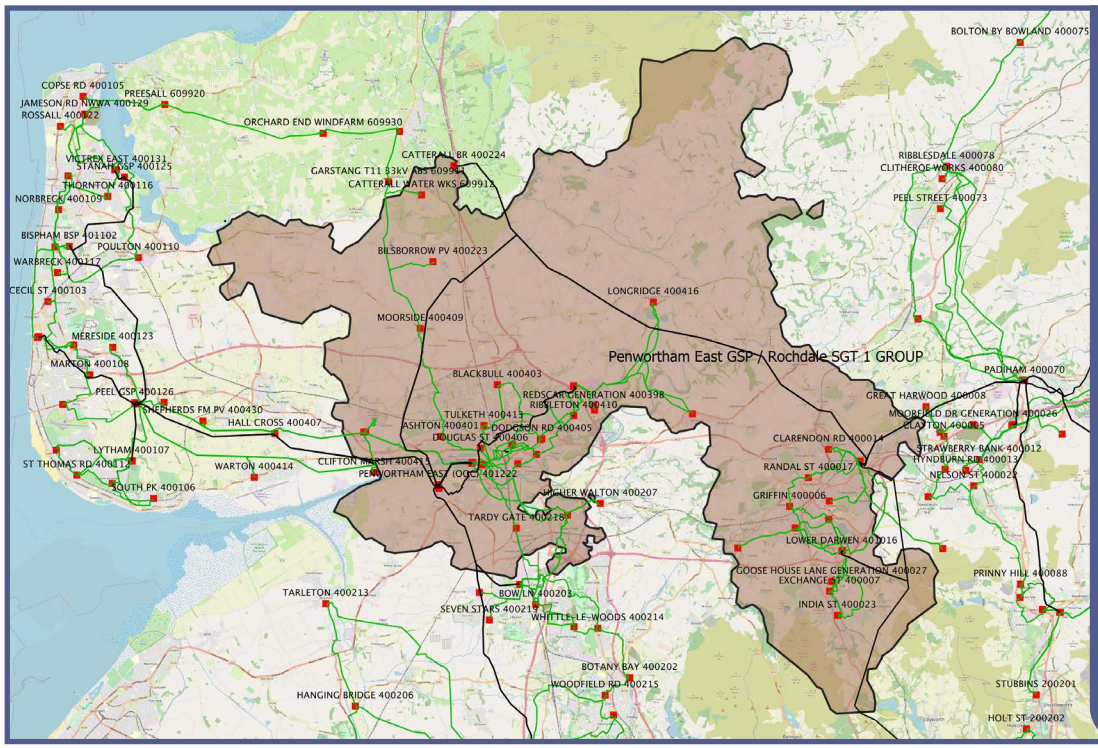
The number of load-based interventions up to 2050 is shown below. As expected the number of interventions increases over time as the load grows.

By 2050, the Central Outlook forecast indicates that half the BSPs and 32% of the primary substations will exceed existing capacity with an additional 21MVA of primary capacity required. Nelson and Padiham BSPs are both expected to exceed their existing firm capacity between 2030 and 2040.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that all the BSPs and 80% of the primary substations will be overloaded with an additional 112MVA of primary capacity required. This is to be expected as large portions of the network supply areas of large urban towns such as Haslingden, Accrington, Padiham and Burnley.



Penwortham East/Rochdale GSP



Summary

Penwortham East GSP is a 400/132kV substation comprising three SGTs. The GSP operates in parallel with a single SGT at Rochdale GSP forming the Penwortham East/ Rochdale group. The GSP group supplies approximately 167,000 customers across east and west Lancashire and comprises three 240MVA transformers at Penwortham East and a single 120MVA transformer at Rochdale. Peak demand is currently 384MVA, supplied via four BSPs and 31 primary substations.

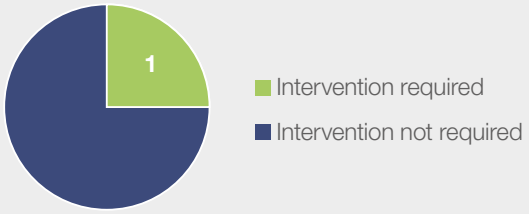
Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

A new primary substation, due to be completed in the RIIO-ED1 period, will supply the new Samlesbury Enterprise Zone and will be fed from Blackburn BSP.

Only one intervention may be required: Lower Darwen BSP which is driven by fault level.

BULK SUPPLY POINTS



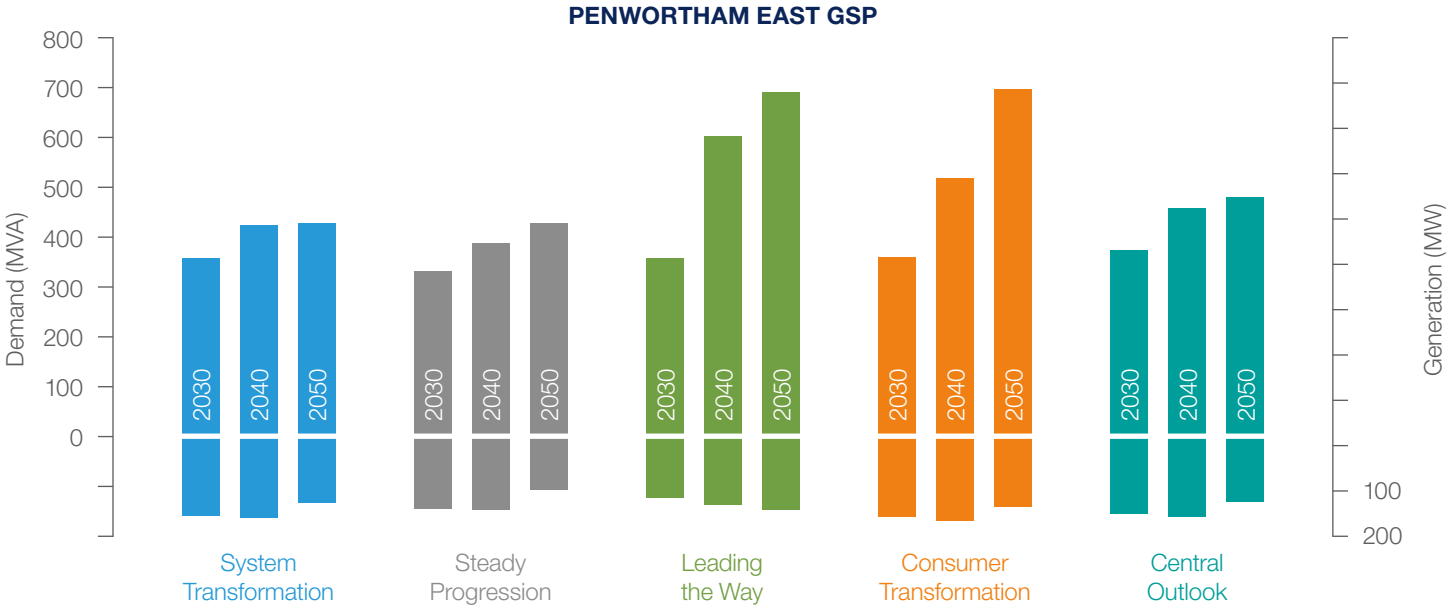
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Lower Darwen	132/33kV substation 2 x 90MVA transformers 17 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Samlesbury Enterprise Zone	New enterprise zone comprising one million sq ft of business space, maximum demand estimated to reach 16MVA	No available primary substations in the area with spare capacity and demand transfers unavailable to accommodate 16MVA	New 2 x 23MVA, 7 panel 33/11kV primary substation and approximately 2 x 9km 33kV supply cable

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The high level of generation in 2030 for all the scenarios, except Leading the Way, is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent de-commissioning of this generation results in the forecast reduction in generation by 2050.

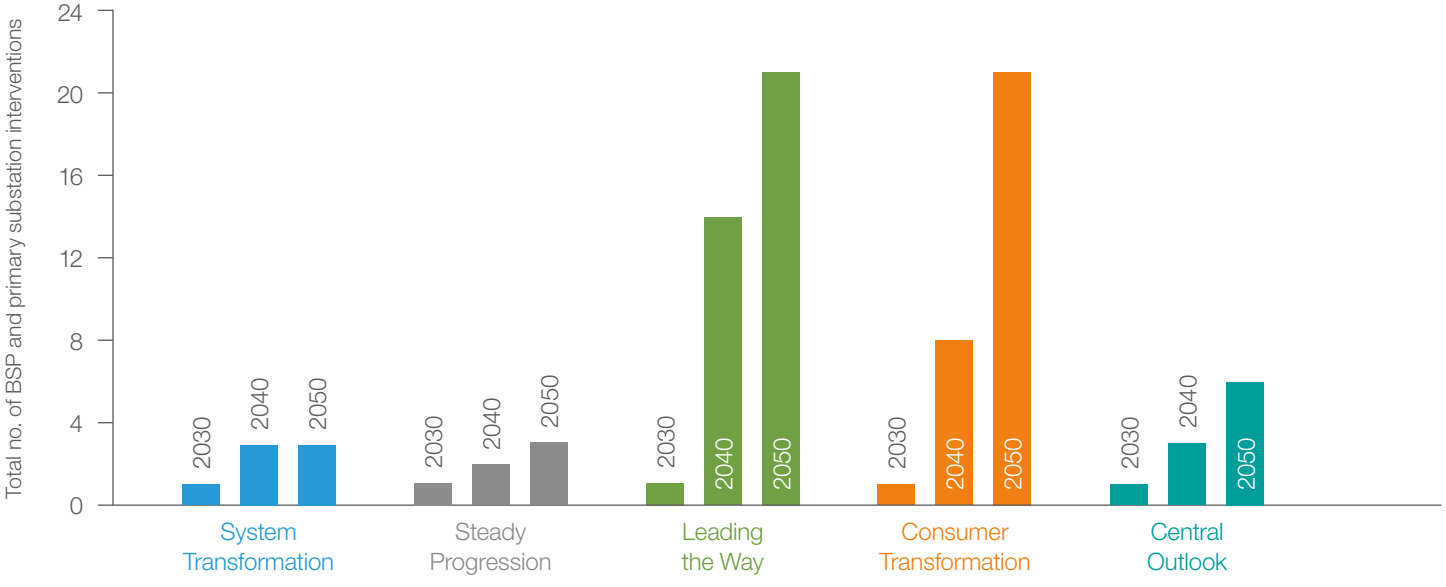


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates 25% of the BSPs and 21% of the primary substations will exceed their existing capacity with an additional 4MVA of primary capacity required. Lower Darwen BSP is forecast to exceed its existing firm capacity by 2031 and Holme Road primary substation by 2038.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate 75% of the BSPs and 67% of the primary substations will be overloaded with an additional 112MVA of primary capacity required.



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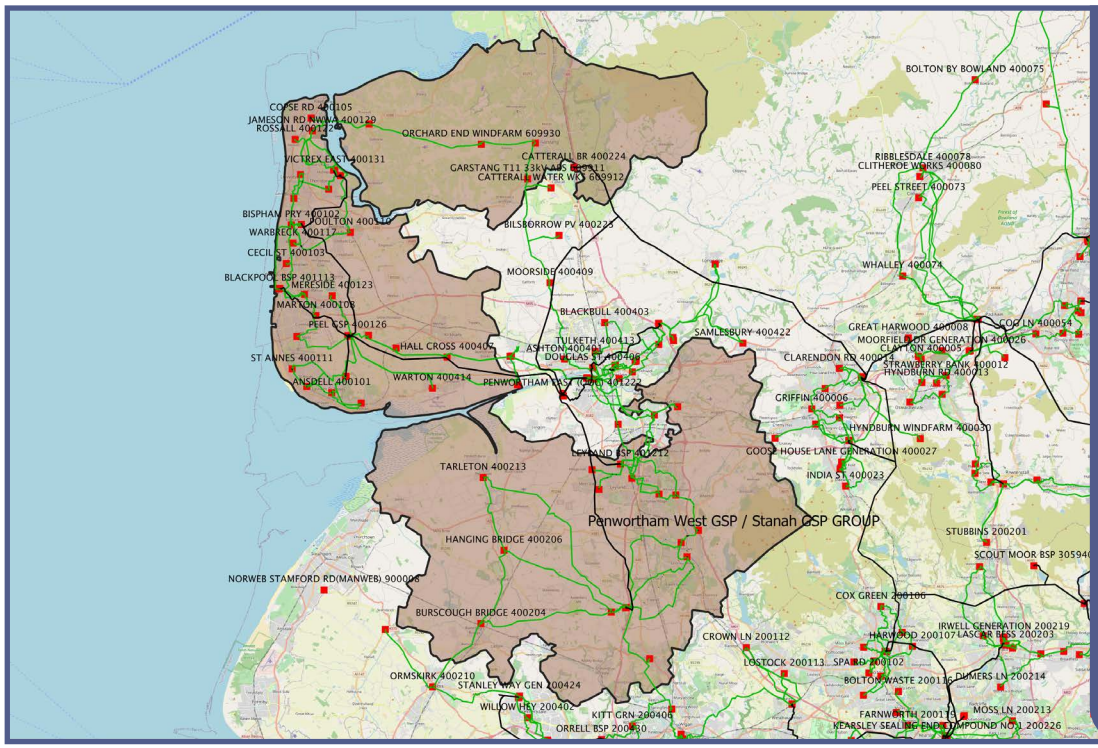
Penwortham West GSP/Stanah GSP Group



Summary

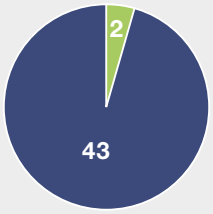
Penwortham West GSP is a 400/275/132kV substation comprising three 240MVA transformers located near Preston. Stanah GSP is a 400/132kV substation comprising two 240MVA transformers, located on the Fylde peninsula. The two GSPs operate in parallel to form the Penwortham West/ Stanah group. The group supplies approximately 240,000 customers across west Lancashire, including a large offshore wind farm, the Isle of Man and a feed to SP Manweb. Peak demand is currently 447MVA, supplied via seven BSPs and 45 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only two interventions may be required, both at primary level and both driven by demand.

PRIMARY SUBSTATIONS



Intervention required

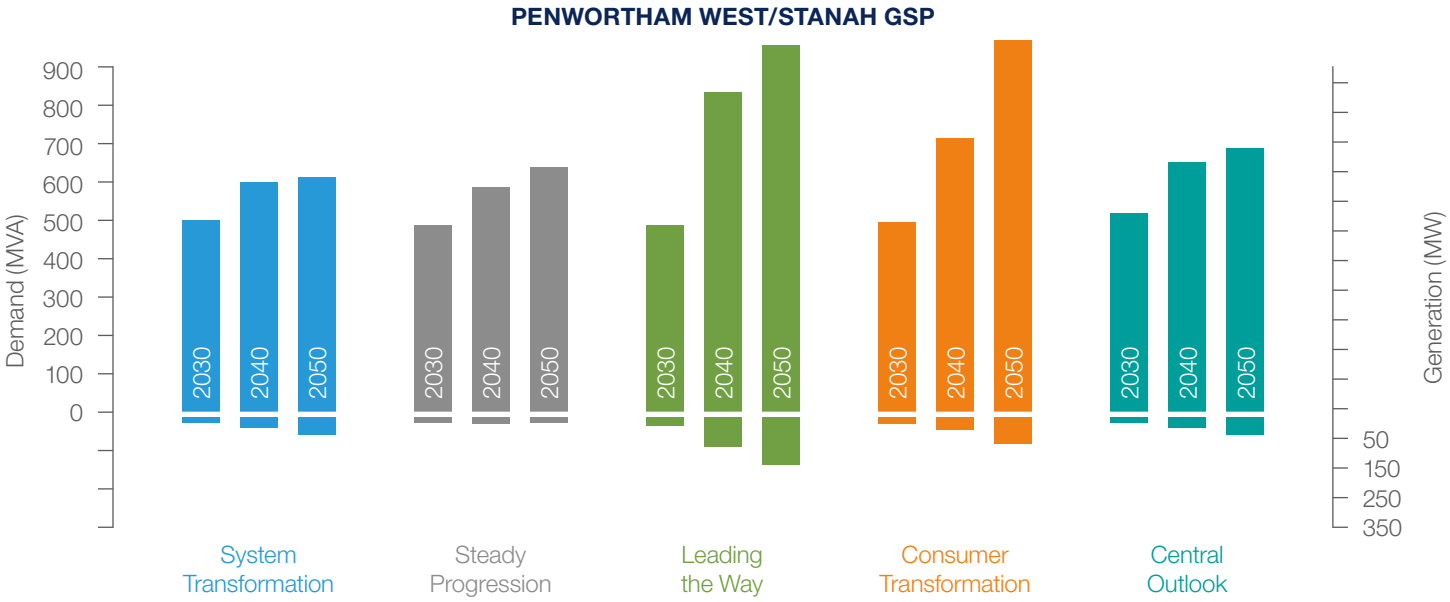
Intervention not required

Site name	Description	2030 need	Asset-based solution
Primary substations			
Bow Lane	33/11kV substation 2 x 23MVA transformers 18 panel, 11kV switchboard	The demand on the primary is limited by the 0.1in^2 overhead line circuit from Bow Lane to Whittle-le-Woods, the rating of this section is forecast to be exceeded in 2028	Replace the 0.1in^2 overhead line section in the circuit or remove completely and replace with approximately 1.9km of underground cable
Chorley South	33/11kV substation 1 x 23MVA & 1 x 14MVA transformers 10 panel, 11kV switchboard	Existing firm capacity forecast to be exceeded in 2027 due to the high demand growth in the area	Uprate existing transformers/ switchgear or transfer demand onto adjacent primaries

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand, while generation stays fairly level with an increase in inverter-based generation balanced with the decommissioning of existing non-inverter-based generation.

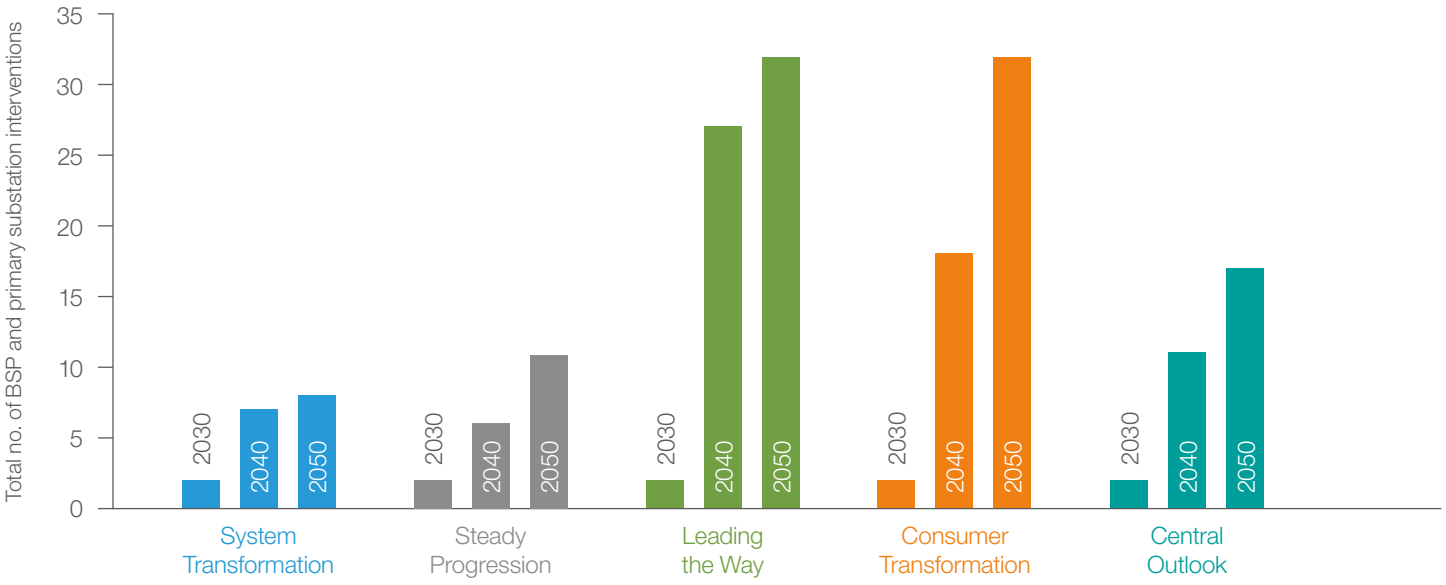


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates 43% of the BSPs and 47% of the primary substations will exceed existing capacity with an additional 46MVA of primary capacity required. Wrightington BSP is forecast to exceed its existing firm capacity in 2035. Bispham and Hall Cross primary substations are forecast to exceed their existing firm capacities early in the 2030-2040 period.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate all the BSPs and 69% of the primary substations will be overloaded with an additional 228MVA of primary capacity required.



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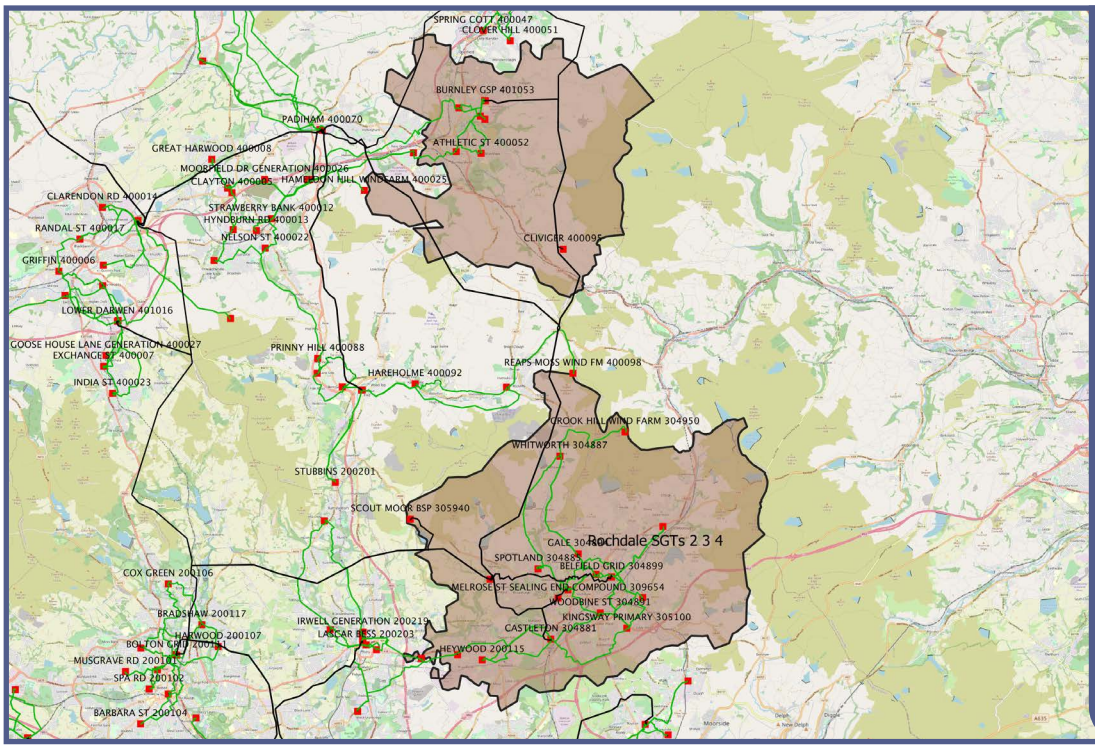
Rochdale GSP



Summary

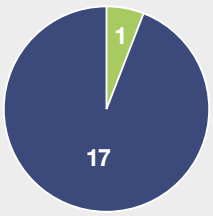
Rochdale GSP is a 275/132kV substation comprising four SGTs. The GSP operates split with SGTs 2, 3 and 4 forming the main Rochdale GSP, and SGT1 operating in parallel with Penwortham East GSP. The main GSP supplies approximately 155,000 customers across east Lancashire and north Peak and comprises three 240MVA SGTs supplied from National Grid's 275kV network. Peak demand is currently 185MVA, supplied via four BSPs and 17 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only one intervention may be required at primary level driven by demand for the Northern Gateway development.

PRIMARY SUBSTATIONS



Intervention required

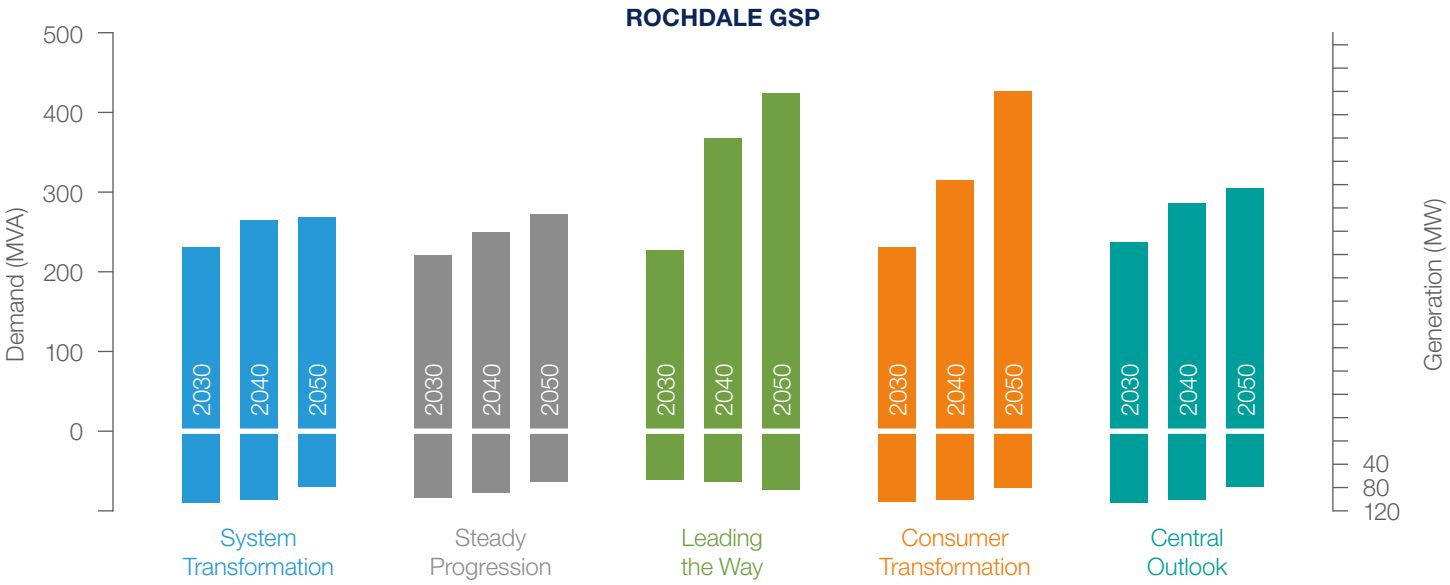
Intervention not required

Site name	Description	2030 need	Asset-based solution
Primary substations			
Northern Gateway / South Heywood	New 33/11kV substation 2 x 32MVA transformers 11V switchboard	Significant development in north-east growth corridor along M62. Supported by GMCA, the estimated demand is 20-25MVA	Establish new primary substation supplied from Castleton BSP to support the demand

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. Similarly, the generation forecast for the Leading the Way scenario in 2050 has the largest increase, driven by a large amount of inverter-based generation connecting to the network. The high level of generation in 2030 for all the scenarios, except Leading the Way, is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent de-commissioning of this generation results in the forecast reduction in generation by 2050.

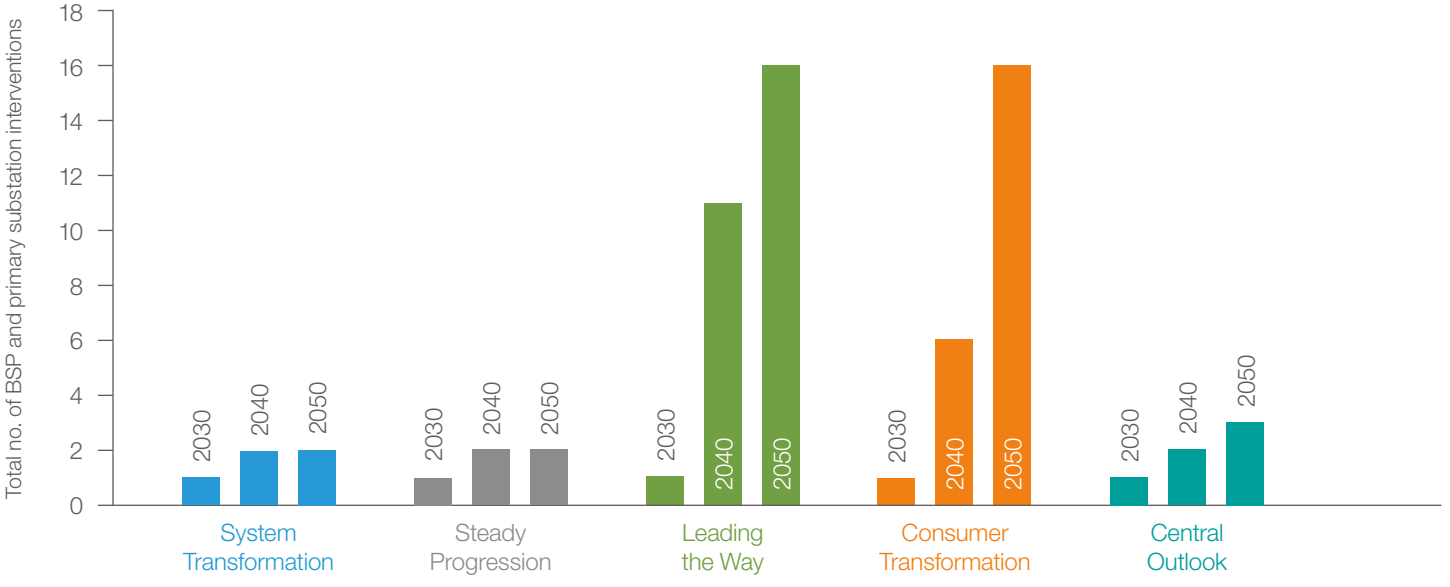


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 is shown below. As expected the number of interventions increases over time as the load grows.

By 2050, the Central Outlook forecast indicates that no BSPs and only 18% of the primary substations will exceed existing capacity, with Heywood and Littleborough primary substations forecast to exceed their existing capacity first.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate 50% of the BSPs and 82% of the primary substations will be overloaded with an additional 76MVA of primary capacity required.



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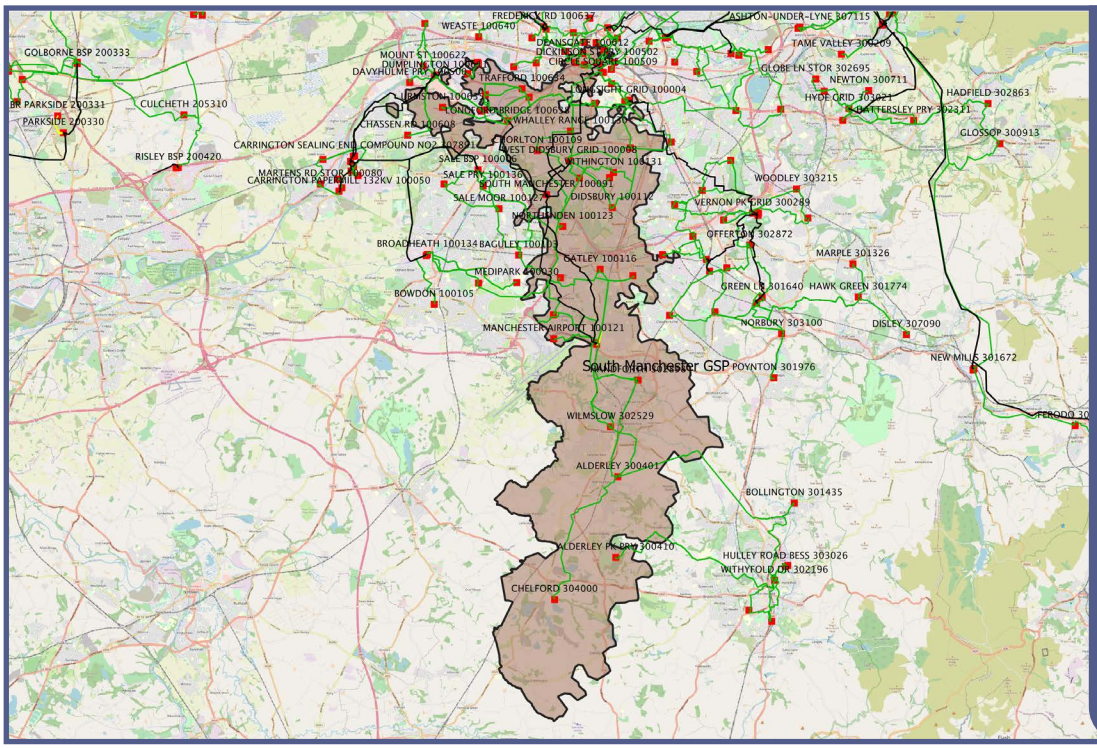
South Manchester GSP



Summary

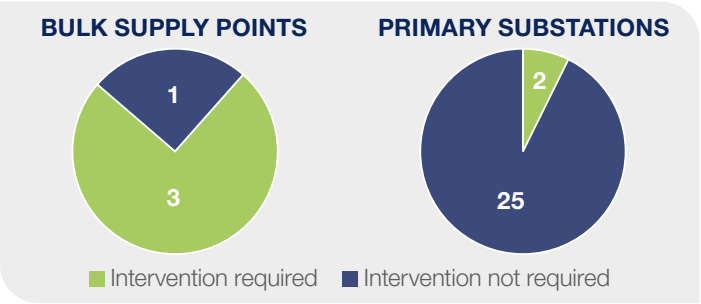
South Manchester GSP is a 400/132kV substation which supplies approximately 156,000 customers across south Manchester. The substation comprises four 240MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 318MVA, supplied via four BSPs and 27 primary substations.

The existing 132kV switchgear is an outdoor double busbar arrangement with main and reserve bars, and nine feeder bays. Based on age and condition, the switchgear will be replaced, likely with an indoor GIS solution which is due to be completed by 2026.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Six interventions may be required, at three BSPs and two primary substations, driven by generation and demand growth.



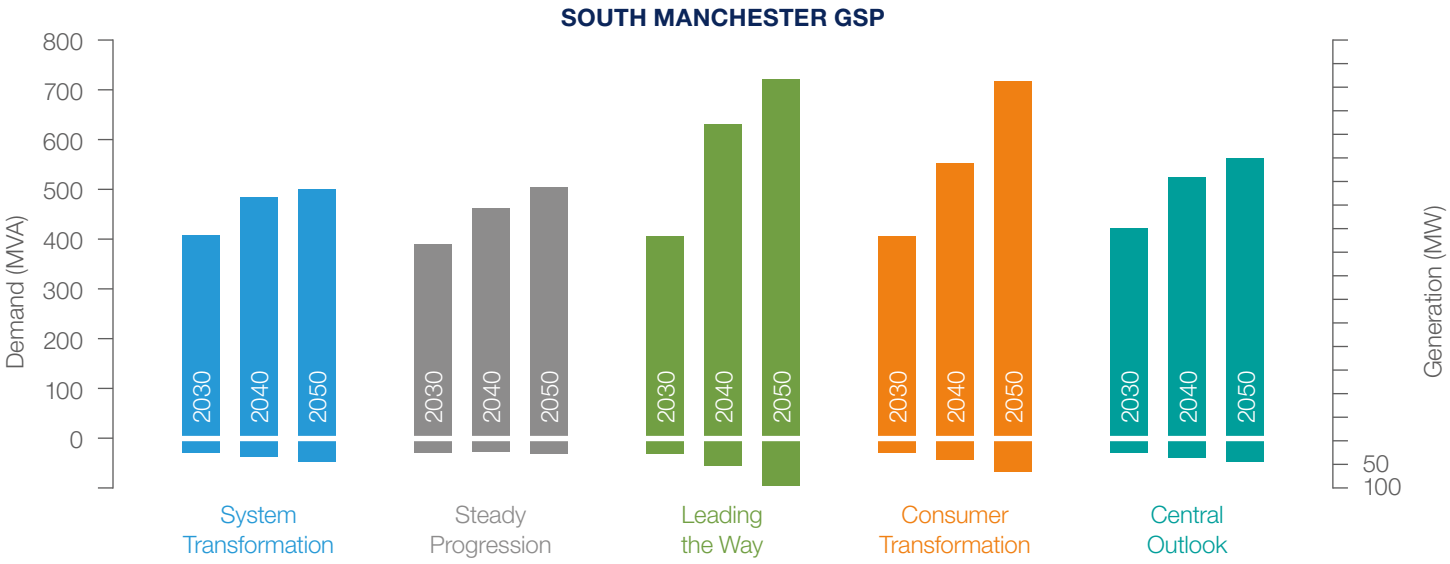
5 Grid supply point results

Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Bloom Street	132/33kV substation 2 x 90MVA transformers 33kV switchboard	Forecast overload due to demand growth in Manchester city centre and capacity of BSP limited due to transformers being indoor	Transfer Piccadilly primary substation off Bloom Street BSP onto Stuart Street BSP, by laying two new 33kV cables from Stuart Street into the centre of Manchester. Contingent of Stuart Street BSP reinforcement being complete
West Didsbury	132/33kV substation 3 x 60MVA transformers Four section, 19 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Moss Nook	132/33kV substation 3 x 60MVA transformers Three section, 14 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Moss Nook	132/33kV substation 3 x 60MVA transformers 33kV switchboard	Forecast overload due to demand growth at Manchester Airport. Existing capacity limited by switchgear and transformer rating	Assuming switchgear replaced from fault level perspective (above), the capacity could be increased by replacing the three 60MVA transformers with 90MVA units

Site name	Description	2030 need	Asset-based solution
Primary substations			
Whalley Range	33/6.6kV substation Local 6 panel 33kV switchboard 2 x 21MVA transformers 6.6kV switchboard	The existing operational approach for managing 6.6kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 6.6kV switchboard or network reconfiguration/innovation
Thorley Lane	New 33/11kV substation 2 x 32MVA transformers 11kV switchboard	Significant re-development and expansion of Manchester Airport and the surrounding area. Supported by GMCA, the estimated demand is 30MVA	Establish new primary substation called Thorley Lane supplied from Moss Nook BSP, to support the demand

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter-based and inverter-based generation increasing from 2030-2050, however the amount of generation is fairly small.

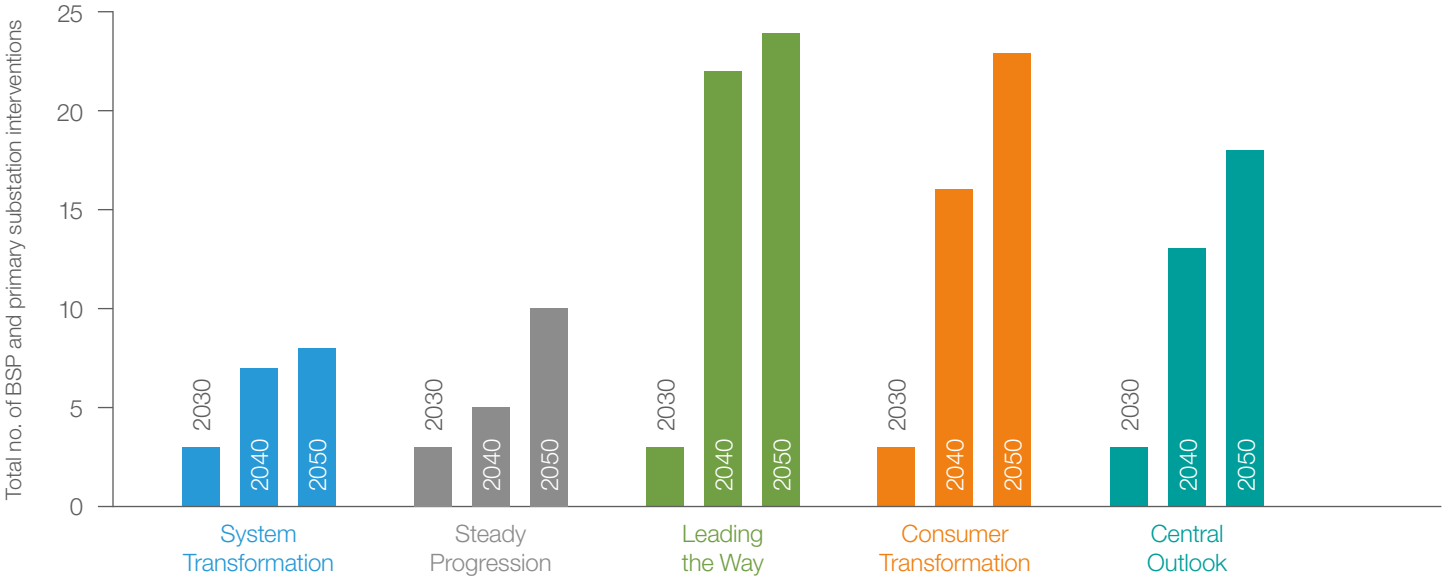


Load-based interventions by scenario (2030-2040-2050)

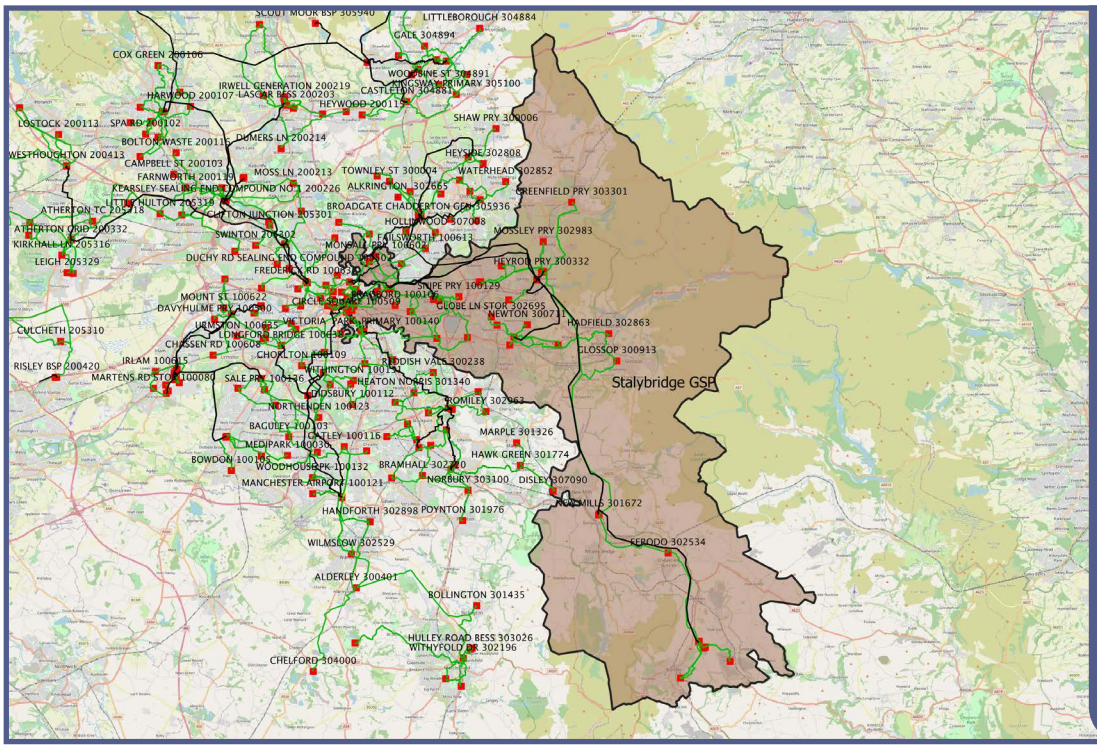
The number of load-based interventions up to 2050 is shown below. As expected the number of interventions increases over time as the load grows.

By 2050, the Central Outlook forecast indicates 75% of the BSPs and 58% of the primary substations will exceed existing capacity with an additional 51MVA of primary capacity required. Bloom Street BSP in central Manchester, Moss Nook BSP near the airport and West Didsbury BSP are all forecast to exceed existing capacity by 2033. This is predominately driven by load growth in and around Manchester city centre and at Manchester Airport.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate all the BSPs and 77% of the primary substations will be overloaded with an additional 164MVA of primary capacity required.



Stalybridge GSP



Summary

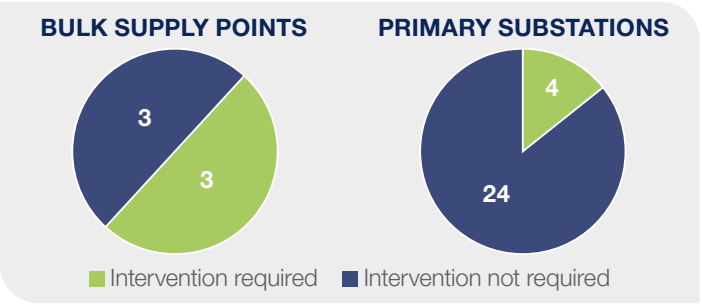
Stalybridge GSP is a 275/132kV substation which supplies approximately 216,000 customers across the Peak and east Manchester region. The substation comprises two 240MVA transformers and two 180MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 355MVA, supplied via six BSPs and 28 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Seven interventions may be required, at three BSPs and four primary substations, driven by generation and demand growth.

Stalybridge supplies Stuart Street BSP which is close to a number of development schemes in east and central Manchester. These traditionally older residential/commercial areas have experienced limited investment over the years, but are now subject to a number of significant large-scale redevelopment plans, driving demand growth in the area.



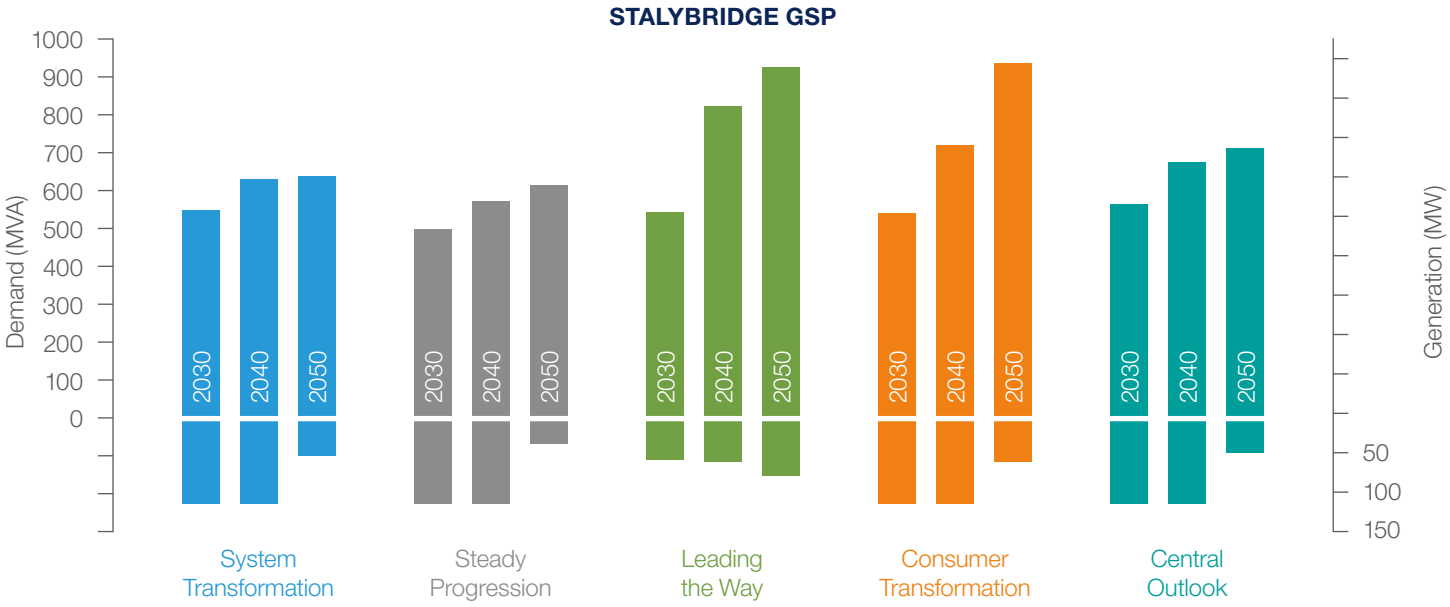
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Buxton	132/33kV substation 2 x 90MVA transformers 13 panel 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Droylsden	132/33kV substation 3 x 60MVA transformers 12 panel 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Stuart Street	132/33kV substation 2 x 90MVA transformers 33kV switchboard	Forecast overload due to demand growth in Manchester city centre and east Manchester. Also facilitates Piccadilly primary transfer to relieve overload on Bloom Street BSP	On-going reinforcement scheme to install third 90MVA transformer and extend 33kV switchboard

Site name	Description	2030 need	Asset-based solution
Primary substations			
Eastlands	33/6.6kV substation 2 x 23MVA transformers 6.6kV switchboard	Forecast overload due to significant development around Etihad Campus	Install third 23MVA transformer and extend 6.6kV switchboard
Hattersley	33/11kV substation 2 x 14MVA transformers 11kV switchboard	Forecast overload due to demand growth in the surrounding area	Replace transformers with two 23MVA units
Mayfield	New 33/6.6kV substation 2 x 23MVA transformers 6.6kV switchboard	Significant commercial and residential re-development around Piccadilly station including HS2 terminal. Forecast overload of existing primaries	Establish new primary substation close to Manchester Piccadilly station and supplied from Stuart Street BSP
Queens Park	33/6.6kV substation 2 x 23MVA transformers, three section 6.6kV switchboard	Significant development along the Irk Valley, north east of Manchester centre, to deliver around 15,000 homes	Install third 23MVA transformer. Site already equipped with three section board and spare transformer bay

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The high level of generation in 2030 for all the scenarios, except Leading the Way, is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent de-commissioning of this generation results in the forecast reduction in generation by 2050.

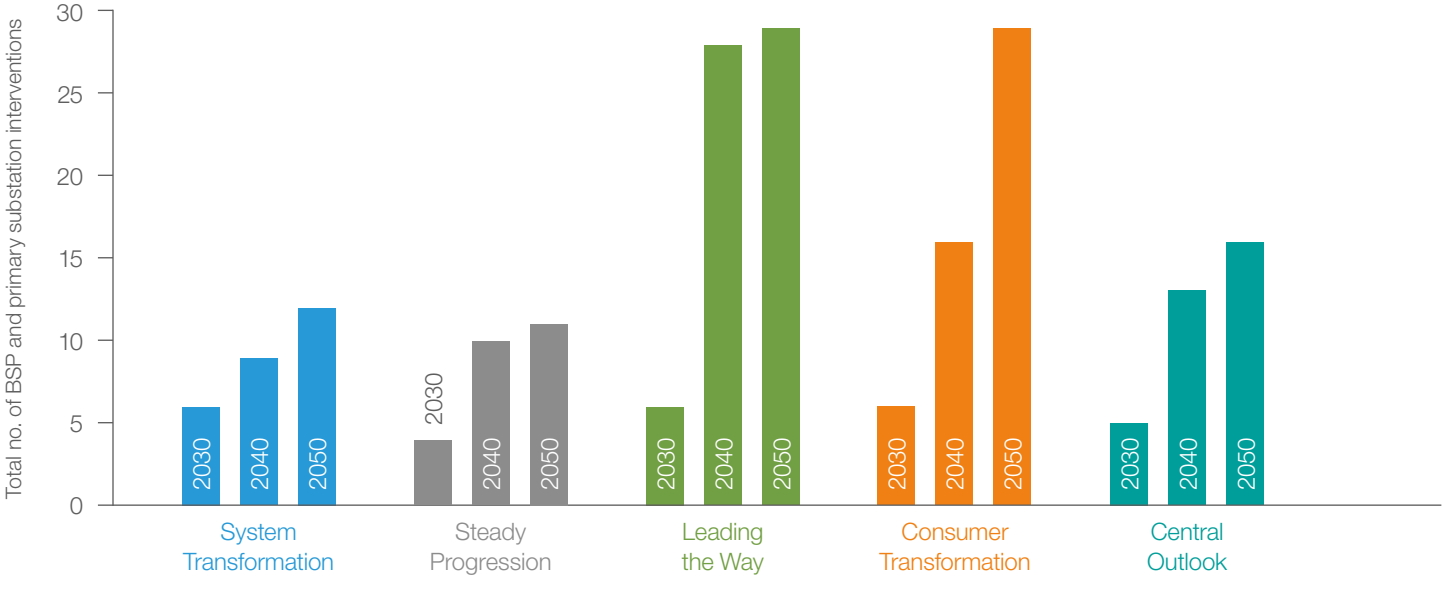


Load-based interventions by scenario (2030-2040-2050)

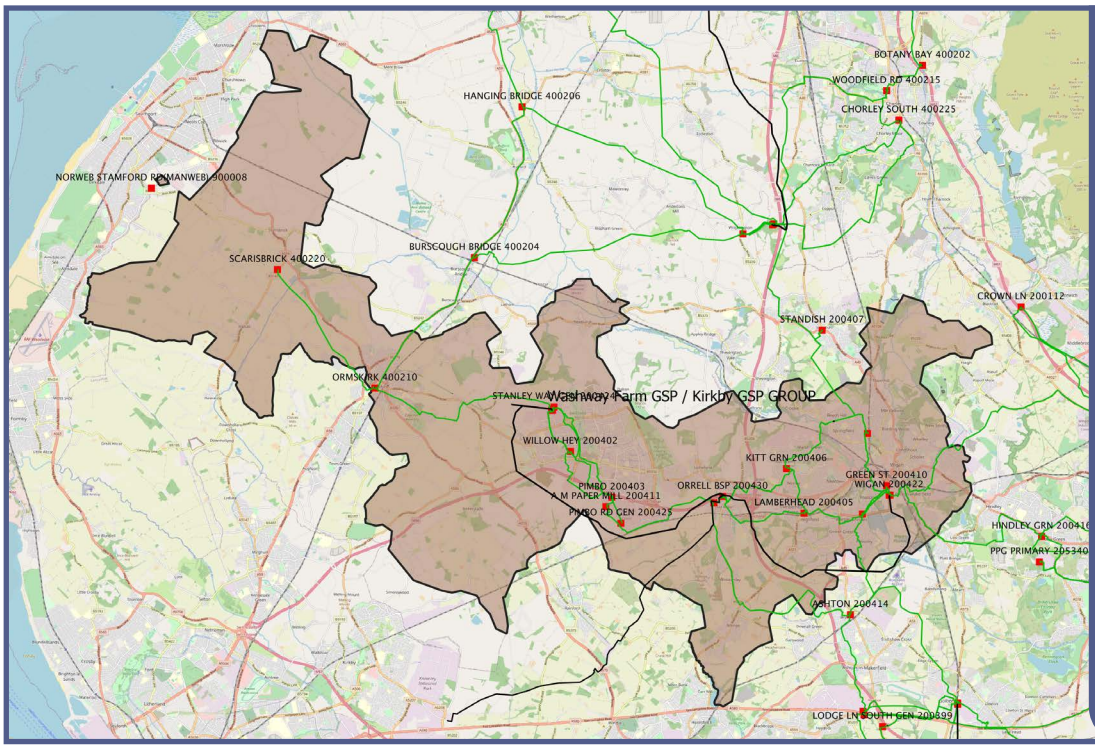
The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates that half the BSPs and 45% of the primary substations will exceed existing capacity with an additional 125MVA of primary capacity required. In addition to forecast overloads at city centre primary substations such as Ardwick and Central Manchester, overloads are also forecast at sites in east Manchester and Tameside, such as Droylsden, Ashton and Hyde.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate that 83% of BSPs and 83% of primary substations will be overloaded with an additional 293MVA of primary capacity required.



Washway Farm GSP/Kirkby GSP Group



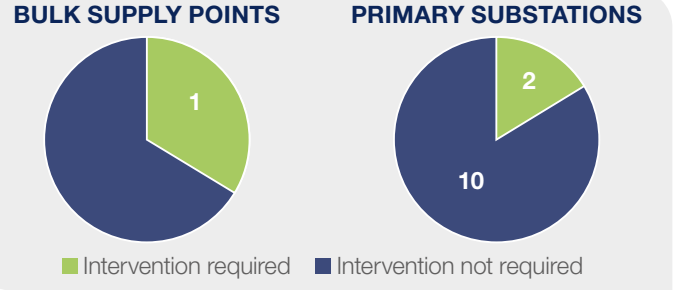
Summary

Washway Farm GSP/ Kirkby GSP Group supplies approximately 74,000 customers across south Lancashire. Washway Farm GSP takes its supply from National Grid's 275kV network via two 180MVA SGTs. Kirkby GSP which is an SP Manweb site supplies Electricity North West via a 240MVA SGT. The GSP group feeds into three BSPs and 12 primary substations. Peak demand is currently 154MVA.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Three interventions may be required: one BSP and two primary substations all driven by generation.



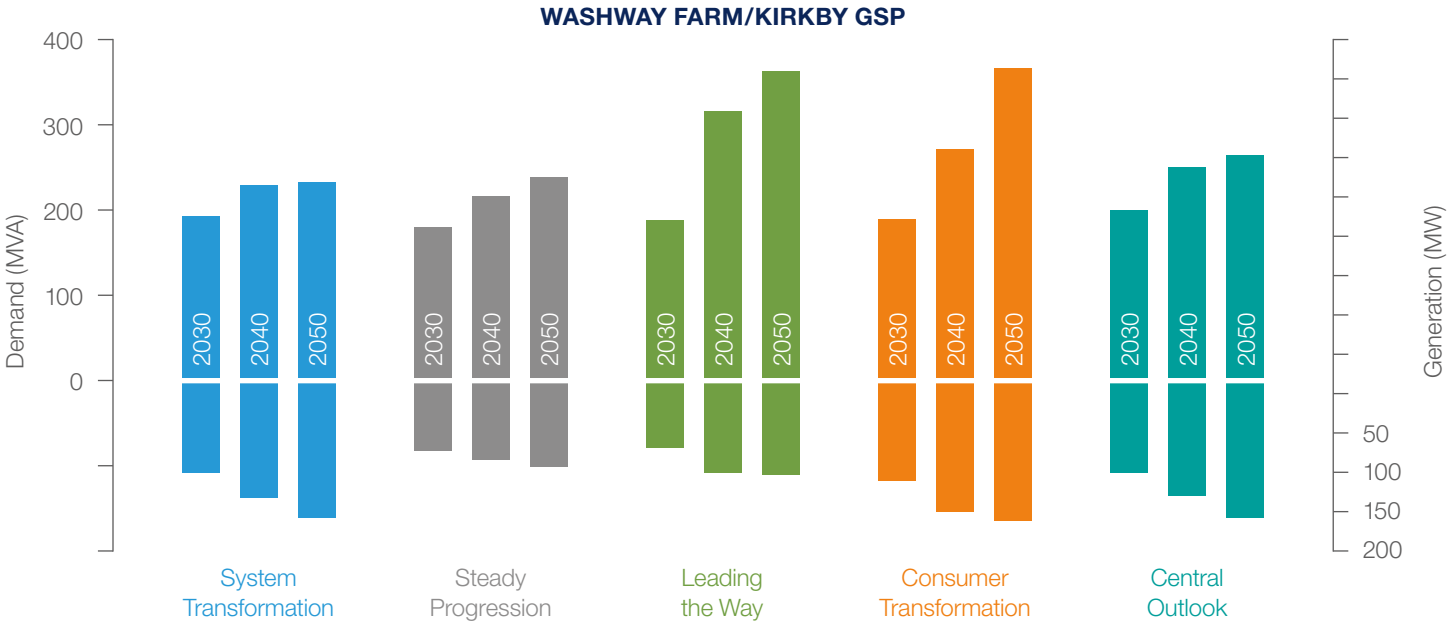
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Skelmersdale	132/33kV substation 2 x 90MVA transformers 10 panel, 33kV switchboard	An operational restriction is in place to manage 33kV make fault level to ensure it remains within switchgear rating	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Skelmersdale	33/11kV substation 2 x 23MVA transformers 7 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation
Willow Hey	33/11kV substation 2 x 23MVA transformers 6 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter-based and inverter-based generation increasing from 2030-2050.

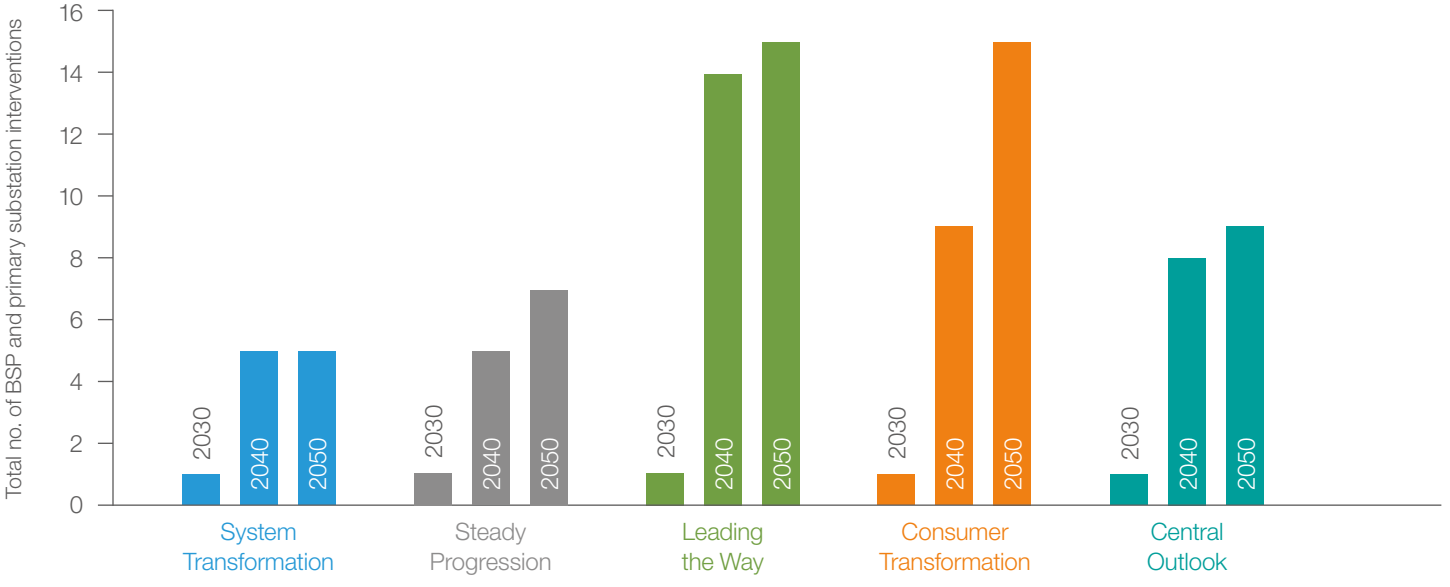


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 is shown below. As expected the number of interventions increases over time as the load grows.

By 2050, the Central Outlook forecast indicates a third of the BSPs and 62% of the primary substations will exceed existing capacity with an additional 20MVA of primary capacity required. Wigan BSP is forecast to overload before 2030, and Green Street and Ashton-in-Makerfield primary substations will exceed their existing firm capacity by 2031.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate all the BSPs and 92% of the primary substations will be overloaded with an additional 111MVA of primary capacity required.



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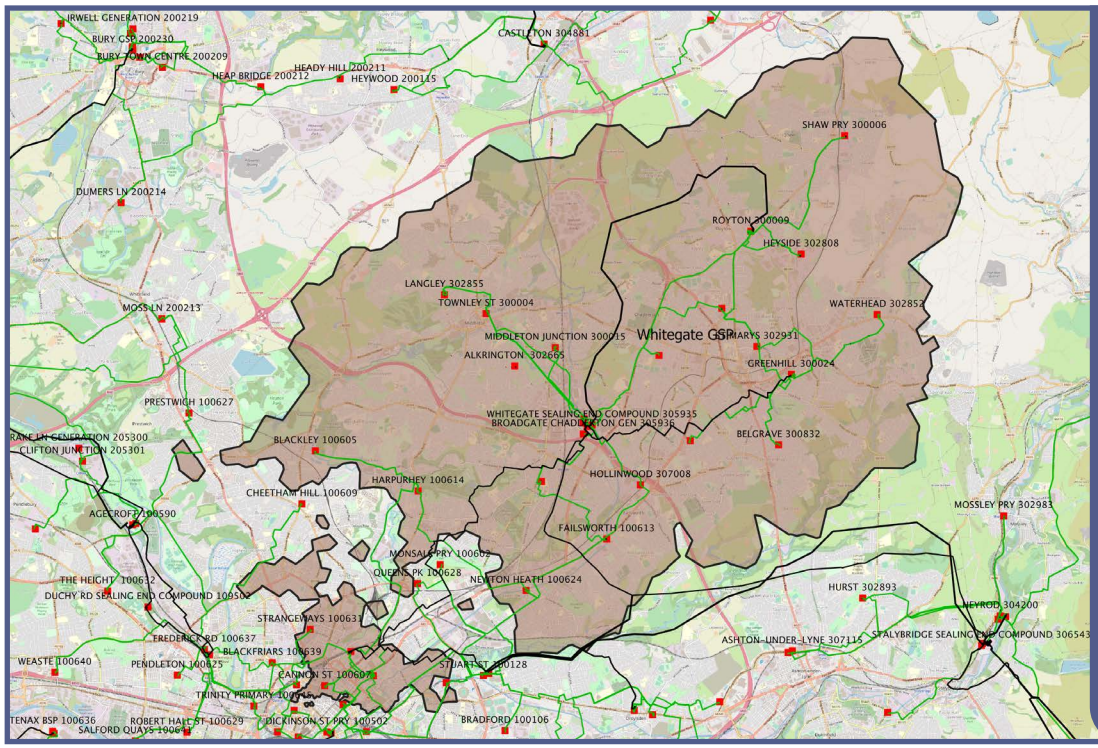
Whitegate GSP



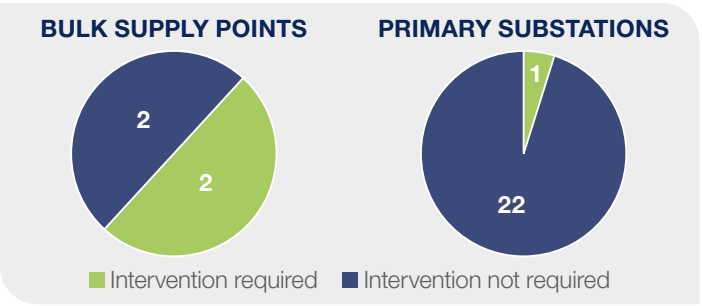
Summary

Whitegate GSP is a 275/132kV substation which supplies approximately 179,000 customers across the north Peak and north Manchester region. The substation comprises three 240MVA transformers supplied from National Grid's 275kV network. Peak demand on the GSP is currently 262MVA, supplied via four BSPs and 23 primary substations.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, existing network capacity is sufficient to accommodate demand and generation growth at the majority of sites.

Only three interventions may be required: two at BSP level and one primary substation, all driven by generation growth.

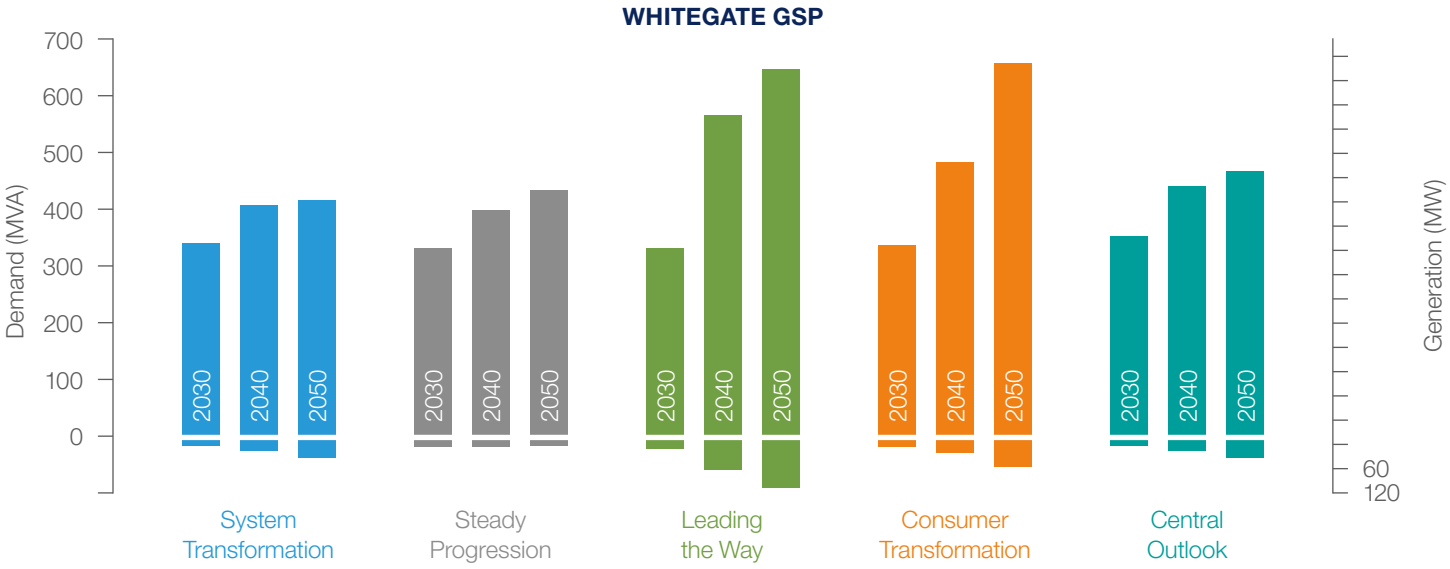


Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Greenhill	132/33kV substation 2 x 90MVA transformers 14 panel 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation
Royton	132/33kV substation 2 x 90MVA transformers 11 panel, 33kV switchboard	An operational restriction is in place to manage the 33kV make fault level to ensure it remains within switchgear rating. Break fault level forecast to exceed rating	Replace 33kV switchboard or network reconfiguration/innovation

Site name	Description	2030 need	Asset-based solution
Primary substations			
Cannon Street	33/6.6kV substation 3 x 23MVA transformers Three section, 32 panel, 6.6kV switchboard	The existing operational approach for managing 6.6kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Network reconfiguration/innovation (Existing rating relatively high, therefore replacement unlikely)

Demand and generation forecasts by scenario (2030-2040-2050)

Each scenario forecasts an increase in demand with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The high level of generation in 2030 for all the scenarios is attributed to the large-scale, non-inverter-based generation still connected to the network. The subsequent de-commissioning of this generation results in the forecast reduction in generation by 2050.

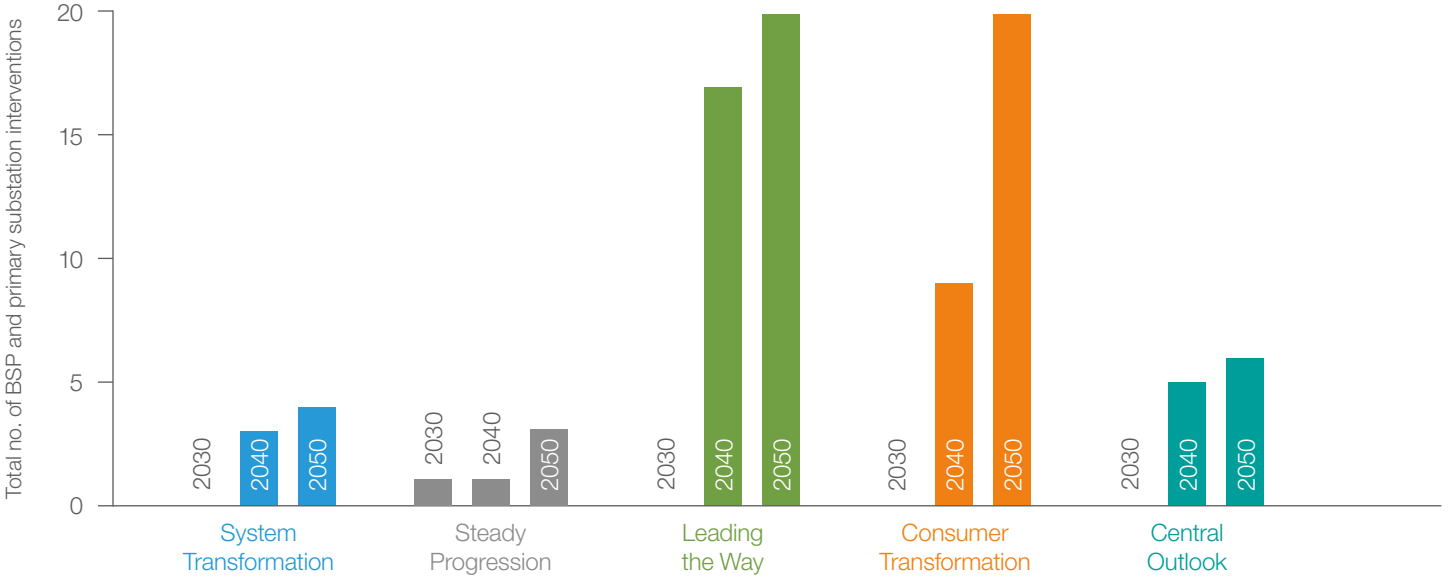


Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 is shown below. As expected the number of interventions increases over time as the load grows.

By 2050, the Central Outlook forecast indicates 25% of the BSPs and 21% of the primary substations will exceed existing capacity. Primary substations such as Strangeways, Ancoats and Newton Heath are forecast to exceed existing capacity first, driven by load growth in north Manchester.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, the forecasts for these scenarios indicate all the BSPs and 65% of the primary substations will be overloaded with an additional 117MVA of primary capacity required.



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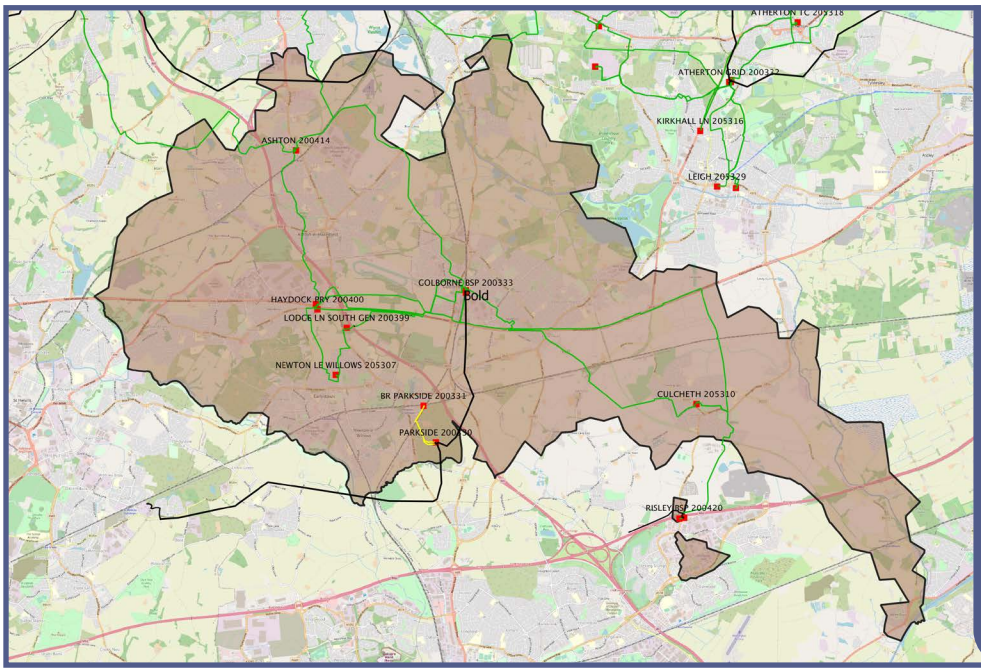
Bold switching station



Summary

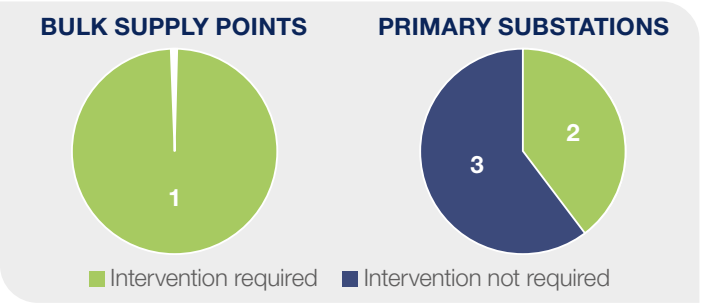
Bold is a 132kV switching station that takes its supply from Rainhill GSP on the SP Manweb network. There is an agreement in place between Electricity North West and SP Manweb to share the four 240MVA SGTs at Rainhill. This gives us 114MVA of capacity supplied from Bold to feed Golborne BSP and British Rail Parkside. The supply to Golborne BSP feeds approximately 34,000 customers across south Lancashire. The peak demand from five primary substations is currently 81.9MVA.

Accommodating demand and generation forecasts to 2030

Based on the Central Outlook forecasts up to 2030, we expect the existing network capacity at Golborne BSP and Golborne and Newton-le-Willows primary substations to be exceeded.

Therefore, three interventions may be required:

- Golborne BSP, driven by demand and generation growth on the network
- Golborne primary substation, driven by demand growth
- Newton-le-Willows primary substation, driven by generation growth.



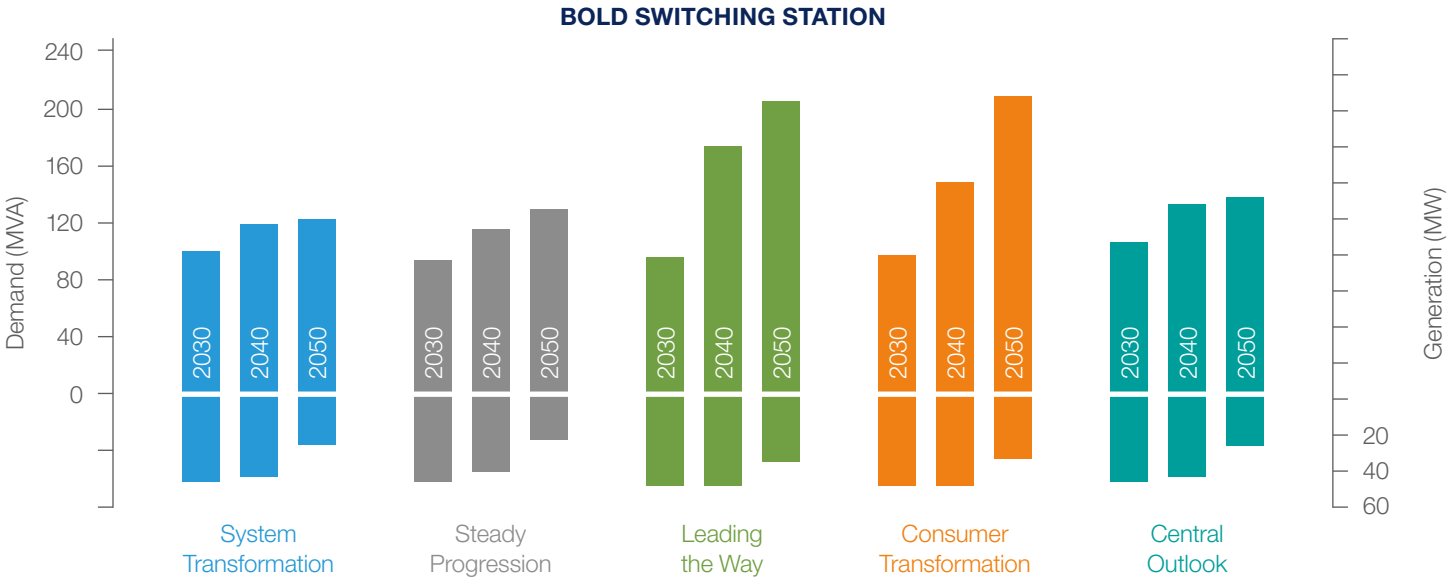
Site name	Description	2030 need	Asset-based solution
Bulk supply points			
Golborne	132/33kV substation 2 x 90MVA transformers 14 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard (currently being carried out and due for completion in the RIIO-ED1 period)

Site name	Description	2030 need	Asset-based solution
Primary substations			
Golborne	33/11kV substation 2 x 32MVA transformers 20 panel, 11kV switchboard	Existing firm capacity forecast to be exceeded by 1.5MVA in 2027	Install third transformer and extend 11kV switchboard
Newton-le-Willows	33/11kV substation 2 x 23MVA transformers 5 panel, 33kV switchboard	The existing operational approach for managing 33kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 33kV switchboard or network reconfiguration/innovation

5 Grid supply point results

Demand and generation forecasts by scenario (2030-2040-2050)

Overall each scenario shows an increase in demand with the Leading the Way and Consumer Transformation scenarios showing the highest increase. Generation is highest in 2030 due to the significant amount of non-inverter-based generation on the network. This decreases up to the 2050 period where most of the generation is then inverter-based.



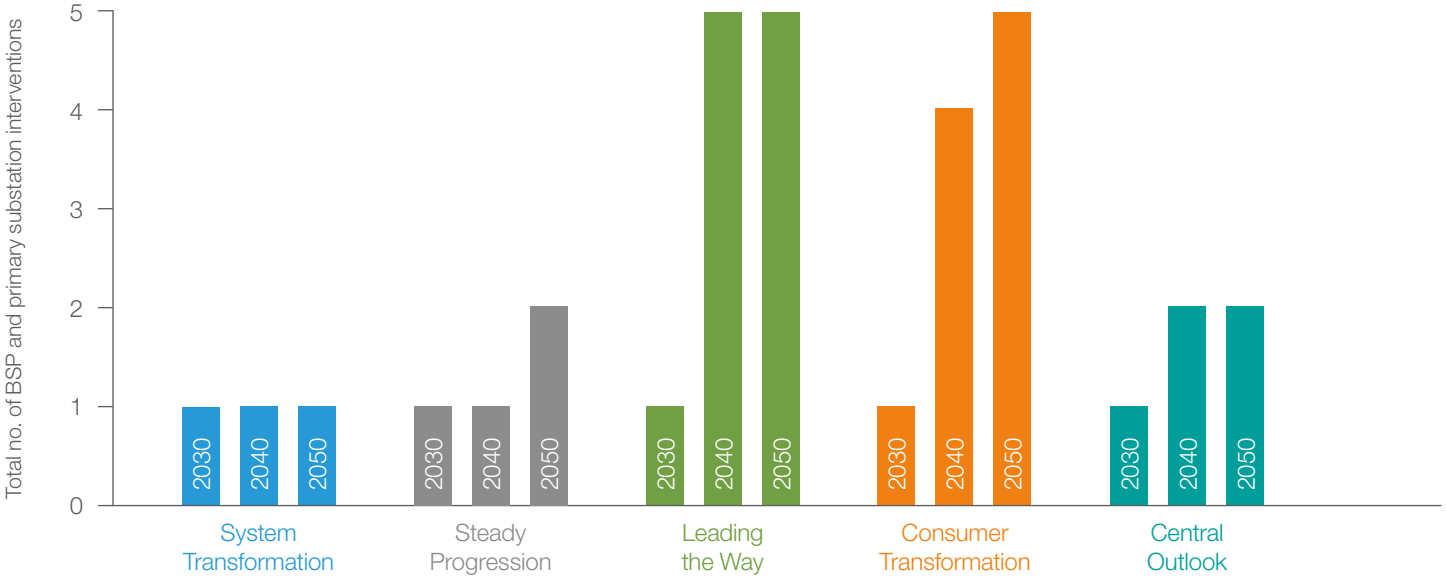
Load-based interventions by scenario (2030-2040-2050)

The number of load-based interventions up to 2050 increases over time as the load grows.

By 2050, the Central Outlook forecast indicates that 50% of the primary substations will exceed existing capacity with an additional 12MVA of primary capacity required. Golborne primary substation will exceed its existing firm capacity before 2030 and Culcheth primary substation is expected to exceed existing firm capacity by 2040.

The Leading the Way and Consumer Transformation scenarios show the greatest number of interventions required. By 2050, forecasts for these scenarios indicate that Golborne BSP and all the primary substations will be overloaded with an additional 57MVA of primary capacity required.

Portions of the network supply large conurbations such as Golborne, Newton-le-Willows and Haydock owing to the large increase in demand.



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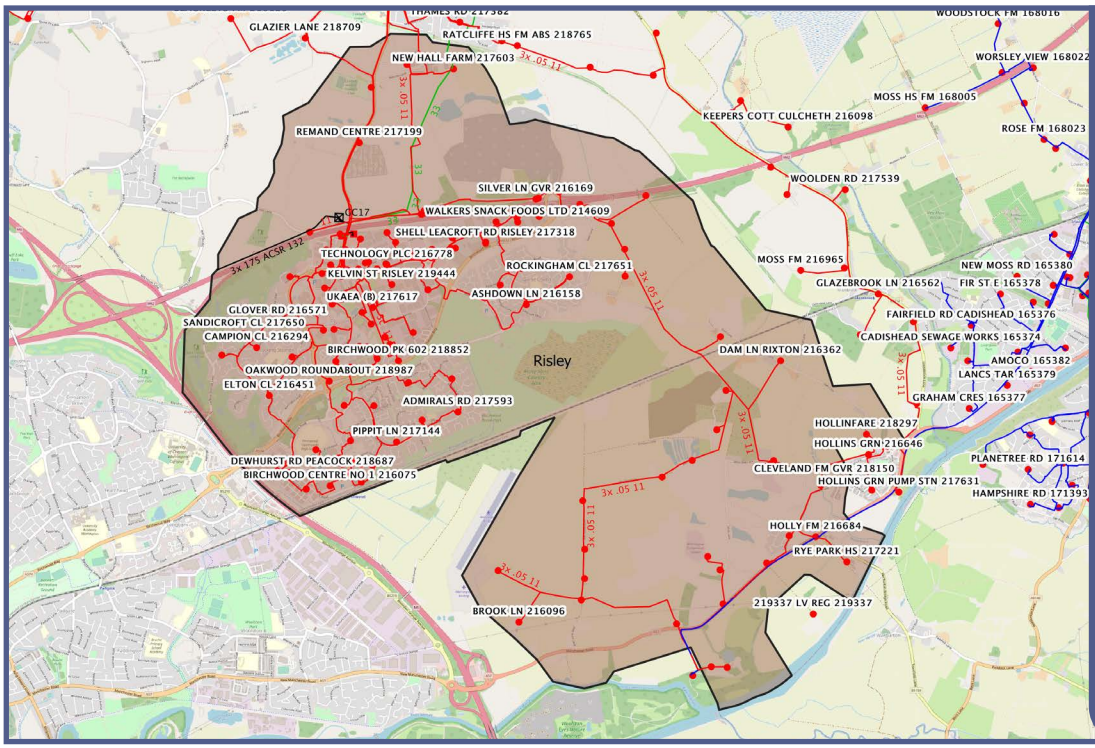
Risley primary substation

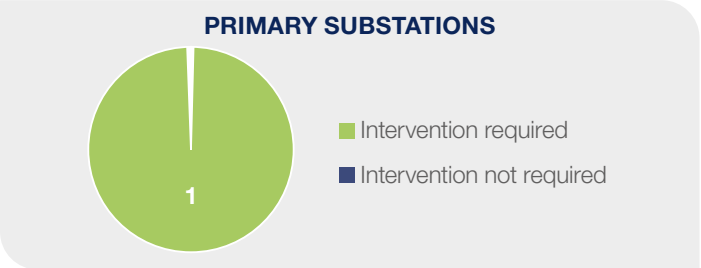


Summary

Risley is a 132/11kV primary substation supplied from the SP Manweb network via a single 15/30MVA grid transformer. The supply feeds approximately 5,000 customers across south Lancashire. Peak demand is currently 15MVA.

Accommodating demand and generation forecasts to 2030

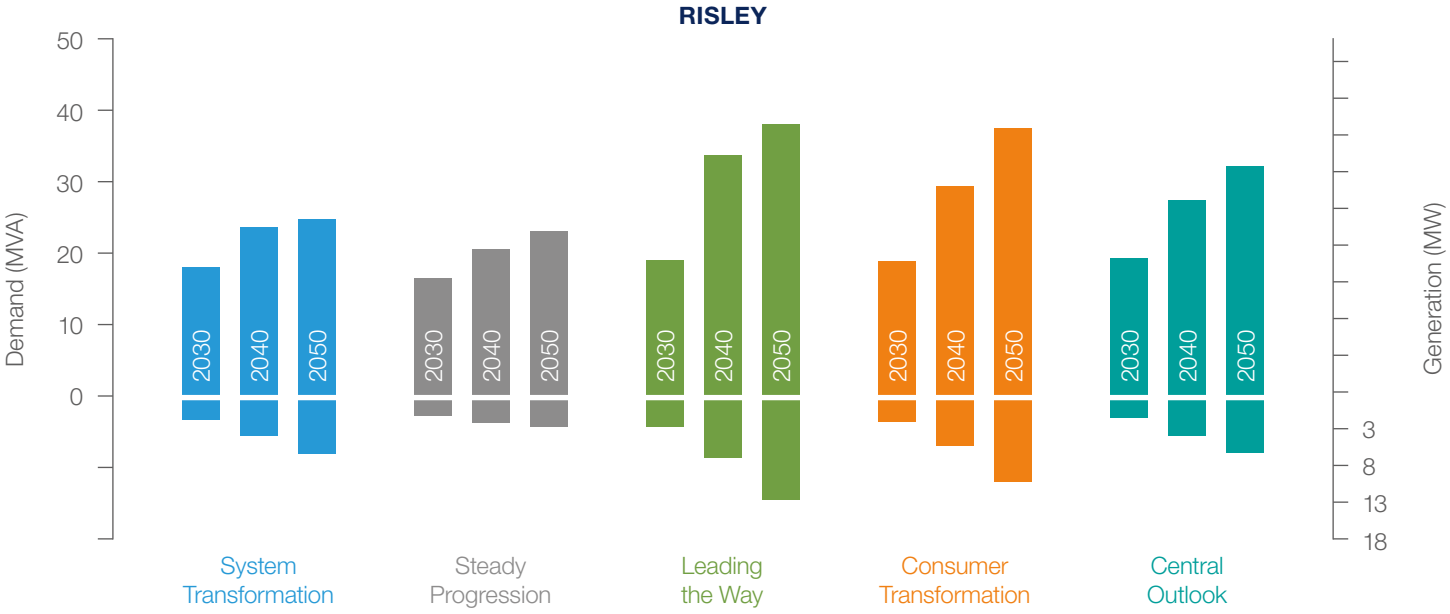
Only one intervention may be required at Risley primary substation which is driven by generation.



Site name	Description	2030 need	Asset-based solution
Primary substations			
Risley	132/11kV substation 1 x 30MVA transformer 13 panel, 11kV switchboard	The existing operational approach for managing 11kV make fault levels is less suitable as generation connections increase in the area and the switchgear will need to be enhanced or upgraded	Replace 11kV switchboard or network reconfiguration/innovation

Demand and generation forecasts by scenario (2030-2040-2050)

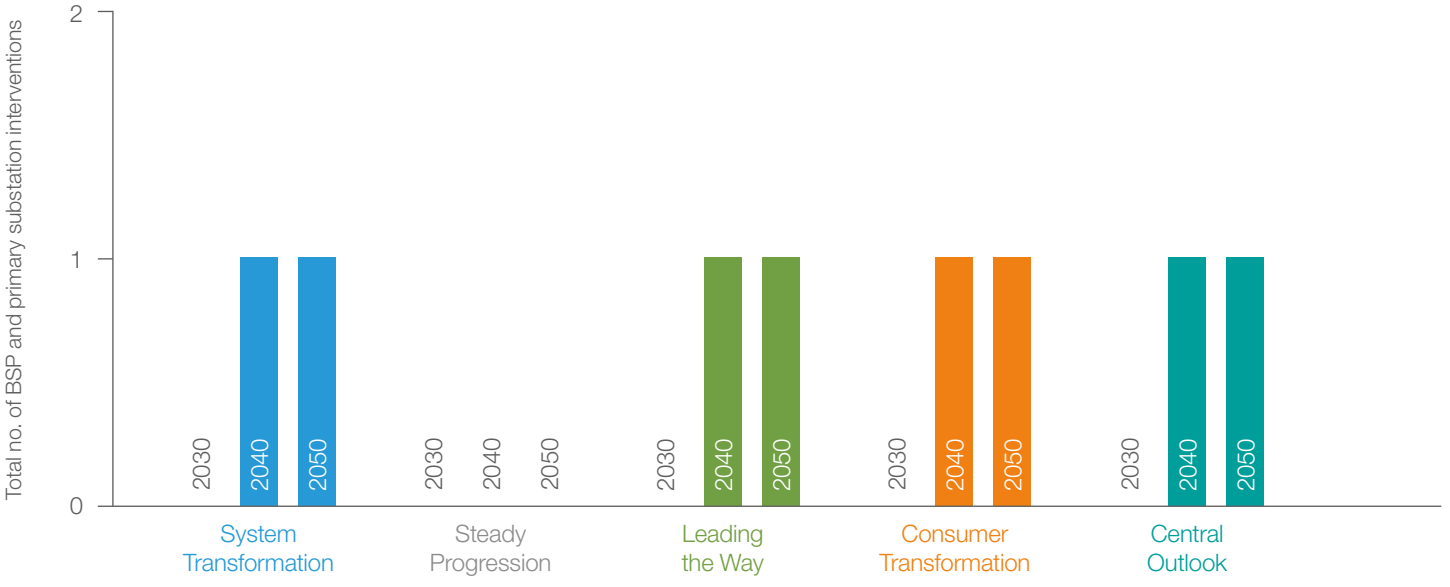
Each scenario forecasts an increase in demand and generation, with the largest increases occurring in the Consumer Transformation and Leading the Way scenarios. The forecasts show both non-inverter-based and inverter-based generation increasing from 2030-2050, the exception being the Steady Progression scenario which shows only a small increase.



Load-based interventions by scenario (2030-2040-2050)

By 2040 intervention is required at Risley under all scenarios with the exception of Steady Progression. By 2050, the Central Outlook forecast indicates an additional 8MVA of capacity will be required.

The Leading the Way and Consumer Transformation scenarios show the largest increase in demand with an additional 13MVA required by 2050.



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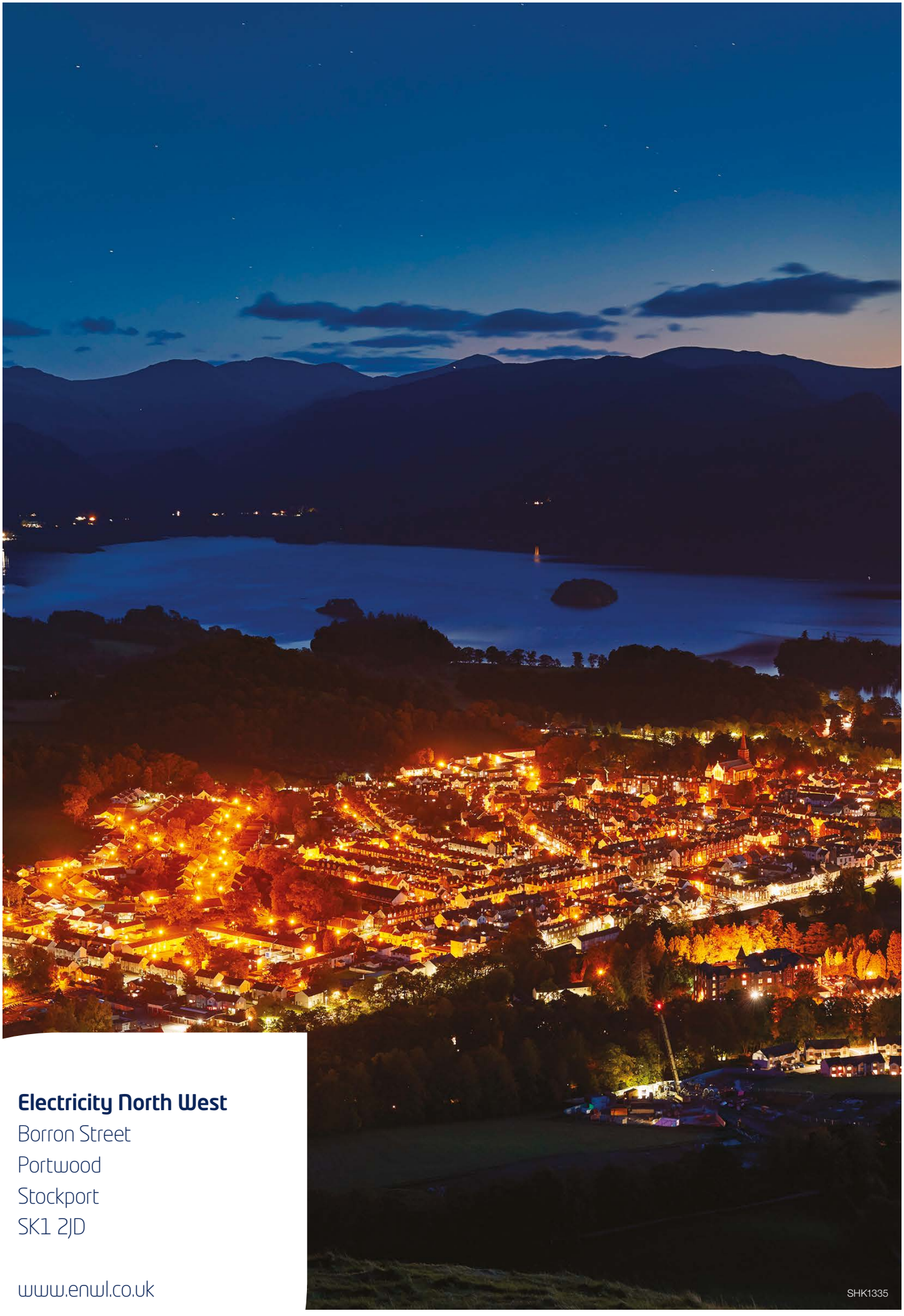

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