LALEHAM GRID SUPPLY POINT: STRATEGIC DEVELOPMENT PLAN

Our network serving communities across west London and the east of Surrey

Draft for consultation

September 2025

Scottish & Southern Electricity Networks

CONTENTS

1. EXECUTIVE SUMMARY

SSEN is taking a strategic approach in the development of its distribution networks. This will help to enable the net zero transition at a local level to the homes, businesses, and communities we serve. Our Strategic Development Plans (SDPs) take the feedback we have received from stakeholders on their future energy needs from today out to 2050 and translate these requirements into strategic spatial plans of distribution network needs. This helps us transparently present our future conceptual plans and facilitate discussion with local authorities and other stakeholders. The overall methodology and how it fits into our wider strategic planning process is presented in the Strategic Development Plan methodology.

The focus area of this SDP is the area that is supplied by Laleham Grid Supply Point (GSP), shown below.

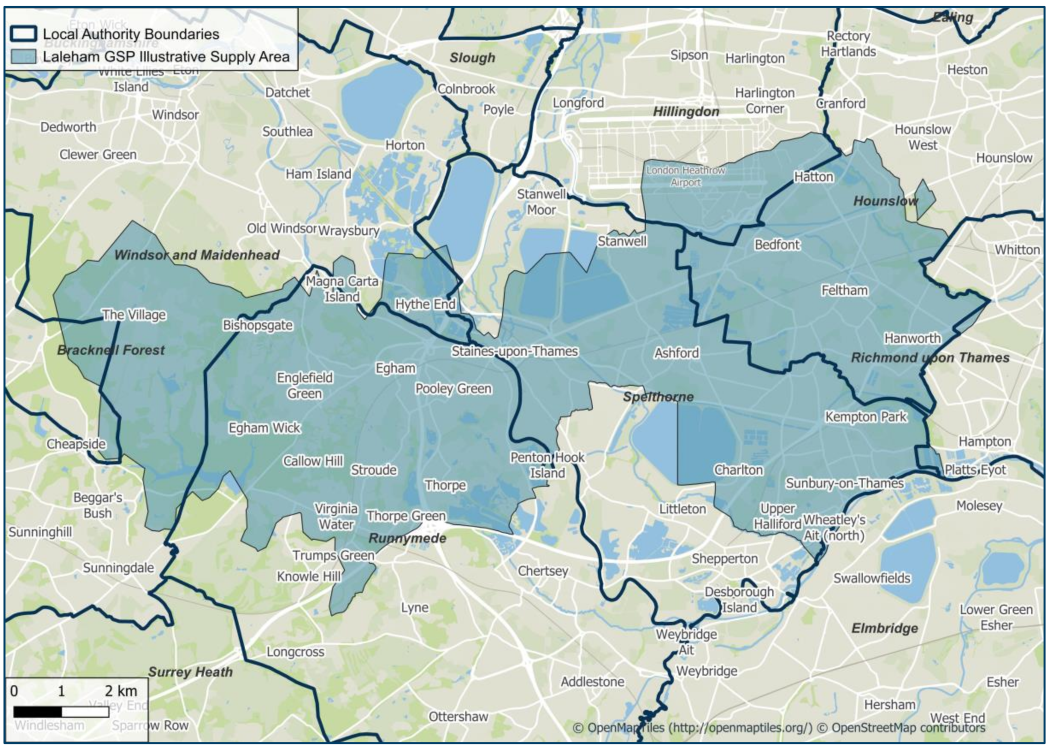

Figure 1 Area of focus for this SDP.

This report documents the stakeholder led plans that are driving net zero and growth in the local area, the resulting electricity demands, and the network needs arising from this. Plans across Windsor and Maidenhead, Runnymede, Spelthorne, and Hounslow have been considered in preparation for this plan. Some reinforcement work has been triggered in this area through the Distribution Network Options Assessment (DNOA) process. This SDP utilises the Distribution Future Energy Scenarios (DFES) to understand the pathway to a 2050 network that can support net zero and growth in the local economy. Recommendations from this report outline the initial steps that we believe should be taken on that pathway to develop the network in an efficient and stakeholder-led way.

2. INTRODUCTION

The aim of this report is to demonstrate how local, regional, and national targets align with stakeholder ambitions in the area to provide a robust evidence base for load growth out to 2050 across the area served by Laleham Grid Supply Point (GSP). A GSP is an interface point with the national transmission system where SSEN Distribution then takes power to local homes and businesses within a geographic area. Context for the area this represents is shown above in Figure 1.

To identify the future requirements of the electricity network, SSEN commissions Regen to produce the annual Distribution Future Energy Scenarios (DFES). The DFES analysis is based on the National Energy System Operator (NESO) Future Energy Scenarios (FES), while incorporating more granular stakeholder insights from agencies such as local authorities and new demand and generation connection applications. The DFES provides a forward-looking view of how demand and generation may evolve under different scenarios as we move towards the national 2050 net zero target. These scenarios are summarised in Figure 2. SSEN uses Holistic Transition as the central case scenario, reviewing this position annually. Any more recent unforeseen demand changes, for example customer connection requests, is also considered in our forecasts to ensure that the projected load more accurately reflects what we expect to see in the future.

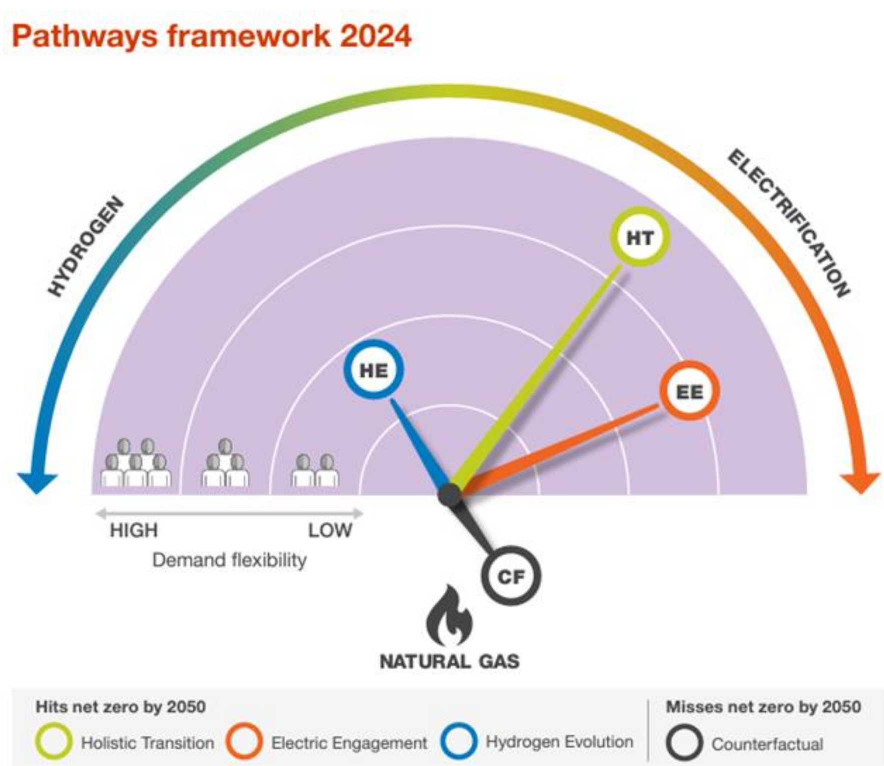

Figure 2: The FES Scenario framework (source: NESO)

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

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

Further information on the FES framework can be found in the DFES 2024 introductory report.

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The local authorities that are supplied by Laleham GSP include Hounslow, Runnymede, Spelthorne, and Windsor and Maidenhead as shown in Figure 3. The development plans 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.

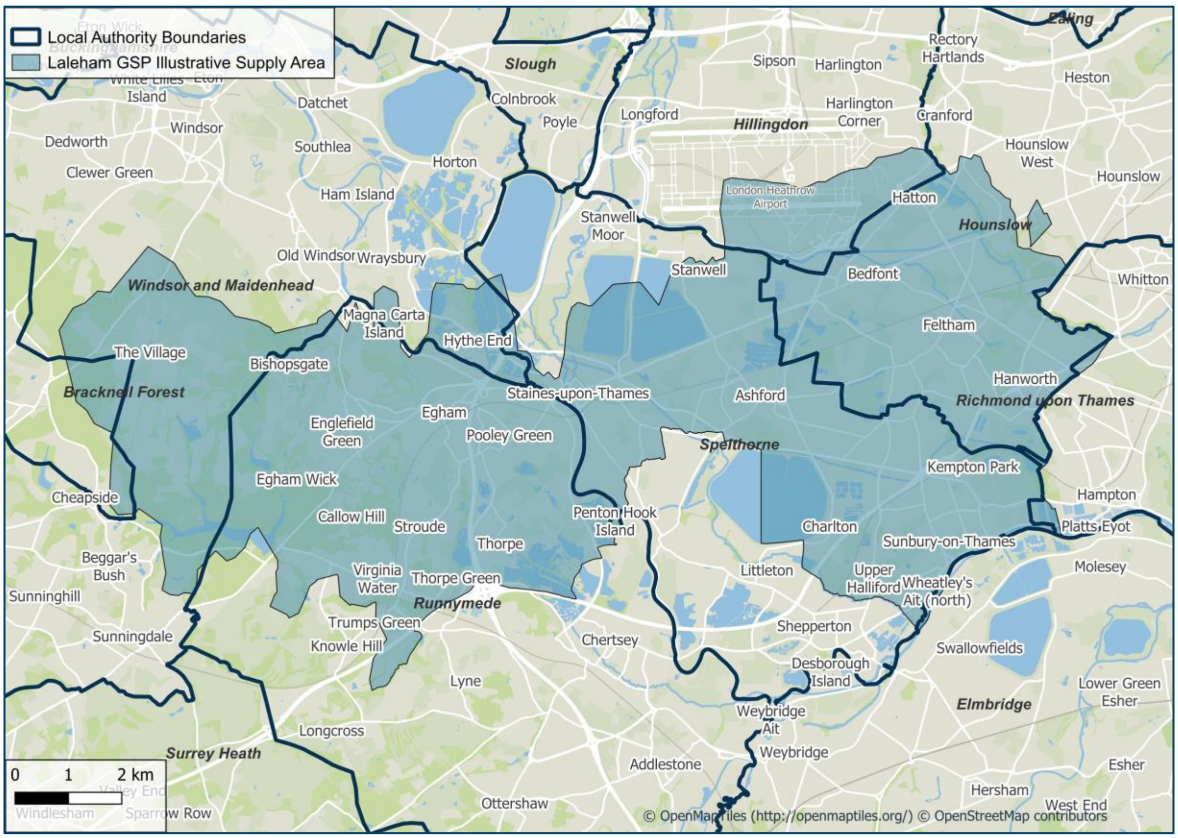

Figure 3 Area of focus for this SDP.

3.1.1. Hounslow

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. The emerging Hounslow Local Plan covers the period from 2020-2041 with updated site allocations, this information has been shared with SSEN through the DFES process. 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.

In addition to the Local Plan, London Borough of Hounslow have published a Climate Emergency Action Plan further demonstrating local ambition and pursuant to their target of net zero by 2030.

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. Further to the strategies introduced above, there are also several pipeline projects that Hounslow are progressing that will impact the local energy system. These include:

- Council assets and solar opportunities.
- Net-Zero Neighbourhoods – aims to leverage blended finance, including private sector investment, to deliver deep retrofit at a neighbourhood scale alongside climate-focused and community infrastructure projects.
- Phase 2 Local Area Energy Plan – now complete with outputs shared with SSEN
    - This will inform the DFES 2025 and the upcoming regulatory price control period Electricity Distribution (ED) 3 business plan decisions.

3.1.2. Runnymede

Runnymede Brough Council has a 2030 net zero target for its own operations and a target of 2050 for geographic emissions. The Council's Climate Change Action Plan was adopted in February 2024 and identifies several actions.

The Action Plan identifies the need to retrofit and improve energy efficiency and heating systems of existing Council assets including domestic and non-domestic assets. Specific measures are yet to be determined. It also identifies the need to develop an energy strategy which includes exploring solar PV on Council-owned car parks and exploring purchasing battery storage.

The Council's adopted Local Plan also supports the development of stand-alone renewable development and supports infrastructure such as battery energy storage systems where appropriate. It also supports the creation of new/expanded heat networks as part of large-scale new developments, but there are none planned yet.

The Council's adopted Local Plan sets out EV charging standards for parking (in the Parking Guidance SPD) and the council has adopted an EV Strategy to increase charging availability across the Borough.

3.1.3. Spelthorne

Spelthorne Borough Council targets to reach net zero in its scope 1 and 2 emissions by 2030. The draft local plan for the period from 2022-2037 states that there will be provision for an additional 618 homes per annum in Spelthorne Borough over the plan period. Surrey County Council states in its Climate Change Strategy that it aims for all twelve member local authorities to:

- Reach net zero emissions no later than 2050.
- Supply 15% of electricity demand from solar PV by 2032.
- Have half of all vehicles electric by 2025.

3.1.4. Windsor and Maidenhead

The Royal Borough of Windsor and Maidenhead Council have committed to reach net zero by 2050 and have an Environment and Climate Strategy to support this, which includes incremental targets in preceding years. This is supported by a target to increase renewable generation ten-fold by 2025 from 2019 figures. Solar PV and heat pumps have been installed on council-owned properties, and they have organized a group purchasing scheme for solar PV, Solar Together.

The Council has an Electric Vehicle ChargePoint Implementation Plan which was published in February 2023. They aim to have electric vehicle charge points in all council car parks by 2028 and by 2035, 70% of homes without driveways are within a 5-minute walk of a public charge point.

3.1.5. Specific whole system considerations

In the current configuration, Heathrow Airport is partly supplied by Laleham GSP. As a strategic transport hub, it is important to continue our close working relationship with Heathrow to provide capacity for decarbonsiation, modernisation, and potential expansion of the site.

The route to decarbonisation will likely include use of various energy vectors, for example hydrogen and synthetic aviation fuels. As a result, whole system thinking is required to progress solutions that benefit the whole system rather than favouring a particular energy vector.

3.1.6. Transmission interactions

National Grid Electricity Transmission (NGET) are currently investigating strategies for development of the 275kV network in West London. This includes the Ealing to Laleham 275kV circuits that connect into the central London 400kV network via Willesden. We are working in collaboration with NGET to factor our longer-term requirements.

3.1.7. Flexibility Considerations

Flexibility services

SSEN procures Flexibility Services from owners, operators, or aggregators of Distributed Energy Resources (DERs) or Consumer Energy Resources (CERs), 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 purchases Flexibility Services from all types of providers (e.g. domestic or commercial). Information on the process for procurement and how to participate 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.[1,2]

SSEN regularly recruits new Flexibility Services providers and increases the procured Flexibility Services with the latest bidding round for long term requirements held in May 2025 and recruitment through the Mini-Competition process most recently opening in mid-July 2025.[2]

Areas across Laleham GSP where flexibility has been procured is shown below in Figure 4. This map shows all Flexibility Services procured, which covers requirements beyond those identified for managing the deferral of reinforcement.

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

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

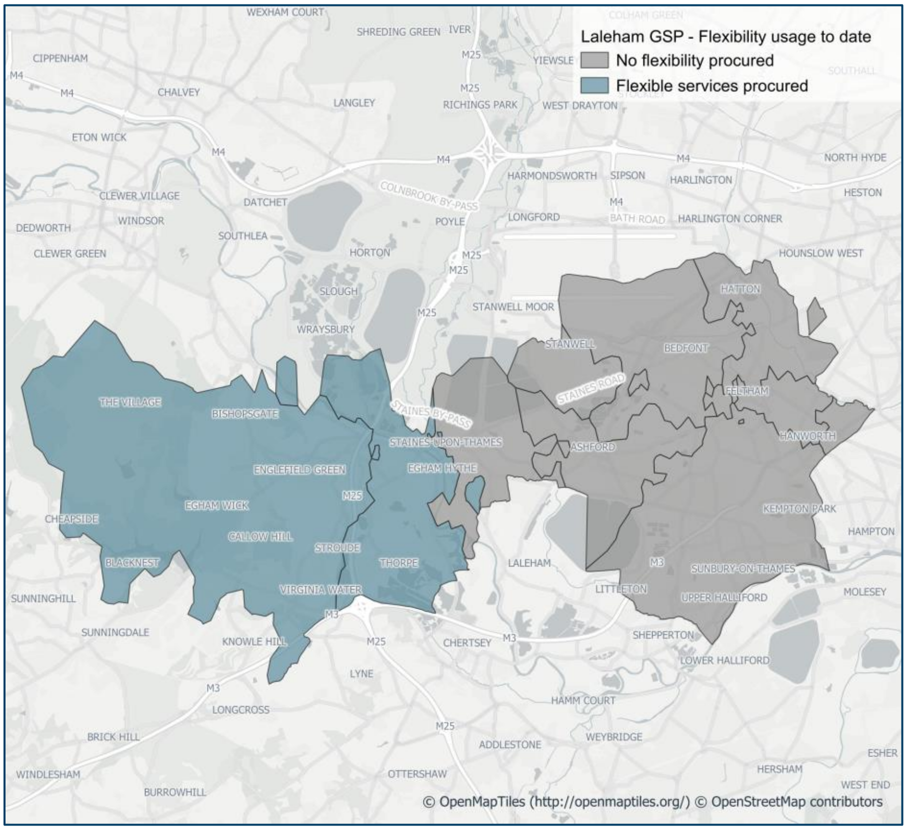

Figure 4 Flexibility procurement across Laleham GSP

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Laleham Grid Supply Point Context

The Laleham GSP network is made up of 132kV, 33kV, 22kV, 11kV, 6.6kV, and LV circuits. It supplies a predominantly urban area, with a small amount of rural network to the west of Egham. In total, the GSP serves approximately 76,700 customers. Table 2 shows the values for the GSP, and the primary substations supplied by the GSP (noting that some sites for single customers are not shown here). The peak maximum demand refers to the peak at each individual substation which may not be at a coincident time as the others (meaning we would not expect the values for all primary substations to sum to that at the GSP).

Substation Name	Site Type	Number of Customers Served (approximate)	2023/24 Substation Maximum demand in MVA (Season)
Laleham	Grid Supply Point	76,700	264.32
East Bedfont A	Bulk Supply Point	22,700	48.17
Staines	Bulk Supply Point	47,500	108.59
East Bedfont 11	Primary Substation	9,000	16.84
Church Road	Primary Substation	9,000	10.24
Feltham	Primary Substation	5,500	10.92
Hope and Anchor	Primary Substation	2,100	2.51
North Feltham	Primary Substation	6,000	17.47
Causeway	Primary Substation	7,300	16.72
Egham	Primary Substation	10,100	22.56
Sidney Road	Primary Substation	7,100	11.98
Stanwell	Primary Substation	4,400	8.22
Sunbury Cross	Primary Substation	18,700	34.12

Table 1 Customer number breakdown and substation peak demand readings (2023-2024)

4.2. Current Network Topology

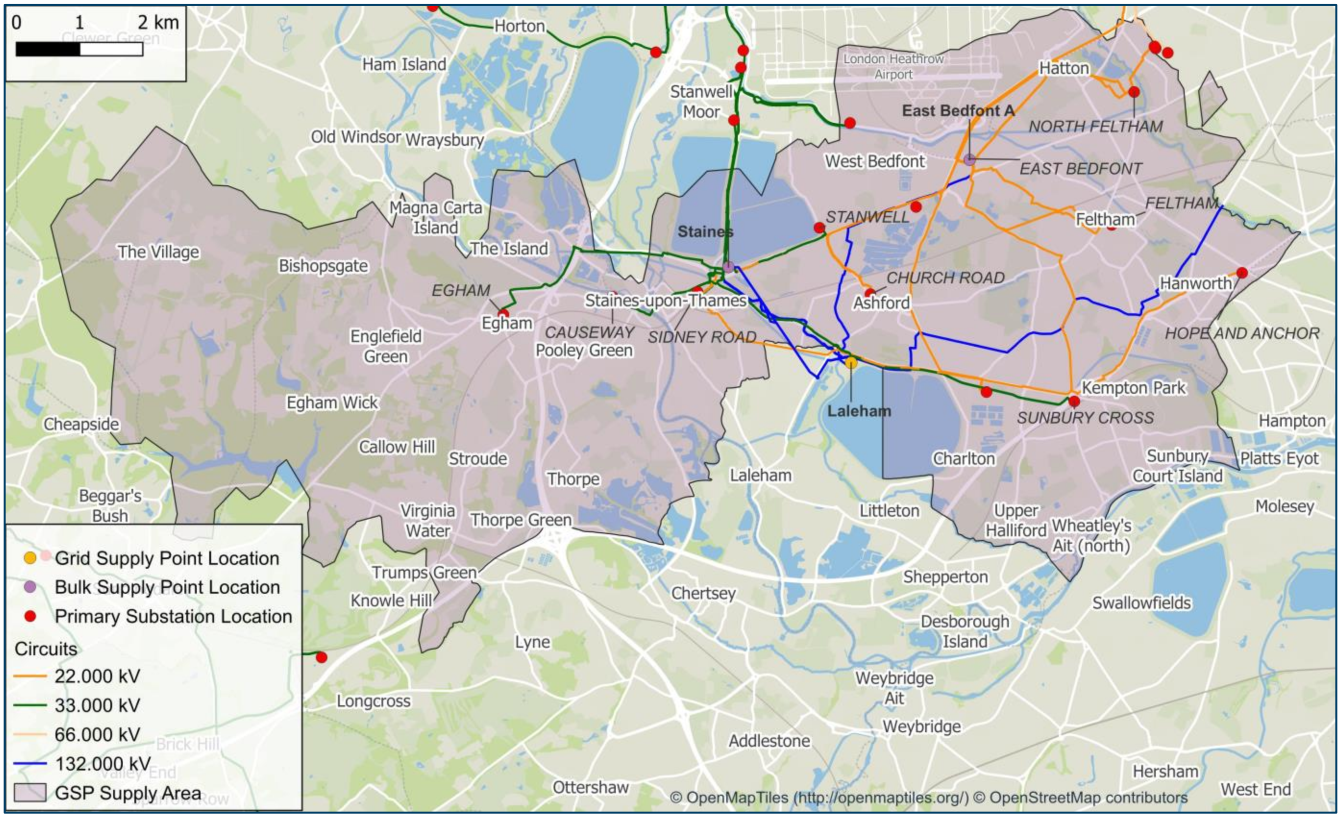

Figure 5 Geographic Information System view of Laleham electricity network.

4.3. Current Network Schematic

The existing 132kV network at Laleham GSP is shown below in Figure 6. Additional schematics for the network fed by Staines and East Bedfont can be found in appendix A.

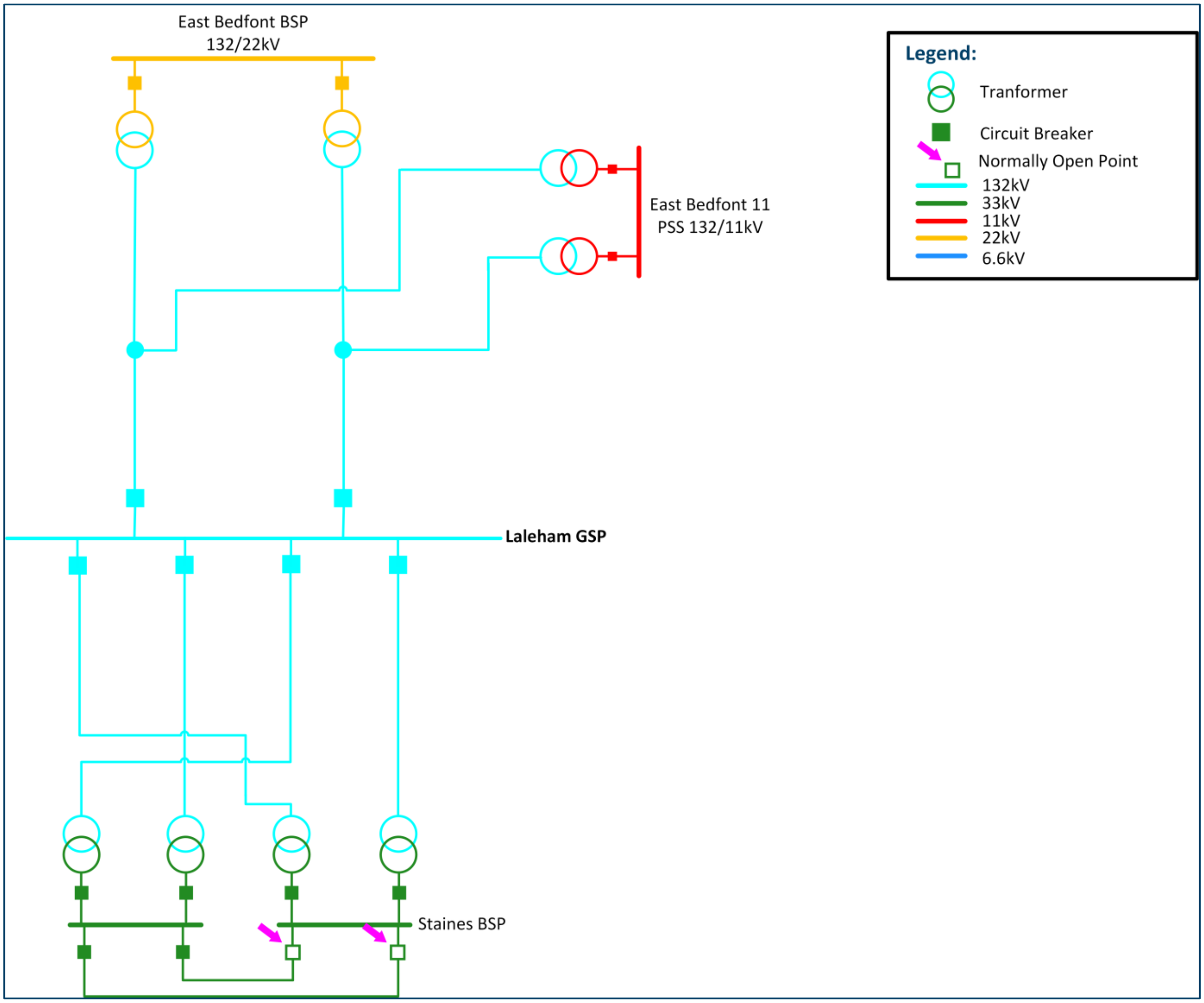

Figure 6 Existing network supplied by Laleham GSP

5. FUTURE ELECTRICITY LOAD AT LALEHAM GSP

The following section details load growth across the technologies projected in the Distribution Future Energy Scenarios. There are important notes on the values presented here:

- These projections relate to the GSP supply area highlighted in Figure 1 and are not directly aligned to a particular local authority.
- Where 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.
- For projections specific to individual primary substations or local authorities, please refer to our online dashboard.[3]

5.1. Generation and Storage

DFES Scenario	Generation capacity				Electricity storage capacity			
	Baseline	**2030**	**2040**	**2050**	**Baseline**	**2030**	**2040**	**2050**
Holistic Transition	10MW	53MW	158MW	204MW	0MW	66MW	87MW	100MW
Electric Engagement		52MW	98MW	138MW		64MW	83MW	90MW
Hydrogen Evolution		32MW	124MW	149MW		61MW	69MW	79MW
Counterfactual		24MW	56MW	74MW		5MW	13MW	16MW

3 SSEN DFES Technology Projections - Microsoft Power BI

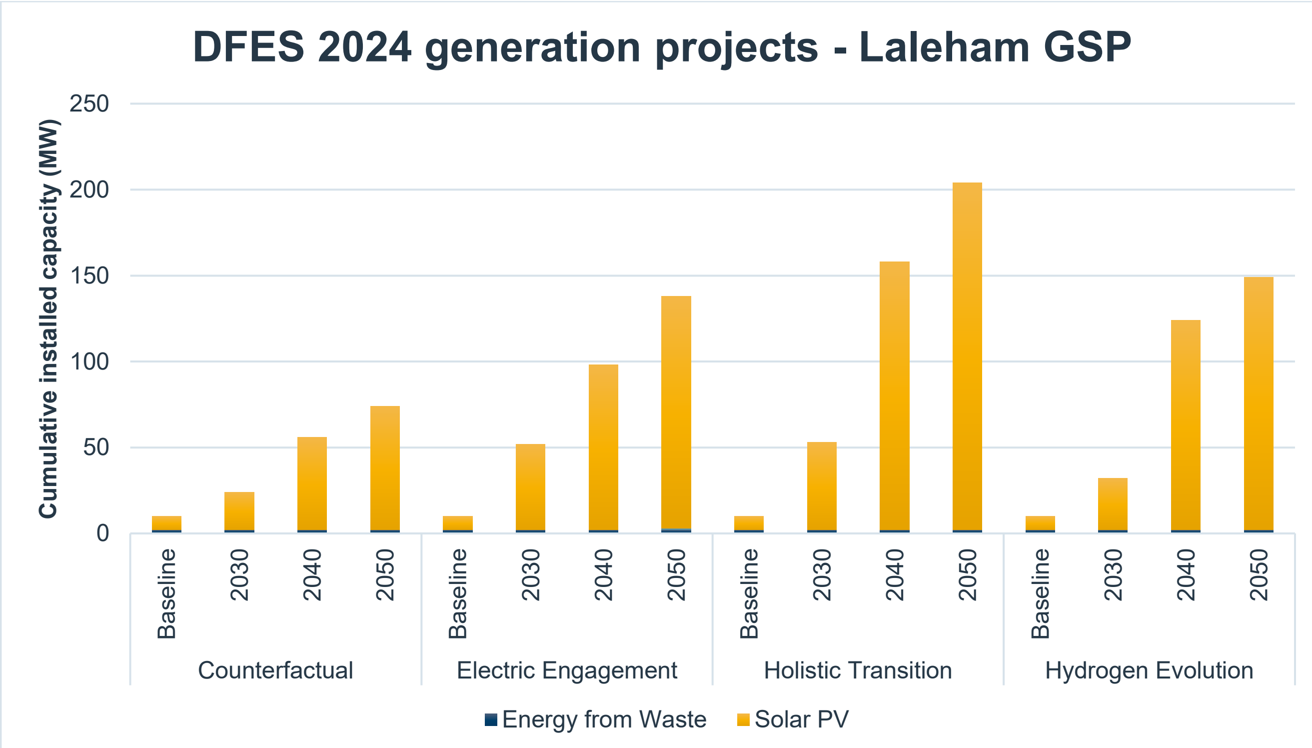

Figure 7 Projected cumulative distributed generation capacity Laleham GSP (MW). *Source: SSEN DFES 2024*

5.2. Transport Electrification

DFES Scenario	Chargers - Domestic (number of units)				Chargers – Non-domestic (MW)			
	Baseline	**2030**	**2040**	**2050**	**Baseline**	**2030**	**2040**	**2050**
Holistic Transition	4,752	18,327	53,583	56,139	0MW	16MW	81MW	93MW
Electric Engagement		29,365	53,513	55,728		31MW	94MW	95MW
Hydrogen Evolution		18,224	53,265	55,489		19MW	101MW	116MW
Counterfactual		15,016	51,067	55,192		7MW	68MW	112MW

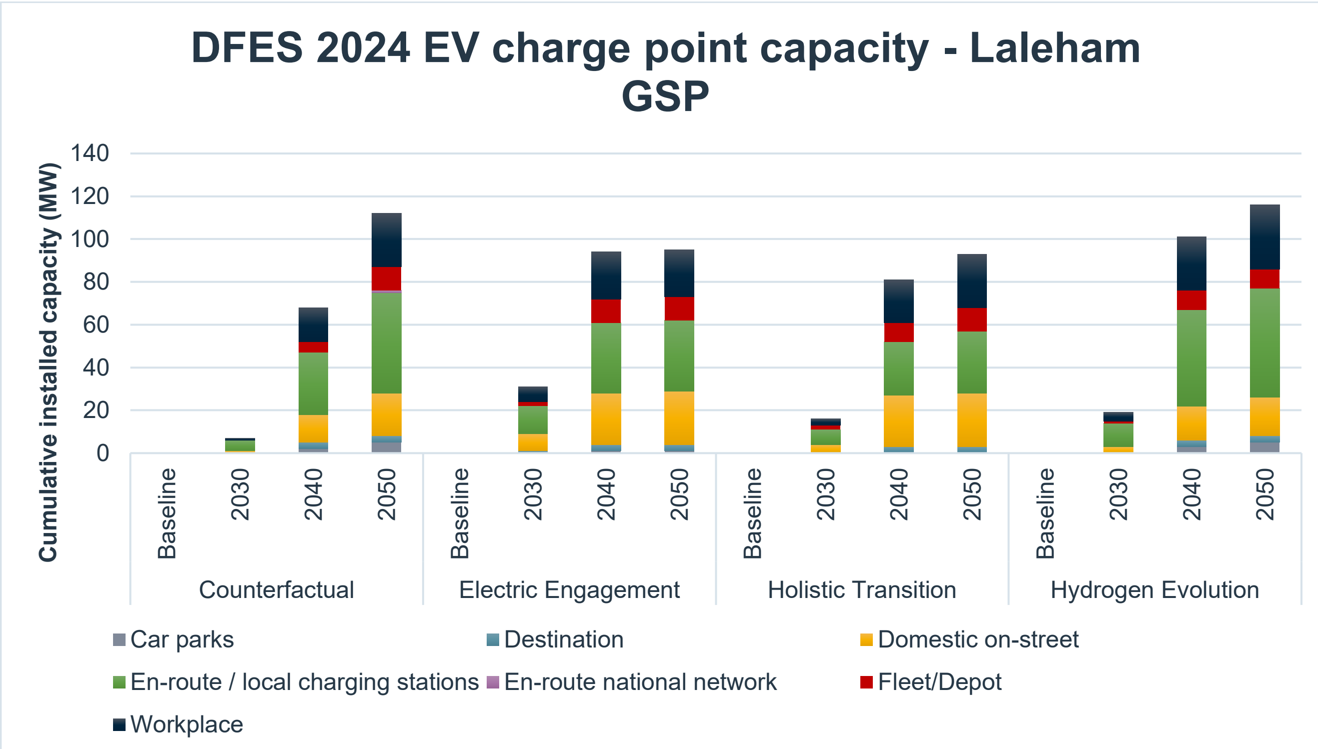

Figure 8 Projected EV charge point capacity across Laleham GSP. *Source: SSEN DFES 2024*

5.3. Electrification of heat

DFES Scenario	Non-domestic heat pumps (m^2 of floorspace)				Domestic heat pumps (number of units)			
	Baseline	2030	2040	2050	Baseline	2030	2040	2050
Holistic Transition	2,755m^2	773,471 m^2	1,895,851 m^2	2,218,449 m^2	478	10,576	48,694	72,318
Electric Engagement		548,810 m^2	1,792,617 m^2	2,257,026 m^2		9,595	46,104	72,231
Hydrogen Evolution		516,049 m^2	1,409,264 m^2	1,732,612 m^2		9,688	41,688	62,987
Counterfactual		253,067 m^2	932,505 m^2	1,394,637 m^2		4,033	17,270	45,056

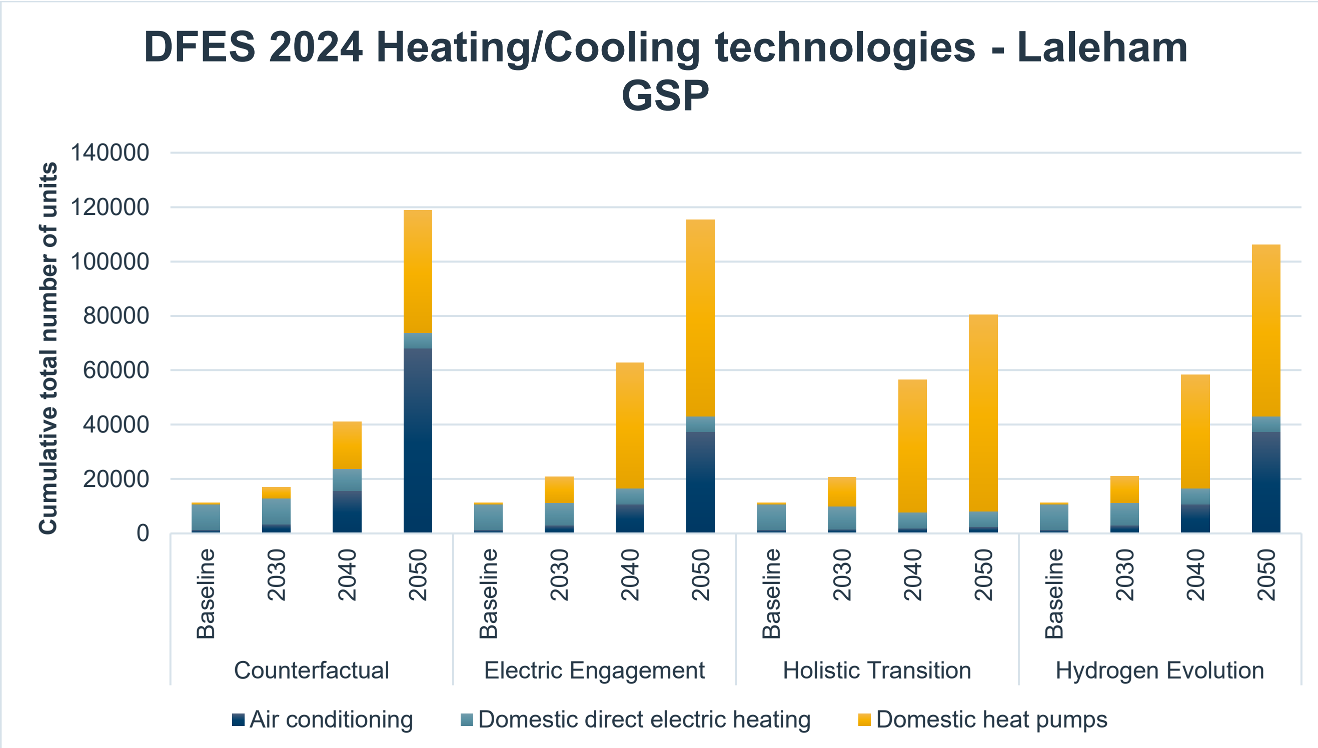

Figure 9 Projected number of heating/cooling technologies across Laleham GSP. *Source: SSEN DFES 2024*

5.4. New building developments

Through engagement with local authorities, we have developed an understanding of new development across our licence areas. This has allowed us to gauge an insight into future electricity demand for new developments ahead of a formal connection application. Below we investigate the non-domestic new developments across the study area for this SDP. Further to this, there is also a significant increase in the number of new homes between today and 2050, with the DFES currently capturing approximately 10,000 new homes across the study area by 2050.

DFES Scenario	New non-domestic development (m^2)		
	2030	2040	2050
Holistic Transition	94,429m^2	212,025m^2	212,025m^2
Electric Engagement	59,670m^2	212,025m^2	212,025m^2
Hydrogen Evolution	59,001m^2	212,025m^2	212,025m^2
Counterfactual	33,519m^2	212,025m^2	212,025m^2

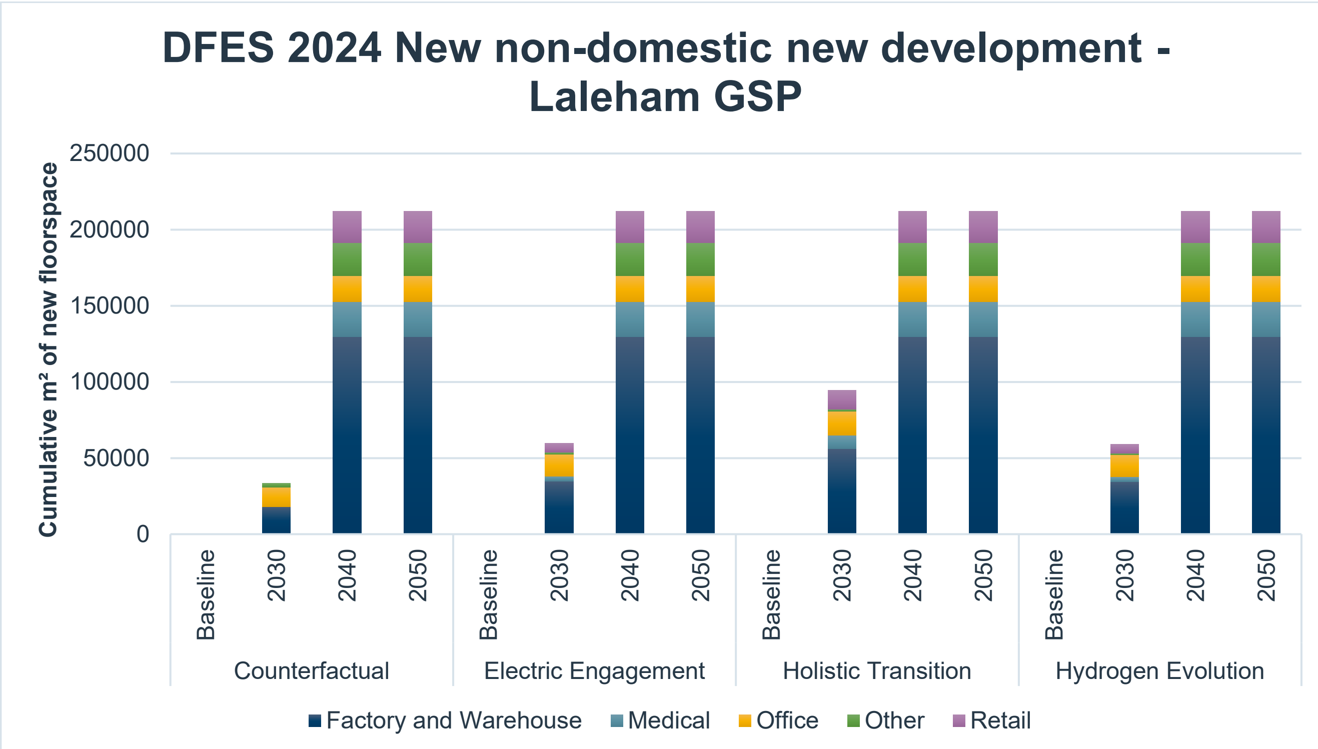

Figure 10 non-domestic new development under Laleham GSP. *Source: SSEN DFES 2024*

5.5. Commercial and industrial electrification

There are a number of industrial customers connected at the High Voltage level (11kV and 6.6kV) across Laleham GSP. In addition to this, there are larger EHV connected customers with examples including data centre providers and water treatment works. SSEN should carry out further targeted engagement with stakeholders such as Thames Water to understand the future energy requirements at these sites. This will ensure that additional capacity requirements can, where appropriate, be factored into our strategic plans.

6. WORK 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 Laleham 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. Summary of existing works is tabulated below:

ID (Schematic Reference)	Substation	Description	Driver	Forecast completion	Fully resolves strategic needs to 2050?
1	East Bedfont (132/11kV) PSS	Reinforcement of the lower rated transformer at East Bedfont from a rating of 20MVA to 40MVA. This will release the full capacity of the existing 40MVA transformer.	Primary Reinforcement	2026	
2	East Bedfont (132/22kV) BSP	Reinforcement of the two existing 132/22kV transformers with higher rated 132/33-22kV (dual ratio) units. This releases capacity while also future proofing by enabling removal of the non-standard 22kV voltage level in the future.	DNOA Process	2028	
3	Egham PSS	Installation of a third 33/11kV transformer. Installation of a third 33kV circuit from Staines BSP to Egham PSS (5km). Requires additional circuit breaker at Staines.	DNOA Process	2032	
4	Staines BSP	Establish a 132kV double busbar and a third 90MVA 132/33kV transformer at Staines BSP. Reinforcement of 132kV circuit from Laleham to match the new firm	DNOA Process	2033	

		capacity of the group demand.			

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 aim to provide capacity across the GSP for 2050 based on current projections.

Alongside these asset solutions being deployed, flexibility solutions are also being used to release additional capacity.

1.1. Network Schematic (following completion of above works)

The network schematic below in Figure 11 shows the 132kV network with changes highlighted and referenced to the table above. Additional schematics for changes to the 33kV network supplied by Staines can be found in appendix A.

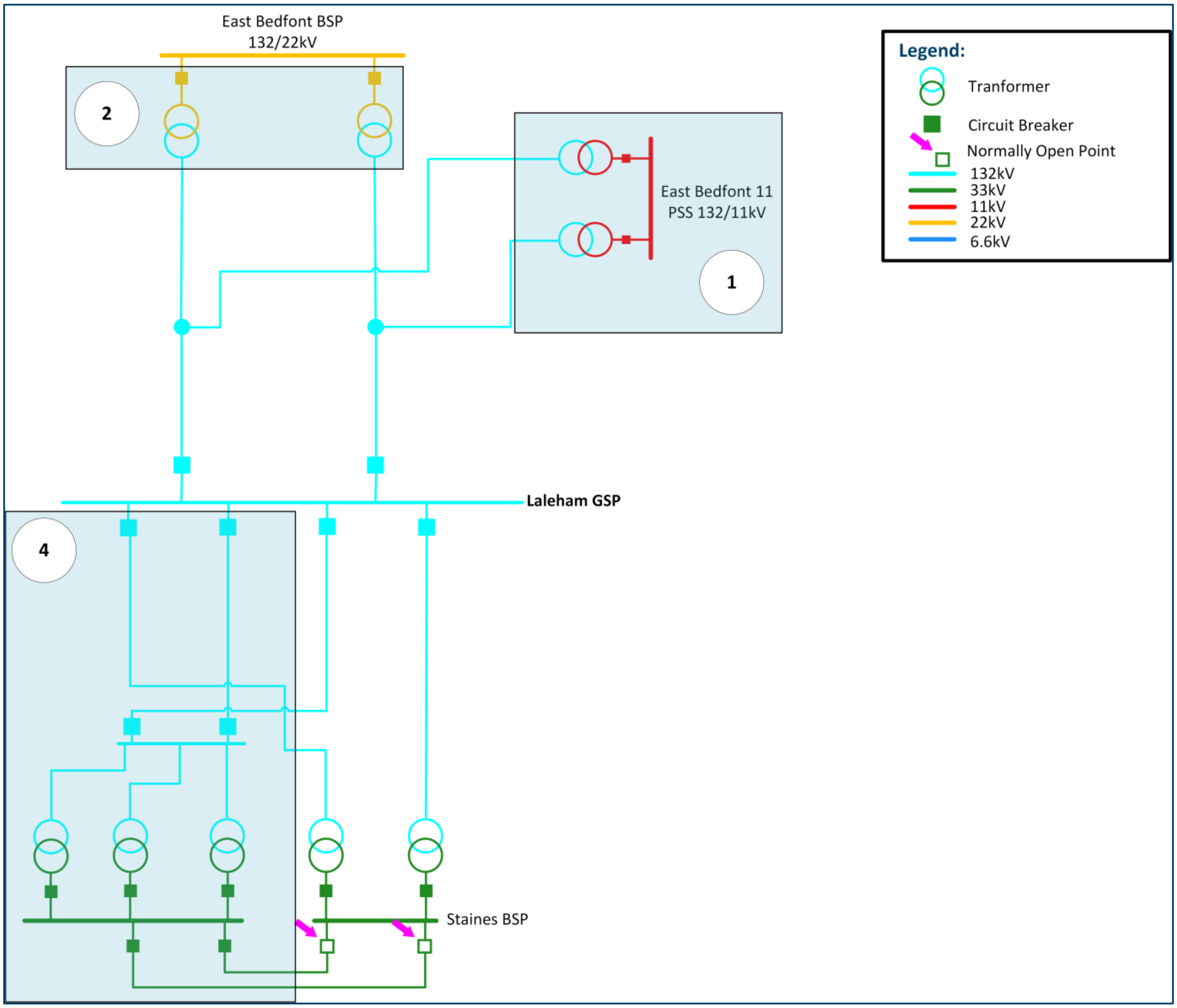

Figure 11 Laleham Network schematic following completion of triggered works.

7. SPATIAL PLAN OF FUTURE NEEDS

7.1. Extra High Voltage / High Voltage spatial plans

The EHV/HV spatial plan shown below in Figure 12 shows the projected headroom or capacity shortfall due to demand increases at primary substations across the Laleham SDP study area. Darker shades indicate that there is a projected capacity shortfall whereas lighter blue shades indicate that there is headroom capacity based on current projections. EHV/HV spatial plans for the other DFES scenarios are presented in appendix B.

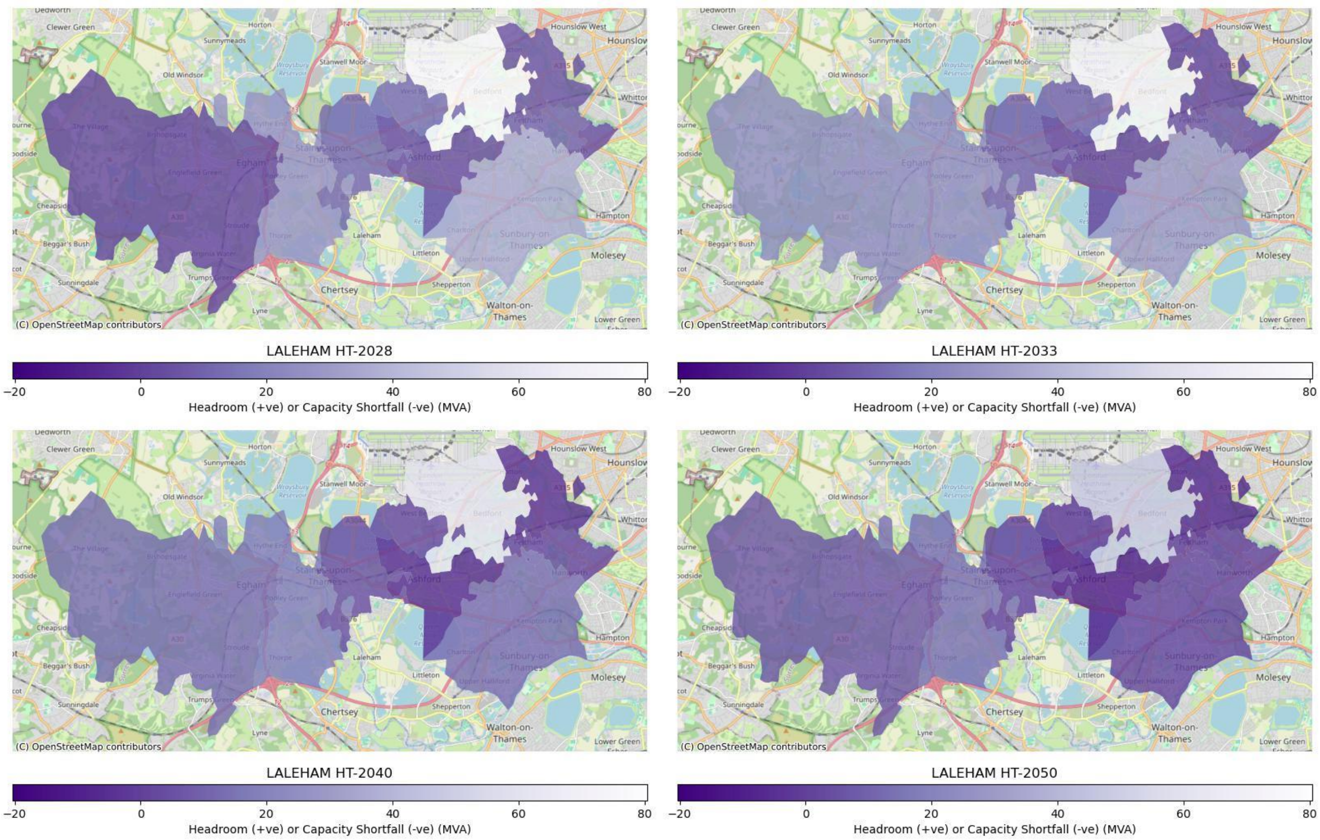

Figure 12 Laleham GSP - EHV/HV Spatial Plans – Holistic Transition

7.2. HV/LV spatial plans

The HV/LV spatial plans shown below in Figure 13 show the point locations of secondary transformers supplied by Laleham GSP. The points are colourised based on the projected percentage loading with red meaning higher percentage loading and green being lower percentage loading. The HV/LV spatial plans for the other DFES 2024 scenarios are available in Appendix C.

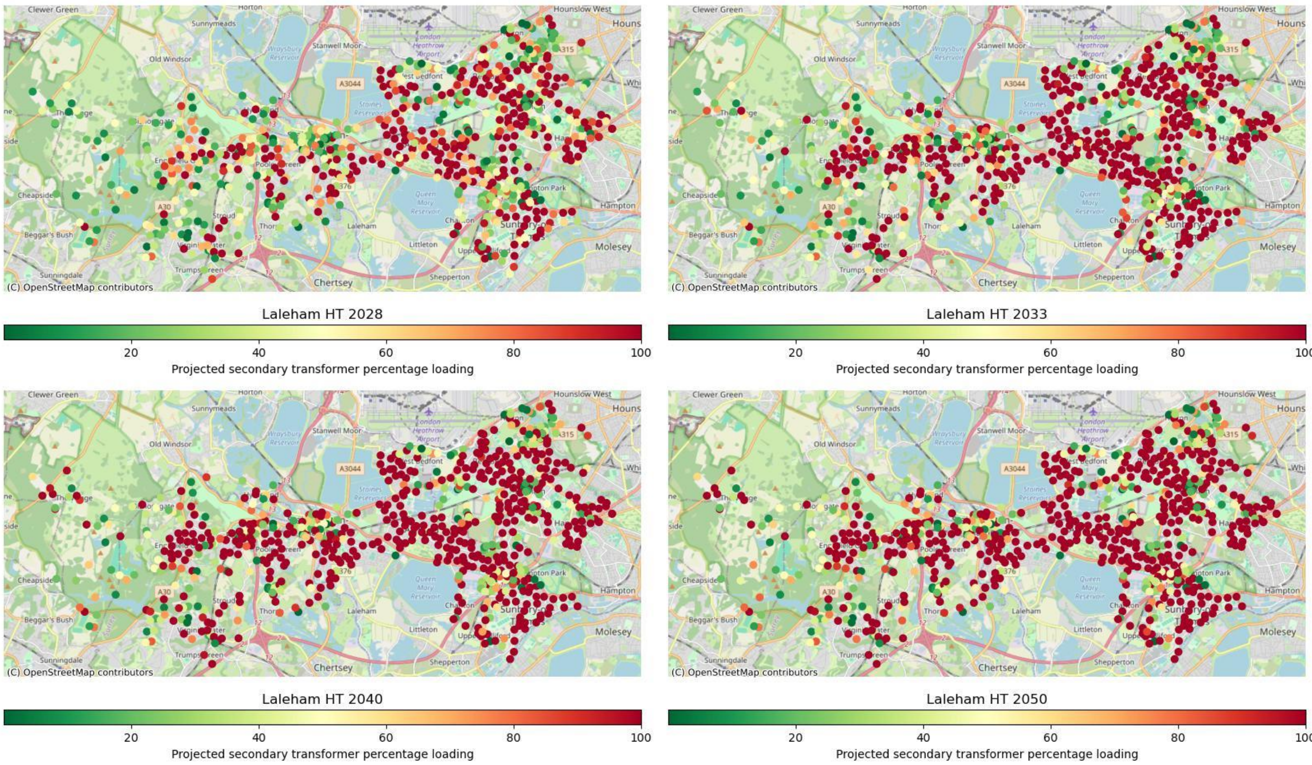

Figure 13 Laleham GSP - HV/LV Spatial Plans – Holistic Transition

8. SPECIFIC SYSTEM NEEDS AND OPTIONS TO RESOLVE

8.1.1. Overall dependencies, risks, and mitigations

There are several 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.
Highlight the potential dependencies/risks and what we have done here or plan to do in order to mitigate these risks.

Dependency: Delivery of the currently triggered work is required to enable some of the solutions proposed here.
Risks: Further investigation into the high-level solutions proposed here will allow further options to be identified if necessary
Mitigation: Annual update of this Strategic Development Plan will consider the timeline of delivery and flag if/where additional options may need to be developed.

Dependency: Requirement for new sites to be identified for a new primary substation in the near term, and potentially a BSP in the medium to long-term.
Risks: High cost and delays to network development due to land availability across west London.
Mitigation: Engagement with the GLA has allowed us to share a forecast range of land requirements for new substations across west London from now until 2050.

Dependency: To align with SSEN's long-term strategy to remove legacy voltage levels, there is a requirement to uprate East Bedfont BSP and downstream substations from 22kV to 33kV.
Risks: Complex project that will need an innovative delivery solution to achieve alongside delivering capacity upgrades at many of the downstream primary substations ahead of 2050.
Mitigation: Requirement has been flagged in this SDP, recommendation to begin understanding how this can be achieved in the near term as some of the 22/11kV and 22/6.6kV primary substations have been identified as requiring intervention in the ED3 period.

8.2. Future EHV System Needs ahead of 2033

The following table details the near-term to medium-term distribution network system needs that have been identified through power system analysis. While asset solutions are described in the table below it is important to note that the use of flexibility will be evaluated for all schemes to ensure the best possible solution is progressed. For the projects shown in Table 4 we recommend that these are progressed through the DNOA process so that there is sufficient time for solutions to be designed and delivered.

ID	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
1	North Feltham PSS 22/11kV transformers	2026	2025	2025	2025	N-1: Loss of one North Feltham 22/11kV transformer	As shown in ID 6, the 22kV supply circuits are projected to be overloaded approximately 5 years later. Potential options to resolve: • Short term solution: reinforcement of the three existing transformers with three higher rated 22/11kV units.

<table>
<tr><th>ID</th><th>Location of proposed intervention</th><th>HT Year</th><th>EE Year</th><th>HE Year</th><th>CF Year</th><th>Network State</th><th>Comments and potential options to resolve the system need</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>• Longer term solution: following the completion of the new BSP (132/33kV) proposed under ID4/ID5, install higher rated 33/11kV transformers at North Feltham PSS and construct new 33kV circuits to the new BSP. This would require deferral of this reinforcement through flexibility to align delivery timescales, significant industrial demand connected to the 11kV network under North Feltham may enable this.</td></tr>
<tr><td>2</td><td>Church Road PSS 22/11kV transformers</td><td>2029</td><td>2027</td><td>2027</td><td>2029</td><td>N-1: Loss of one Church Road PSS 22/11kV transformer</td><td>As shown in section 8.3, the 22kV supply circuits are projected to be overloaded approximately 3 years later. Potential options to resolve:
• Short term solution: reinforcement of the two existing transformers with two higher rated 22/11kV units.
• Longer term solution: reinforcement of the two existing transformers with higher rated units. As detailed in ID1, there is the opportunity to defer this reinforcement to enable transfer to a new BSP proposed under ID4/ID5. This would enable 33/11kV transformers to be installed which aligns to the longer-term strategy for removal of the 22kV network.</td></tr>
<tr><td>3</td><td>Staines BSP to Stanwell PSS 33kV circuits</td><td>2030</td><td>2029</td><td>2031</td><td>2032</td><td>N-1: Loss of one Staines BSP to Stanwell PSS 33kV circuit.</td><td>The transformers at the site are projected to overload in 2041, as such the solution deployed here should enable intervention on the transformers in the future. Potential options to resolve could include:
• Shorter term solution: reinforcement of the existing 33kV circuits to match the rating of the existing transformers (30MVA). This provides sufficient capacity until approximately 2041 when the transformer projected overload is observed.
• Medium term solution: reinforcement of the existing 33kV circuits to 40MVA to match the potential future rating of transformers installed in the 2040s.</td></tr>
<tr><td>4</td><td>East Bedfont BSP 132/22kV transformers</td><td>2030 - 2035</td><td>2030 - 2035</td><td>2030 - 2035</td><td>2030 - 2035</td><td>N-1: Loss of one transformer or 132kV circuit from Laleham GSP to East Bedfont BSP.</td><td rowspan="2">There are two high-level options to resolve the constraints at East Bedfont BSP, these include:
Option 1:
• Development of a new 132/33kV BSP under Laleham GSP.
• Enables programmatic reinforcement and uprating of the existing 22kV network.
• Once complete the existing East Bedfont BSP could be uprated to 132/33kV and interconnection at 33kV could be established between the two sites to enhance security of supply.
Option 2:
• Installation of a third 90MVA transformer at East Bedfont BSP. This should be dual ratio in the</td></tr>
<tr><td>5</td><td>Laleham GSP to East Bedfont BSP 132kV circuits</td><td>2031</td><td>2030</td><td>2031</td><td>2034</td><td>N-1: Loss of one 132kV circuit from Laleham GSP to East Bedfont.</td></tr>
</table>

ID	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
							secondary winding 132/33-22kV (to enable uprating of the 22kV network later if appropriate). • Installation of a new 5km 132kV circuit from Laleham GSP to the new 132/33-22kV transformer. • This work will double the firm capacity of the site however requires significant redesign. It is also dependent on a modification application to NESO. • Consideration of uprating the site from 22kV to 33kV at this stage should be considered. • Replacement of any switchgear with 33kV assets operated at 22kV would likely be a more optimum solution.
6	East Bedfont BSP to North Feltham PSS 22kV circuits	2031	2031	2032	2035	N-1: Loss of one 22kV circuit from East Bedfont BSP to North Feltham PSS.	Required reinforcement of the transformers at the site flagged in **ID1** - consider delivery of this work alongside that to minimise disruption. Potential options to resolve: • Reinforcement of the existing circuits to match the rating of the new transformers – releases the full capacity of these transformers. • Longer term solution would be to install 33kV circuits to a potential new BSP, as introduced in **ID1**. This would result in North Feltham PSS being uprated to 33/11kV.
7	East Bedfont BSP to Church Road PSS 22kV circuits	2032	2031	2033	2035	N-1: Loss of one East Bedfont BSP to Church Road PSS 22kV circuit.	Required reinforcement of the transformers at the site flagged in a previous year, consider delivery of this work alongside that to minimise disruption. Potential options to resolve: • Reinforcement of the existing circuits to match the rating of the new transformers – releases the full capacity of these transformers. • Longer term solution would align with that proposed in **ID2**, requiring installation of new 33kV circuits to the proposed new BSP. This would result in Church Road PSS being uprated to 33/11kV.
8	Staines BSP to Sunbury Cross PSS 33kV circuits	2032	2031	2032	2036	N-1: Loss of one Staines BSP to Sunbury Cross 33kV circuits.	There are three 33kV circuits from Staines BSP to Sunbury Cross PSS, each of these are approximately 6km long. Site selection of the new primary substation proposed in **ID9** below may compliment the solution here. • Option 1: Reinforcement of existing 33kV circuits to a higher rating (40MVA) which will then enable transformer reinforcement in a later year. • Option 2: If the site for the new primary proposed below is located sufficiently close to Sunbury Cross; load transfers through the HV network may enable the projected demand growth without the need for the circuit reinforcement described above.

Table 3 Summary of system needs identified in this strategy through to 2033 along with indicative solutions.

8.3. Future EHV System Needs to 2040

	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
9	East Bedfont PSS 132/11kV transformers	2034	2033	2033	2037	N-1: Loss of one East Bedfont PSS 132/11kV transformer.	The strategy for enabling capacity in the area served by East Bedfont 132/11kV PSS could follow two paths, these are limited due to space requirements at the existing PSS meaning expansion is not possible. Option 1 (22kV network remains): • Development of a new primary substation with two new 40MVA transformers connected to East Bedfont BSP. Option 2 (dependent on new 132/33kV BSP (**ID4**/**ID5**): • Development of a new 33/11kV primary substation that is supplied from the new 132/33kV BSP that is proposed under **ID4**/**ID5.**
10	Feltham PSS 22/6.6kV transformers	2036	2033	2037	2038	N-1: Loss of one Feltham PSS 22/6.6kV transformer.	Feltham PSS is one of the larger primary sites downstream of East Bedfont BSP. Therefore, it makes it the best candidate for expansion, potential options include: • Short-term solution: connect future load to the new primary substation proposed above that is going to connect downstream of East Bedfont BSP. • Medium-term solution: reinforce the existing transformers with higher rated units – these should be dual ratio (22/11-6.6kV) to enable uprating of the HV network in the future. • Long-term solution: reinforcement of the existing transformers with higher rated 33/11kV units, connecting them to the new BSP proposed under ID4/ID5. Alternatively, if this route is followed at this stage Hope and Anchor could be decommissioned with East Bedfont BSP now uprated to 33kV alongside Feltham PSS (and circuits to Ashford Common)– resulting in the removal of the 22kV network across Laleham BSP ahead of 2040. This removes the requirement for additional work listed under **ID15**/**ID16**/**ID17**.
11	Sunbury Cross PSS 33/11kV transformers	2037	2034	2036	2040	N-1: Loss of one Sunbury Cross PSS 33/11kV transformer.	Dependent on the solution progressed for the 33kV supply circuits and new primary substation site for **ID8**/**ID9**: • Reinforcement of the three 33/11kV transformers to 20/40MVA rated units. • Do not carry out reinforcement at this site and instead use load transfers through the HV network to neighbouring primary substations.
12	Staines BSP to Sidney Road PSS 33kV circuits	2038	2037	2039	2044	N-1: Loss of one Staines BSP to Sidney Road PSS 33kV circuit.	Proposed solution: • Reinforcement of approximately 1km of each 33kV circuit from Staines BSP to Sidney Road PSS. A minimum rating of 30MVA is required to release the

	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
							full capacity of the existing 33/11kV transformers at the site.

Table 4 Summary of system needs identified in this strategy through to 2040 along with indicative solutions.

8.4. Future EHV System Needs to 2050

	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
13	Stanwell PSS 33/11kV transformers	2041	2043	2048	2048	N-1: Loss of one Stanwell PSS 33/11kV transformer.	Dependent on solution progressed for **ID3**. Medium term option is favoured as this enables the reinforcement of the 33/11kV transformers to 20/40MVA units providing capacity until beyond 2050.
14	East Bedfont BSP to Feltham PSS 22kV circuits	2045	2045	-	-	N-1: Loss of one East Bedfont BSP to Feltham PSS 22kV circuit.	Uncertainty of this requirement due to the long-term nature. • Longterm solution proposed in **ID10** would result in installation of 33kV circuits to Feltham PSS – sizing new assets appropriately will mitigate this requirement.
15	East Bedfont BSP to Hope and Anchor PSS 22kV circuits	-	2047	2047	2044	N-1: Loss of East Bedfont BSP to Ashford Common 22kV circuit.	Uncertainty of this requirement due to the long-term nature. • As a single transformer site, security of supply is dependent on back feeds through the 6.6kV network – requirements for this will likely arise at an earlier year, raised in section 8.5.1. • Potential to decommission the single transformer site and uprate the downstream 6.6kV network to 11kV allowing it to be transferred to neighbouring primary substations. • The reduction in demand on the 22kV circuits that are shared by Ashford Common and Hope and Anchor PSS by decommissioning would also remove the requirement to reinforce the East Bedfont BSP to Ashford Common 22kV circuit.
16	Hope and Anchor PSS 22/6.6kV transformer	-	2048	2048	2045	Intact	
17	East Bedfont BSP to Ashford Common 22kV circuit	-	-	-	2049	N-1: Loss of East Bedfont BSP to Hope and Anchor PSS 22kV circuit.	
18	Staines BSP to Causeway PSS 33kV circuit	-	-	-	2049	N-1: Loss of Staines BSP to Causeway PSS 33kV circuit.	Uncertainty of this requirement due to the long-term nature. No proposed work at this stage, re-assessment with annual forecast updates will identify whether a built solution should be progressed or opportunities to mitigate overloads through flexibility and energy efficiency.

Table 5 Summary of system needs identified in this strategy through to 2050 along with indicative solutions.

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

Our HV/LV spatial plans have shown that there is no clear pattern to 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 Laleham GSP high voltage and low voltage network needs to 2050.

8.5.1. High Voltage Networks

Voltage rationalisation

As identified in other SDPs, there is ongoing work to uprate legacy 6.6kV HV network across SSEN's licence area to 11kV. In the case of Laleham this relates to two primary substations: Feltham PSS, and Hope and Anchor PSS. As identified in section 8.4 it is likely that Hope and Anchor will be decommissioned ahead of 2050. As recommended above, dual ratio 22/11-6.6kV transformers should be installed at Feltham when the firm capacity of the existing transformers is set to be exceeded. For a period after this Hope and Anchor should remain in-service to support the remaining 6.6kV network during uprating.
Once this is complete, the demand at Hope and Anchor PSS can be supported by Feltham PSS with the legacy 6.6kV network removed in place of 11kV.

HV Capacity needs

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 the load model that is produced by SSEN's Data and Analytics team.[4]
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 10 primary substations supplied by Laleham 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 14 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.

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

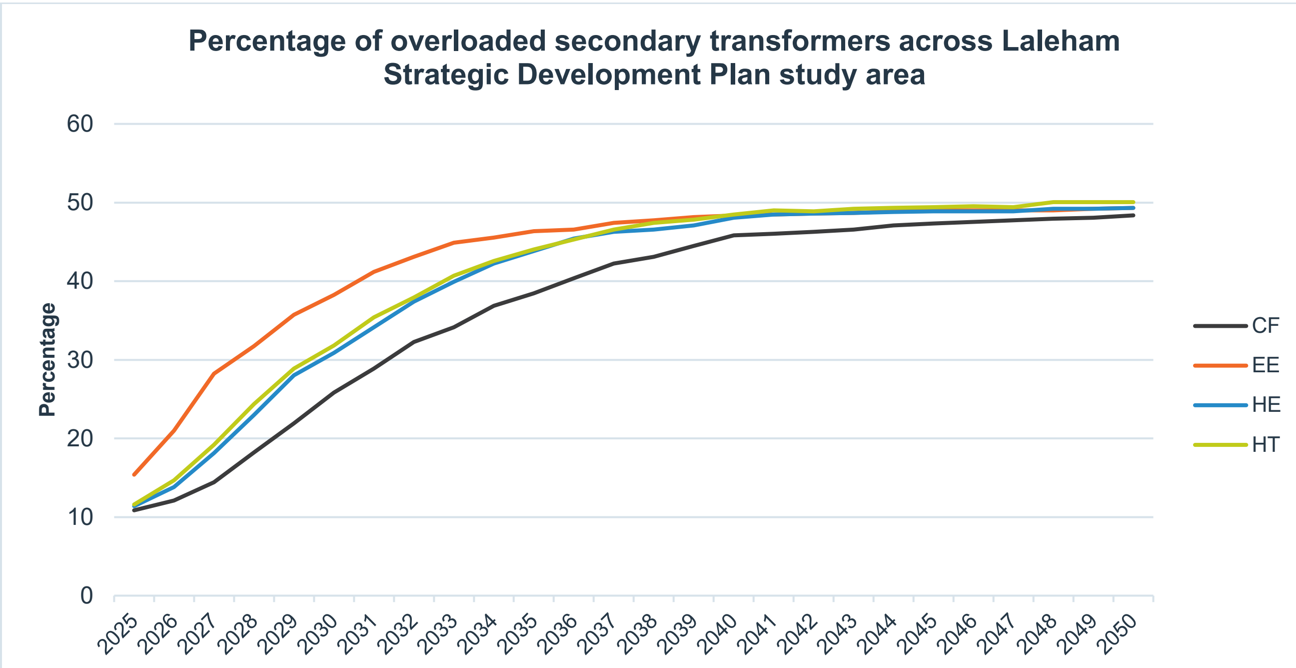

Figure 14 Laleham GSP Projected secondary transformer loading. *Source: SSEN Load Model*

Considering the Just Transition in HV development

SSEN are building on the findings from the Vulnerability Future Energy Scenarios (VFES). This innovation project investigated how the use of new fore-sighting techniques, along with data analytics and expert validation could be used to identify and forecast consumers in vulnerable situations as we move toward net zero. Use of the outputs from the VFES enable SSEN to develop the network in a way that truly accounts for the levels of vulnerability their customers in different locations face.

One of the outputs from this innovation project was the report produced by the Smith Institute.[5] This work groups LSOAs[6] that share similar drivers of vulnerability. The groupings were informed by mathematical analysis of demographic data and of SSEN's priority service register, using machine learning to model the complex relationships that exist between the two. The resulting group numbers and descriptions are shown in Figure 15.

Group Number & Level of Vulnerability	Description of Group
1 – Very high	Driven up by higher levels of poor health and disability/mental health benefit claimants, reduced by smaller household sizes.
2 – High	Driven up by larger household sizes, reduced by lower elderly population levels.
3 – High	Driven up by larger elderly population levels, reduced by lower levels of disability and mental health benefit claimants.

5 VFES Machine Learning Discovery of Vulnerability Signatures Report, Smith Institute, 08/11/2022, (NIA SSEN 0063: VFES – Vulnerability Future Energy Scenarios | SSEN Innovation)

6 Lower layer Super Output Areas (LSOAs) (Statistical geographies - Office for National Statistics)

4 – Slightly higher than average	Driven up by larger elder population levels and moderately higher provision of care, reduced by smaller household sizes.
5 – Slightly lower than average	Driven down by lower elderly population levels and larger levels of ethnic diversity, increased by higher household sizes and greater provision of care.
6 – Low	Driven down by lower level of bad health and disability/mental health benefit claimants, increased by moderate elderly population levels and household sizes.
7 – Very low	Driven down by substantially lower elderly population levels, less provision of care and a higher level of households in private rented dwellings.

Figure 15 VFES Groupings

As shown in Figure 16, there are several Lower-layer Super Output Areas (LSOAs) that are class 1 meaning they have been identified as very high vulnerability. From using the load model, we can identify secondary transformers that are projected to be over 100% loaded by 2028. Some of these are also identified as being located within the areas classed as highly vulnerable.

These secondary transformers should be prioritised for load related reinforcement as it will reduce the likelihood of asset failure for load reasons and increase network resilience in these areas.

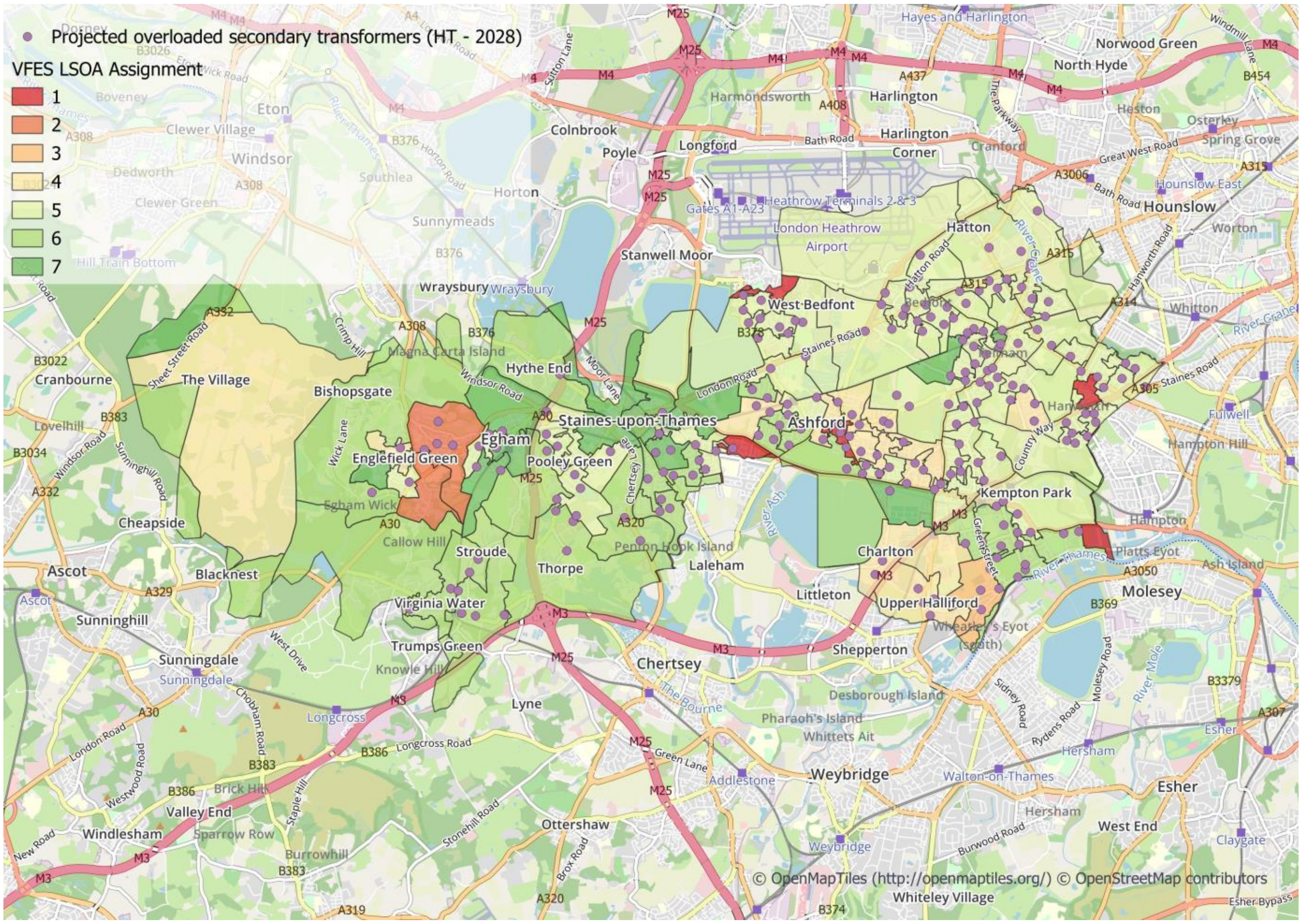

Figure 16 Laleham GSP area VFES output with secondary transformer overlay

8.5.2. 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 system need of the LV network across Laleham 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 22% of low voltage feeders may need intervention by 2035 and 32% by 2050 under the HT scenario as shown in Figure 17. 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.

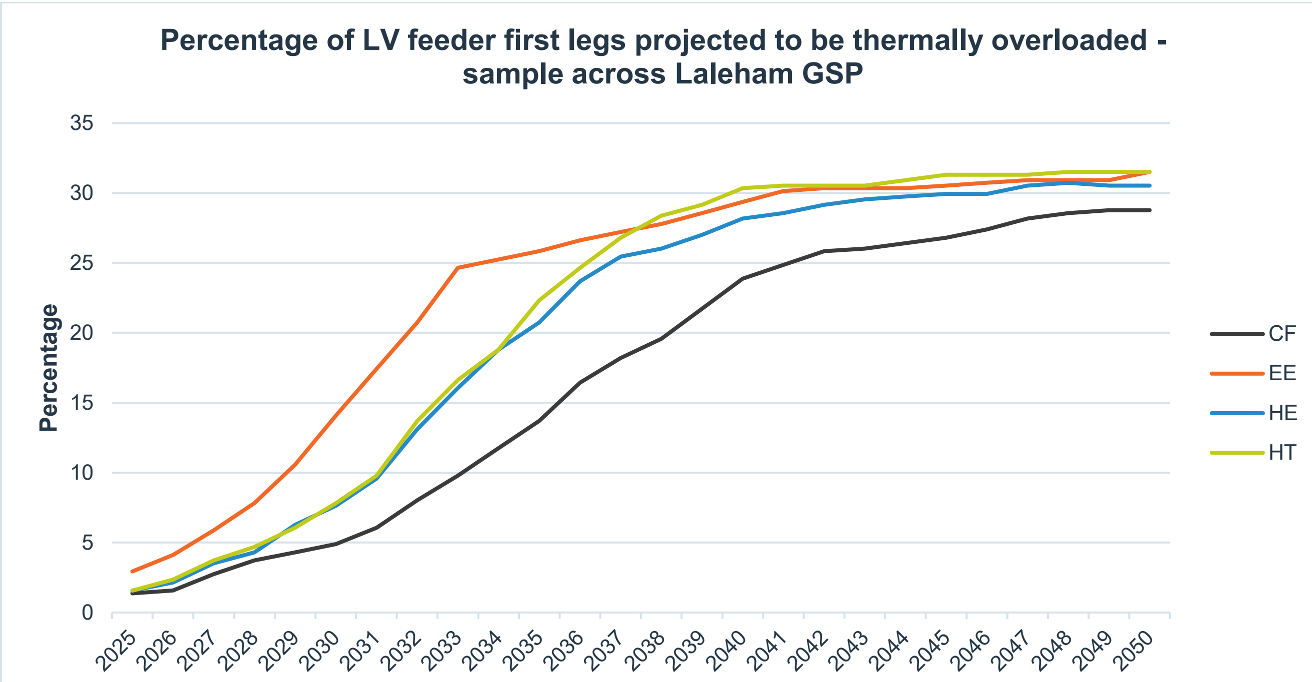

Figure 17 Percentage of LV feeders projected to be overloaded under Laleham GSP

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2024 DFES analysis provides a robust evidence base for load growth across Laleham GSP group in both the near and longer term. Drivers for load growth across Laleham GSP arise from multiple sectors and technologies. These drivers impact not only the EHV network but will drive system needs across all voltage levels.

The findings from this report have provided evidence for 4 key recommendations:

1. System needs that have been identified to arise in the near-term should be progressed through the DNOA process to develop a more in-depth solution. For this SDP, this includes:
    a. North Feltham PSS 22/11kV transformers and East Bedfont BSP to North Feltham PSS 22kV circuits.
    b. Church Road PSS 22/11kV transformers and East Bedfont BSP to Church Road PSS 22kV circuits.
    c. Staines BSP to Stanwell PSS 33kV circuits.
    d. East Bedfont BSP 132/22kV transformers and Laleham GSP to East Bedfont 132kV circuits.
    e. Staines BSP to Sunbury Cross PSS 33kV circuits.
2. Continued engagement with the GLA to understand land availability and suitable sites for new substations (including a new primary substation in the next 10 years).
3. Develop a detailed plan for uprating of East Bedfont BSP from 22kV to 33kV while carrying out the required capacity increases at primary substations that are currently fed from the site.
4. Continued collaboration with NGET and rollout of further innovative solutions like the West London ramping agreement will enable connections ahead of transmission reinforcement dates (subject to distribution capacity).

Actioning these recommendations will allow SSEN to develop a network that supports local net zero ambitions and enables growth in the local economy. By doing so, this will ultimately contribute to net zero targets at a national level.

Appendix A: Additional network schematics

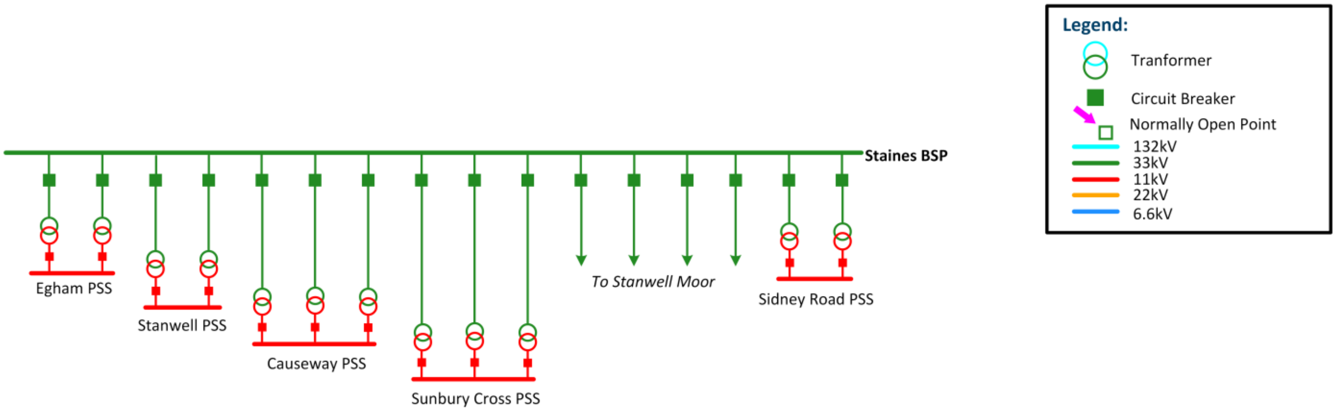

Figure 18 Schematic diagram of the existing network supplied by Staines BSP

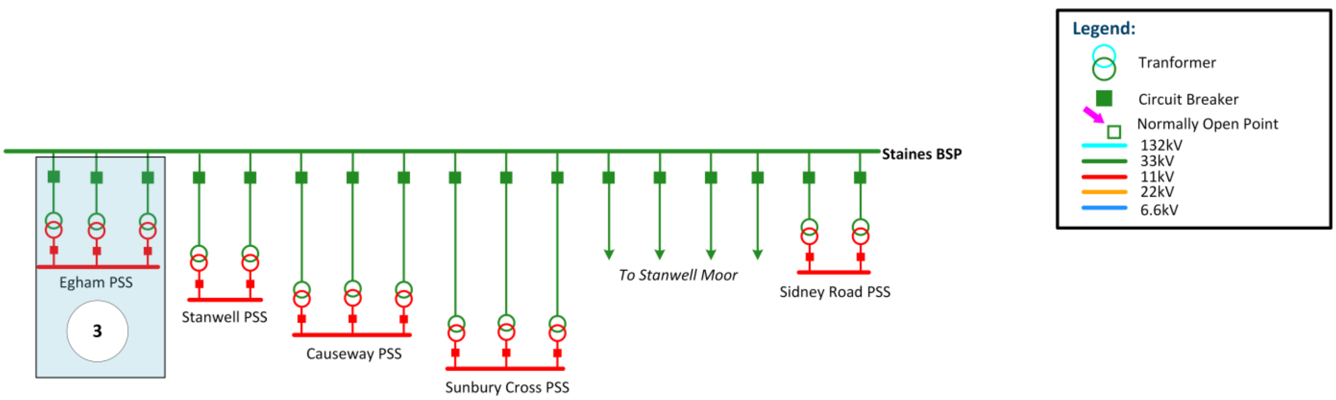

Figure 19 Schematic diagram of the network supplied by Staines BSP following the completion of triggered work

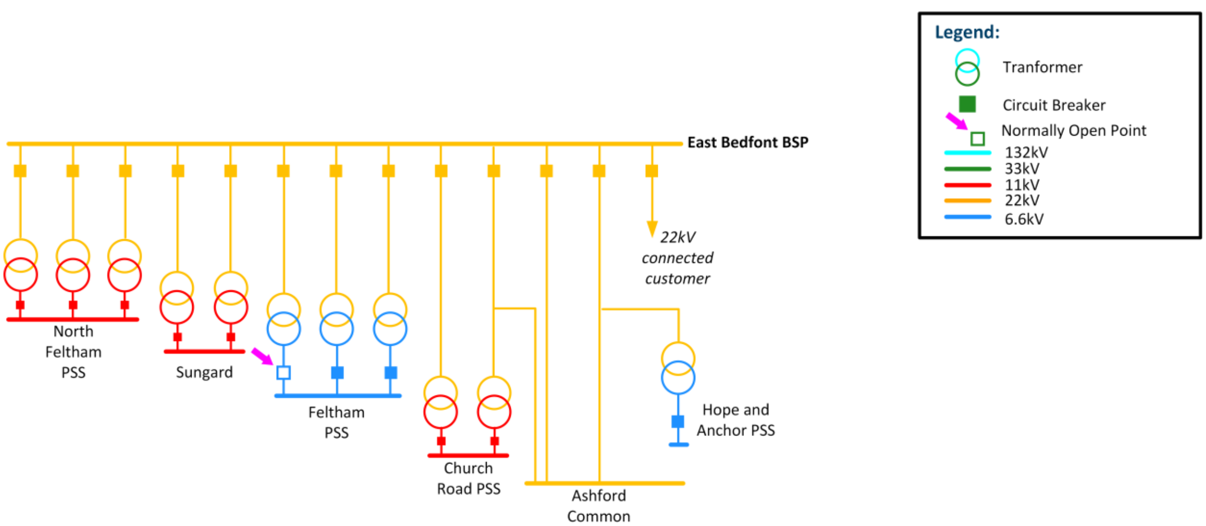

Figure 20 Schematic diagram of the network supplied by East Bedfont BSP

Appendix B: EHV/HV spatial plans for other DFES scenarios

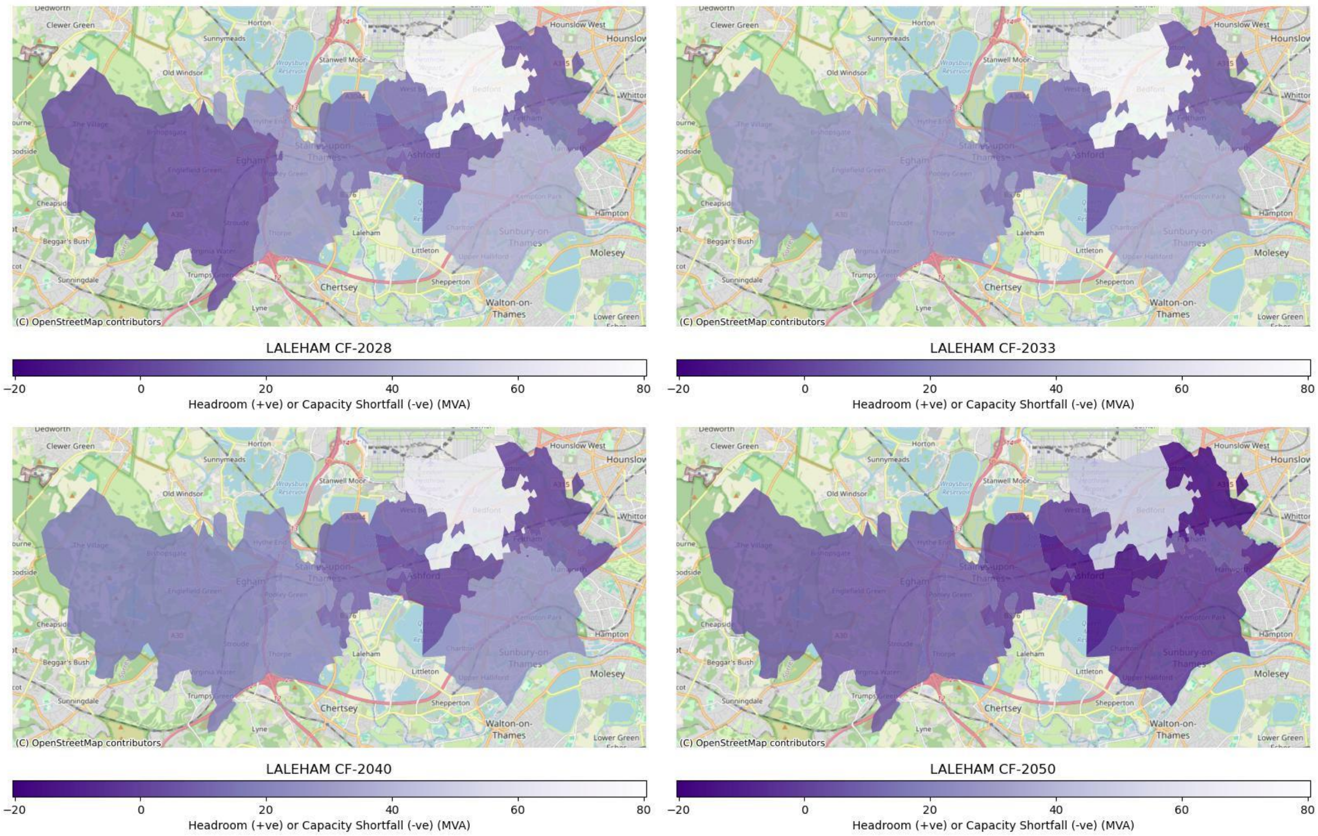

Figure 21 Laleham GSP - EHV/HV Spatial Plan - Counterfactual

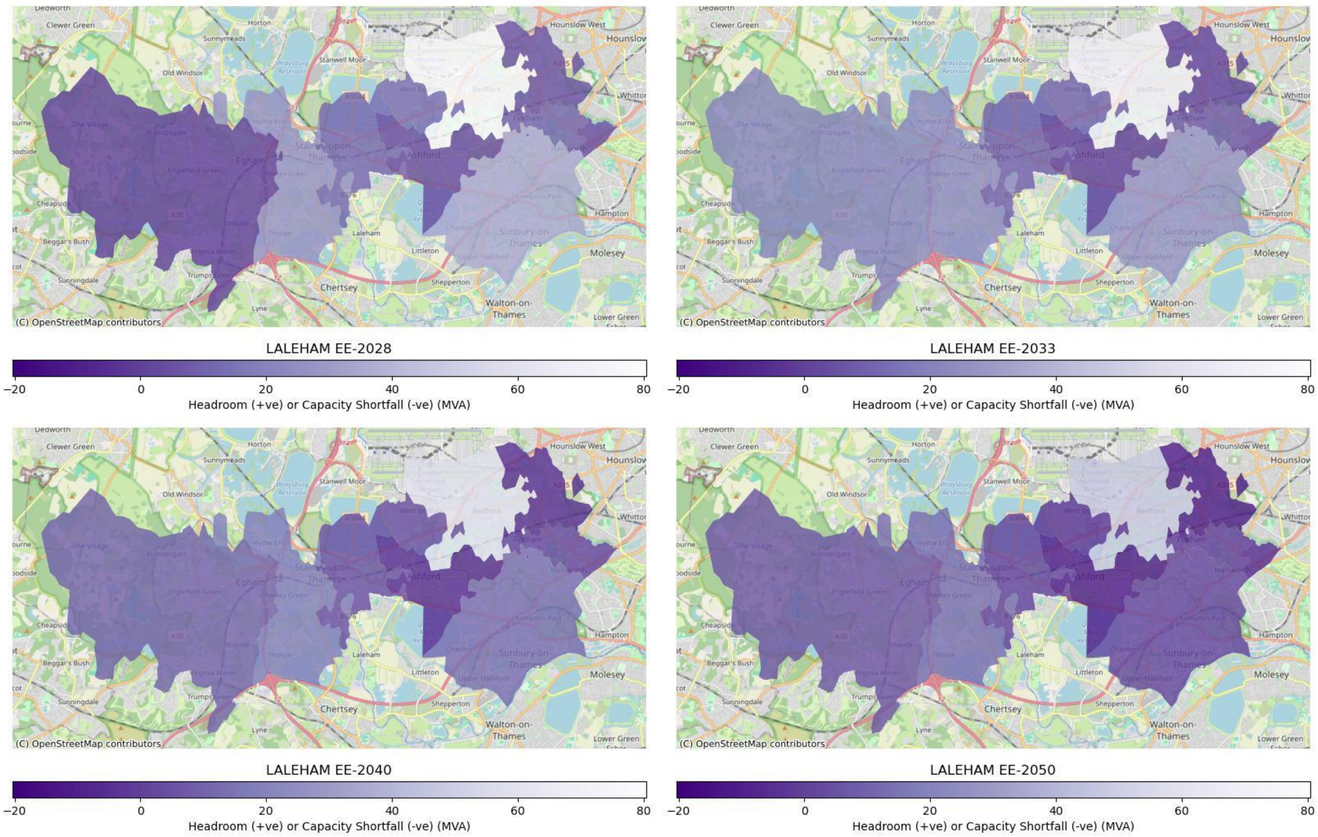

Figure 22 Laleham GSP - EHV/HV Spatial Plan – Electric Engagement

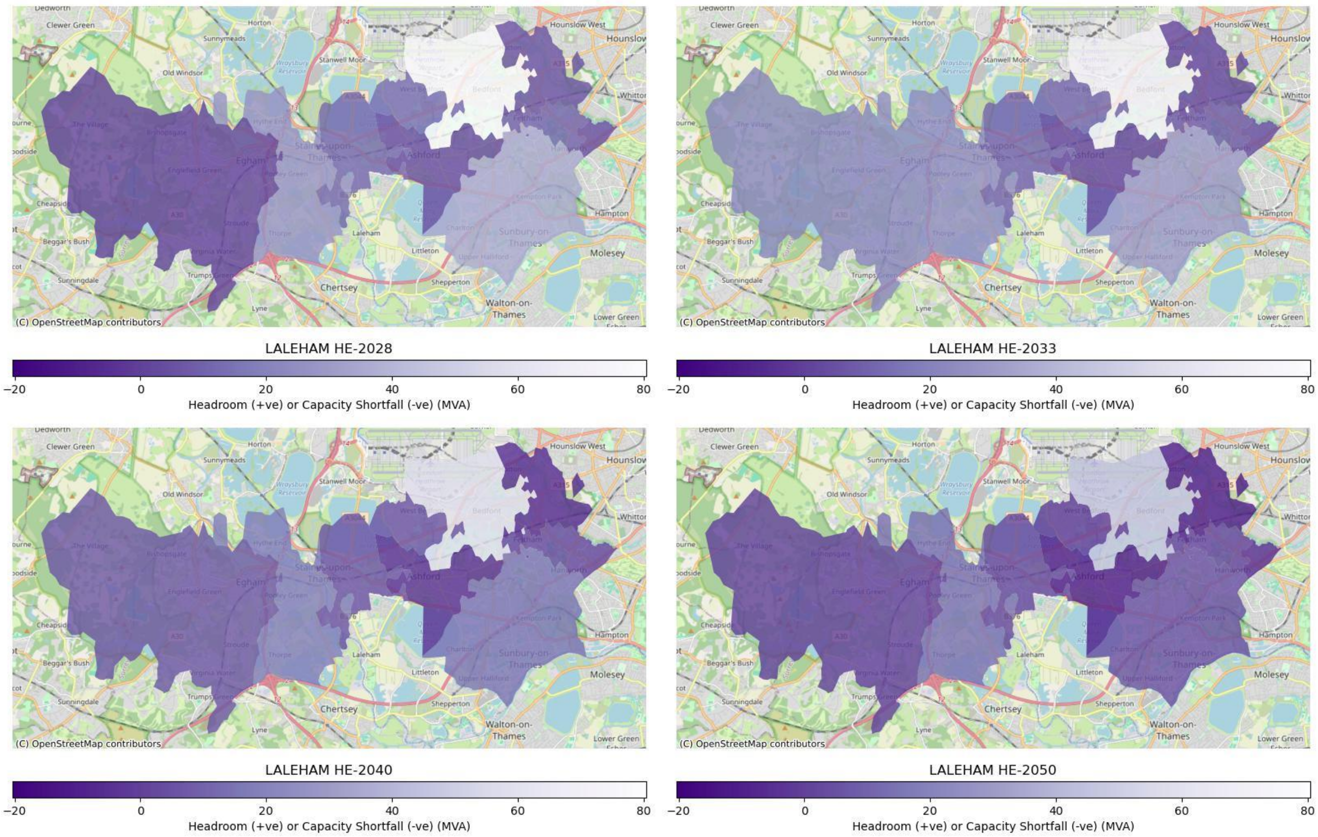

Figure 23 Laleham GSP - EHV/HV Spatial Plan – Hydrogen Evolution

Appendix C: HV/LV spatial plans for other DFES scenarios

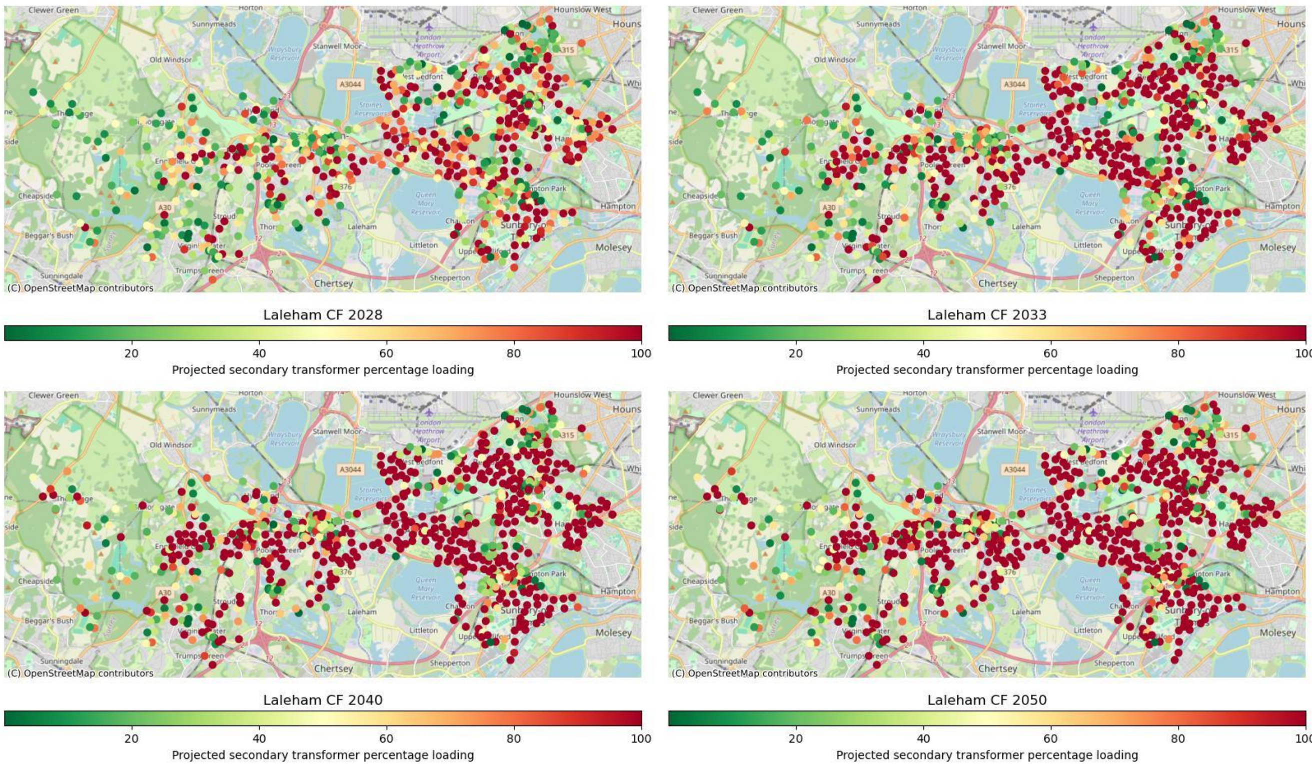

Figure 24 Laleham GSP - HV/LV Spatial Plan – Counterfactual

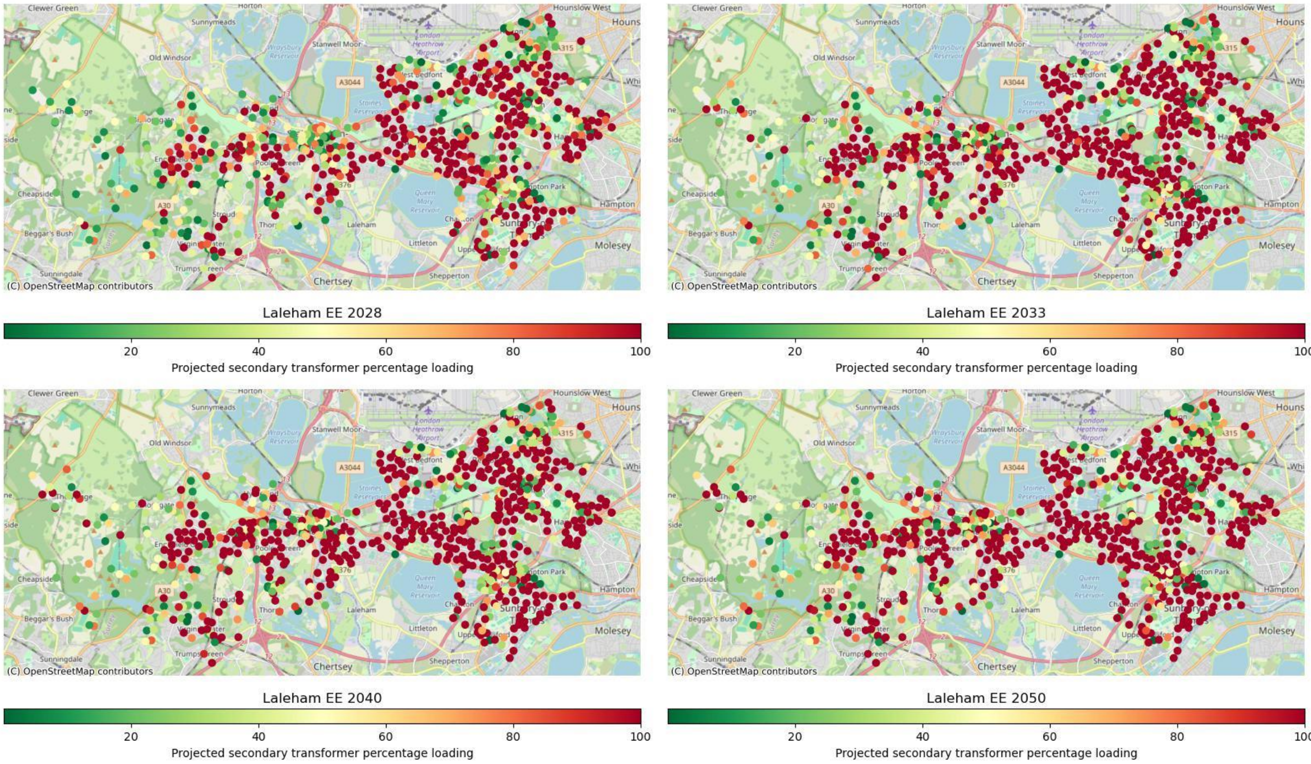

Figure 25 Laleham GSP - HV/LV Spatial Plan – Electric Engagement

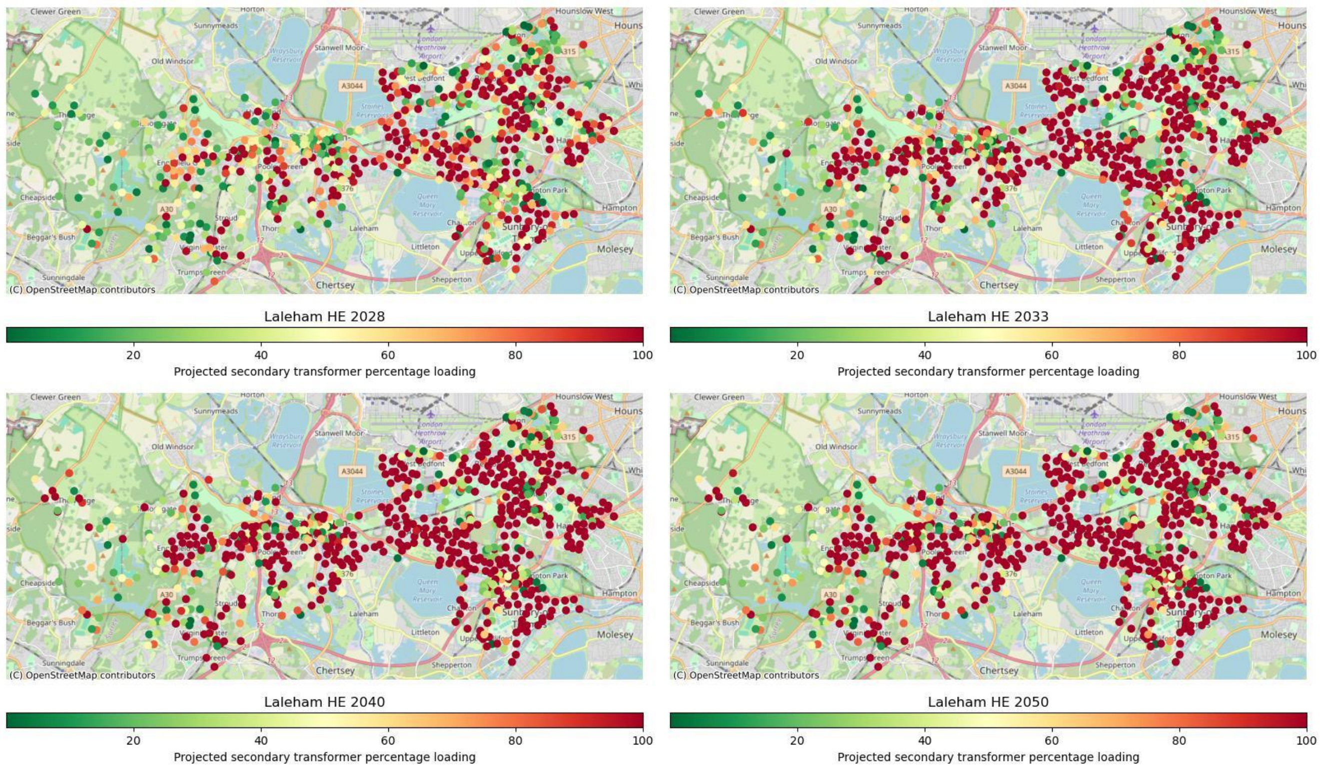

Figure 26 Laleham GSP - HV/LV Spatial Plan – Hydrogen Evolution

Appendix D: Glossary

Acronym	Definition
AIS	Air Insulated Switchgear
ANM	Active Network Management
BAU	Business as Usual
BSP	Bulk Supply Point
CB	Circuit Breaker
CBA	Cost Benefit Analysis
CER	Consumer Energy Resources
CF	Counterfactual
CMZ	Constraint Managed Zone
CT	Consumer Transformation
DER	Distributed Energy Resources
DESNZ	Department for Energy Security and Net Zero
DFES	Distribution Future Energy Scenarios
DNO	Distribution Network Operator
DNOA	Distribution Network Options Assessment
DSO	Distribution System Operation
DSR	Demand Side Response
EE	Electric Engagement
EHV	Extra High Voltage
EJP	Engineering Justification Paper
ER P2	Engineering Recommendation P2
NESO	National Energy System Operator
NGET	National Grid Electricity Transmission
ENA	Electricity Networks Association
EV	Electric Vehicle

FES	Future Energy Scenarios
FS	Falling Short
GIS	Gas Insulated Switchgear
GSPs	Grid Supply Point
HE	Hydrogen Evolution
HT	Holistic Transition
HV	High Voltage
kV	Kilovolt
LAEP	Local Area Energy Planning
LCT	Low Carbon Technology
LENZA	Local Energy Net Zero Accelerator
LV	Low Voltage
LW	Leading the Way
OHL	Overhead Line
PSS	Primary Substation
PV	Photovoltaic
NSHR	Network Scenario Headroom Report (part of the Network Development Plan)
MW	Megawatt
MVA	Mega Volt Ampere
ODM	Operational Decision Making
RESOP	Regional Energy System Operation Planning
RIIO-ED1/2	Revenue = Incentives + Innovation + Outputs, Electricity Distribution 1 / 2 (regulatory price control periods)
SDP	Strategic Development Plan
SEPD	Southern Electric Power Distribution
SLC	Standard Licence Condition
SSEN	Scottish and Southern Electricity Networks
ST	System Transformation

UM	Uncertainty Mechanism
VFES	Vulnerability Future Energy Scenarios
WSC	Worst Served Customers

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Scottish & Southern Electricity Networks