EALING GRID SUPPLY POINT: STRATEGIC DEVELOPMENT PLAN

Our network serving communities in West London

(Final following consultation)

November 2024

Scottish & Southern Electricity Networks

CONTENTS

1. Executive Summary 3
2. Introduction 7
3. Stakeholder engagement and whole system considerations 9
  3.1. Local Authorities and Local Area Energy Planning 9
    3.1.1. Greater London Authority 9
    3.1.2. Ealing Council 10
    3.1.3. London Borough of Hounslow 10
  3.2. Whole system considerations 10
    3.2.1. West London Capacity Constraints 10
  3.3. Flexibility considerations 11
4. Existing network infrastructure 12
  4.1. Current network arrangements 12
5. Future electricity load at Ealing GSP 14
  5.1. Distributed Energy Resource 14
  5.2. Transport electrification 15
  5.3. Electrification of heat 16
  5.4. New building developments 17
  5.5. Commercial and industrial electrification 18
6. Projects in progress 19
  6.1. Network schematic (following completion of above works) 20
7. Spatial plans of future System needs 21
  7.1. Extra High Voltage / High Voltage spatial plans for system needs 21
  7.2. HV/LV system need spatial plans 26
8. Specific system needs and options to resolve 30
  8.1. Overall dependencies, risks, and mitigations 30
  8.2. Future EHV system needs to 2040. 31
    8.2.1. Future system strategy: rationalisation of non-standard voltage levels (22kV network) 32
    8.2.2. Future system strategy: potential new primary substation 32
  8.3. Future EHV system needs to 2050. 32
  8.4. Future requirements of the High Voltage and Low Voltage Networks 34
    8.4.1. High Voltage networks 34
    8.4.2. Low Voltage networks 35
9. Recommendations 37

1. EXECUTIVE SUMMARY

SSEN is taking a strategic approach in the development of its distribution networks. This will enable Net Zero at a local level to the homes, businesses, and communities we serve. Our Strategic Development Plans provide a blueprint of long-term electricity system needs that allow us to work with other stakeholders to design and build the local markets and networks they need to decarbonise their power needs.

Strategic Development Plans take the feedback we have received from stakeholders on their future energy needs through to 2050 and translate these requirements into strategic spatial plans of the future distribution network needs of the future. Increasingly this includes insights provided through Local Area Energy Plans (LAEPs)

These strategic spatial plans help us transparently present our future conceptual plans and facilitate discussion with Local Authorities and other stakeholders on how these can be translated in the local power systems of the future. To that end, these are living plans that we will update annually reflecting changes from our updated DFES as well as insights gathered from local stakeholders.

These plans become blueprints for our future plans which are endorsed and supported by local stakeholders. They can help streamline the planning of complex work programmes through accounting for local factors and requirements. On an annual basis, or as parties seek to connect or change their power use, we will use the Strategic Development Plans to guide our more detailed development works through the Distribution Network Options Assessment (DNOA)[1] process. We need additional capacity to be delivered ahead of need and typically we would look at detailed development through the DNOA process up to seven years ahead of need. Through this approach we ensure that our projects and flexibility opportunities are developed as part of an overall strategic design of our networks.

This Strategic Development Plan contains a number of recommended interventions that we believe need to be progressed through the DNOA process imminently. These will be further developed in 2024, and the detailed project proposals published in a forthcoming DNOA outcomes report. This report will also provide context on timescale for delivery of infrastructure works or use of flexibility services.

1 Earlier this year we published our first Distribution Network Options Assessment (DNOA) methodology describing how we are making transparent decisions over flexibility and network investment options. The DNOA methodology forms a key component of our Net Zero strategic planning process. SSEN DNOA Methodology March 2024

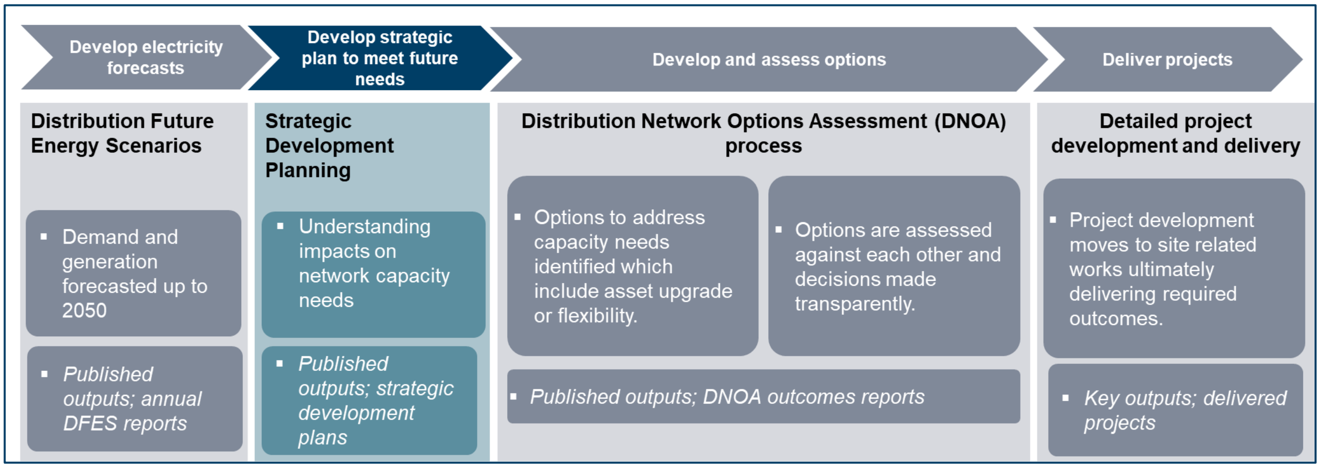


Figure 1 Overview of how Strategic Development Plans fit into SSEN's strategic planning process.

Our overall strategic planning process is summarised above. We adopt a neutral facilitator role throughout our strategic planning process exploring flexibility options alongside network investment needs. Flexibility is a key component in the transition to Net Zero both assisting in earlier connection of customers as well as helping to optimise timing decisions around future investment needs.

We operate our local networks across a range of differing voltage levels as power is transformed down to reach individual homes and businesses. This Strategic Development Plan considers networks at all these voltage levels and is tailored to the specific needs of each type recognising their different challenges.

This report focuses on the area of West London covered by Ealing grid supply point. The specific geographic area is shown in Figure 2 below and covers part of the local authority areas of Ealing and Hounslow. It is predominately urban and so relies (almost entirely) on underground cables to provide electrical supplies.

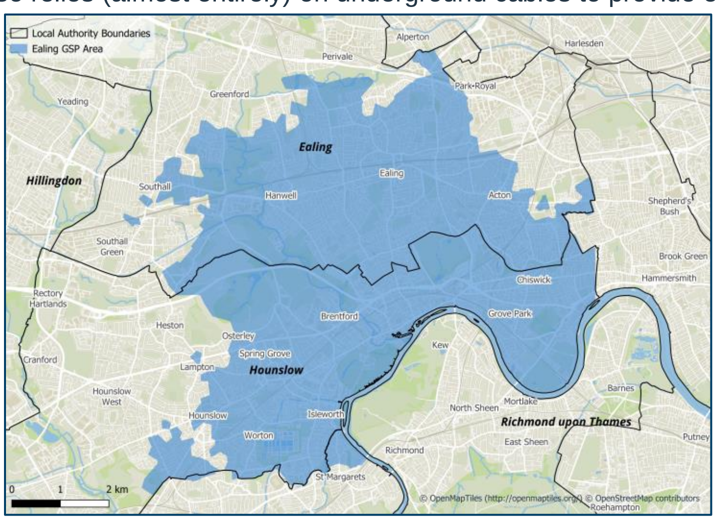


Figure 2 Geographic area covered by this report.

In the report we provide an overview of:

- The future demand and generation requirements for the Ealing GSP area
- The impact of these requirements on our electricity networks
- Proposed activities to resolve the system needs highlighted in the spatial plans.

The future demand and generation requirements for the Ealing GSP area. Much of this information is drawn from our work with Regen[2] to develop the 2022 DFES. However, we also consider additional information from connection request activities in the area and local stakeholder insight. Local Energy Net Zero Accelerator (LENZA)[3] is currently being rolled out to local authorities within SSEN's licence areas to assist with Local Area Energy Planning (LAEP) to feedback stakeholder insights to SSEN.

The impacts of these requirements on our electricity networks. We describe how future requirements affect both our higher voltage networks and also the lower voltage circuits feeding individual homes and businesses. From this we develop spatial plans of future network needs at key time intervals through to 2050.

The 2050 spatial plan for our extra high voltage (EHV) system needs is shown below in Figure 3. This shows how our planned works in these areas, as described in our recent DNOA outcomes publication[4] are supporting the transition to Net Zero by releasing significant additional capacity[5]. Areas such as Copley Dene and Brentford need capacity in the longer term, and we will work with stakeholders to take a strategic view of these future needs also considering how they interact with the neighbouring needs in Ironbridge and Southfield Road.

The 2050 spatial plan for our high voltage and low voltage (HV/LV) system needs is shown in Figure 4. This plan shows the specific load driven requirements of different local communities and a need to take a bespoke approach to reinforcement of these networks and/or use of flexibility. However, there is a clear volume driver for this work to ensure we are building the capacity for our customers in our Ealing GSP supply area to decarbonise.

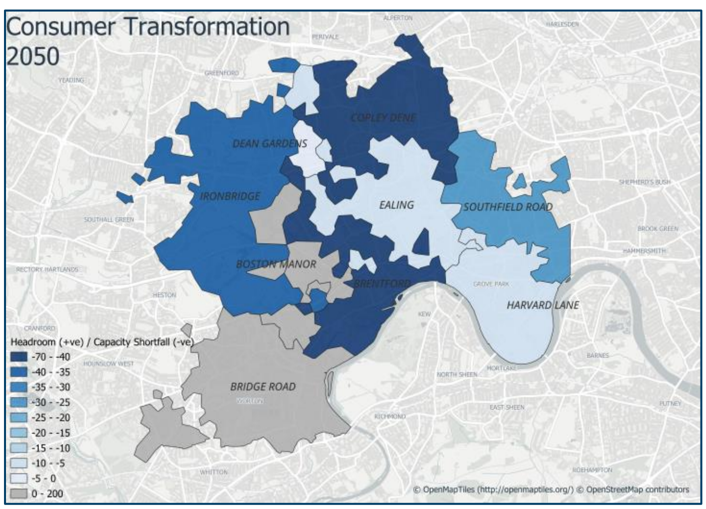


Figure 3 Ealing Consumer Transformation 2050 EHV/HV system needs spatial plan.

---

2 Home - Regen

3 https://www.ssen.co.uk/our-services/tools-and-maps/lenza/

4 ssen-dnoa-outcome-reports-march-24.pdf

5 Please note that whilst EHV capacity may be available, there may be issues at other voltage levels. Please contact our Connections team for specific advice on a potential development.

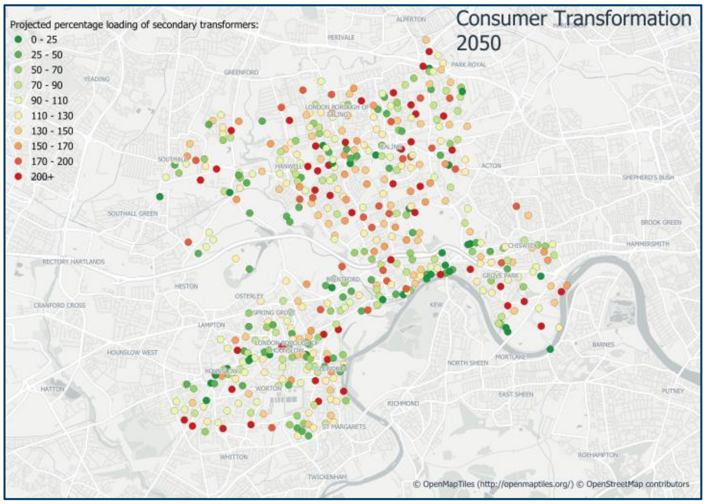


Figure 4 Ealing 2050 HV/LV system needs spatial plan.

Proposed activities to resolve the system needs highlighted in the spatial plans. An overview of work that we have already progressed through the DNOA process and initial proposals for projects that we recommend are developed further through the DNOA process. These are generally projects that we believe are needed within the next seven years. We also provide outline thoughts on longer term needs to 2050 with a view to further discussions with key local stakeholders such as Local Authorities.

The pathways to decarbonisation and Net Zero are not always clear and our use of four DFES backgrounds in the report recognises these future uncertainties. Whilst the Ealing strategic development plan provides a best view of both our spatial needs and required activities, this is subject to change. This plan is therefore a living document that we will update annually reflecting changes from our updated DFES as well as insights gathered from local stakeholders.

2. INTRODUCTION

SSEN is taking a strategic approach in the development of its distribution networks. This will enable Net Zero at a local level to the homes, businesses, and communities we serve. Our Strategic Development Plans provide a blueprint of long-term electricity system needs that allow us to work with other stakeholders to design and build the local markets and networks they need to decarbonise their power needs. Further information about our strategic development plans can be found in our Methodology on our **DSO Consultation Library.**

This Strategic Development Plan summarises how local, regional, and national targets link with other stakeholder views in the area to provide a robust evidence base for load growth out to 2050 across the Ealing Grid Supply Point (GSP) area. A GSP is an interface point with the national transmission system where SSEN then take power to local homes and businesses within a geographic area. Context for the area this represents is shown above in **Figure 2**. This Ealing Strategic Development Plan has been consulted on prior to publication to ensure it is supported by our stakeholders and informed by their insights. A summary of feedback that has been incorporated into this final document can be found in Appendix C.

To identify the future requirements of the electricity network, SSEN commission Regen to produce the annual Distribution Future Energy Scenarios (DFES). The DFES analysis is derived from the Electricity System Operator (ESO) Future Energy Scenarios (FES) while accounting for more granular stakeholder insights such as local authorities' Local Plans and related development strategies and new demand and generation connection applications. The DFES provides a forward-looking view of how demand and generation may evolve under four different scenarios as we move towards the national 2050 Net Zero target. These scenarios are summarized in Figure 5. SSEN use Consumer Transformation as the central case scenario following stakeholder feedback during the RIIO-ED2 development process. This position is reviewed annually.

We have seen significant customer connection requests across Ealing GSP. Where this demand has not been captured in the DFES we have considered this to ensure that the projected load more accurately reflects what we expect to see in the future.

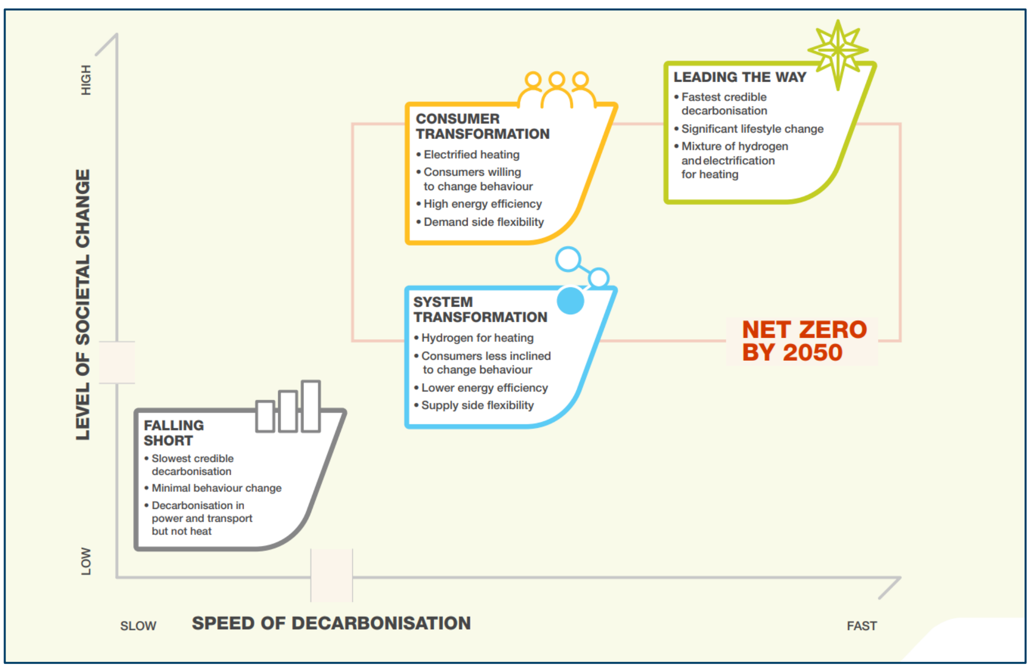


Figure 5 The 4 Future Energy Scenarios adopted for the DFES. ***Source: ESO FES***

Using the DFES, power system analysis has been carried out to identify the future system needs of the electricity network. These needs are summarized by highlighting the year the need is identified under each of the four scenarios, and the projected 2050 load. Here, system needs are identified through power system analysis using the Consumer Transformation scenario. We also model across the other three scenarios to understand when these needs arise and what demand projections should be planned for in the event each of these scenarios is realised.

The DNOA process will provide more detailed optioneering for each of these reinforcements, improving stakeholder visibility of the strategic planning process. Opportunities for procurement of flexibility will also be highlighted in the DNOA, to cultivate the flexibility markets, and to align with SSEN's flexibility first approach.

In the face of the increasing costs of fossil fuels, it has never been more important to ensure that everyone who wishes to adopt clean, electrified technologies can do so. SSEN is committed to supporting a just transition to Net Zero. To do this SSEN is working to identify consumers in vulnerable positions and forecast how those communities and their needs may change in the transition to Net Zero. Going forwards we will leverage our work on the VFES (Vulnerability Future Energy Scenarios) to better forecast impacts on vulnerable customers and how we can ensure they do not miss out on the ability to access low-carbon technologies.

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The main local authorities that are supplied by Ealing GSP are Ealing and Hounslow Borough councils, as shown in **Figure 6.**[6] SSEN also engage extensively with the Greater London Authority (GLA) on developments across West London. The local area energy plans (LAEPs) and development strategies for these local authorities will have a significant impact on the potential future electricity load growth on SSEN's distribution network. As such, it is vital for SSEN to engage with these plans when carrying out strategic network investment.

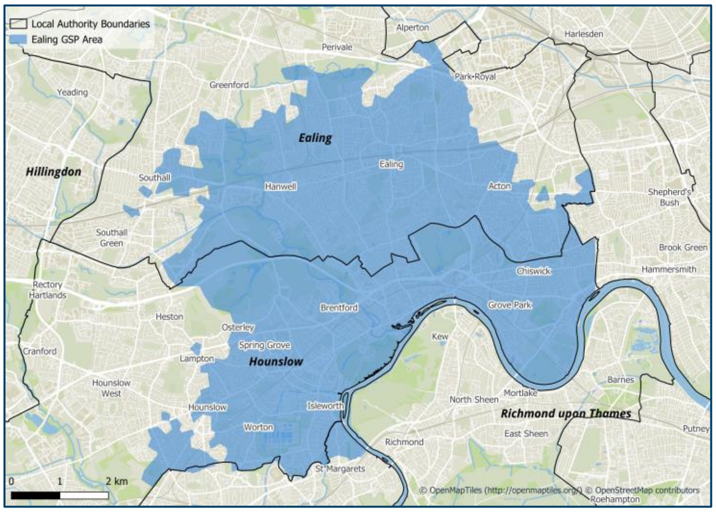


Figure 6 Ealing GSP Supply Area and Local Authority Boundaries

3.1.1. Greater London Authority

The Mayor of London targets for the city to be zero-carbon by 2030, following an 'Accelerated Green pathway'[7] which emphasizes improved energy efficiency, electrification of heating, district heat networks, reduction in car travel, and phaseout of fossil fuel powered transport.

The Greater London Authority's (GLA's) 2021 London Plan[8] sets out the strategic direction of economic, social, and environmental development across the city. Sustainable modes of transport and sufficient electricity infrastructure to power heat and transport have been noted as priorities. In addition to net zero pathways, wider development activities are likely to impact load on the electricity system. Southall and the Great West Corridor (just west of Chiswick) have been identified as Opportunity Areas that have significant potential to contribute to London's forecast homes and jobs needs; Ealing and Hounslow's 10-year housing targets (to 2028/2029) are 21,570 and 17,820 units, respectively. There are also several identified Strategic Industrial Locations across the two boroughs.

---

6 Marginal areas within Richmond upon Thames, Hammersmith and Fulham, and the Old Oak and Park Royal Development Corporation are also supplied by Ealing GSP.

7 Pathways to Net Zero Carbon by 2030 | London City Hall

8 the_london_plan_2021.pdf

The GLA funded Phase One of a west London subregional Local Area Energy Plan (LAEP)[9], which some of the underlying boroughs are now progressing into Phase Two. New homes and commercial floorspace, heat pumps, electric vehicles, and data centres are highlighted as key sectors of growing electricity load across the subregion. Deep and shallow retrofit scenarios to improve energy efficiency along with expanded solar PV generation are also explored.

3.1.2. Ealing Council

Over the past decade (2011 to 2021) the population of Ealing increased by 8.5% to approximately 367,100.[10] The borough is strategically placed with Heathrow Airport to the West and the new High Speed 2 (HS2) terminus at Old Oak Common opening in 2030 to the North-East of the borough. Five new Elizabeth Line stations opened across the borough in 2022 in addition to the existing underground and mainline stations.
Ealing Council have published multiple action plans and strategies highlighting their Net Zero ambitions, including their target to become carbon neutral by 2030.[11]

3.1.3. London Borough of Hounslow

As observed in Ealing, the population of Hounslow has increased significantly over the past decade. Between the last two censuses (2011 and 2021), the population of Hounslow increased by 13.5% to around 288,200 in 2021.[12] Hounslow Council adopted their most recent Local Plan in 2015, which will form part of the Borough's planning framework until 2030. As with all Local Plans across London Boroughs, it follows the key policy requirements set out in both the National Planning Policy Framework (NPPF), and the London Plan. Key policy requirements from these plans will impact SSEN's Electricity Network.[13] In addition to the Local Plan, Hounslow Council have published a Climate Action Plan further demonstrating local ambition, showing the Council is committed to reducing carbon emissions to net zero by 2030 across its own operations whilst influencing a wider borough emission reduction.[14] In November 2022, Hounslow approved a strategy which aims to deliver over 2,000 new charge points across the borough, providing a range of different charge point types, with the aim of delivering a good minimum level of service for all residents and businesses.[15]

3.2. Whole system considerations

3.2.1. West London Capacity Constraints

The west London electricity capacity constraints are well known and understood[10]. Over the past few years, there has been a steep increase in the number of new electricity connection requests across West London, driven by new housing developments, commercial investment and datacentres. In response, we have led collaboration with NGET, NGESO, and UKPN and key stakeholder the Greater London Authority (GLA) –

---

9 West London Local Area Energy Plan.

10 Census 2021, January 2023, How life has changed in Ealing: Census 2021.

11 Ealing Council, January 2021, Climate and Ecological Emergency Strategy

12 Census 2021, January 2023, How life has changed in Hounslow: Census 2021.

13 London Borough of Hounslow, 2015, Local Plan 2015 to 2030 volume one.

14 London Borough of Hounslow, 2023, Climate Emergency Action Plan Annual Report 2023.

15 London Borough of Hounslow, 2022, Hounslow Electric Vehicle Charging Strategy (link)

supported by Ofgem – that has aimed to provide solutions to the constraints highlighted above. SSEN has provided some immediate solutions in West London[16].

Following this, a total of 10.5MVA of demand capacity is now being provided through ramped connections solutions. This has enabled, 7,800 new homes to be unlocked through GLA support and introduction of the 1MVA ramping solution (as of March 2024). This includes how flexibility services can be deployed to help accelerate connections.

3.3. Flexibility considerations

SSEN procures flexibility services from owners, operators, or aggregators of Distributed Energy Resources (DERs), which can be generators, storage, or demand assets. These services are needed in areas of the network which have capacity constraints at particular times or under certain circumstances. SSEN act as a neutral market facilitator, welcoming bids from all types of flexibility service provider (e.g. domestic or commercial). Information on the process for procurement are published on the Flexibility Services website and information on real time decision making on which providers are dispatched can be found in the Operational Decision-Making document.[17,18]

SSEN regularly recruits new Flexibility Services providers and increases the procured Flexibility Services with the latest bidding round for long term requirements held in August 2024 and recruitment through the Mini-Competition process in October 2024.[17] These have offered an opportunity for all potential providers of flexibility within our licence areas to come forwards (with a capacity over 10kW).

In the May 2024 tender for services, a required capacity of 37MW went out to tender for 2024/25. The breakdown of this across constraint managed zones (CMZs) in the area was19:

- Ealing (E) – primary substation – Required capacity of 21MW
- Southfield Road – primary substation – Required capacity of 10MW
- Boston Manor Road – primary substation – Required capacity of 6MW.

The August 2024 long-term bidding round highlights the need for flexibility services of the same capacity and zones as above for Winter 2025/26 and Winter 2026/27.[20]

---

16 West London electricity capacity constraints, GLA; West London electricity capacity constraints | London City Hall

17 SSEN, Flexibility Services Procurement (Flexibility Services Procurement - SSEN)

18 SSEN, 02/2024, Operational Decision Making (ODM), SSEN Operational Decision Making ODM

19 SSEN, Tender for Services – May 2024 (Flexibility Services Document Library - SSEN)

20 SSEN, Tender Requirements August 2024 bidding round (Flexibility Services Document Library - SSEN).

4. EXISTING NETWORK INFRASTRUCTURE

The Ealing GSP Network is made up of 66kV, 22kV, 11kV, and LV circuits. It is an urban network located in West London where the land use is a mix of residential, commercial, and industrial with little to no agricultural land. In total the GSP supplies approximately 130,000 customers with the breakdown for each substation shown in Table 1.

Substation Name	Site Type	Number of Customers Served	2023 Substation Maximum MVA (Season)
EALING GSP	Grid Supply Point	131,516	192.3 (Winter)
EALING (D)	Bulk Supply Point	30,445	39.5 (Winter)
BOSTON MANOR	Primary Substation	4,121	25.7 (Winter)
BRENTFORD	Primary Substation	14,936	18.7 (Winter)
BRIDGE ROAD	Primary Substation	23,889	32.2 (Winter)
COPLEY DENE	Primary Substation	19,824	24.8 (Winter)
DEAN GARDENS	Primary Substation	3,101	3.9 (Winter)
EALING	Primary Substation	17,669	27.9 (Winter)
HARVARD LANE	Primary Substation	12,408	22.1 (Winter)
IRONBRIDGE	Primary Substation	14,783	22.5 (Winter)
SOUTHFIELD ROAD	Primary Substation	20,785	25.4 (Winter)

Table 1 Customer number breakdown and substation peak demand readings (2023)

4.1. Current network arrangements

The network at Ealing Grid Supply Point (GSP) is supplied form the 275kV transmission system via Super-Grid Transformers (SGTs) which transform the voltage to 66kV. This Strategic Development Plan focuses on the network supplied from Ealing GSP which supplies substations across part of West London. The local 66kV and 22kV SSEN networks are shown in geographic and schematic formats in Figures 7 and 8 respectively.

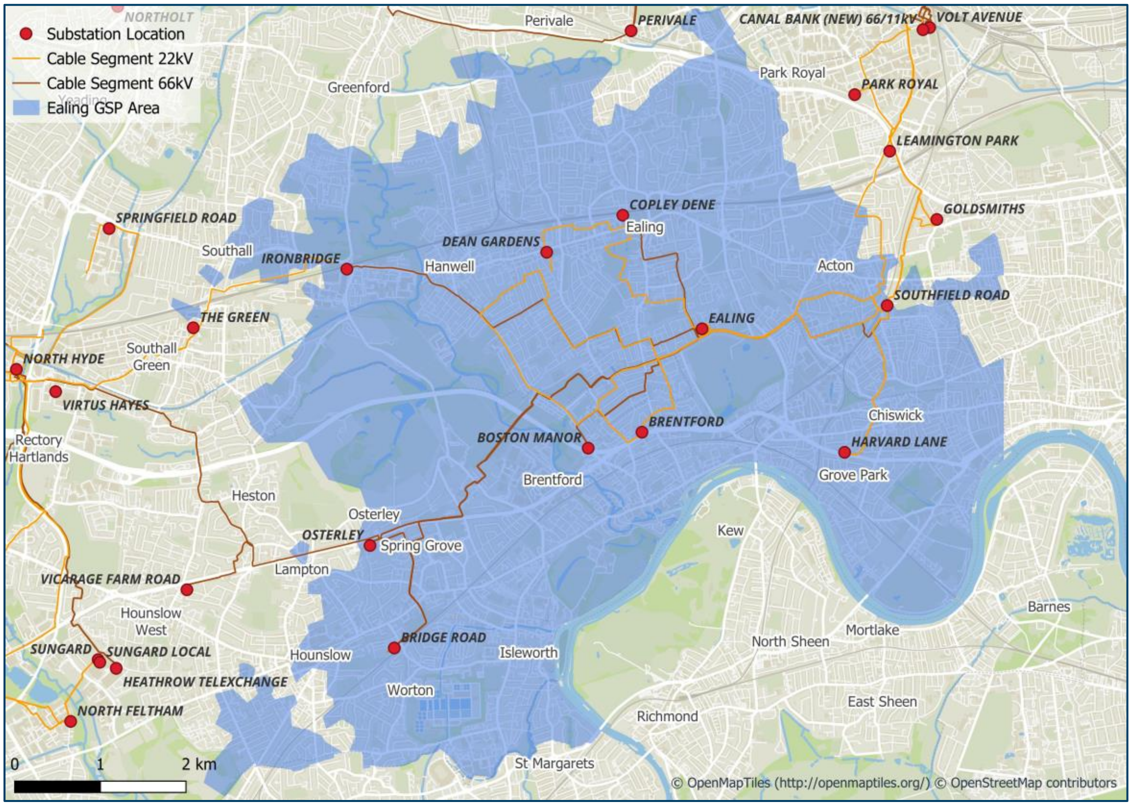


Figure 7 Ealing GSP geographic view of substation locations and Extra-High Voltage circuits.

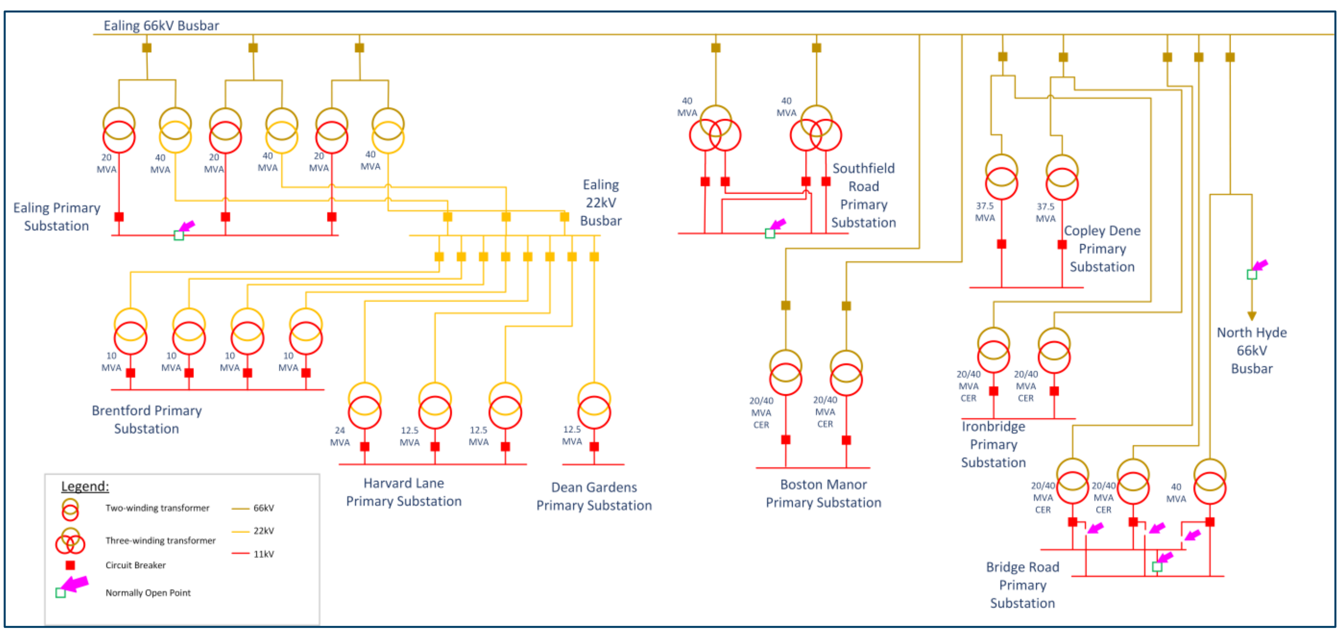


Figure 8 Ealing GSP network schematic - current running arrangement - transformer nameplate rating

5. FUTURE ELECTRICITY LOAD AT EALING GSP

The following section details load growth across the technologies projected in the Distribution Future Energy Scenarios. Where megawatt (MW) values are presented in this section, they represent ***total installed capacity.*** When conducting network studies these values are appropriately diversified to represent the coincident maximum demand of the entire system rather than the total sum of all demands. The projections presented here are the outputs from the most recent DFES 2023 analysis, it should be noted that values from the DFES 2022 were used as the basis for the power system analysis presented in later sections.[21] For future iterations of the DFES, additional work will be carried out to ensure that the demand projections are rationalised against the West London LAEP. Work is ongoing for this to be complete ahead of the 2024/25 DFES.

5.1. Distributed Energy Resource

Due to the land use and availability in the West London area, there are not any baseline or pipeline large energy generation or storage projects in the Ealing GSP area.

DFES Projections

Generation

Based on the DFES projections, under the Consumer Transformation scenario, distributed renewable generation across Ealing GSP group will increase significantly from 11.5MW in the currently connected baseline to 119MW in 2050 (as shown in Figure 9). We see decommissioning of small-scale gas and diesel generation ahead of 2035, with Solar PV accounting for the vast majority of the distributed generation from 2025 onwards.

The majority of the Solar PV forecast to connect is sized at less than 10kW (rooftop arrays), with no sites that are greater than or equal to 1MW. In the DFES projections, we also see some solar PV sized between 10kW-1MW accounting for 22MW by 2050 under the Consumer Transformation scenario. While this is projected across all building types, some of it may refer to council-owned properties, the opportunity for this has been identified by local authorities relevant to the area.

21 This is due to overlapping timescales with publication of the new DFES and production of this document. Refreshed power system analysis will be produced as part of the annual update process.

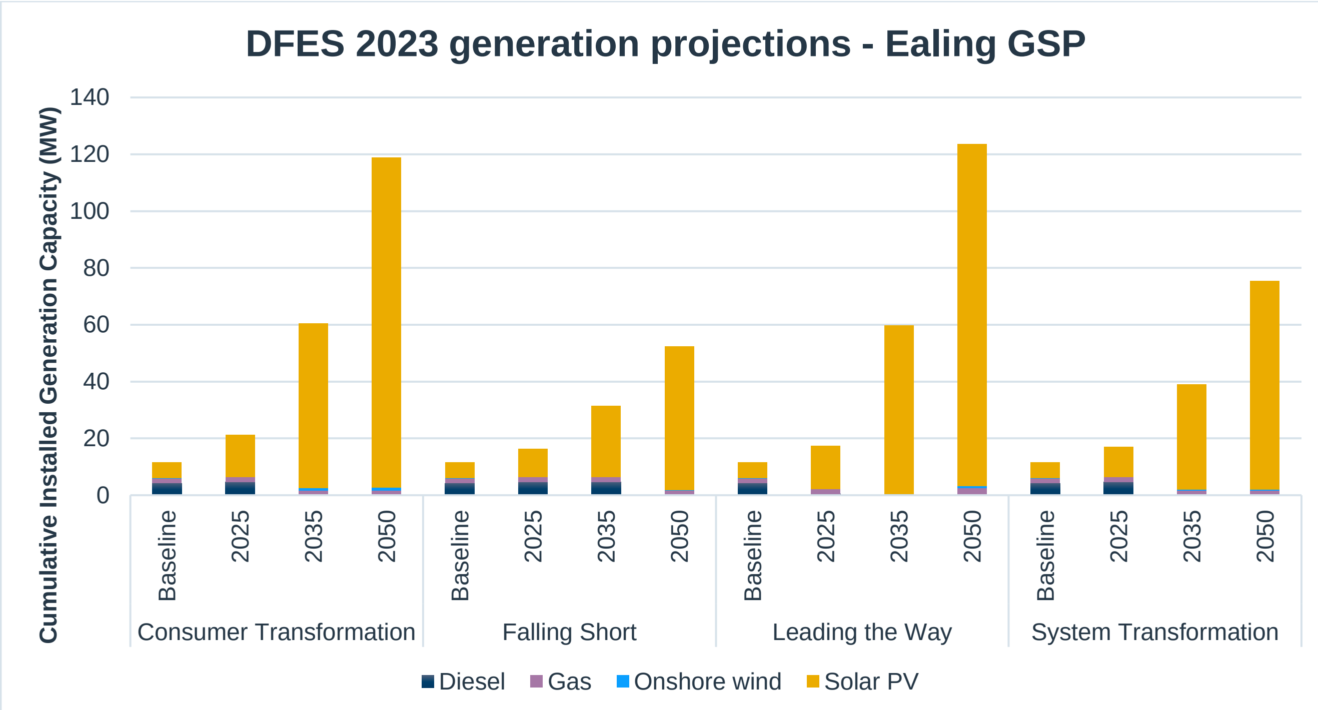


Figure 9 Projected Cumulative Distributed Generation Capacity Ealing GSP (MW). ***Source: SSEN DFES 2023***

Storage

While multiple storage technologies have projected uptake modelled in the DFES, in the Ealing GSP supply area we only see a significant increase in the installation of domestic batteries. This refers to those 1-15kW in scale, designed to enable households to increase the self-consumption of domestic solar PV, as well as acting as a backup power supply households in more rural locations. A cumulative storage capacity of approximately 36MW is projected by 2050 under the Consumer Transformation scenario.

5.2. Transport electrification

The shift to electrified transport is likely to be a large source of electricity load growth across West London and will be a key consideration for strategic planning. As introduced earlier, Ealing is near Heathrow airport and is also well serviced by underground and overground rail links. While the decarbonisation of these sites is significant on a local, regional, and national level, Ealing GSP group currently does not have any large demand connections to rail networks or Heathrow airport.

DFES Projections

SSEN's DFES analysis projects that there could be over 100,000 Electric Vehicles (EVs) and Light Goods Vehicles (LGVs) across Ealing GSP area by 2035.

As the network operator, it is important for SSEN to understand the network facing demand of EVs. To do this we can use the projected EV charger capacity (MW) from SSEN's DFES analysis. The SSEN DFES project that the total connected EV charge point capacity under Ealing GSP, excluding off-street domestic chargers, could total 104MW by 2035 (as shown in Figure 10). It is important to note that this value represents the ***total*** installed capacity and does not consider diversity. In our studies for future system needs diversity is taken into consideration so the studied capacity across Ealing GSP is not equivalent to 104MW.

The uptake of domestic off-street chargers follows a similar trend. By 2035, there could be 49,700 domestic off-street chargers installed under Ealing GSP with this increasing to approximately 53,500 by 2050.

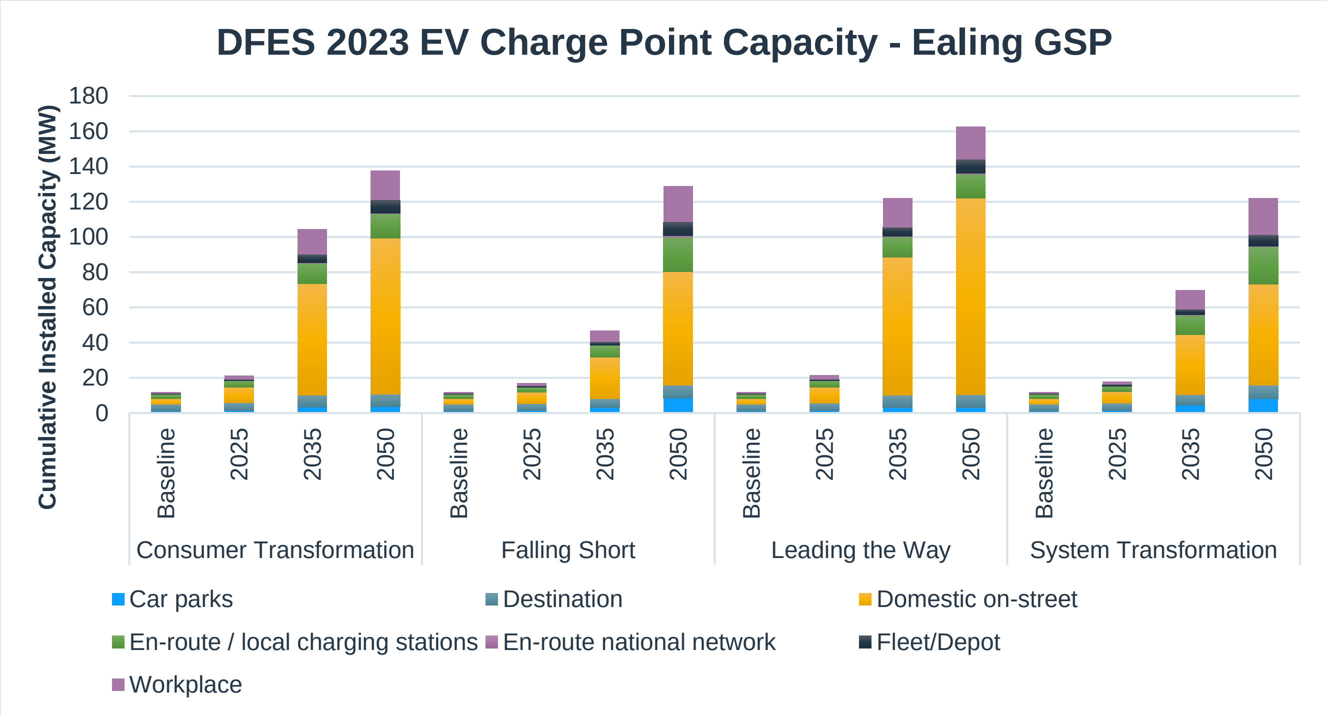


Figure 10 Projected EV Charge Point Capacity across Ealing GSP group. ***Source: SSEN DFES 2023***

5.3. Electrification of heat

The decarbonisation of space heating technologies in homes and businesses will have a significant impact on the future energy system. Currently, across Ealing and Hounslow, central heating is over 70% attributable to mains gas only.[22] Government legislation and consumer behaviour are just two of many factors that will impact the future electricity demand arising from space heating.

Engagement with the Greater London Authority (GLA) has informed SSEN that there are aspirations for the development of heat networks across the West London area. Viable sites have been identified through the West London Local Area Energy Plan (LAEP) and are emerging through Department for Energy Security and Net Zero (DESNZ) national heat network zoning. These will be incorporated into the 2024/25 DFES where available and form part of future Strategic Development Plans.

Currently, the presence of heat networks is considered through the DFES analysis using heat network project pipelines[23] in the near term and DESNZ opportunity areas for district heating networks[24] in the longer term. This is aligned to targets for heat networks to serve 20% of domestic heating by 2050. This impacts the projections through a decrease in the number of standalone heat pumps in the DFES across dense urban areas (for example Ealing). While heat networks do not have a standalone technology projection in the current DFES, this will be carefully considered with the possibility of inclusion in further iterations.

22 Census 2021, January 2023, Central Heating.

23 Heat networks pipelines - GOV.UK (www.gov.uk)

24 Opportunity areas for district heating networks in the UK: second National Comprehensive Assessment - GOV.UK (www.gov.uk)

DFES Projections

Under the Consumer Transformation scenario, we see an increase from a baseline of 908 heat pumps to 90,611 by 2050 connected to the network under Ealing GSP (as shown in Figure 11). This will contribute towards GLA targets. In dense urban areas like West London, we also see an increased uptake of AC units due to the urban heat island effect. Other factors like population density and affluence also contribute towards the 82,800 air conditioning units projected in Ealing by 2050.

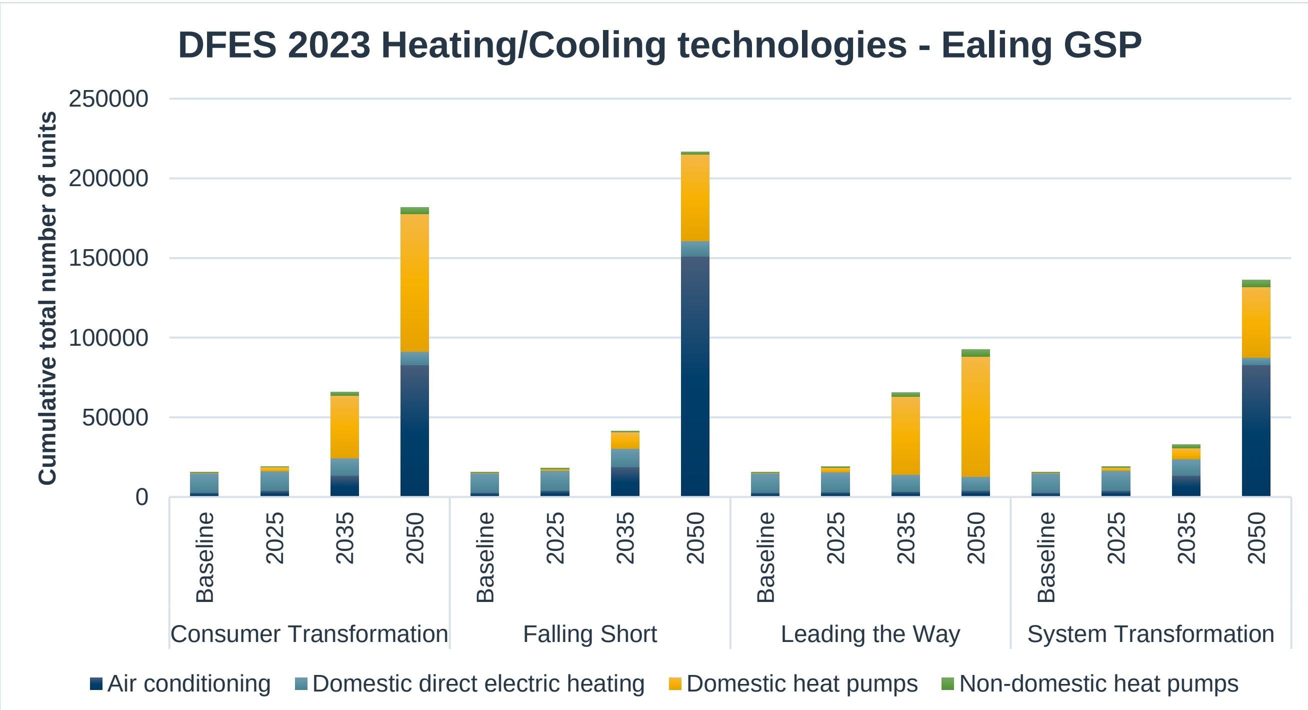


Figure 11 Projected number of Heat Pumps across Ealing GSP group. *Source: SSEN DFES 2023*

5.4. New building developments

To produce the SSEN DFES, Regen undertook engagement with local authorities to understand local authority development plans across our licence areas.

DFES Projections

For Ealing GSP supply area 14,903 new homes are projected by 2050 under the Consumer Transformation scenario.

In addition to domestic development, the DFES also projects the cumulative floorspace of non-domestic new developments. Figure 12 shows that the two building classifications contributing to the largest floorspace growth are factory and warehouse developments, and new office space.

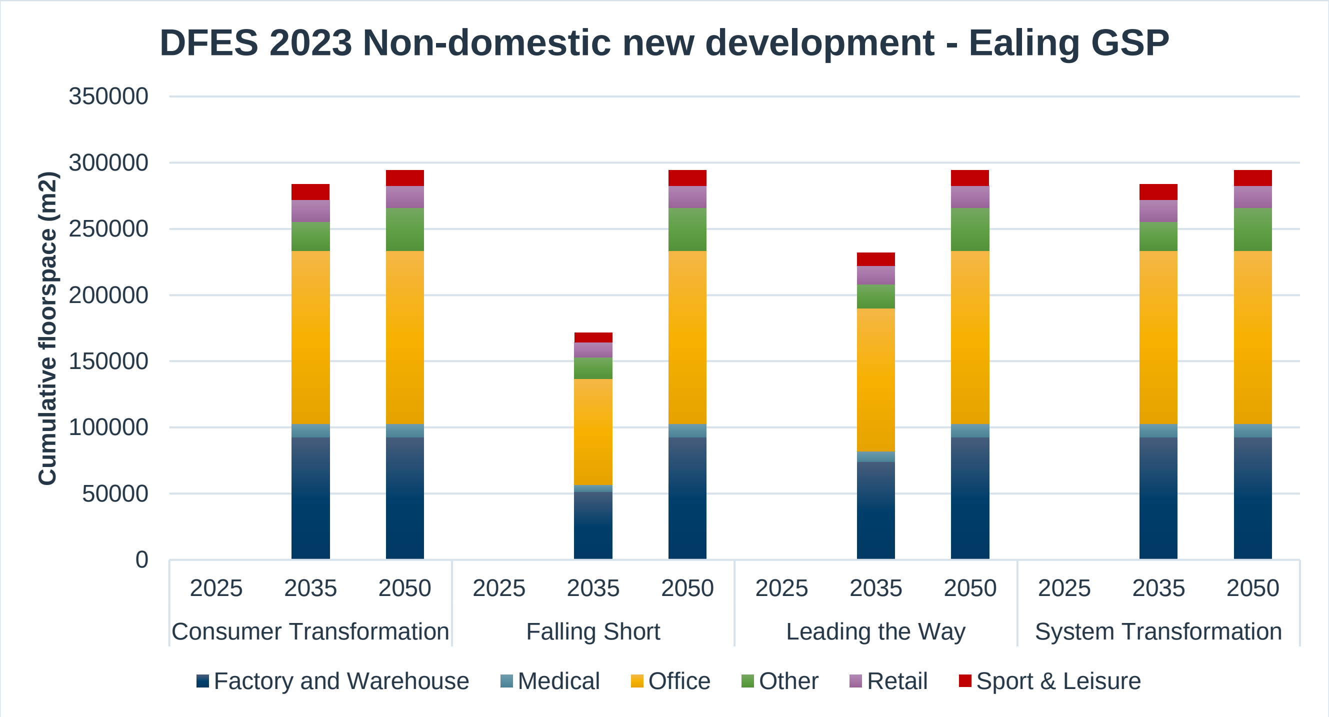


Figure 12 Projected new non-domestic development across Ealing GSP. *Source: SSEN DFES 2023*

5.5. Commercial and industrial electrification

Data Centres

As highlighted in the west London capacity constraints section, growth of data centre demand across West London has resulted in capacity constraints. A recent report by CBRE indicates that demand for data centre space in London remains strong, though a lack of power available power in London remains an inhibitor to growth.[25]

Data centre projects may be held up based on constraints on National Grid Electricity Transmission's (NGET) network and therefore subject to the outcome of a modification application process. Additionally, Data Centre customers applying for connections at Ealing GSP may also be dependent on Ealing 66kV fault level works. Over the last 5 years, there have been multiple requests to SSEN from data centres that want to connect at Ealing GSP however, none of these offers have been accepted or progressed any further.

We have added a building block for data centres in our DFES analysis to allow improved forecasting of future growth. Whilst this is helpful in forecasting future potential, the relative size of connection required by data centres means it is critical to understand their likely specific connection points. We are looking to enhance our forecasting of larger demand users going forwards and will work with stakeholders to develop this methodology.

25 CBRE UK, 2023, UK Real Estate Market Outlook 2024: Chapter 17 Data Centres

6. PROJECTS IN PROGRESS

Network interventions can be caused by a variety of different drivers. Examples of common drivers are load-related growth, specific customer connections, and asset health. Across Ealing GSP these drivers have already triggered network interventions that have now progressed to detailed design and delivery. For this report, these works are assumed to be complete, with any resulting increase in capacity considered to be released. An index to the relevant DNOA outcome reports for these works can be found in Appendix B.

The summary of existing works shown below:

Substation	Description	Driver	Forecast completion[26]	Fully resolves future strategic needs to 2050?
Ealing 22kV	Fault Level Reinforcement of 22kV Circuit Breakers	DNOA process	2028	N/A
Ealing 66kV	Fault Level Reinforcement of 66kV Circuit Breakers	DNOA process	2028	✓
Harvard Lane	Network Rearrangement and 2 x transformer replacement	DNOA process	2028	✗
Ealing 11kV	3 x 66/11kV Transformer Replacement	Customer Connection	2027	✗
Southfield Road	2 x 66/11kV Transformer Replacement	Customer Connection	2026	✗
Boston Manor	2 x 66/11kV Transformer Replacement	Customer Connection	2028	✓
Brentford	4 x 22/11kV Transformer Replacement	Customer Connection	2027	✗
Copley Dene	2 x 66/11kV Transformer Replacement	DNOA process	2027	✗
Bridge Road	3 x 66/11kV Transformer Replacement	DNOA process	2028	✓

Table 2 Works already triggered through customer connections and the DNOA process.

Where the above works are marked as not providing sufficient capacity for 2050 peak demands, it is important to note that this relates to the individual primary substation's firm capacity. When considering the further works identified in this report, the holistic plans provide capacity across the GSP for 2050.

26 These dates are best view at the time of publication and subject to change during the delivery process.

Alongside these asset solutions being deployed, flexibility solutions are also being used to release additional capacity. For example, flexibility is being utilised at Harvard Lane to efficiently create additional capacity ahead of network investment (details of this scheme presented in appendix B).

6.1. Network schematic (following completion of above works)

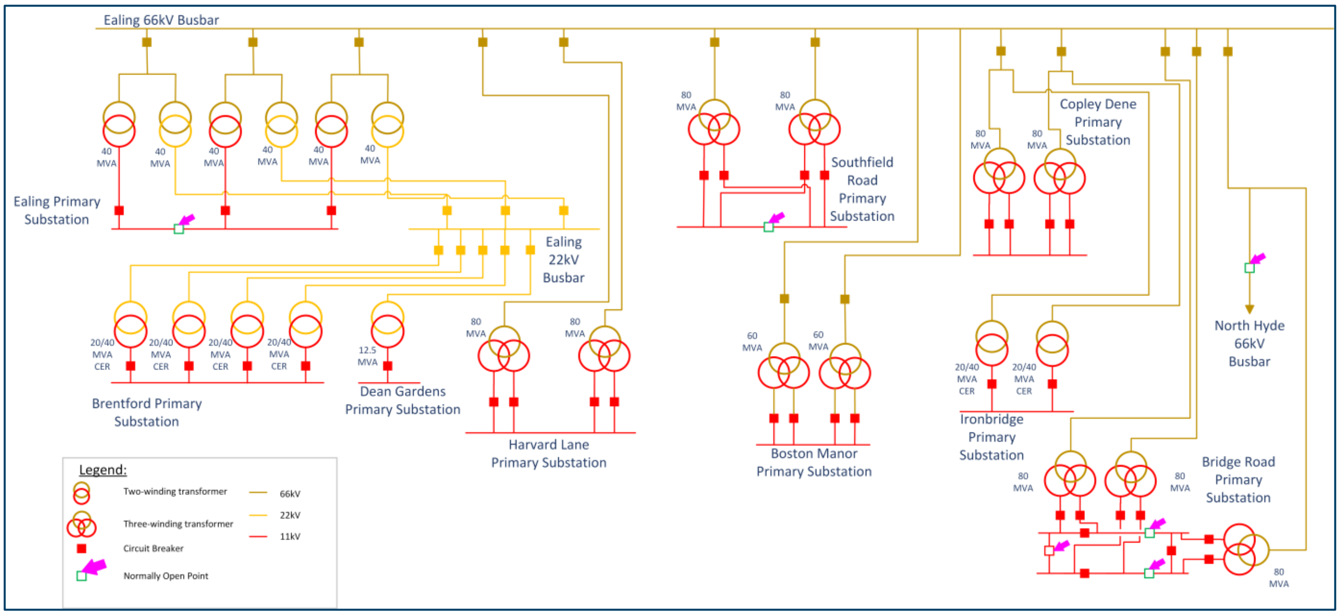


Figure 13 Ealing GSP network schematic – following completion of triggered works – transformer nameplate ratings.

7. SPATIAL PLANS OF FUTURE SYSTEM NEEDS

The previous section summarised Ealing GSP's forecast future demand and generation requirements. We have used this information to understand what this means for the local networks in Ealing. Initially this is developed through the creation of a spatial plan of future system needs.

We have created spatial plans at a primary substation level (66/11kV or 22/11kV) and secondary substation level (11kV/LV). Snapshots are provided for 2028, 2033, 2040, and 2050 enabling clear visualisation of future system needs beyond the network capacity following completion of triggered works. Plans are based on the projections across all four scenarios from the DFES 2022 analysis.

7.1. Extra High Voltage / High Voltage spatial plans for system needs

The following four figures show the projected headroom or capacity shortfall across the illustrative primary supply areas. This is calculated by comparing the firm capacity of the site with the projected demand at that site. Negative values indicate a shortfall in capacity, positive values indicate headroom.

As shown in the legend, greyed out areas indicate that there is projected headroom in mega-Volt-amperes (MVA) at the site, while the shades of blue reflect the magnitude of the capacity shortfall. Darker blue indicates a larger capacity shortfall (more negative value). These are presented for each of the four DFES scenarios to understand how the projected availability of network capacity changes under each of these scenarios. It should be noted that the network scenario headroom report accounts for triggered works up to the point of publication (May 2024) additional works triggered following this date may not have the new firm capacity captured. The purpose of these figures is simply to highlight the areas that SSEN need to deploy a solution to resolve the capacity need, and how these areas relate to one another geographically.

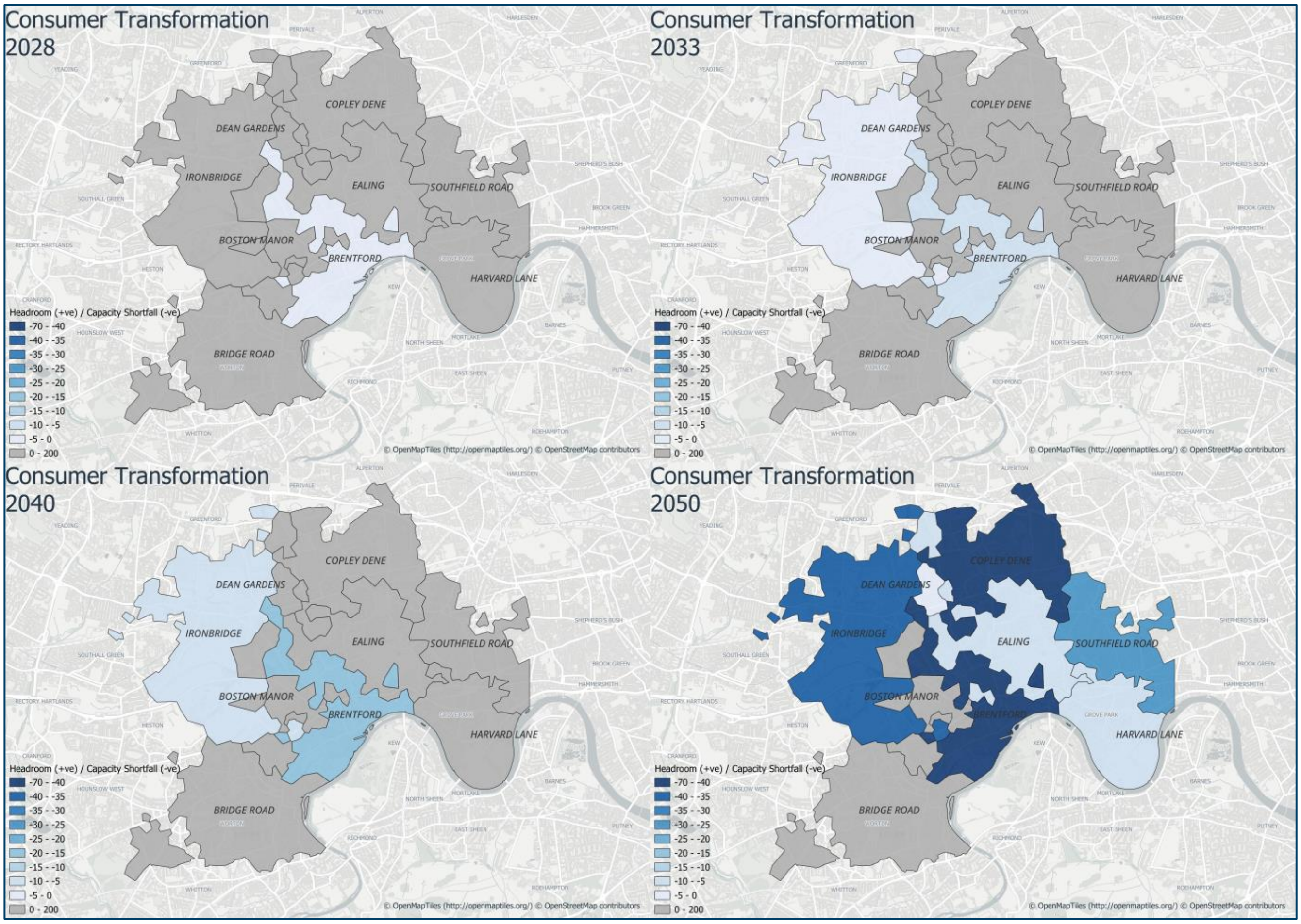


Figure 14 Ealing EHV/HV system need spatial plans under the Consumer Transformation scenario for 2028, 2033, 2040, and 2050.

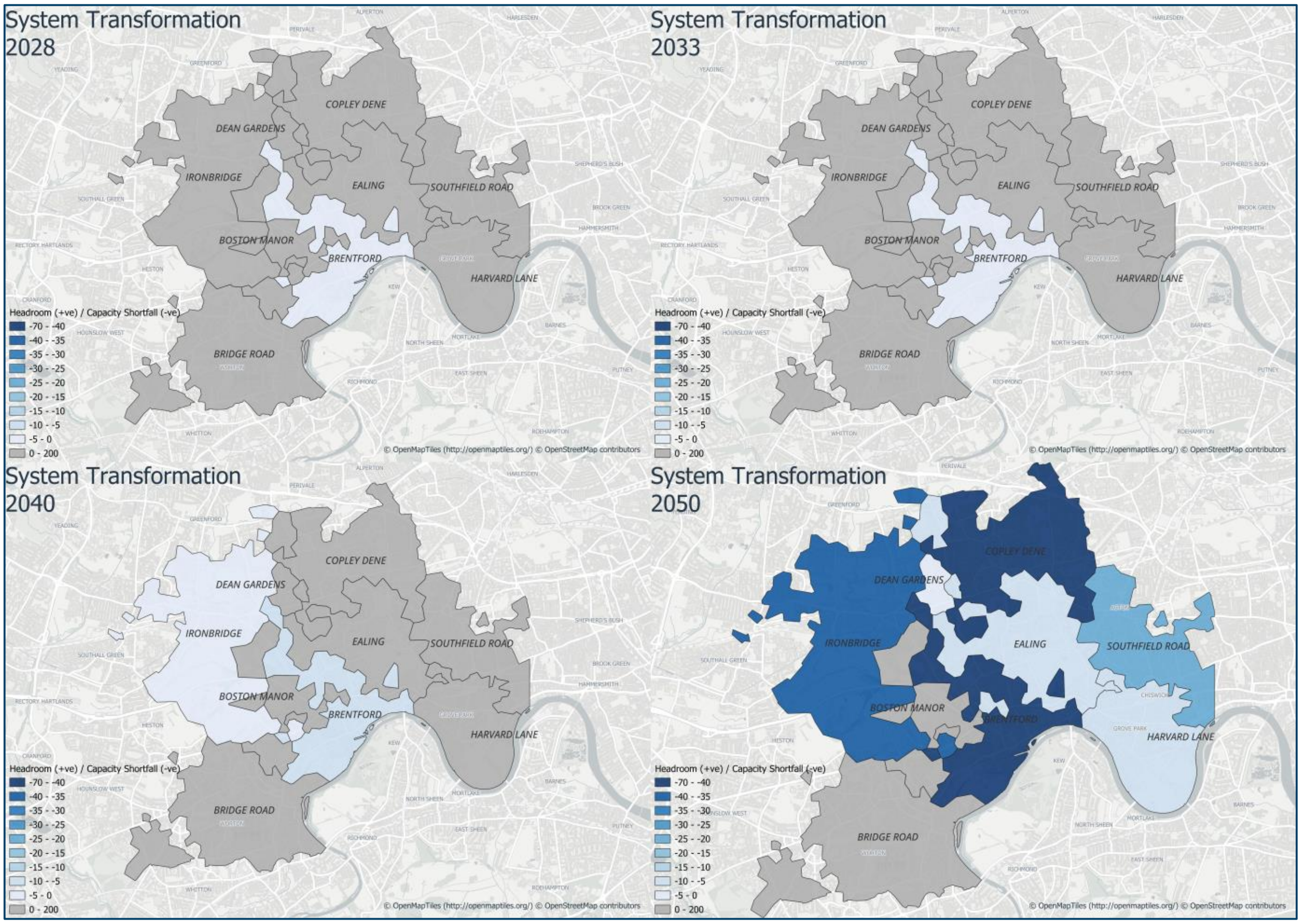


Figure 15 Ealing EHV/HV system need spatial plans under the System Transformation scenario for 2028, 2033, and 2050.

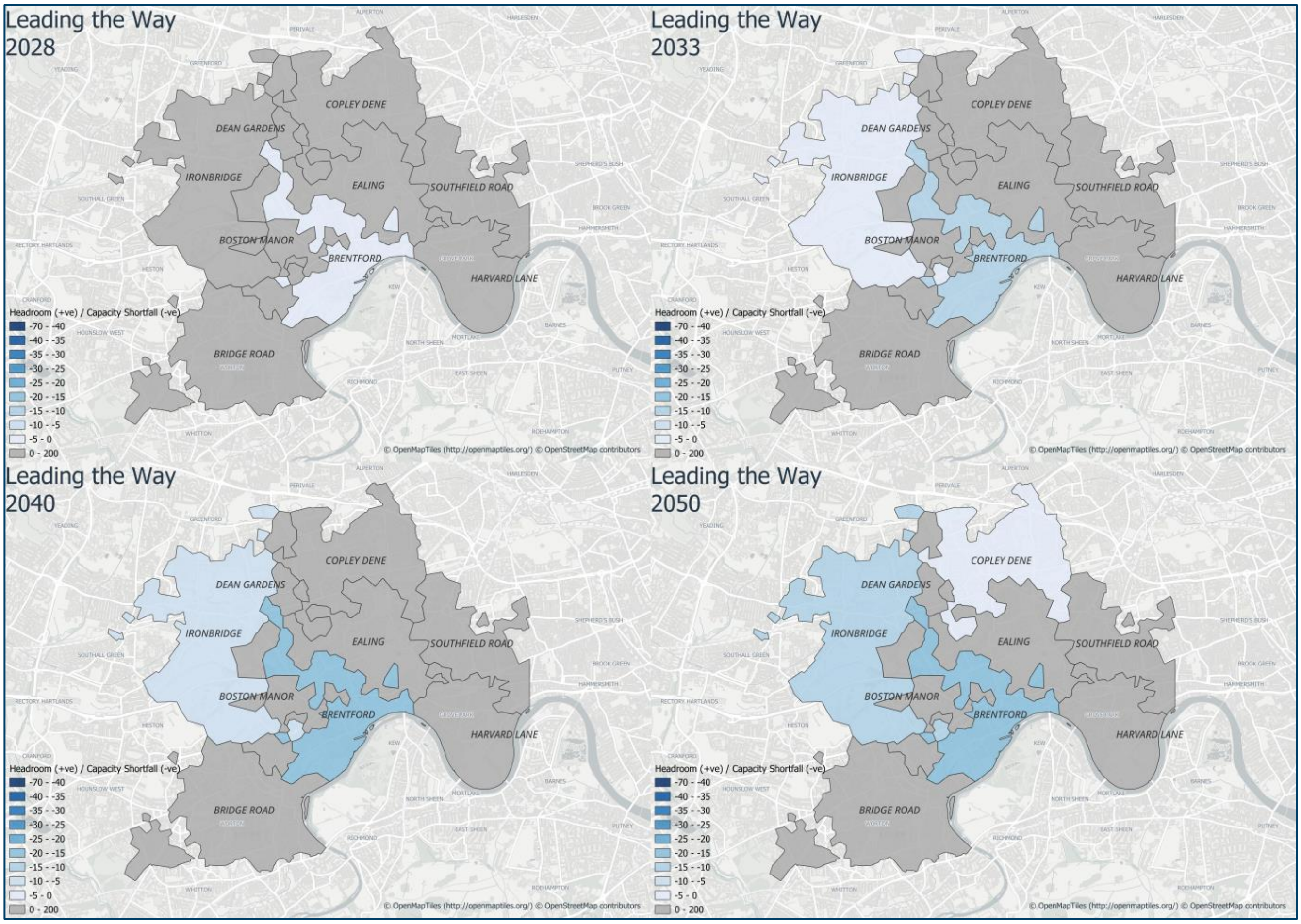


Figure 16 Ealing EHV/HV system need spatial plans under the Leading the Way scenario 2028, 2033, 2040, and 2050.

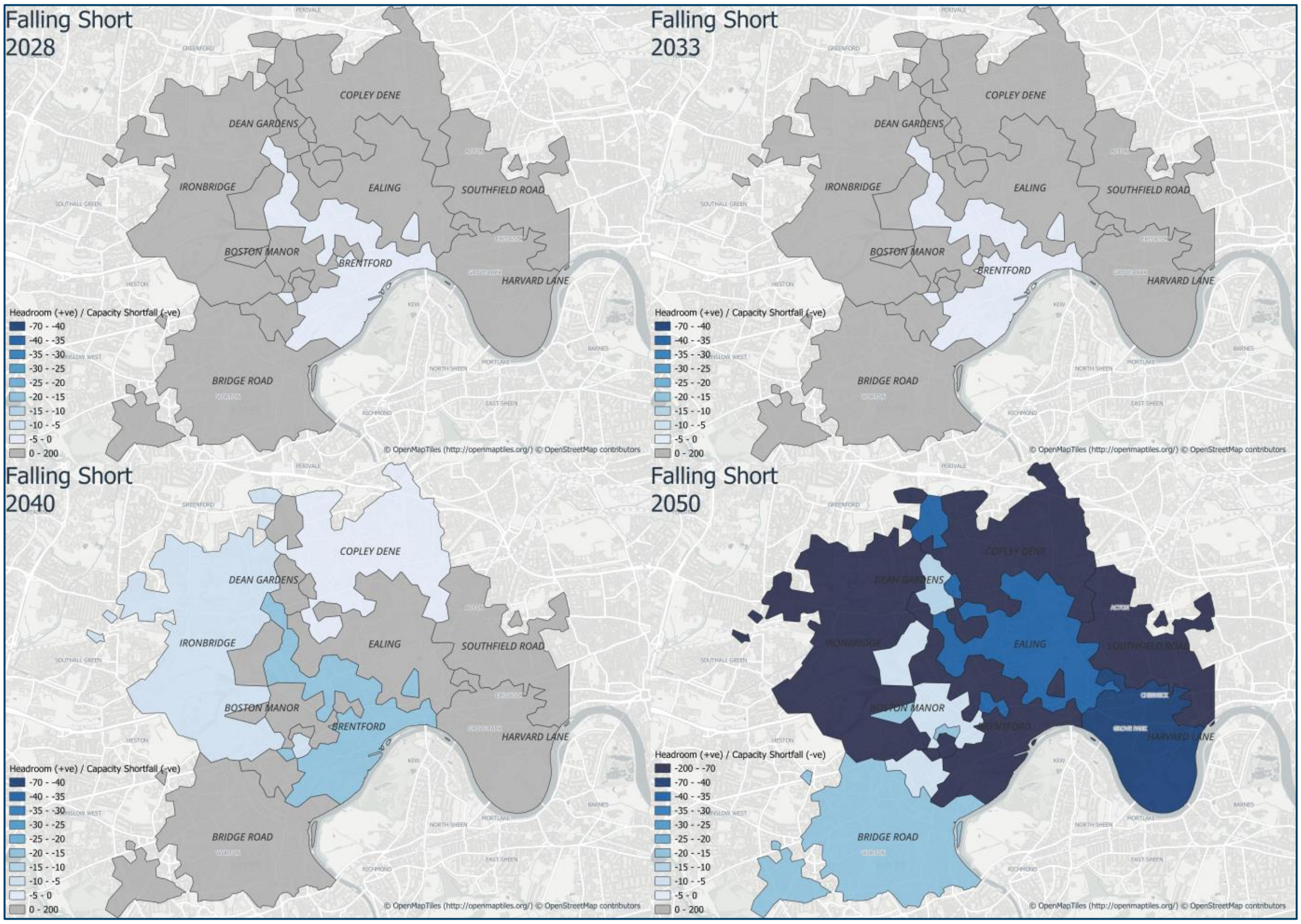


Figure 17 Ealing EHV/HV system need spatial plans under the Falling Short scenario for 2028, 2033, 2040, and 2050.

7.2. HV/LV system need spatial plans

To understand, where load is growing at a lower granularity, we have used information from the SSEN load model.[27]

The following four figures present the percentage loading of secondary transformers in 2028, 2033, 2040, and 2050 across each of the four DFES scenarios. As shown in the legend, the points are coloured based on their percentage loading with green being low percentage loading and darker reds being higher percentage loading (see legend for detail on loading bands and colouring). There is no clear trend for the location of demand increases or specific areas of load growth. Local demand trends and underlying demographic factors contribute to load growth at secondary transformers across the GSP.

However, we can see there is a volume of increasing need across our lower voltage networks.

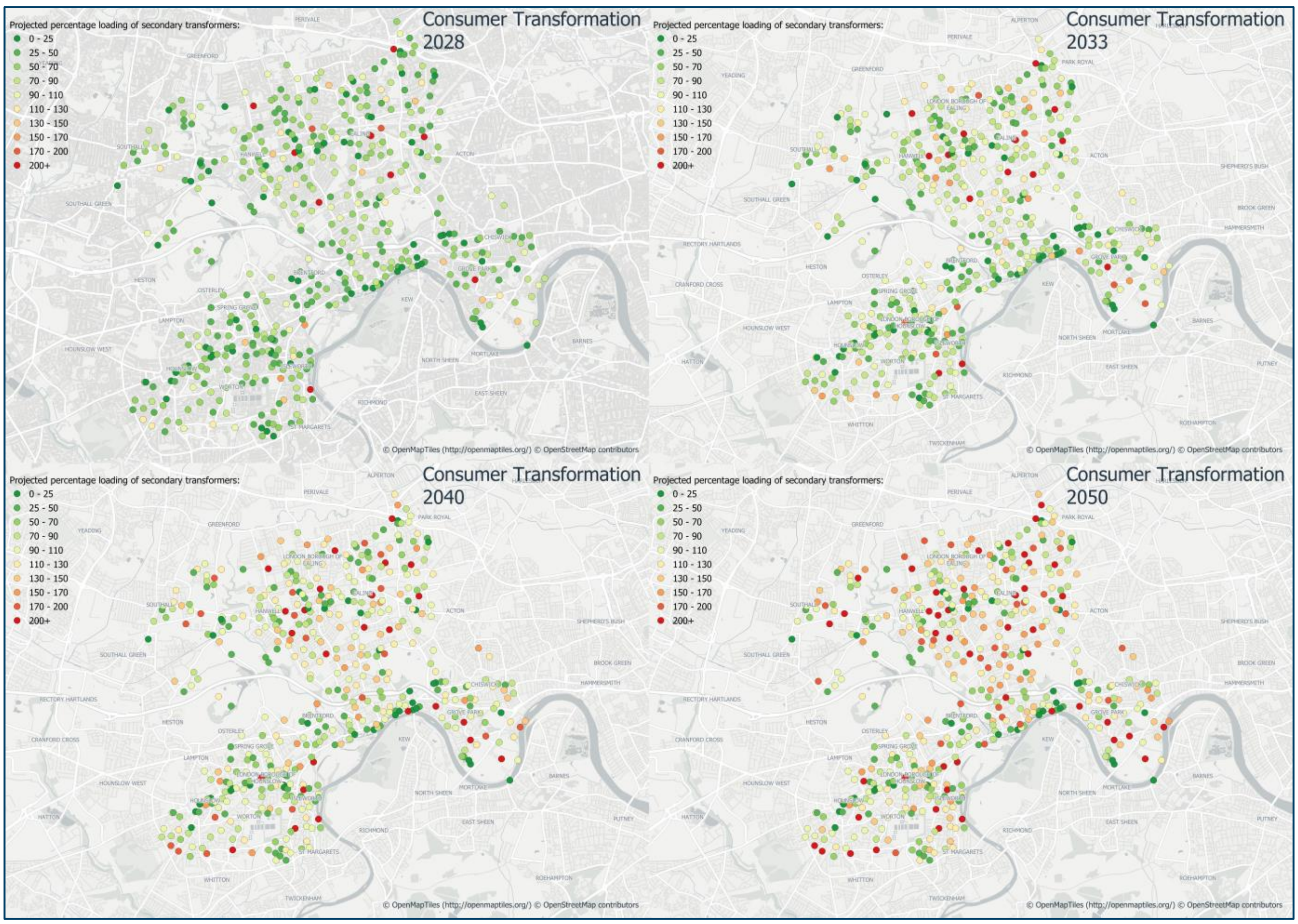


Figure 18 Ealing HV/LV system need spatial plans under the Consumer Transformation scenario for 2028, 2033, 2040, and 2050.

---

27 SSEN Secondary Transformer - Asset Capacity and Low Carbon Technology Growth - Data Asset - SSEN Distribution Data Portal

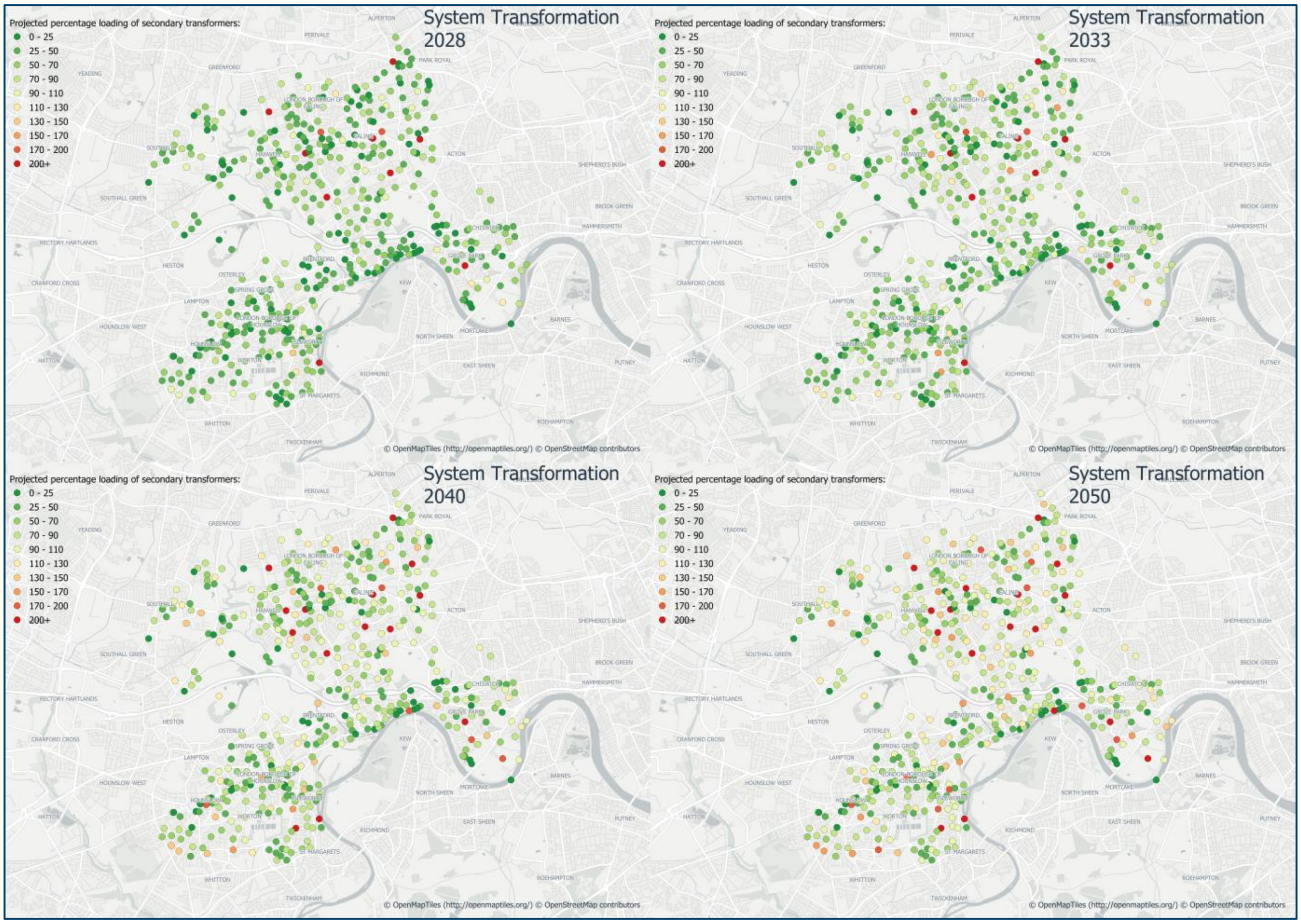


Figure 19 Ealing HV/LV system need spatial plans under the System Transformation scenario for 2028, 2033, 2040, and 2050.

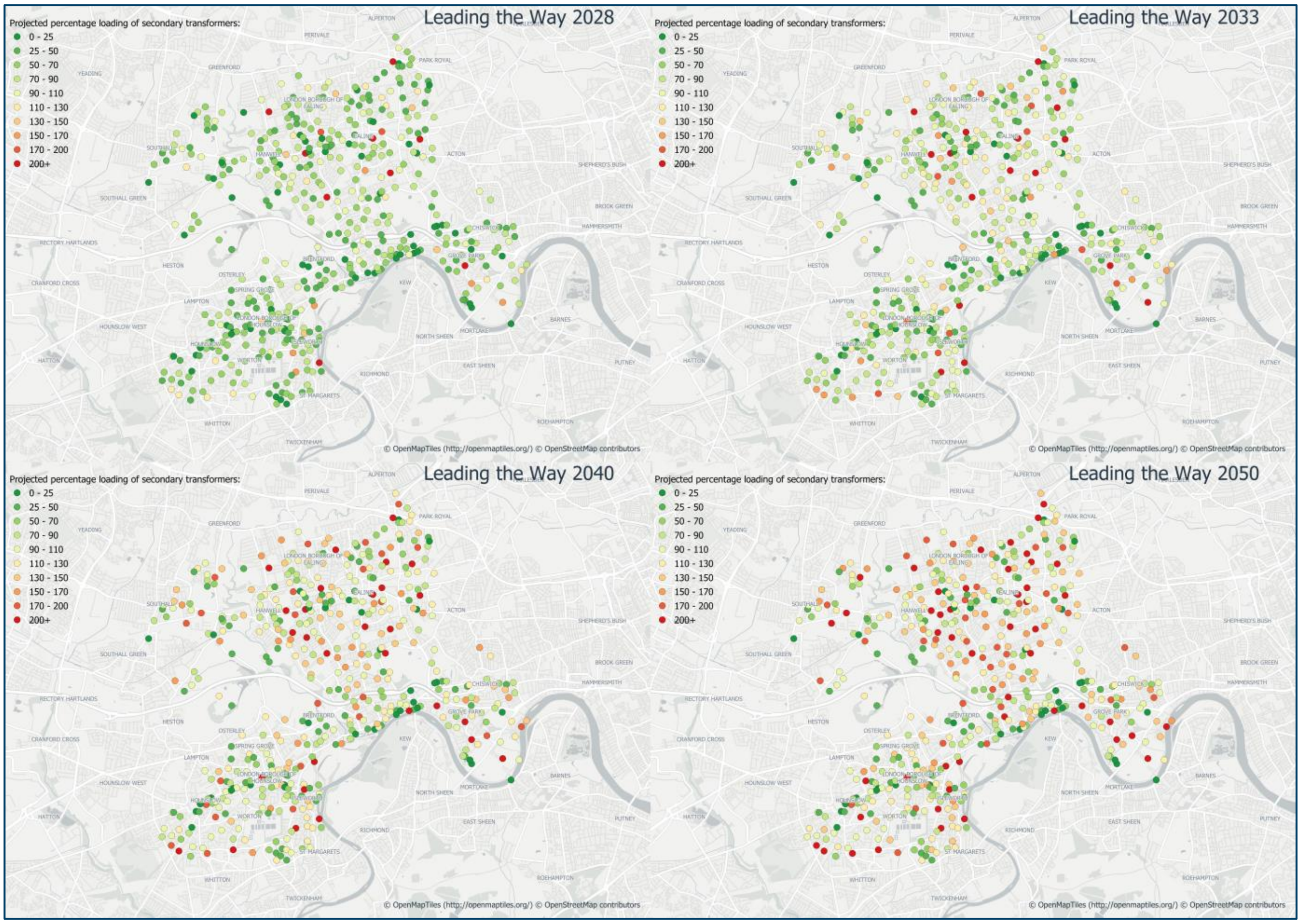


Figure 20 Ealing HV/LV system need spatial plans under the Leading the Way scenario for 2028, 2033, 2040, and 2050.

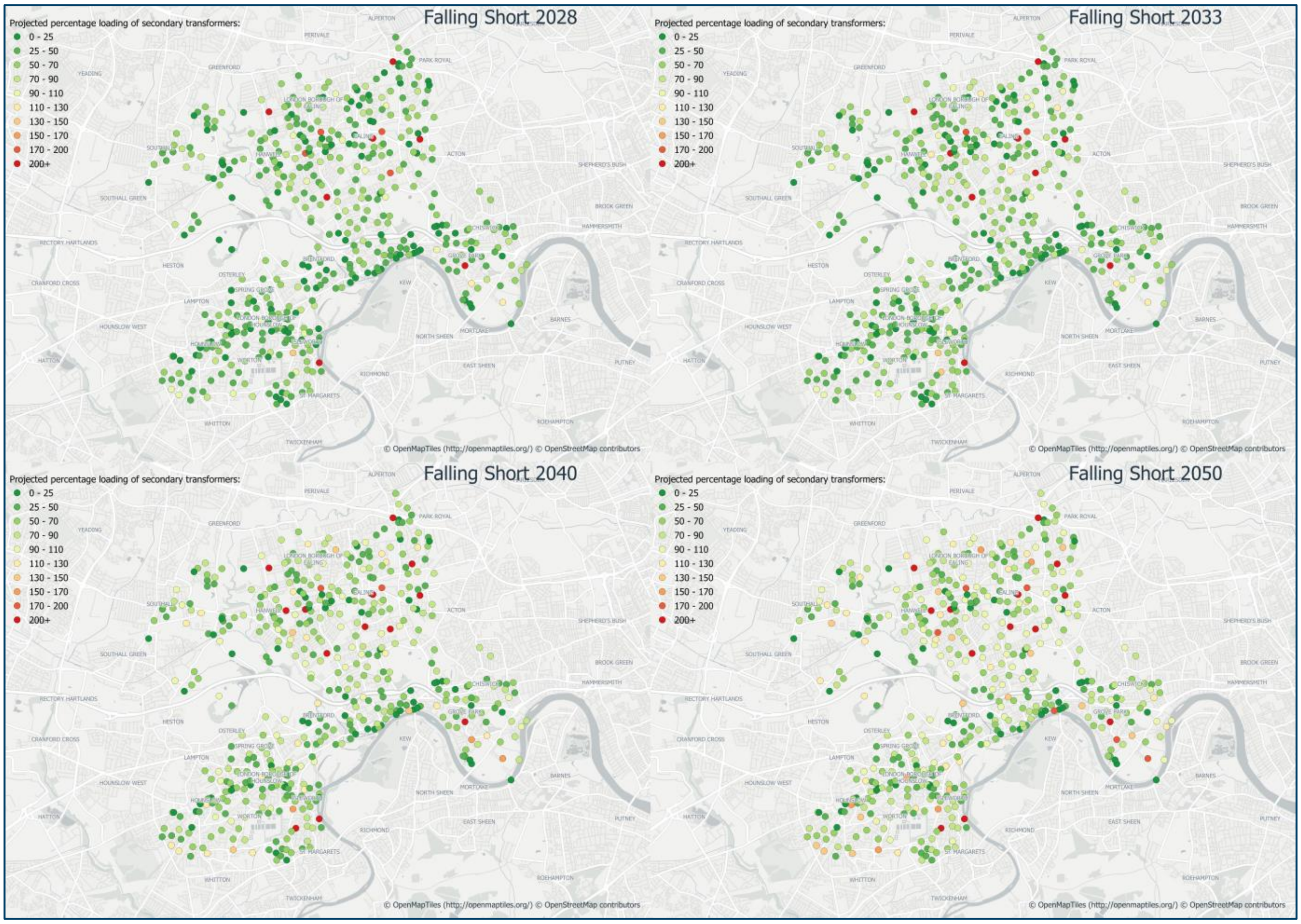


Figure 21 Ealing HV/LV system need spatial plans under the Falling Short scenario for 2028, 2033, 2040, and 2050.

8. SPECIFIC SYSTEM NEEDS AND OPTIONS TO RESOLVE

In this section we summarise the more specific needs arising from our future spatial plans. We also propose some initial options to resolve. These will be further developed through the DNOA process, where they will be considered alongside the potential for flexibility.
The section is split into three parts.

- Future EHV system needs to 2040 – these needs are more certain and therefore we have more clearly defined options to meet the requirements. For needs within the next seven years, we will recommend these are progressed through the DNOA process. In all cases we are proposing solutions that meet the projected requirements for 2050. We also provide a summary of more strategic elements that also need to be considered in these timeframes.

- Future EHV system needs to 2050 – there is a greater degree of uncertainty of outcomes in this time frame. This also provides more opportunity to work with stakeholders to develop strategic plans and our outline solutions reflect this initial phase of the work as we look to engage with interested parties.

- Future HV/LV system needs to 2050 – the future needs of the HV and LV networks are locationally specific but can be considered as an aggregated volume. In this section we provide information on our future forecasts for local HV and LV network needs.

8.1. Overall dependencies, risks, and mitigations

There are a number of overarching risks to the delivery of our strategic plan. Below we list these alongside proposed mitigating actions. We will work with stakeholders to develop these mitigating actions further.

Dependency: Works proposed here are dependent on timelines of the Ealing 66kV fault level replacement works. This reinforcement work is described in more detail in the Ealing and Hounslow DNOA outcome report.[28] A current modification application has been submitted requesting SSEN have ownership of the 66kV busbar that is currently owned by National Grid Electricity Transmission.

Risks: Works delay potential interventions downstream and/or do not provide flexibility of future investment gained by 66kV busbar ownership.

Mitigation: Project has been approved to provide fault level reinforcement at the 66kV busbar. Awaiting outcome of Modification Application.

Dependency: Procurement of new land across West London likely to be necessary.

Risks: High cost of land and challenge of procuring suitable site.

Mitigation: Identify need ahead of time to allow long timescales for procurement of land.

Dependency: Procurement of flexible services to defer reinforcement where possible and economically viable.

Risks: Insufficient flexibility in the relevant area to resolve system need.

Mitigation: Flexible service procurement carried out ahead of time with signposting of future needs. Last build date identified to allow time for traditional reinforcement if flexibility not viable.

28 ssen-dnoa-outcome-reports-march-24.pdf

8.2. Future EHV system needs to 2040.

This section provides more detail on the specific system needs and initial options to resolve in the period through to 2040. Figure 22 below summarises these needs alongside more developed work that have progressed through our DNOA process.

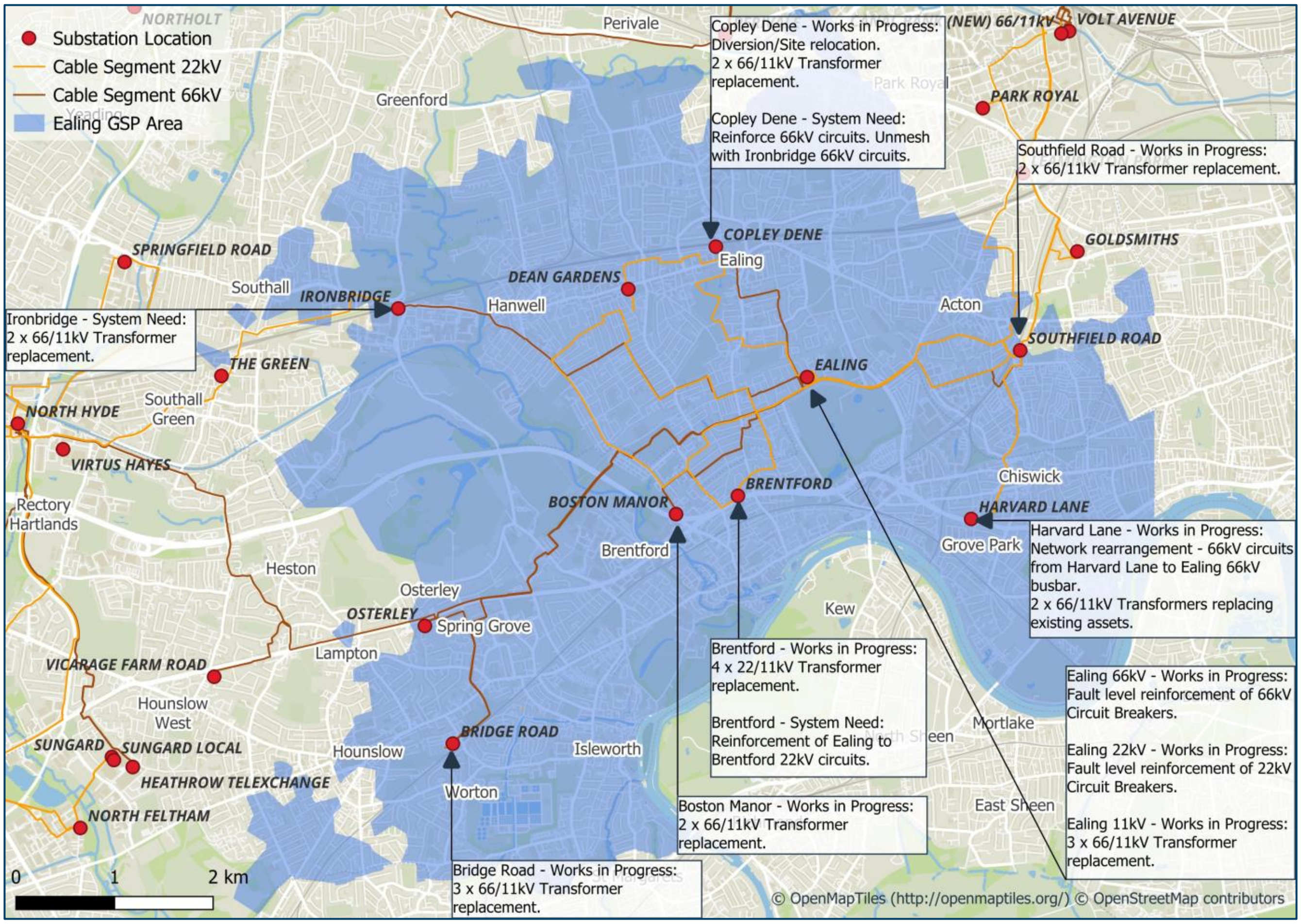


Figure 22 GIS view of network with works in progress and system needs annotated.

The relevant spatial plans provide us with a strategic view of future system needs. We have reviewed this through thermal power system analysis to understand the specific requirements of our EHV networks through to 2040. This analysis has been based on the insights developed from the 2022 DFES alongside other information including known connection applications. Initial needs have been identified using the DFES Consumer Transformation background with sensitivity analysis undertaken against the other three DFES backgrounds. Further context on both the specific system needs and the initial options to resolve can be found in Appendix 1 of this report.

Location of proposed intervention	Scenario	CT Year Identified (Season)	Asset Loading (%)	Network State (Capacity)	FS Need Year (Season)	ST Need Year (Season)	LW Need Year (Season)	Proposed option to resolve
Ironbridge 20/40MVA CER Transformer	CT	2031 (Winter)	102.9	N-1 (40MVA)	2035 (Summer)	2036 (Winter)	2028 (Winter)	Replace existing assets with 2 x 66/11kV 80MVA CER Transformers. Requires new 11kV switchgear. Feeding circuits currently have minimum rating of 50 MVA these could either be reinforced at the same time as the transformer replacement or the investment could be carried out at a later date.
Copley Dene 66kV feeding circuits.	CT	2037 (Summer)	100.3	N-1 (50MVA Summer)	2037 (Summer)	2039 (Summer)	2036 (Winter)	Reinforce 66kV circuits. Directly connect to the 66kV busbar to un-mesh 66kV circuits with Ironbridge.
Ealing 22kV to Brentford 22kV UG Cable.	CT	2028 (Winter)	123.5	N-1 (40.5MVA Summer)	2028 (Winter)	2028 (Winter)	2028 (Winter)	Direct connection into the 66kV busbar would align with SSEN's long term strategy to remove 22kV network. Medium term solution to reinforce 22kV circuits (total of 14.05 km of 22kV circuit).

Table 3 Summary of system needs identified in this strategy through to 2040 along with indicative solutions.

In addition, we have identified the need to consider two strategic developments that need further consideration and collaboration with stakeholders. This is because they are larger, more complex requirements. Both are described in further detail below.

8.2.1. Future system strategy: rationalisation of non-standard voltage levels (22kV network)

It is SSEN's long-term goal to remove non-standard voltage levels. With regard to Ealing GSP, this means removal of the 22kV network. We are already enacting this strategy where opportunity arises but currently Brentford and Dean Gardens primary substations are connected to Ealing 22kV.
Whilst specific needs at Brentford and Dean Gardens may not arise until the 2040s, we need to be aware of our overall strategy and look to implement around any shorter-term requirements.

8.2.2. Future system strategy: potential new primary substation

Ealing GSP is located in a land constrained urban area. We are conscious that as the demand for electricity grows there may be a requirement for an additional primary substation within the area. Whilst this may be required to meet a longer time need, planning and development work needs to be considered well in advance both to consider options and work with stakeholders.

8.3. Future EHV system needs to 2050.

Additional system needs have been identified here that the DFES 2022 signposts may need addressing ahead of 2050. These have been identified through thermal power system analysis and the impact on all four DFES scenarios has been considered. There is significant uncertainty with forecasts in this time period and works need to be considered alongside the strategies described in the previous section.

Table 7 below summarises the specific system needs we have identified. As can be seen in Table 7, the works in progress coupled with the proposed works will provide sufficient capacity across Ealing GSP until 2046 when further work may be necessary. Further investigation into the underlying driver for these large summer demands reveals it to be the Air Conditioning (AC) technology building block. The SSEN DFES is in alignment with national annual electricity demand for domestic AC presented in the ESO FES as described in the 2022 methodology report. Reduced AC uptake projected under the Leading the Way scenario means that many of these further system needs are not projected to be realised ahead of 2050.

The large degree of uncertainty associated with projections this far into the future means that SSEN should continue to monitor these needs. As the likelihood of these demands being realised increases, the necessary mitigations through asset or flexible solutions should be deployed.

Table 4 Further future system needs with a high degree of uncertainty.

Specific system needs	CT Need Year (Season)	ST Need Year (Season)	LW Need Year (Season)	FS Need Year (Season)	CT 2050 Peak Demand Value MVA (Season)	Comment
Dean Gardens Primary Substation	2040 (assumed)	-	-	-	15.17 (Summer)	Decommissioned with removal of 22kV network. There is a system need for the load of this substation.
Boston Manor proposed 66/11kV transformers under N-1 condition.	-	-	-	2049 (Summer)	53.14 (Summer)	Proposed asset would only be overloaded under FS scenario.
Brentford 66/11kV proposed transformers and 66kV circuits under N-2 condition.	2049 (Summer)	2050 (Summer)	-	2046 (Summer)	87.12 (Summer)	Proposed assets/Assets replaced through in progress works overloaded in the late 2040s under CT, ST, and FS scenarios.
Bridge Road 66/11kV proposed transformers and 66kV circuits under N-1 condition.	2050 (Summer)	-	-	2046 (Summer)	123.26 (Summer)	Assets replaced through in progress works overloaded in the late 2040s under CT and FS scenarios.
Copley Dene 66/11kV proposed transformers and circuits under N-1 condition.	2047 (Summer)	2048 (Summer)	-	2044 (Summer)	103.91 (Summer)	Assets replaced through in progress works overloaded in the late 2040s under CT, ST, and FS scenarios.
Ealing 66/11kV proposed transformers under N-1 condition.	2048 (Summer)	2049 (Summer)	-	2045 (Summer)	89.34 (Summer)	Assets replaced through in progress works overloaded in the late 2040s under CT, ST, and FS scenarios.
Harvard Lane 66/11kV proposed transformers under N-1 condition.	2049 (Summer)	2050 (Summer)	-	2046 (Summer)	88.88 (Summer)	Assets replaced through in progress works overloaded in the late 2040s under CT, ST, and FS scenarios.
Ironbridge 66/11kV proposed transformers and	-	-	-	2047 (Summer)	78.88 (Summer)	Proposed asset would only be overloaded under FS scenario.

circuits under N-1 condition.						
Southfield Road 66/11kV proposed transformers and existing circuits under N-1 condition.	2046 (Summer)	2047 (Summer)	-	2043 (Summer)	108.49	Assets replaced through in progress works overloaded in the late 2040s under CT, ST, and FS scenarios.

8.4. Future requirements of the High Voltage and Low Voltage Networks

Our HV/LV spatial plans have shown that a rising need for interventions to meet future demands on these lower voltage networks. We are therefore planning on a forecast volume basis and this section provides further context on this work for both the Ealing high voltage and low voltage network needs to 2050.

8.4.1. High Voltage networks

As well as the EHV system needs identified in the previous section, increased penetration of low carbon technologies (LCTs) connecting to the distribution network will result in system needs on the High Voltage (HV) and Low Voltage (LV) networks. To provide a view on the impact of these technologies on the distribution network here we have used SSEN's load model.[29]

The load model is a machine learning product which estimates a half-hourly annual demand profile for each household based on a series of demographic, geographic and heating type factors. This enables us to estimate capacity on the electricity network while protecting individual customers data privacy by using modelled data. These views are then aggregated up the network hierarchy based on the combinations of customers associated with each asset. This view is supplemented with the DFES to highlight the projected impact of LCTs on the network.

For the nine primary substations supplied by Ealing GSP, the percentage of secondary substations where projected peak loading exceeds the nameplate rating of the secondary transformer was taken from the load model data. Figure 23 demonstrates how this percentage changes under each DFES scenario from now to 2050.

To satisfy these requirements a variety of solutions will need to be investigated. It is likely that a combination of flexibility and asset replacement will be employed to resolve the projected HV system needs. It is important to note that for HV needs, flexibility is likely to be provided through Distributed Energy Resources (DER), Consumer Energy Resources (CER), and domestic/commercial Demand Side Response (DSR). One of the challenges associated with procuring flexibility to High Voltage and Low Voltage system needs is that only a small number of customers can provide a flexible service due to the requirement to be supplied by a specific secondary transformer. As the role of aggregators develops, we may see a shift in the potential for flexibility in an area. Where the magnitude of an overload is too large for flexibility to be feasible, addition of new assets or asset replacement will be necessary.

29 SSEN Open Data Portal, 2023, SSEN Secondary Transformer – Asset Capacity and Low Carbon Technology Growth.

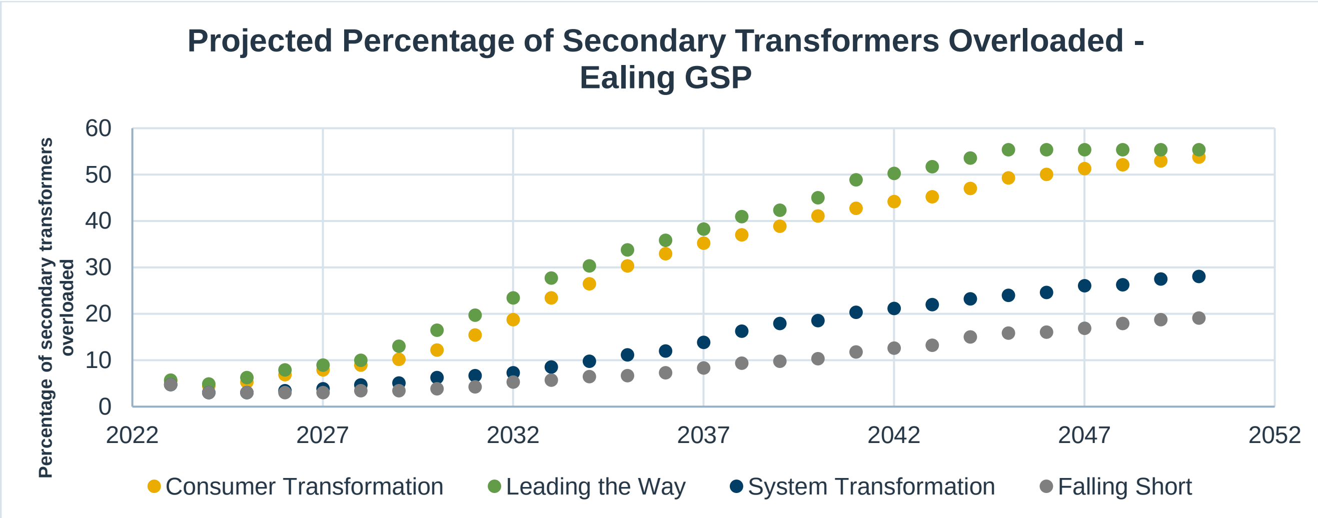


Figure 23 Projected Secondary Transformer Loading. *Source: SSEN Load Model*

8.4.2. Low Voltage networks

Drivers for interventions in low voltage networks may be either capacity related or be driven by voltage requirements. We are progressing options to resolve both of these drivers. From a network perspective the solution typically involves upgrading the number of LV feeders to split/balance the load and improve voltage or to install another substation at the remote end of the LV network to balance load and improve voltage. In both instances, flexibility at a local level, especially voltage management products linked to battery export and embedded generation such as solar is likely to be required alongside traditional reinforcement.

We are leveraging recent innovation work through Project LEO (Local Energy Oxfordshire) and My Electric Avenue to inform this strategy. Enhanced network visibility through Smart meter data analytics and low-cost substation feeder monitoring is also necessary to enable appropriate dispatch of services and network reconfiguration.

Capacity driven needs – Thermal constraints tend to materialise in the sections of cable leading to the substation (transformer) where multiple customer loads join together. We are modelling requirements out to 2050 leveraging low voltage monitoring and metering equipment combined with analytical techniques. This will demonstrate how the magnitude of the requirements of the LV network across Ealing changes across scenarios and years out to 2050.

Voltage driven needs – Generally, connection of Low Carbon Technology and large loads such as heat pumps is limited by voltage constraints before thermal constraints when located more than around 150m from the local secondary transformer. Increased loading on our low voltage networks can reduce the voltages to consumer premises. This is a non-liner relationship and as such requires more complex analysis. We are currently undertaking analysis to better understand the extent of this future need.

Initial analysis indicates that 8.05% of low voltage feeders may need intervention by 2035 and 18.46% by 2050 under the CT scenario as shown in Figure 24. The need is unlikely to be triggered until 2028 onwards. However, due to the timeline to grow workforce, with jointing skills taking typically 4 years to be fully competent, it is necessary to start recruitment and initiate programmes ahead of need to be able to deliver the required volumes from 2028 onwards.

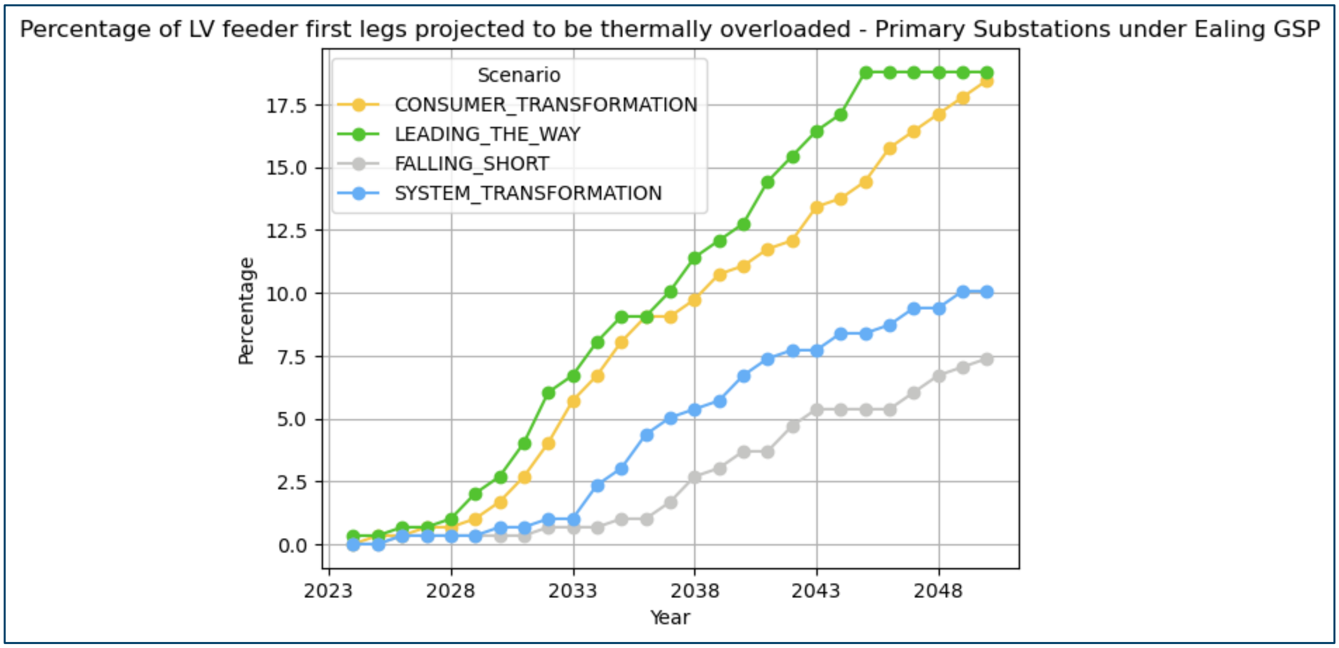


Figure 24 Percentage of LV feeders projected to be overloaded under Ealing GSP

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2022 DFES analysis provides a robust evidence base for load growth across Ealing GSP group in both the near and longer term. Drivers for load growth across Ealing GSP arise from multiple sectors and technologies. These drivers impact not only our EHV network but will drive system needs across all voltage levels.

Across Ealing GSP group, a variety of works have already been triggered through the DNOA process and published in the DNOA Outcomes Report. These are driven by customer connections and system needs that will arise this decade but are being developed to meet 2050 needs.

The findings from this report have provided evidence for three key recommendations:

- Proposed works to resolve the system needs projected in the medium term that should be assessed through the DNOA methodology.[30] This will allow for a variety of solutions to be considered and the viability of flexible solutions to be assessed. The DNOA process will then provide insight on the solution to the system need that provides the most benefit to customers.
- The connection of low carbon technologies across the HV and LV networks will result in significant demand growth. Where it has been identified that there are overloads projected, mitigations will need to be put in place. There is no clear pattern to low voltage load growth in Ealing GSP, so we are taking a volume driver approach. This needs to be based on strategic modelling of lv networks to understand the volume of work needed.
- SSEN should proactively engage with key stakeholders to scope longer term works that have been signposted in this document. This could take the form of input from Local Area Energy Plans (LAEPs), or more specific engagement on the details of individual projects. This needs to include discussions on related activities such as land availability and usage.

30 https://www.ssen.co.uk/globalassets/about-us/dso/consultation-library/distribution-network-options-assessment-dnoa---making-decisions-on-the-future-use-of-flexibility.pdf

Appendix A: 2040 System needs and options to resolve.

The following section provides further context on the specific 2040 system needs identified and the initial options to resolve. Upon annual reassessment, if these needs are projected to be seen in the next seven years (under the CT scenario), then they will be progressed into the DNOA process.

Future system need: Ironbridge

System need description

The Consumer Transformation scenario shows that under an N-1 condition (single asset outage due to either a fault or operational maintenance), the remaining 20/40MVA CER transformer at Ironbridge will be loaded at 102.9% in 2030 Winter. This has been calculated assuming the emergency rating of 40MVA is applicable under the N-1 condition.

System need timeline

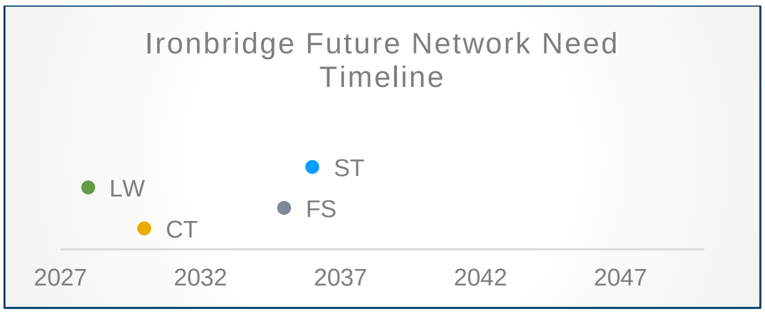


Figure 25 Ironbridge Timeline

2050 Peak demands at Ironbridge

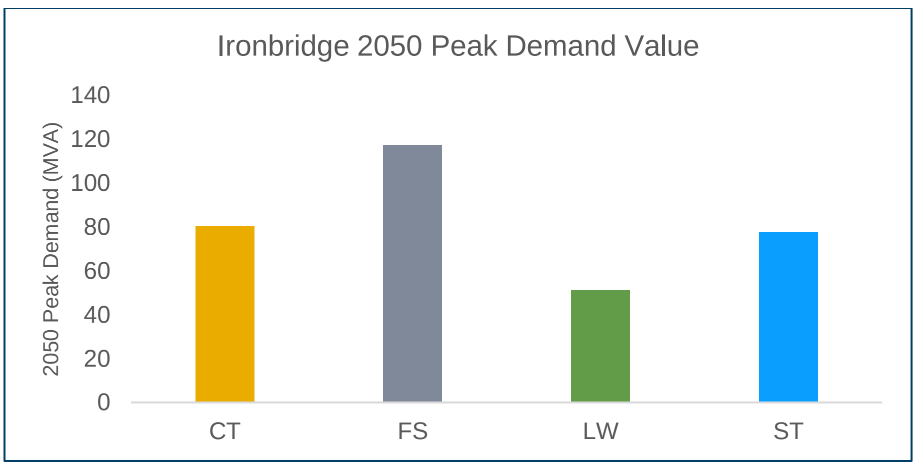


Figure 26 Ironbridge 2050 projected peak demands.

Estimated demand above firm capacity per year under each scenario (MW)

Table 5 Estimated peak demand above firm capacity at Ironbridge (Transformer nameplate ratings).

Ironbridge Primary Substation	2025	2030	2035	2045	2050
CT	-	-	4.55	18.96	40.13
ST	-	-	-	16.02	37.40
LW	-	0.17	6.43	10.68	11.15
FS	-	-	-	33.26	77.17

Proposed outline solution and potential next steps.

Due to the site at Ironbridge, a multipronged approach will be required to resolve the issues highlighted above. The thermal issues could be resolved by replacing the existing two 20/40MVA CER transformers with two 80MVA CMR transformers. The new units will be three-winding transformers, as a result, the 11kV switchgear must also be replaced due to the configuration of the busbar. Currently, Ironbridge and Copley Dene 66kV feeding circuits share circuit breakers from the 66kV busbar. A long-term solution will be to un-mesh the two primaries so that each 66kV circuit has an individual circuit breaker.

For Ironbridge this will mean reinforcement of 2 x 5.15km of 66kV cable with a minimum capacity of 80 MVA (summer rating).

This reinforcement will provide an N-1 capacity of 80MVA (assuming transformer nameplate capacity).

There is limited space available at the existing Ironbridge site and neighbouring land would need to be procured for installation of the higher rated equipment. This means installation of new assets also at this site may not be viable.

To summarize, there is a future system need at Ironbridge from 2030 onwards. Replacement of assets with higher rated equipment is suggested, this will provide a new N-1 capacity of 80MVA.

Future system need: Copley Dene

System need description

Our projections show that under N-1 conditions the in-service 66kV circuit will be loaded at 100.3% in the summer of 2037 under the CT scenario. Reinforcement of the transformers at Copley Dene has been triggered through RIIO-ED2 strategic investment. To release the full capacity of the new 80MVA transformers, the Copley Dene circuits should be reinforced to a minimum rating of 80MVA.

System need timeline

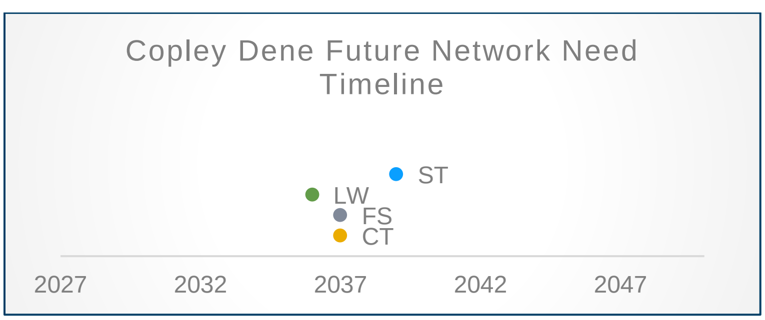


Figure 27 Copley Dene Timeline

2050 Peak demands at Ironbridge

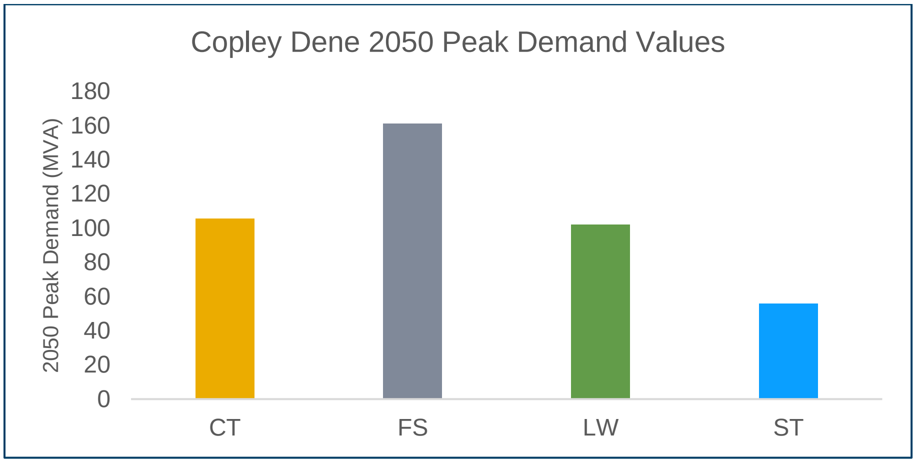


Figure 28 Copley Dene 2050 projected peak demands.

Estimated demand above firm capacity per year under each scenario (MW)

Table 6 Estimated peak demand above firm capacity at Copley Dene (minimum cable rating).

Copley Dene Primary Substation	2025	2030	2035	2045	2050
CT	-	-	-	22.97	55.55
ST	-	-	-	18.84	51.95
LW	-	-	0.05	5.09	5.88
FS	-	-	-	45.1	110.98

Proposed outline solution and potential next steps.

Existing works at Copley Dene have been triggered to replace the existing transformers at Copley Dene with higher rated 80MVA assets. Following this reinforcement, the 50MVA circuit will be the capacity limiting asset at Copley Dene.

This system need has been identified here and projected for 2037 under the CT scenario. To satisfy this need it is recommended that the circuits (2 x 2.05km) should be reinforced to a minimum summer rating of 80MVA.

Due to the timelines of projected needs at Ironbridge and Copley Dene, the 66kV circuits for both primaries should have been separated onto individual circuit breakers at the 66kV bar as part of the works at Ironbridge.

As shown in Figure 29, a firm capacity of 80MVA maximises capacity at Copley Dene but will not be sufficient for the 2050 peak demand projected at the site.

Future system need: Brentford to Ealing 22kV underground circuits

System need description

Studies show that in 2028 Winter, under the Consumer Transformation (CT) scenario, the Ealing 22kV to Brentford Primary substation underground (UG) cables are loaded at up to 123.5% (under N-1 conditions).

As a result, reinforcement of these circuits is required. Previous studies have highlighted the requirement to reinforce the 22kV transformers at Ealing BSP however, the Harvard Lane EJP means thermal issues at these transformers were not observed in the power flow studies carried out as part of this *Net Zero First Investment Strategy*. There is a wider long-term strategy to remove the 22kV network under Ealing GSP.

System need timeline

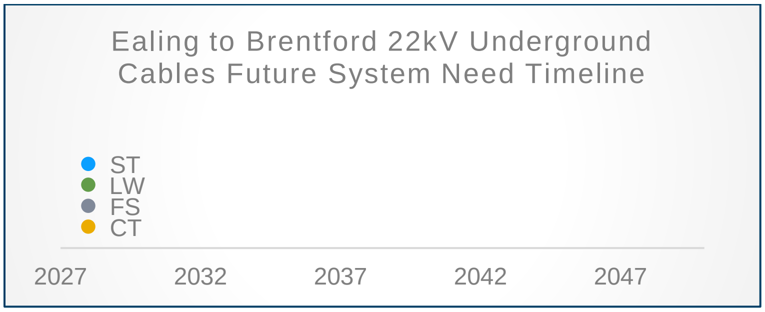


Figure 29 Ealing to Brentford 22kV UG cables timeline.

2050 Peak demands at Brentford

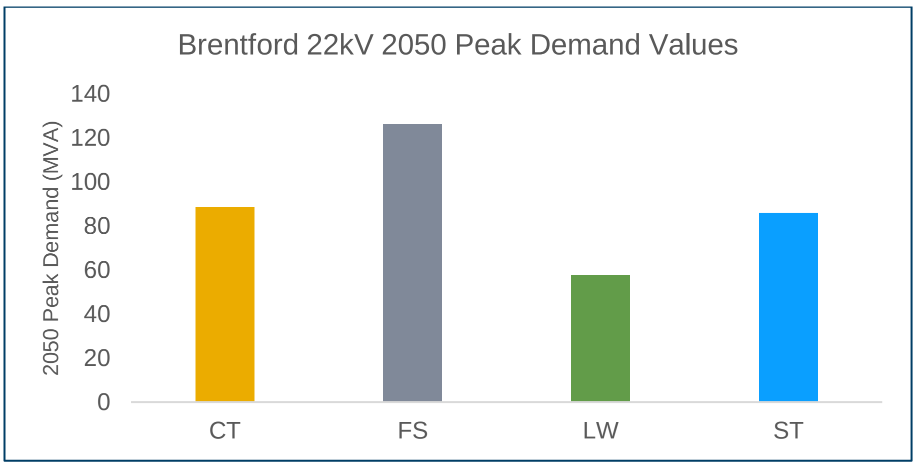


Figure 30 Brentford 2050 projected peak demands.

Estimated demand above firm capacity per year under each scenario (MW)

Ealing to Brentford 22kV underground circuits.	2025	2030	2035	2045	2050
CT	-	4.63	11.61	25.47	48.00
ST	-	1.85	5.05	22.42	45.37
LW	-	6.88	13.02	16.76	17.37
FS	-	1.29	4.24	40.41	86.02

Table 7 Estimated peak demand above firm capacity Ealing to Brentford 22kV UG circuits (minimum cable rating).

Proposed outline solution and potential next steps.

In alignment with SSEN's longer term strategy, the ideal solution would be to directly connect Brentford Primary to the Ealing 66kV busbar, allowing for decommissioning of the 22kV network. New feeding circuits each with a summer rating of 40MVA could be installed to allow for the entire capacity of the 20/40MVA CER transformers currently being installed at Brentford to be utilised.

In addition to this, the transformers will need to be uprated from the existing 22/11kV voltage level to 66/11kV, if transformers are not compatible with the higher voltage level, then new assets will be required. Again, this is likely to be dependent on the works ongoing at the Ealing 66kV busbar.

Due to the relatively near-term nature of this system need and fault level works at Ealing 22kV, reinforcement of the existing 22kV circuits is the best option. If we assume that this is an intermediate solution, then the 22kV cables need to be reinforced to a capacity that is suitable up until the date of the 22kV network removal. The required combined capacity of the circuits will change dependent on the year a second intervention occurs.

Appendix B Relevant DNOA outcome reports

DNOA Outcome Report

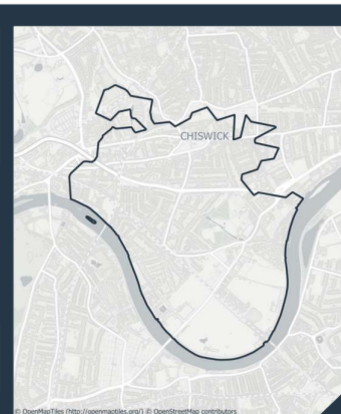
Chiswick

Scheme description

- Harvard Lane Primary Substation is in Chiswick, West London –SSEN's SEPD licence area. Postcode(s): W4
- Load related – thermal overloading. First circuit outage security of supply issues projected under all 4 DFES scenarios ahead of 2050.

Proposed option

- Procure flexibility for 3 years followed by asset solutions: network rearrangement and installation of transformers with increased capacity.
- Option provides the economic benefit of reinforcement deferral. Provides long term compliance with P2 security of supply. Increases network capacity at Harvard Lane and the relevant bulk supply point.
- Releases 51MVA of capacity at Harvard Lane



Sysem need requirement

J	F	M	A	M	J	J	A	S	O	N	D

DNOA History

2023/24	2024/25	2025/26	2026/27	2027/28
Initial assessment				

Indicative flexibility price (if available):

- Availability £150/MWh
- Utilisation £200/MWh

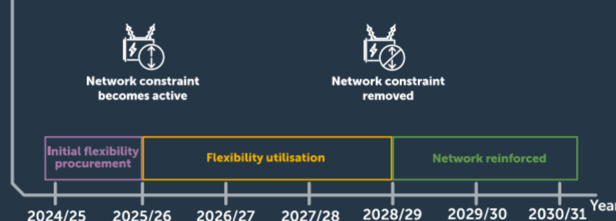
Reinforcement timeline

- 3 years of flexibility to defer reinforcement from 2025/26.
- Reinforcement delivery by the end of 2027/28.

Estimated peak MW outside firm network capacity under each scenario
Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	0.04	0.77	1.51	-(2.30)	-(3.14)	-(4.40)
ST	-	-	-	-	-	-(0.08)	-(0.51)
LTW	-	0.61	1.64	2.75	-(3.95)	-(5.19)	-(6.48)
FS	-	-	-	-	-	-	-(0.01)

Constraint management timeline



DNOA Outcome Report

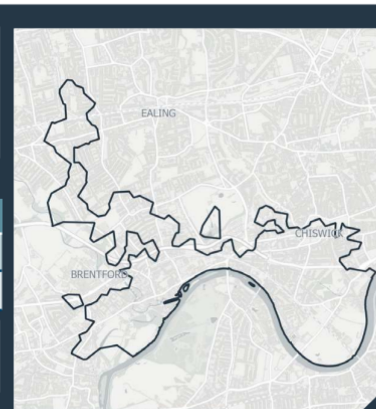
Chiswick and East Brentford

Scheme description

- Ealing 22kV Bulk Supply Point is in West London. Postcode(s): W4, W5, W7, W13, TW7, TW8.
- Fault level related – fault currents at Ealing 22kV busbars exceed the fault ratings of existing circuit breakers during RIIO-ED2.

Proposed option

- Asset solution: replacement of 17 circuit breakers with new circuit breakers with higher fault current ratings.
- Ensures fault level compliance in the long term. 33kV circuit breakers installed and operated at 22kV level.
- Additional current breaking rating of 11.9kA, additional current making rating of 29.1kA (per Circuit Breaker).



Sysem need requirement

J	F	M	A	M	J	J	A	S	O	N	D

DNOA History

2023/24	2024/25	2025/26	2026/27	2027/28
Initial assessment				

Indicative flexibility price (if available):

- N/A

Reinforcement timeline

- Reinforcement delivery by the end of 2027/28

Estimated peak MW outside firm network capacity under each scenario
Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	-	-	-
ST	-	-	-	-	-	-	-
LTW	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-

Constraint management timeline

DNOA Outcome Report

Ealing and Hounslow

Scheme description

- Ealing 66kV Bulk Supply Point is in West London – SSEN's SEPD licence area. Postcode(s): NW10, TW1, TW3, TW4, TW7, TW8, UB1, UB2, UB6, W12, W13, W3, W4, W5, W6, W7.
- Fault level related – fault currents at Ealing 22kV busbars exceed the fault ratings of existing circuit breakers during RIIO-ED2.

Proposed option

- Asset Solution: Existing air insulated switchgear replaced with gas insulated switchgear. 21 New 132kV gas insulated circuit breakers replacing existing 66kV air insulated circuit breakers.
- Ensures fault level compliance in the long term. Low space requirements at a space constrained site. Switchboard can be operated at 132kV if site is uprated.
- Additional current breaking rating of 18.1kA, additional current making rating of 44.2kA (per Circuit Breaker).

Sysem need requirement

J	F	M	A	M	J	J	A	S	O	N	D

DNOA History

2023/24	2024/25	2025/26	2026/27	2027/28
Initial assessment				

Indicative flexibility price (if available):

- Availability: N/A
- Utilisation: N/A

Reinforcement timeline

- Reinforcement delivery by the end of 2027/28

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	-	-	-
ST	-	-	-	-	-	-	-
LTW	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-

Constraint management timeline

DNOA Outcome Report

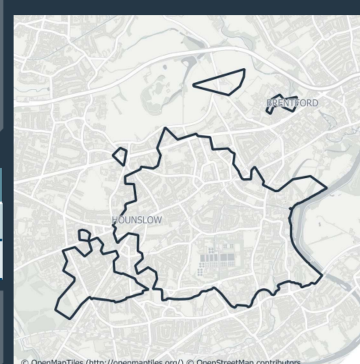
East Hounslow (Bridge Road PSS) Ref. 0724-25

Scheme description

- Bridge Road primary substation is in Hounslow, West London. Postcode(s): TW1, TW3, TW4, TW7, TW8.
- Load related - voltage level issues present under FCO conditions by 2027 with thermal capacity projected to be exceeded by 2030.

Proposed option

- Asset solutions: reinforcement of transformers with new transformers of increased capacity, with new switchboard.
- This option addresses immediate voltage issues and provides sufficient capacity for projected 2050 demand. Deferring reinforcement by using flexibility was deemed not feasible due to the voltage level issues.
- Capacity released: 76.2MVA



System need requirement

J	F	M	A	M	J	J	A	S	O	N	D

DNOA History

2024/25	2025/26	2026/27	2027/28	2028/29
Initial assessment				

Indicative flexibility price (if available):

- Availability: N/A
- Utilisation: N/A

Reinforcement timeline

- Reinforcement delivery by 2027/28.

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	-	-	- (1.47)
ST	-	-	-	-	-	-	-
LTW	-	-	-	-	- (0.20)	- (2.38)	- (4.43)
FS	-	-	-	-	-	-	-

Constraint management timeline

DNOA Outcome Report

North Ealing (Copley Dene PSS) Ref. 0724-31

Scheme description

- Copley Dene primary substation is in Ealing, West London. Postcode(s): W3, W5, W7, W13, NW10.
- Load related – substation overload during FCO conditions due to forecasted demand growth.

Proposed option

- Asset solutions: reinforcement of transformers with new transformers of increased capacity, with a new switchboard.
- This option addresses the thermal issues to 2037, and future proofs the network for higher capacity once the feeding circuits are reinforced. Reinforcement deferral through flexibility was determined to be uneconomical by the CEM tool.
- Capacity Released: 38.7MVA

System need requirement

J	F	M	A	M	J	J	A	S	O	N	D

DNOA History

2024/25	2025/26	2026/27	2027/28	2028/29
Initial assessment				

Indicative flexibility price (if available):

- Availability: £108/MW/h
- Utilisation: £133/MWh

Reinforcement timeline

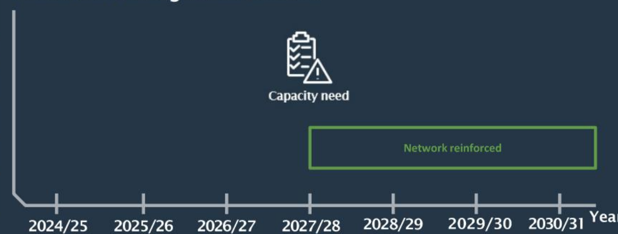
- Reinforcement delivery by 2027/28.

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	- (0.86)	- (1.81)	- (2.95)
ST	-	-	-	-	-	-	-
LTW	-	-	0.07	- (1.10)	- (2.06)	- (3.33)	- (4.70)
FS	-	-	-	-	-	-	-

Constraint management timeline



Appendix C Summary of consultation feedback

Following the consultation for this document, several changes have been made to the document to reflect the feedback received from our stakeholders.
A summary of these changes is tabulated below:

Feedback theme	Action taken	Section (page number)
Flexibility within relevant supply area.	Added further text to clarify estimations	3.3. Flexibility considerations (pg.11)
Local Area Energy Planning	Added additional reference to these plans and ongoing workstreams to better reflect these plans in future iterations.	5. Future Electricity Load at Ealing GSP (pg.14), 5.3. Electrification of heat (pg.16)
Solar PV of council owned buildings	Breakdown of specific building blocks informing solar PV forecasts. Reference to council ambitions in this area.	5.1. Distributed Energy Resource (pg.14)
Heat networks for decarbonisation of heat	Highlight awareness of the plans for heat networks in the area.	5.3. Electrification of heat (pg.16)
Local Authority EV charging strategies	Referenced specific strategy and targets from this strategy.	3.1. Local Authorities and Local Area Energy Planning (pg.9-10)
Data centres	Further described our approach to handling these projected demands and highlighted requirement for improvement.	5.5. Commercial and industrial electrification (pg.18)
Local net zero ambition	Referenced Climate Action Plan to demonstrate ambition.	3.1. Local Authorities and Local Area Energy Planning (pg.9-10)

CONTACT

whole.system.distribution@sse.com

Scottish & Southern Electricity Networks