BRAMLEY – BASINGSTOKE GRID SUPPLY POINT: STRATEGIC DEVELOPMENT PLAN

Our network serving communities across Central Berkshire and North Hampshire

Draft for consultation

September 2025

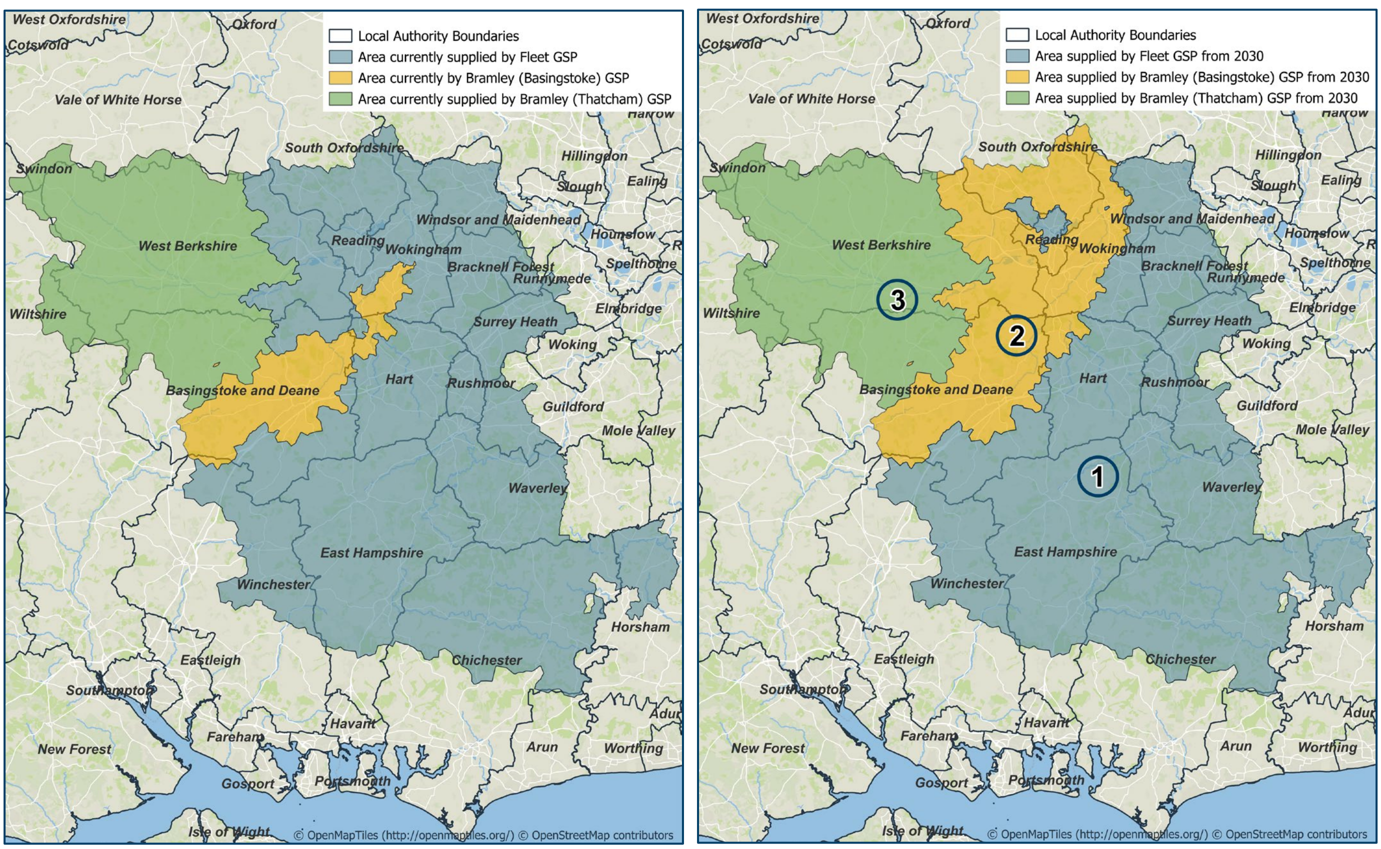
Scottish & Southern Electricity Networks

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 to 2050 and translate these requirements into strategic spatial plans of the future distribution network needs. This helps us transparently present our future conceptual plans and facilitate discussions 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 (SSEN – Strategic Development Plan Methodology).

This SDP focuses on the area served by Bramley – Basingstoke Grid Supply Point (GSP). SSEN is currently undertaking a major project across Fleet GSP and Bramley – Basingstoke GSP to transfer part of the network to Bramley – Basingstoke GSP. Therefore, the area fed by Bramley – Basingstoke GSP is changing. Figure 1a shows the areas supplied by Fleet GSP, Bramley – Basingstoke GSP and Bramley - Thatcham GSP today. In 2030, three bulk supply point (BSP) areas will be moved from being supplied by both Fleet GSP and Bramley – Basingstoke GSP to being fed by only Bramley – Basingstoke GSP – Figure 1b shows what the new area fed by Bramley – Basingstoke GSP will be. As this SDP aims to look at the long-term plan for Bramley – Basingstoke GSP, the area covered by this SDP is that supplied by Bramley – Basingstoke GSP from 2030 onwards which is highlighted in 1b as area 2. Two other SDPs cover areas 1 and 3 in Figure 1b, Fleet SDP and Bramley – Thatcham SDP respectively.



(a) (b)

Figures 1a and 1b show the areas supplied by Fleet GSP, Bramley – Basingstoke GSP and Bramley - Thatcham GSP today and from 2030 respectively.

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 from Basingstoke and Deane, Buckinghamshire, Hart, Reading, South Oxfordshire, West Berkshire, Wokingham, Hampshire County Council, and Oxfordshire County Council have been considered in preparation of this plan. A significant amount of 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 pathways 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 these pathways to develop the network in an efficient and stakeholder led way.

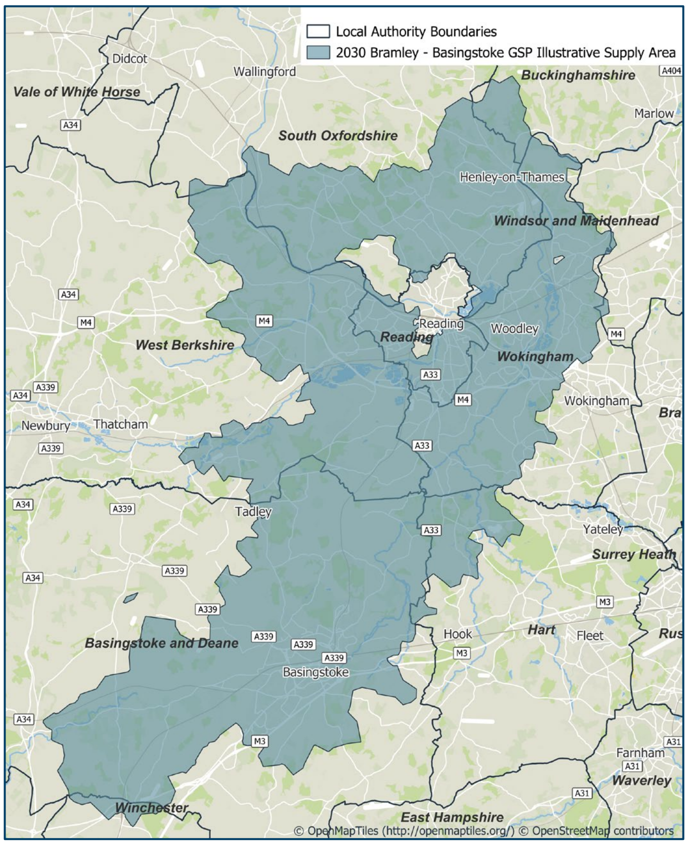


Figure 2 – The future Bramley – Basingstoke GSP supply area and area covered by Bramley – Basingstoke SDP with local authority boundaries.

2. INTRODUCTION

This report demonstrates 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 Bramley – Basingstoke 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.

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 based on the National Energy System Operator (NESO) Future Energy Scenarios (FES) while accounting for 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 as we move towards the national 2050 net zero target. Due to the timing of when this report was produced, this SDP has been informed by the analysis undertaken as part of the DFES 2023. DFES 2023 consists of four different scenarios which are summarised in Figure 3. SSEN currently use Consumer Transformation as the central case scenario following stakeholder feedback during the RIIO-ED2 development process. This position is reviewed annually. The 2024 edition of DFES outlines three new pathways (Holistic Transition, Electric Engagement, and Hydrogen Evolution) that achieve net zero by 2050 against a Counterfactual. Further detail on DFES 2024 can be found in Appendix B and in the DFES 2024 reports.

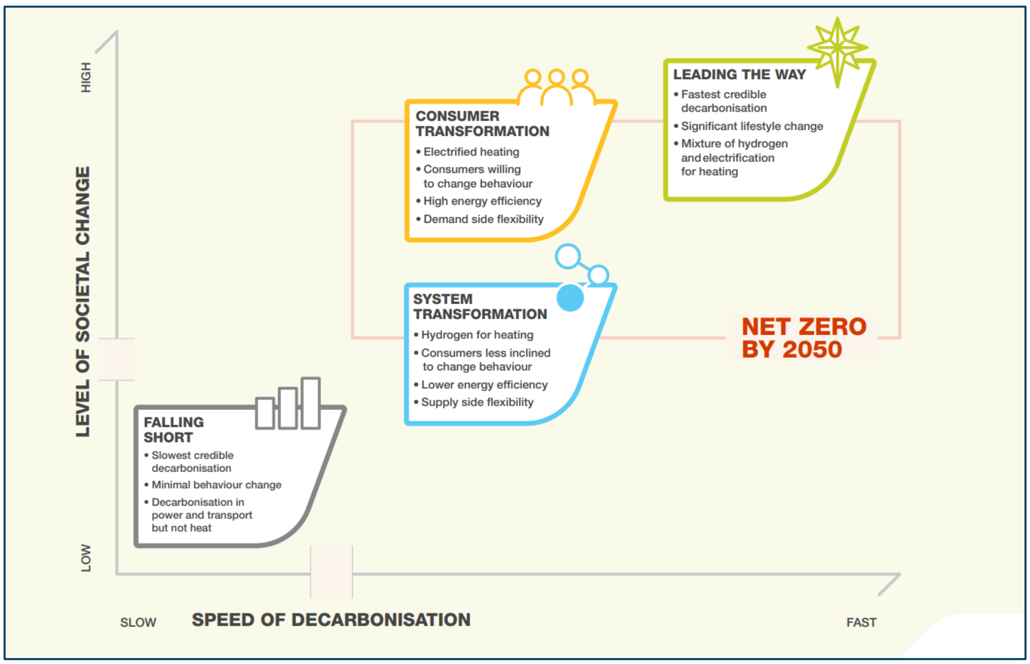


Figure 3 – The 4 Future Energy Scenarios adopted for DFES 2023. Source: NESO FES

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 four scenarios, and the projected 2050 load. Here, system needs are identified through power system analysis using the Consumer Transformation scenario in alignment with evidence gathered in preparation of the SSEN ED2 business plan. 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 strategy.

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The main local authorities that are supplied by Bramley – Basingstoke GSP are Basingstoke and Deane, Buckinghamshire, Hart, Reading, South Oxfordshire, West Berkshire, Wokingham, Hampshire County Council, and Oxfordshire County Council. A map showing the local authorities that will be supplied by Bramley – Basingstoke GSP in the long term is shown in Figure 4. 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.

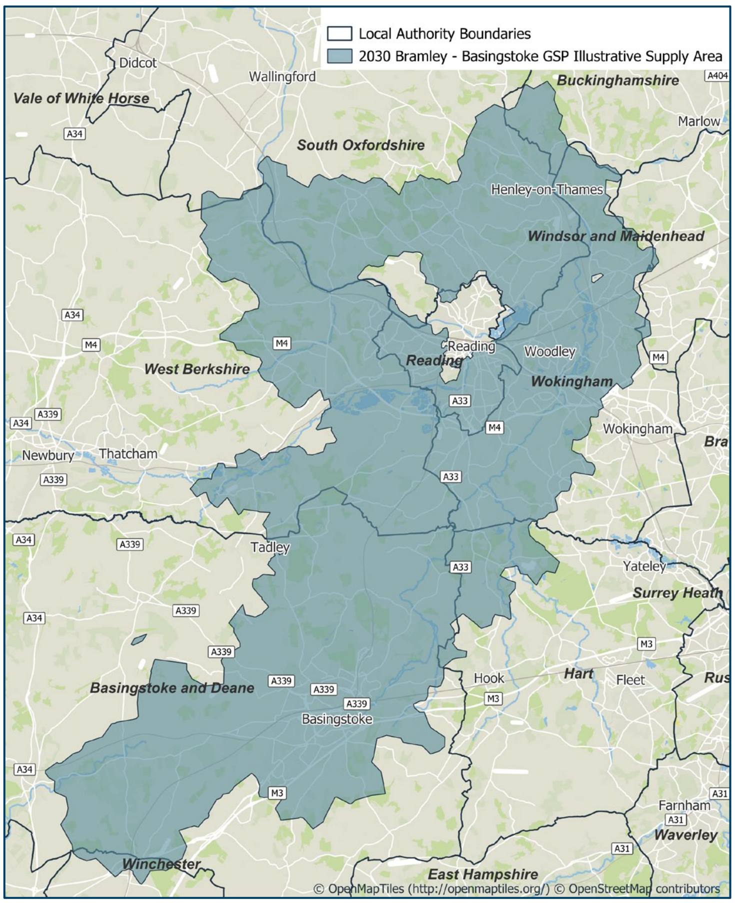


Figure 4 – Bramley – Basingstoke GSP supply area from 2030 and local authority boundaries.

3.1.1. Basingstoke & Deane

Basingstoke and Deane are in the process of updating their Climate Change and Air Quality Strategy which explores possible pathways to Net Zero and the strategy sets out its aim to be a net zero borough by 2045.

The Council has recently adopted its EV Charging Strategy and has been rolling out chargers in car parks, with a proposal for a facility to be operated by Gridserve on Council land. The Council is also working with the County Council for delivery of on-street chargers and is doing a phased electrification of their vehicle fleet and working with public transport operators to look at the longer-term electrification of their fleets.

The Council has undertaken sustainability audits of their building assets and are rolling out decarbonisation plans. This included commissioning a Solar Panel Study of PV potential for all non-domestic rooftops larger than 30 m^2. They are also carrying out domestic energy surveys and signposting support for retrofit[1]. There are three community energy companies in the borough who have received grant funding to help get projects off the ground, and the council has been rolling out Solar Together schemes.

The Council is in the process of developing their updated local development plan which identifies a number of strategic development locations across the borough. As part of the draft plan, they have included a policy to support the installation of renewable energy and are in the process of identifying the areas that may be suitable for renewables. The draft local plan also sets a requirement for all new homes to have a 'net zero' operational energy balance, which means that they are required to generate as much energy as they would use to achieve a 'net zero' balance.

3.1.2. Buckinghamshire

Buckinghamshire Council has seen population growth of 9.5% from around 505,300 in 2011 to around 553,100 in 2021[2]. The Council was formed in 2020, combining the four local councils of Aylesbury Vale, Chiltern, Wycombe, and South Buckinghamshire. It is currently developing its first Local Plan and has produced the Council's Climate Change and Air Quality Strategy, which aims to reduce 75% of council emissions by 2030 and meet the national net zero target by 2050 as a minimum with ambitions to reach this target earlier. In March 2024, the council was successful in securing £1.9 million of government LEVI funding to install hundreds of publicly accessible EV chargers.

The council has also started a new home energy efficiency grant scheme for grants up to £32,000 to be used for energy efficiency improvements in homes across the county, making these houses more suitable for the installation of heat pumps. Furthermore, in April 2024, the council released their Housing Strategy for 2024 to 2029, where energy efficiency is placed in front and centre.

3.1.3. Hart

Hart District Council aims to become a carbon-neutral authority by 2035 and to become a carbon-neutral district by 2040. They also have a Climate Change Action Plan which includes looking at making their council buildings more efficient and to decrease their associated carbon emissions.

In terms of transport, the council is working with Hampshire County Council on expanding the electric vehicle charge point network. The Council has started to deliver public electric vehicle charge points in its town/village centre car parks across the district. The Cycle and Car Parking in New Development supplementary planning document, provides guidance on electric vehicle charge points for developers which requests compliance with Part S of building regulations.

3.1.4. Reading

Reading Borough Council has committed to achieving net zero by 2030 and are currently working on their 2025 to 2030 action plan to achieve this. They aspire to have heat networks and are undertaking detailed feasibility

1 Climate change and what we are doing

2 Census 2021, January 2023, How life has changed in Buckinghamshire: Census 2021.

studies for the north of the station network and the civic quarter.[3] They are expanding their electric vehicle charge point infrastructure, including putting multiple charge points into a town centre car park. The Council are undertaking a local plan review which will include the Future Homes Standard and they are including a heat pump policy.

3.1.5. South Oxfordshire

South Oxfordshire District Council has seen population growth of 11% from around 134,300 in 2011 to around 149,100 in 2021[4]. To meet the expected growth in population, in South Oxfordshire's and Vale of White Horse's Joint Local Plan 2041 (submitted for examination December 2024), the council has a target of building 16,530 new homes between 2021 and 2041. The Council has a target to become operationally net zero in 2030 and become a net zero district by 2045. The Council has secured £1,866,546 in Public Sector Decarbonisation Scheme funding to decarbonise its buildings, such as the Council's art centre where solar PV panels and a heat pump will be installed. To support Oxfordshire County Council's Local Transport and Connectivity Plan, the Council has produced the ambitious Electric Vehicle Infrastructure Strategy that lays the groundwork to accommodate the projected growth in EVs over the next several years. One of several targets outlined in this strategy is to convert 7.5% of local authority owned car park space to EV charge points by 2025. The Council's Park and Charge project, part of the Oxfordshire Council's Electric Vehicle Infrastructure Strategy, is funding the rollout of charge points across the county to achieve this target.

3.1.6. West Berkshire

West Berkshire Council has a declared net zero ambition for both its own organisation and the district by 2030 which is supported by their Environment Strategy. As part of this, they are progressing with building their own solar farm and are keen to explore further opportunities of renewable generation in the borough.

The Council has an Ultra Low Emission Vehicle Strategy and is rolling out off-street and on-street electric vehicle charge points via the LEVI scheme.

The Council is creating a Heat Decarbonisation Strategy and is applying for funding to decarbonise a leisure centre.

3.1.7. Wokingham

Wokingham Borough Council has committed to be carbon neutral by 2030 and has a Climate Emergency Action Plan to support this. Development is underway to connect a 20MW solar farm in 2026 and the Council aims to deliver an additional solar farm by 2027. The Council are retrofitting their corporate assets and schools with solar PV and delivering upgrades to the council-owned social housing through the Social Housing Decarbonisation Fund. They are also supporting residential retrofits through schemes like Solar Together, an advice service and supporting residents accessing funding schemes.

The Council has a draft Electric Vehicle Charging Strategy, which identifies that by 2030, the public sector should facilitate the delivery of an additional 783 fast and 49 rapid charging sockets.

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3 Climate change - Reading Borough Council

4 Census 2021, January 2023, How life has changed in South Oxfordshire: Census 2021.

3.1.8. Hampshire County Council

Hampshire County Council has two targets: to be carbon neutral by 2050 and to build resilience to a two-degree rise in temperatures. The Council has published a strategy, action plan and strategic framework for action to achieve its carbon neutral aims and details numerous steps it has planned to electrify various sectors of the local economy.

In its strategic framework, the Council lays out plans to develop and roll out an electric vehicle strategy across the county and development of an electric vehicle charge point strategy is underway, supported by the LEVI fund. In terms of its own estates, the Council aims to transition to fossil-fuel-free heating and install solar PV on depot buildings. A retrofit programme for privately owned residential properties has been identified and the Solar Together programme for group buying solar PV and battery storage has already taken place.

3.1.9. Oxfordshire County Council

Oxfordshire County Council declared a climate emergency in 2019 and has the ambition target of becoming carbon neutral by 2030. To help achieve this target the council annually publishes a review of its 'Carbon Management Plan' to ensure progress is up to date and new actions are identified. The council has also received Zero Emissions Bus Regional Area funding, funding 159 electric buses in Oxfordshire and was also awarded LEVI funding of £3.6 million to triple public electric vehicle charging provision by 2025.
In addition to this the council was also one of three that SSEN partnered with through the RESOP Project to trial LAEP+ (now LENZA), an innovative local area energy planning tool created by Advanced Infrastructure and is currently in the process of working with district councils to develop the new Oxfordshire LAEP programme.

The Oxfordshire LAEP programme comprises the creation of the LAEPs and also builds the additional capacity and capability to conduct LAEP activities in-house in future years. The Oxfordshire LAEP project comprises of 5 District LAEPs and a county overview. To support this SSEN is part of the Future Oxfordshire Partnership's governance structure for the Oxfordshire LAEP programme, furthermore it also sits on the County Council's energy planning working group and executive steering board to provide network insights.

3.2. Whole System Considerations

3.2.1. Specific whole system considerations

Bramley – Basingstoke GSP is experiencing high levels of battery storage and generation connection applications, the impact of Clean Power 2030 on connections relating to current works and future system needs will need to be carefully considered and this SDP will be updated in future iterations accordingly.

The M3 and M4 (including Reading motorway service area) fall within Bramley – Basingstoke GSP area. The DFES for the GSP forecasts significant growth in demand from EV charge points along national highways and as such, we will continue to engage with Motorway Service Areas and other possible sites of large EV charging stations on their long-term future demand.

3.2.2. Transmission interactions

In the Fleet-Bramley area, National Grid Electricity Transmission (NGET) have referenced in their T3 business plan (2026-2031) that they plan to replace overhead line conductors on the Bramley – Fleet 1 & 2 circuit to increase capacity on the route[5]. We are working with NGET on managing load in the area and will continue to work closely together on long-term strategic planning to ensure we are coordinated on the 2050 vision for Bramley – Basingstoke GSP.

5 National Grid – South East: Future Network Blueprint (https://riiot3.nationalgrid.com/document/30126/download)

3.3. Flexibility Considerations

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.[6, 7]

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

Figure 5 shows the primary substation areas across the Bramley – Basingstoke SDP area where flexibility has been procured. This map shows all Flexibility Services procured.

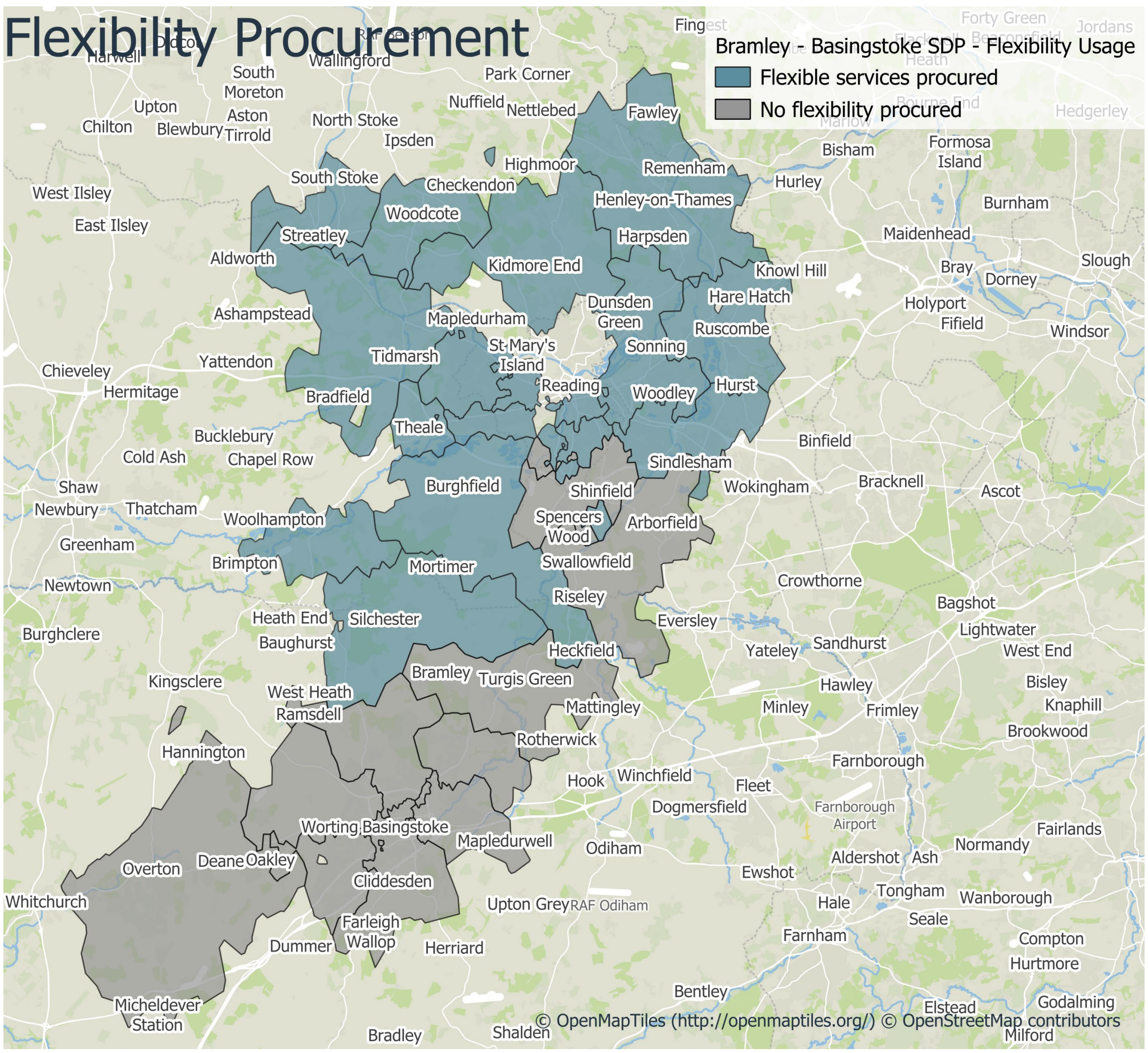

Figure 5 – Flexibility procurement areas across the Bramley - Basingstoke SDP area.

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6 SSEN, Flexibility Services Procurement, [Flexibility Services Procurement - SSEN]

7 SSEN, 02/2024, Operational Decision Making (ODM), [SSEN Operational Decision Making ODM]

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Bramley – Basingstoke Grid Supply Point Context

Bramley – Basingstoke GSP covers part of Berkshire and North Hampshire and is made up of 132kV, 33kV, 11kV, and low voltage (LV) circuits – Figure 6 shows a map with the current network topology. The area fed by Bramley – Basingstoke GSP has urban areas including large towns such as Basingstoke and Reading as well as more rural areas of Berkshire and Hampshire. In total, the GSP currently supplies approximately 64,000 customers[8] with the breakdown for each BSP shown in Table 1. Information for Primary substations can be found in Appendix A. 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 each BSP to sum to that at the GSP).

Substation name	Site type	Number of customers served (approximate)	2023-2024 Substation maximum demand in MVA and season with peak demand
Bramley – Basingstoke[8]	Grid Supply Point	64,100	122.6 (Winter)
Basingstoke T1A & T2A	Bulk Supply Point	13,600	43.6 (Spring/Autumn)
Basingstoke T1B & T2B	Bulk Supply Point	32,700	55.2 (Winter)
Basingstoke T3 & T4	Bulk Supply Point	17,800	33.2 (Winter)
Burghfield Main	Bulk Supply Point	37,600	63.1 (Winter)
Burghfield Reserve	Bulk Supply Point	25,700	48.4 (Winter)
Reading	Bulk Supply Point	68,700	114.2 (Winter)

Table 1 - Customer number breakdown and substation peak demand readings (2023-2024) for Bramley – Basingstoke GSP and the BSPs in the Bramley – Basingstoke SDP area.

8 Note that the figures in this table refer to the Bramley – Basingstoke GSP under current running arrangements – see Section 1 and Figures 1a and 1b.

4.2. Current Network Topology

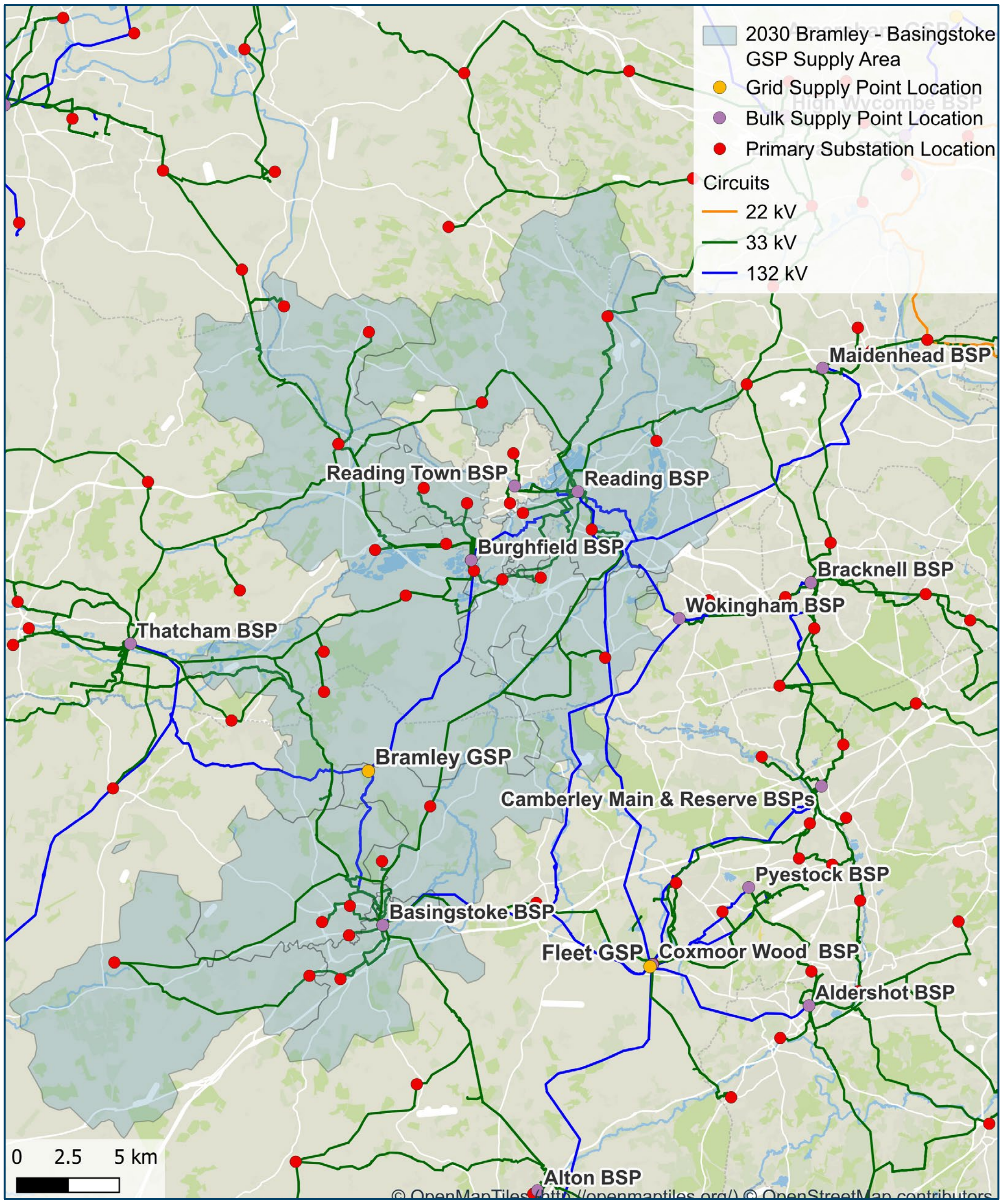

Figure 6 - Current network topology of Bramley – Basingstoke GSP.

4.3. Current Network Schematic

Figure 7 shows an illustrative 132kV network schematic for Bramley – Basingstoke GSP with part of Fleet GSP shown to highlight how they are currently interconnected, please see Appendix A for 33kV network schematics for the current network.

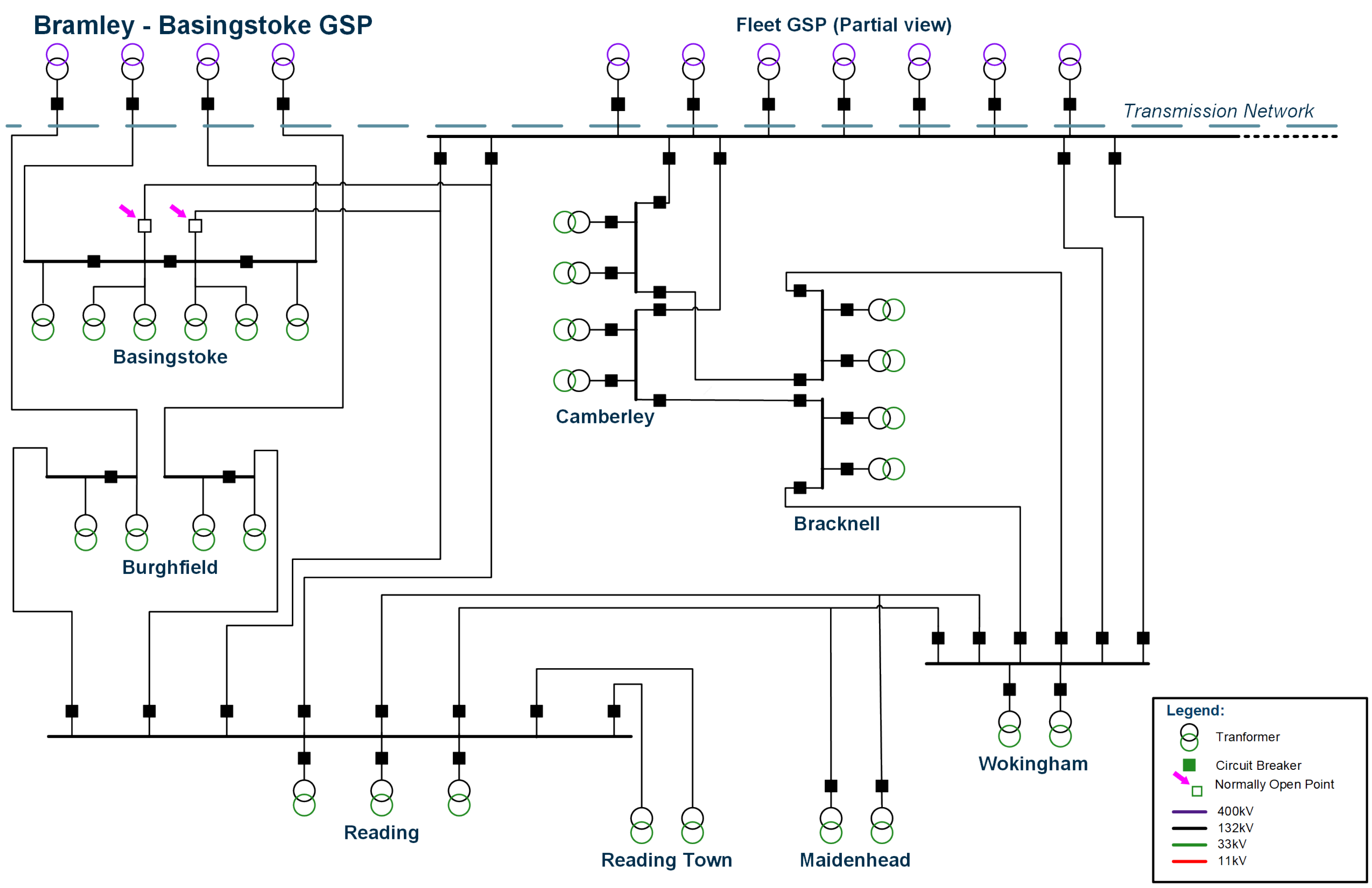

Figure 7 - Existing 132kV network supplied by Bramley - Basingstoke GSP with a partial view of Fleet GSP to illustrate how they are currently connected.

5. FUTURE ELECTRICITY LOAD AT BRAMLEY – BASINGSTOKE GSP

The following section details load growth across the technologies projected in the Distribution Future Energy Scenarios (DFES) 2023[9]. There are important notes on the values presented here:

- The load growth described in this section is based upon DFES 2023 to align with the DFES data used to analyse network needs in this report. DFES 2024 insights are now available and can be found in Appendix B. These will be used in the more detailed analysis to follow through the DNOA process.
- This SDP and the analysis conducted has been completed ahead of any changes arising from Clean Power 2030.
- These projections relate to the GSP supply area highlighted in Figure 2 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 reflect the likely peak demand experienced on the network. Diversifying load values accounts for the fact that not all demand load connected to the network peaks at the same time and so provides a more realistic total expected peak power.

For future iterations of the DFES, additional work will be carried out to ensure that the demand projections are rationalised against local area energy plans (LAEPs) produced in the Bramley – Basingstoke GSP area.

5.1. Distributed Energy Resource

5.1.1. DFES Projections

Generation

Based on the DFES projections, under the CT scenario, distributed generation across Bramley – Basingstoke GSP group will increase significantly from 98MW in the baseline to around 614MW in 2050, as shown in Figure 8. We see decommissioning of diesel generation ahead of 2035 in all scenarios. However, gas generation is expected to expand under the CT scenario, as reciprocating engines convert into hydrogen peaking power stations in DFES assumptions. Solar PV currently makes up the largest portion of the baseline generation energy mix and is expected to grow to around 460MW by 2050 with a notable increase in large-scale solar sites (>=1MW).

Storage

In the Bramley – Basingstoke GSP area, there is a substantial uptake in energy storage leading up to 2050. The consumer transformation, leading the way, and system transformation scenarios all see a significant increase in battery storage out to 2050, with 206 MW predicted by the CT scenario by 2050, as shown in Figure 9. Under the CT scenario, standalone (grid services) battery capacity increases to around 87MW by 2050 and there is also a significant increase in the levels of domestic battery storage with around 60MW forecast to connect by 2050.

9 SSEN Distribution Future Energy Scenarios 2023

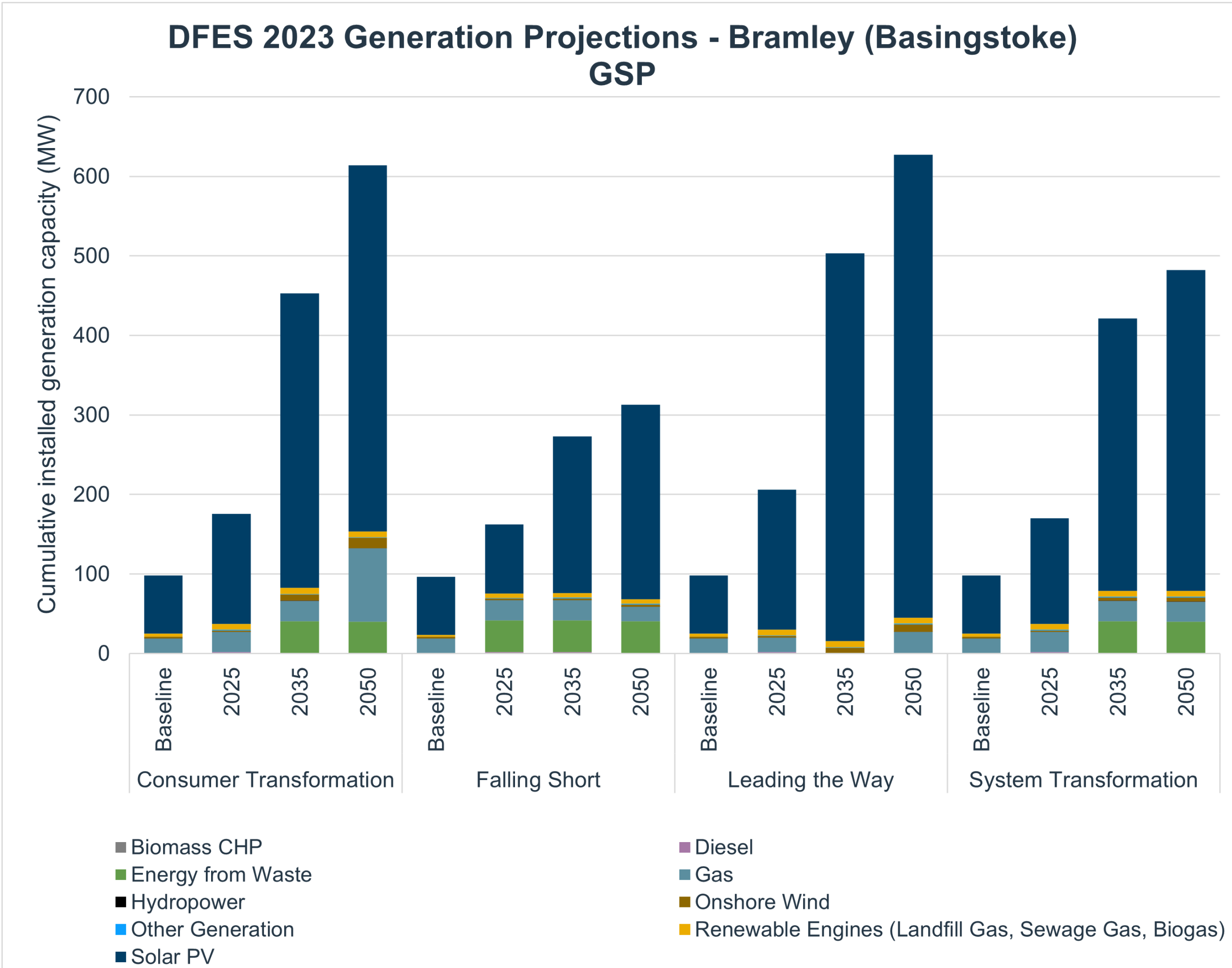

Figure 8 - Projected cumulative distributed generation capacity across Bramley - Basingstoke GSP (MW). Source: SSEN DFES 2023

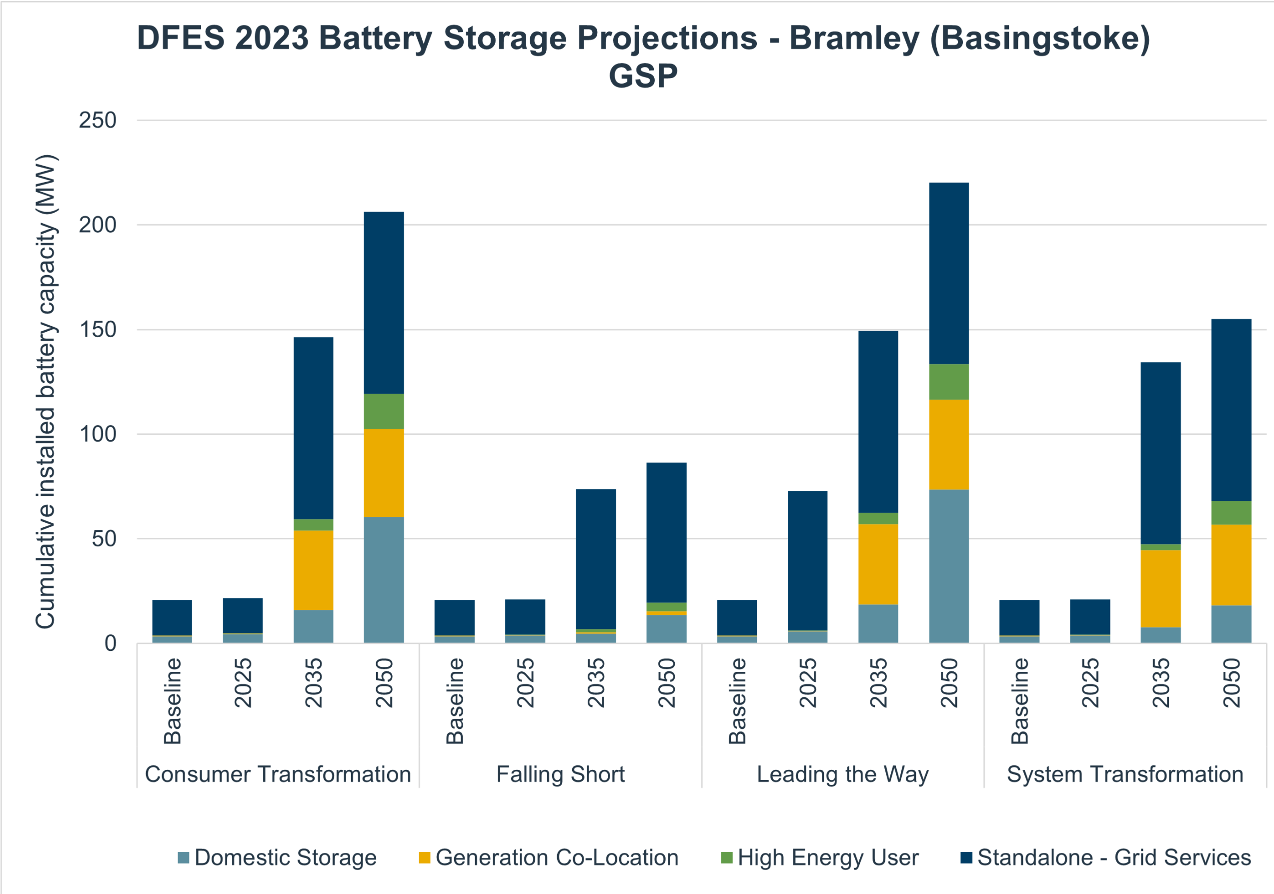

Figure 9 - Projected battery storage capacity across Bramley – Basingstoke GSP. Source: SSEN DFES 2023

5.2. Transport Electrification

The shift to electrified transport is likely to be a large source of electricity load growth across the Bramley – Basingstoke GSP area and will be a key consideration for strategic planning. Given the presence of the M3 and M4 motorway in the region, the growth of EV charging along these routes has been considered.

5.2.1. DFES Projections

As the network operator, it is important for SSEN to understand the network facing demand of EVs. The DFES projects that the total EV charge point capacity under Bramley – Basingstoke GSP, excluding off-street domestic chargers, could total 270MW by 2050 under the CT scenario, 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.

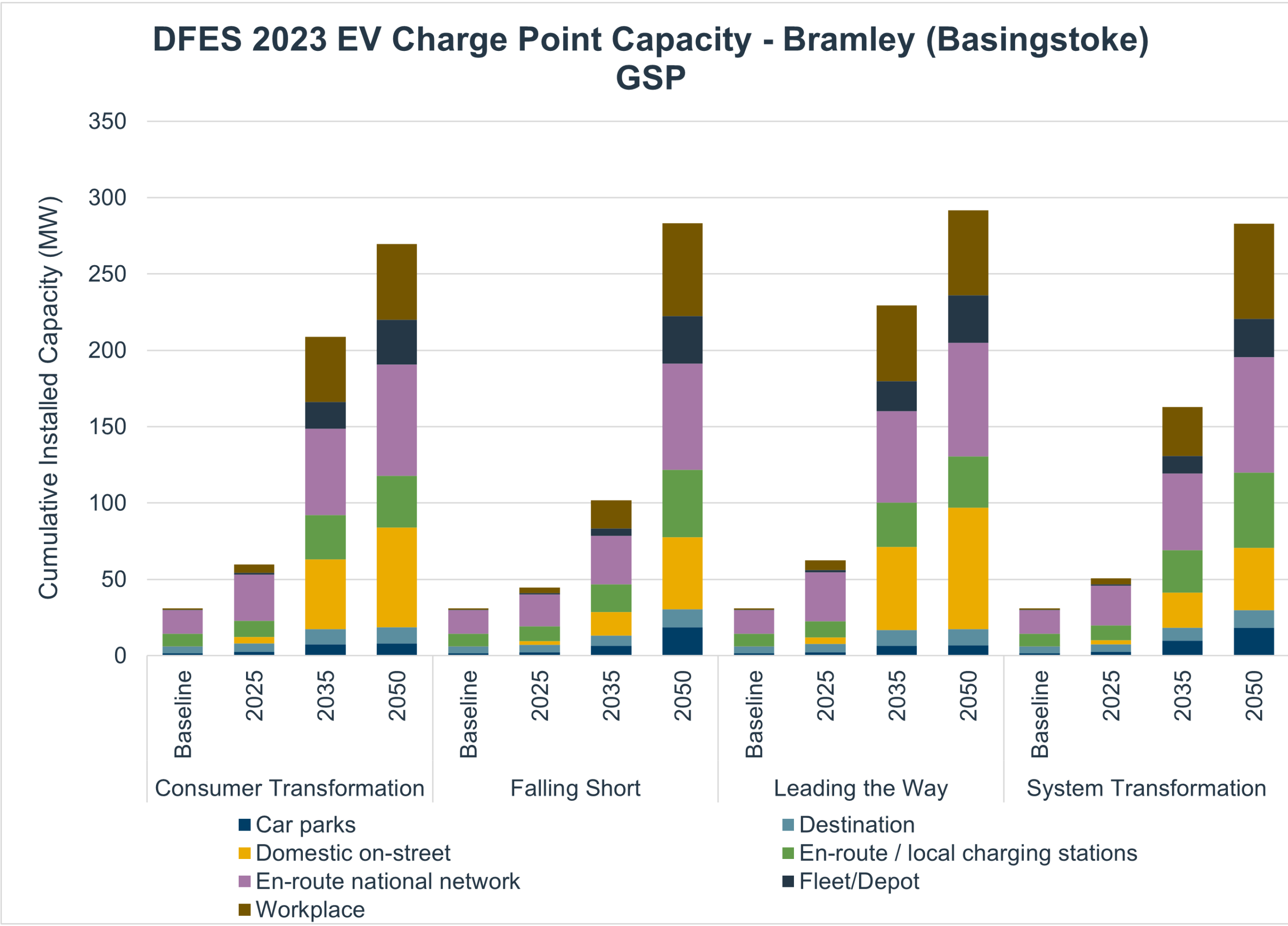

Figure 10 – Projected EV charge point capacity across Bramley – Basingstoke GSP. Source: SSEN DFES 2023

5.3. Electrification of heat

As the UK moves towards net zero, the electrification of heat has the potential to result in a significant increase in electricity demand across the UK. The demand for heat pumps and air conditioning in this area is expected to be substantial. As referred to in Section 3.1.4, there is also interest in developing heat networks in Reading which would have different implications on the local electricity network compared to individual domestic heat pumps. As such, early engagement with local authorities on their plans for decarbonising heat will continue to inform strategic planning.

5.3.1. DFES Projections

Under the CT scenario, we see a notable increase in the number of domestic heat pumps with around 1,300 units in the baseline rising to over 162,000 units by 2050. The projected use of air conditioning in this area is also forecast to be high under certain scenarios, potentially reaching up to 164,080 units by 2050 under the Falling Short scenario. However, in the Leading the way scenario, where heat decarbonisation is considered more likely to be delivered using mostly domestic heat pumps, the number of air conditioning units is projected to be around 4,500 in 2050. The uptake projections for other heating and cooling technologies are shown below in Figure 11.

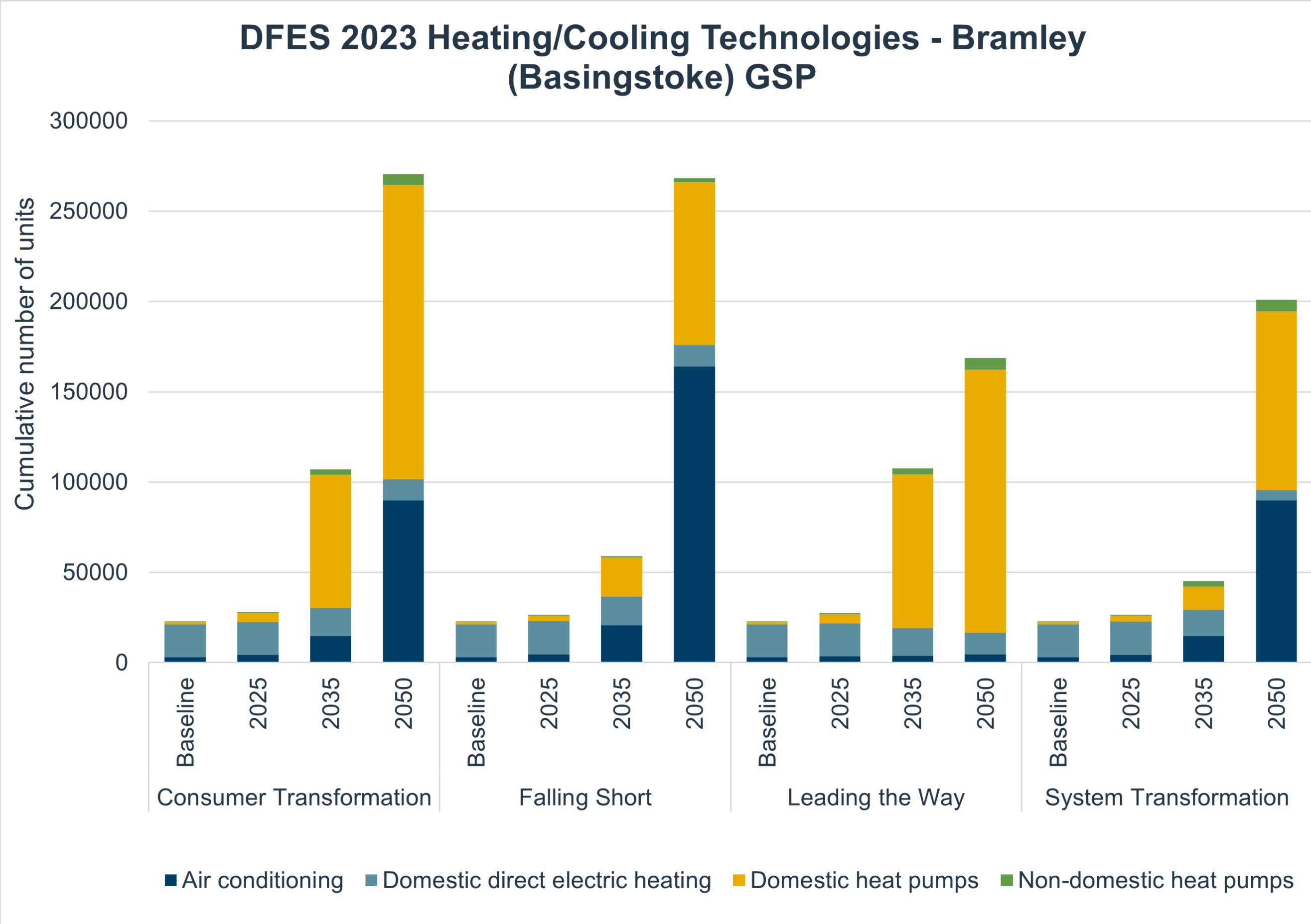

Figure 11 - Projected number of heating/cooling technologies across Bramley – Basingstoke GSP. Source: SSEN DFES 2023.

5.4. New building developments

A key stage in producing the DFES is engagement with Local Authorities. On an annual basis, local authorities provide their current best view on new development plans to inform these projections. The results presented here are based on information shared by local authorities during the DFES 2023 development process. Where we do not have responses from local authorities, these values are determined from published documents, for example adopted local plans. These updates will then be reflected in the next DFES publication and feed into the subsequent SDP as part of the annual update process.

5.4.1. DFES Projections

The non-domestic new development projections for Bramley – Basingstoke GSP supply area show growth in several areas, with the largest growth coming from factories and warehouses, office space, and schools and colleges, as shown in Figure 12. Under the CT scenario, the increase in factory and warehouse floor space is projected to be around 149,000m^2 by 2050. Domestic new development projections reach a similar cumulative number of homes by 2050 across the four scenarios but at varying rates which can be seen in Figure 13.

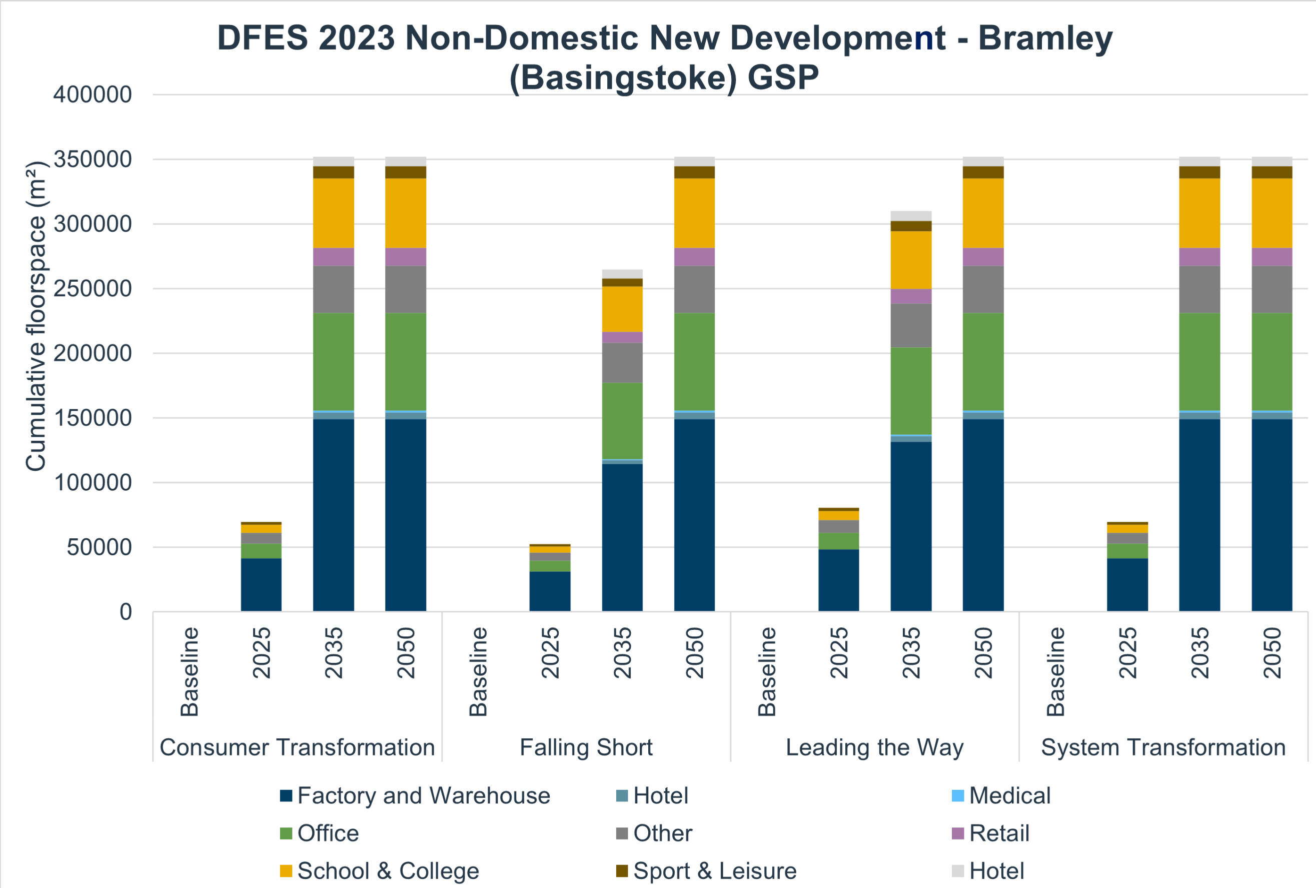

Figure 12 - Projected non-domestic new development across Bramley – Basingstoke GSP. Source: SSEN DFES 2023

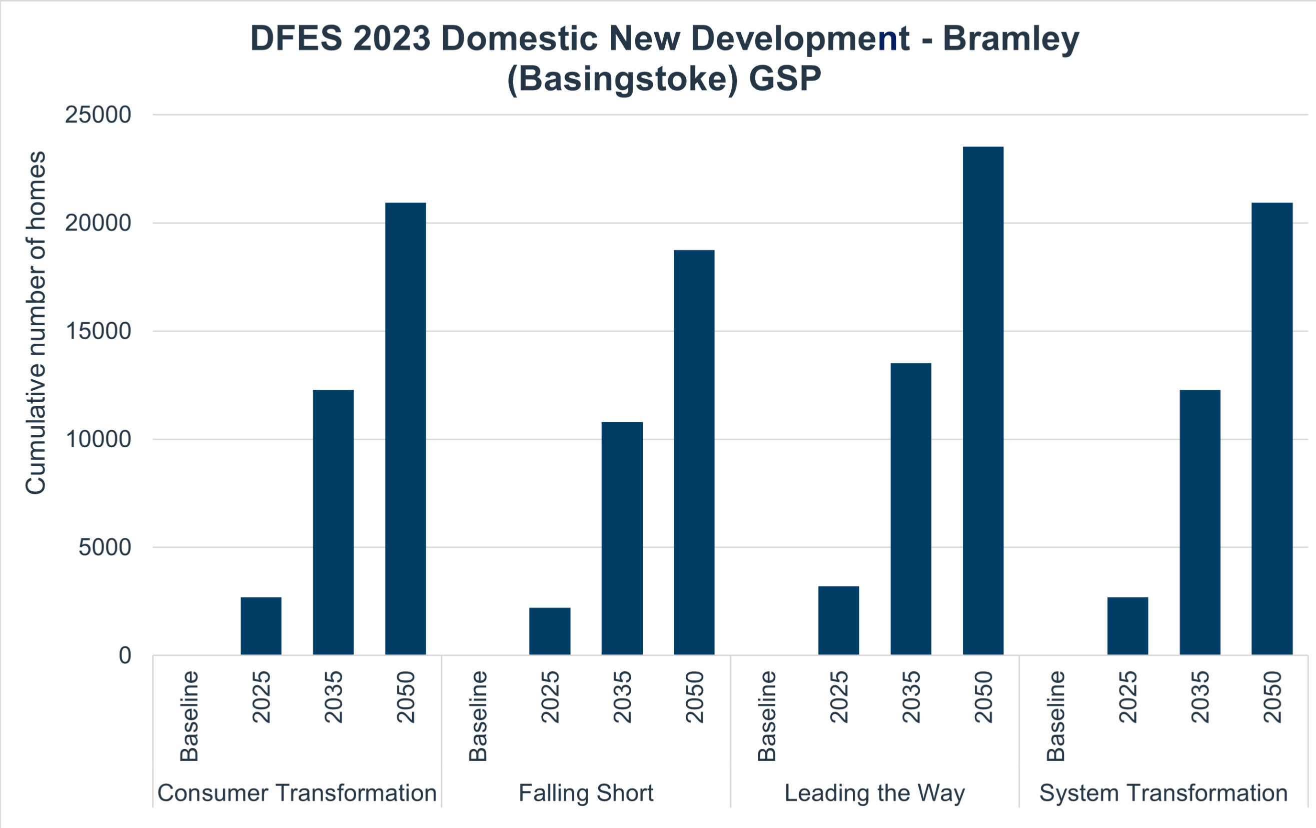

Figure 13 - Projected domestic new development across Bramley – Basingstoke GSP. Source: SSEN DFES 2023

5.5. Commercial and industrial electrification

SSEN regularly engage with large industrial demand users in the area. Close collaboration on required capacity and how best to facilitate this is carried out. This is key to enable investment and development of the local economy.

5.5.1. Large-Scale Commercial Battery Storage

In Bramley – Basingstoke GSP supply area, most of the DFES forecast battery storage capacity is due to standalone grid services. This is mirrored in the high levels of battery storage applications which have been seen in this area which can have a significant impact on the network and available capacity.

5.5.2. Data Centres

Bramley – Basingstoke GSP does not expect to see the same levels of data centre connection as other part of the network such as West London. However, there have been recent data centre applications which due to their large energy requirements, have a significant impact on network capacity even though only a relatively small number have applied.

6. WORKS 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 Bramley – Basingstoke 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. The drivers listed in the below table are predominantly where a customer connection application has driven the work or where investment proposals developed through our DNOA process are driving the reinforcement work. The published DNOA outcomes relevant to Bramley – Basingstoke GSP are included in Appendix G. The work included here is work that has passed through the ID2 gate of our Distribution Governance and Investment Framework (DGIF), further information on this process is available in the DSO service statement 2025.[10] The network considered for long-term modelling is shown in Figure 14 and the summary of existing works shown below in Table 2.

ID	Substation	Description	Driver	Forecast completion	Resolves future strategic needs to 2050?
		Fleet-Bramley Demand Group Split			
1a	Bramley GSP	Install a new 132kV Gas Insulated Switchgear (GIS). Connected to this switchboard: • Two Super Grid Transformers (SGTs) currently feeding Basingstoke BSP. • Two Super Grid Transformers (SGTs) currently feeding Burghfield BSP. • Two 132kV circuits to Basingstoke BSP. • Four 132kV circuits to Burghfield BSP including two new circuits.	DNOA Process	2030	
1b	Burghfield BSP	Install a new 132kV GIS switchboard at Burghfield BSP and add two additional circuits from Bramley GSP to Burghfield BSP.			
1c	Bramley – Basingstoke-Basingstoke-Reading Tee Circuit	Upgrade sections of the Bramley – Basingstoke GSP – Basingstoke BSP – Reading BSP tee-circuit.			

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1d	Reading BSP	Adjust the normal switching arrangement on the 132kV switchboard at Reading BSP to split Reading BSP from Bramley – Basingstoke GSP so that it is fed from Bramley GSP.			
1e	Wokingham BSP (Fleet GSP)	Replace two 132kV switch disconnectors on the 132kV bus.			
Basingstoke T1A & T2A, T1B & T2B and T3 & T4 BSPs					
2	Basingstoke BSPs shared site	Replace part of the existing 33kV switchgear with a new indoor gas insulated switchgear.	Customer Connection	2029	
3	Basingstoke T1A & T2A BSP	Replace the 132/33kV transformer T2A.	Asset Replacement	2025	
4	Houndmills PSS	Install a new 33kV GIS busbar at Houndmills primary.	Customer Connection	2028	
Burghfield Main and Reserve BSPs					
5	Burghfield BSPs shared site	Install a new 33kV GIS switchboard connected to Burghfield Main and Reserve BSPs.	Flood Mitigation	2028	
Reading BSP					
6	Reading BSP	Install a fourth 132/33kV transformer at Reading BSP.	Customer Connection	2026	
7	Reading BSP	Replace transformers A1 & A3 at Reading BSP.	Asset Replacement	2027	
8	Little Hungerford PSS and Bramley Green PSS	Upgrade part of the 33kV circuit between Little Hungerford PSS and Bramley Green PSS.	Customer Connection	2027	

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.

As shown in section 3.3, alongside the asset solutions detailed in the table above, there is active flexibility service procurement ongoing across the Bramley – Basingstoke SDP area.

6.1. Network Schematic (following completion of above works)

Figure 14 shows an illustrative 132kV network schematic for Bramley – Basingstoke GSP following the completion of the works in Table 2, please see Appendix D for 33kV network schematics for the future network.

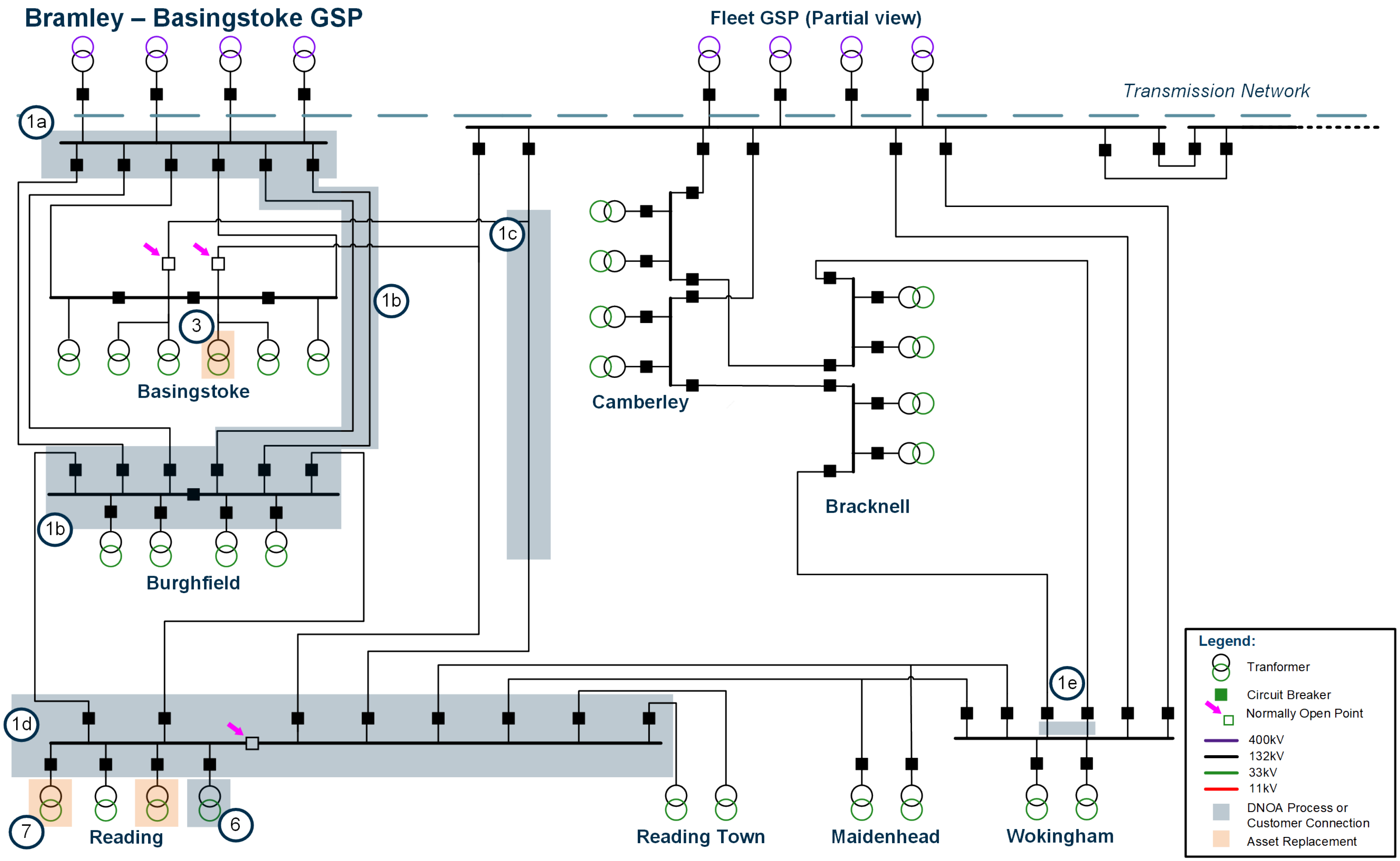


Figure 14 - Future 132kV network for Bramley - Basingstoke GSP and part of Fleet GSP to illustrate how they will be connected after they are split.

7. SPATIAL PLAN OF FUTURE NEEDS

7.1. Extra High Voltage / High Voltage spatial plans

The EHV/HV spatial plans shown below in Figure 15 illustrate the projected headroom or capacity shortfall due to demand increases at primary substations across the Bramley – Basingstoke SDP study area. Darker blue shades indicate that there is a projected capacity shortfall whereas lighter blue shades indicate that there is headroom capacity based on current projections. The charts below are drawn from the CT DFES scenario, EHV/HV spatial plans for the other DFES scenarios are presented in Appendix E.

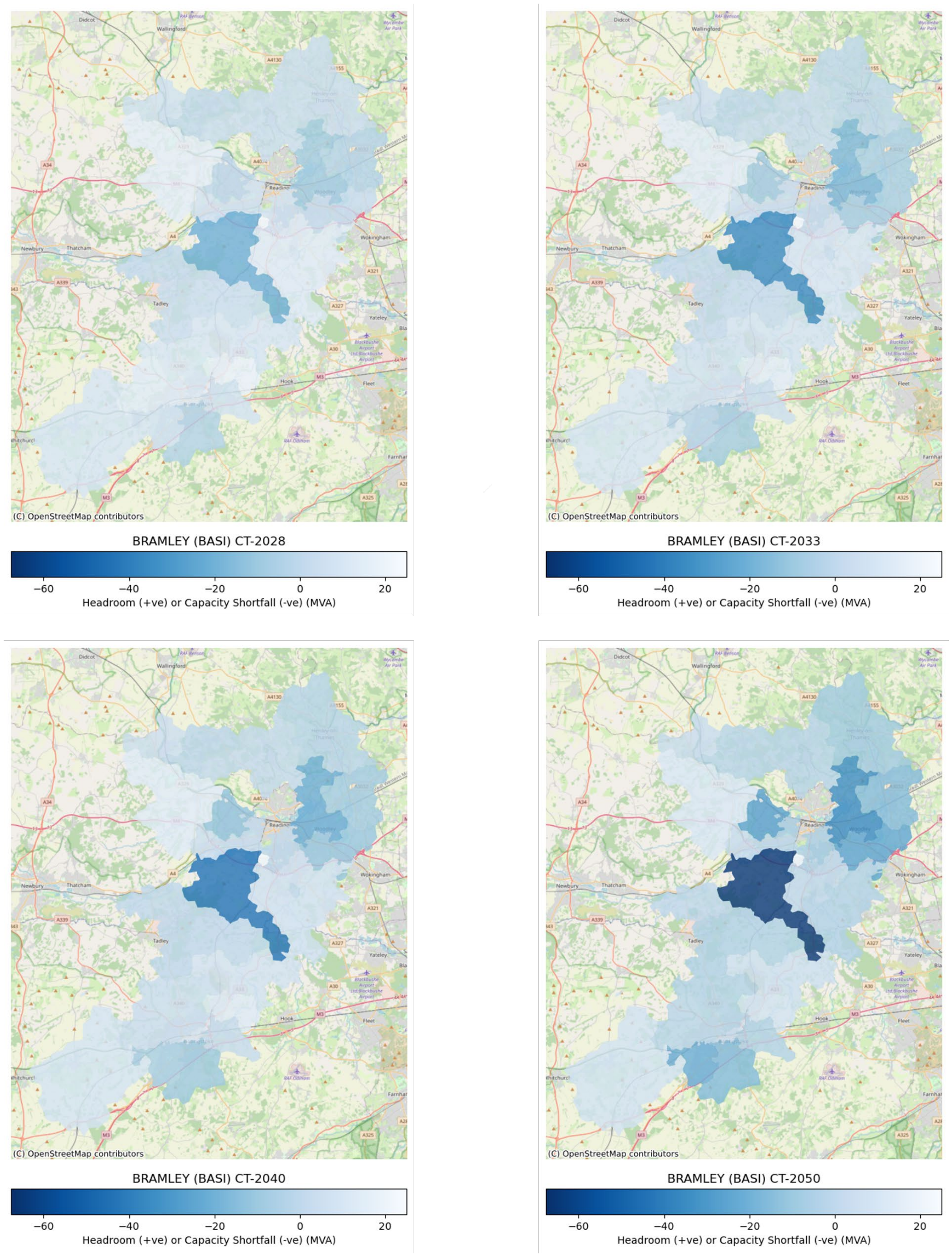


Figure 15 - Bramley – Basingstoke GSP - EHV/HV Spatial Plan - Consumer Transformation

7.2. HV/LV spatial plans

The HV/LV spatial plans shown below in Figure 16 show the point locations of secondary transformers supplied by Bramley – Basingstoke GSP. The points are colourised based on the projected percentage loading with red meaning a higher percentage loading and green meaning a lower percentage loading. The plans below are drawn from the CT DFES scenario, HV/LV spatial plans for the other DFES scenarios are available in Appendix F.

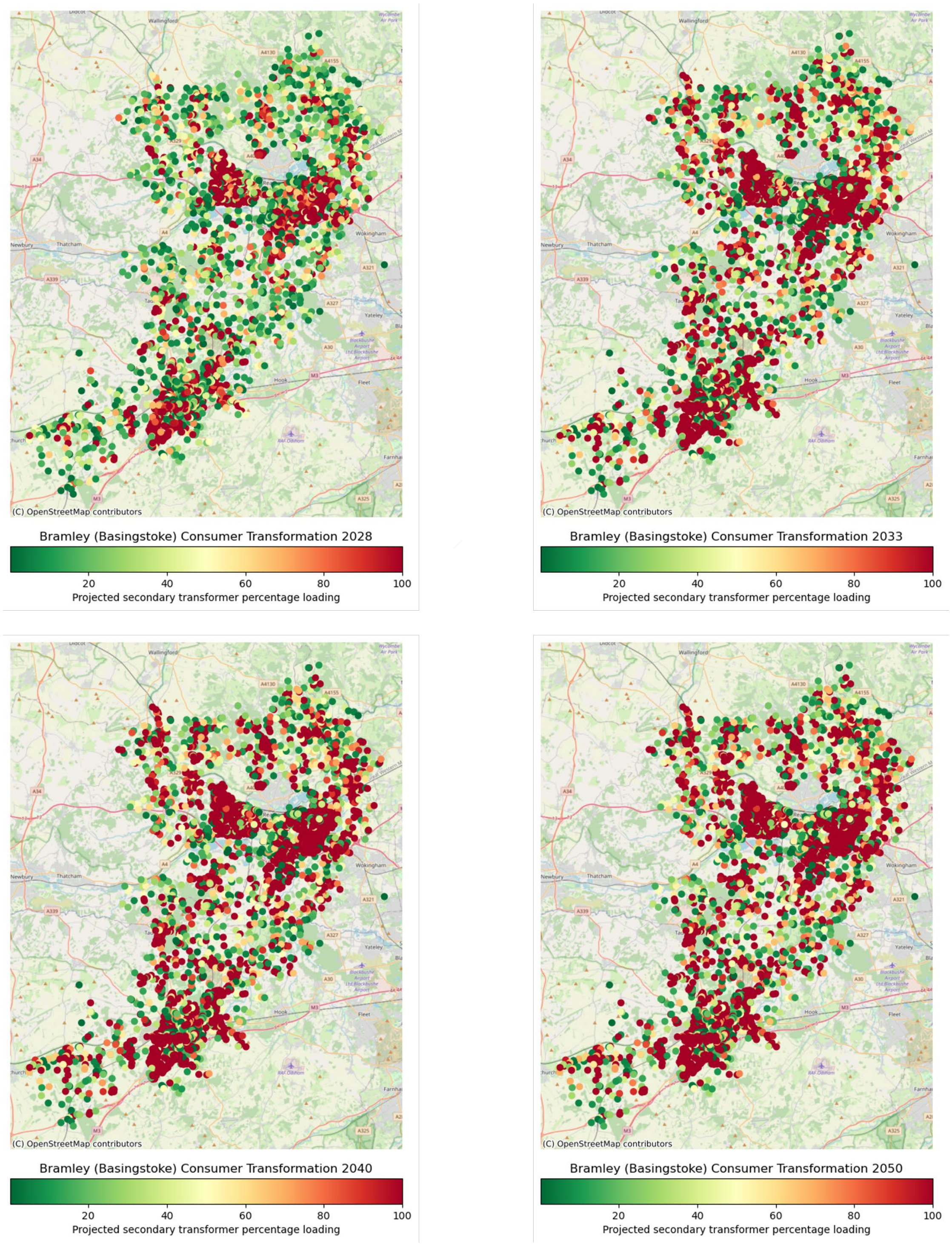


Figure 16 - Bramley - Basingstoke GSP - HV/LV Spatial Plans - Consumer Transformation

8. SPECIFIC SYSTEM NEEDS AND OPTIONS TO RESOLVE

In this section we summarise the specific needs arising from our future spatial plans. The outputs of the power system analysis in this section show where we may observe the need for further intervention on the distribution network. This could be through asset solutions or flexibility services including access products which may be used to enable connection of projects ahead of reinforcement delivery. We also propose some initial options to resolve the needs forecasted. If required during the next ten years, these will be further developed through the DNOA process.

The section consists of three sets of results:

- 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 ten years, we recommend that these are progressed through the DNOA process. In all cases, we are proposing solutions that meet the projected requirements for 2050 and where appropriate, system needs arising in the early 2040s are taken into account to ensure a holistic solution. 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 opportunities 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: Delivery of the reinforcement work highlighted in the works in progress section (section 6) will be required to enable both capacity in the near-term but also to enable the proposed future options in this system needs section.
Risks: Delays or changes to triggered works fail to release capacity in the near-term and/or do not provide flexibility of future investment.
Mitigation: Current reinforcement projects are included in this strategic development plan and dependencies are identified as part of the DNOA process and form part of the handover of work to delivery teams for consideration. Proposed work should also ensure that it is enabling future network development such as considering space constraints at the site.

Dependency: Triggered works and future proposed options are particularly dependent on the completion of works to enable the Fleet-Bramley demand group to be split. These works include installing a new 132kV switchboard and two additional 132kV circuits to the Burghfield BSPs at the Bramley GSP site which is shared with National Grid Electricity Transmission.
Risks: Delays to works have the potential to delay customers connecting and to delay dependent reinforcement schemes.
Mitigation: Continue to progress design and execution of the Fleet-Bramley split and as part of this, continue productive engagement with National Grid Electricity Transmission to enable works at the GSP site.

Dependency: Some of the system needs do not arise until the late 2030s or after 2040.

Risks: This may lead to unnecessary reinforcement work being carried out.
Mitigation: Our SDPs will be reviewed annually, and system needs reassessed using the latest DFES forecast and view of connections in pipeline. The impact of Clean Power 2030 and Connections Reform will also be assessed in future iterations of this SDP. Works will not be triggered until they have gone through the DNOA process where system needs will be reviewed in detail before deciding whether reinforcement works are necessary.

8.2. Future EHV System Needs

In this section, a detailed list of the constraints identified through network modelling is presented alongside potential options to meet forecasted demand – note that where asset sizing is given, this is indicative and subject to further analysis in the DNOA process. The interactions between possible options have been considered to identify potential synergies and efficiencies. As such, constraints have been grouped strategically to be considered alongside each other and any additional interactions between constraints referenced.

8.2.1. System needs out to 2040

Constraint ID	Location of proposed intervention	CT Year	ST Year	LW Year	FS Year	Network state[11]	Comments and potential options to resolve the system need
132kV Network							
1	There is significant load growth expected around Reading out to 2050 which is forecast to lead to constraints under Burghfield Main BSP, Burghfield Reserve BSP and Reading BSP. The network needs at these BSPs and on the network connecting them to Bramley – Basingstoke GSP are outlined in Constraints 1a-c. Potential options to resolve each of the system needs are given below as well as a holistic solution for consideration.						
1a	Burghfield Main BSP transformers	2030-2034	2035-2039	2030-2034	2035-2039	N-1: Loss of one of the transformers.	Option a: • Add a third transformer at both Burghfield Main BSP and Burghfield Reserve BSP. Option b: • Replace and uprate both transformers at Burghfield Main BSP and both transformers at Burghfield Reserve BSP.
	Burghfield Reserve BSP transformers	2035-2039	2035-2039	2030-2034	2040-2044	N-1: Loss of one of the transformers.	
1b	132kV circuits from Bramley GSP to Burghfield 132kV busbar.	2035-2039	2040-2044	2035-2039	2040-2044	N-1: Loss of one of the circuits.	Option a: • Add an additional 132kV circuit between Bramley GSP and Burghfield 132kV busbar.
1c	Reading BSP transformers	2045+	No issue	2045+	No issue	N-1: Loss of one of the transformers.	There is significant load growth expected under Reading BSP and as such, consideration of the future arrangements of the network to ensure security of supply under N-1 and N-2 scenarios needs to be taken. This should be done in conjunction with optioneering for the 132kV network configuration under Fleet GSP. Due to the load growth under Fleet GSP and Reading BSP, the recommendation to resolve constraints on the circuits between the
	132kV circuits from Burghfield 132kV switchboard to Reading 132kV switchboard.	2035-2039	2035-2039	2030-2034	2035-2039	N-1: Loss of one of the circuits.	

11 Network state refers to the situation where the asset becomes overloaded. N-1 refers to a scenario where an outage is taken on the network, **or** a fault occurs. N-2 refers to a scenario where an outage is taken on the network **and** a fault occurs.

							Burghfield 132kV and Reading 132kV sites is to add two additional circuits. However, if there are significant changes to the network configuration of Fleet GSP, there may be additional options to explore at that stage. Option a: • Add two additional transformers and split Reading BSP. • Add two additional 132kV circuits between the Burghfield 132kV and Reading 132kV sites.

	Holistic option for constraints 1a-c.	From 2030-2034	From 2030-2034	From 2030-2034	From 2030-2034	As above for constraints 1a-c	• Build a new BSP with three 132/33kV transformers between the Burghfield BSPs and Reading BSP.
							• Transfer load from Burghfield Main BSP, Burghfield Reserve BSP and Reading BSP to the new BSP.
							• Options to connect the new BSP:
							  ○ Add three 132kV circuits from Bramley GSP to the new BSP.
							  ○ Add two 132kV circuits from Bramley GSP to Burghfield 132kV switchboard and add three 132kV circuits from Burghfield 132kV switchboard to the new BSP.
							• Add a third 132kV circuit from Burghfield 132kV switchboard to Reading BSP.

2	132kV circuits from Bramley GSP to Basingstoke BSP 132kV busbar.	2035-2039	2035-2039	2035-2039	2035-2039	N-1: Loss of one of the transformers.	Option a: • Add a third circuit from Bramley GSP to Basingstoke BSP 132kV busbar.
33kV Network							
3	Jays Close PSS transformers	2030-2034	2035-2039	2030-2034	2040-2044	N-1: Loss of one of the transformers.	Option a: • Add a third transformer at Jays Close PSS. • Transfer load from Basingstoke PSS to Jays Close PSS or Brook Street PSS. Option b: • Build a new primary substation and transfer load from Jays Close PSS and Basingstoke PSS to the new primary substation. Option c: • Add a third transformer at Jays Close PSS. • Add a third transformer at Basingstoke PSS or replace and uprate both existing transformers.
	Basingstoke PSS transformers	2040-2044	2040-2044	2035-3039	2045+	N-1: Loss of one of the transformers.	
4	Down Grange PSS transformers	2030-2034	2035-2039	2030-2034	2035-2039	N-1: Loss of one of the transformers.	Option a: • Build a new primary substation. • Transfer load from Houndmills PSS, Down Grange PSS, and Oakridge PSS to the new primary substation.
	Circuit from Basingstoke T1B & T2B to Down Grange	Ahead of 2030	2035-2039	Ahead of 2030	2035-2039	N-1: Loss of one of the circuits from	

<table>
<tr><td rowspan="7"></td><td>PSS via tee with Alton BSP.</td><td></td><td></td><td></td><td></td><td>Basingstoke T1B & T2B to Down Grange PSS.</td><td rowspan="7">Build new 33kV circuits from Basingstoke T1B & T2B BSP or Basingstoke T3 & T4 to the new primary substation.
Option b:
At Down Grange PSS, replace the two existing transformers with three transformers and add a third 33kV circuit from Basingstoke T1B & T2B BSP.
At Houndmills PSS, replace the two existing transformers with three transformers and add a third 33kV circuit from Basingstoke T1B & T2B BSP.
At Oakridge PSS:
Replace and uprate the two existing transformers and replace both of the existing 33kV circuits.
Or, add a third transformer and a third 33kV circuit.
Or, transfer load from Houndmills PSS to Overton PSS and from Oakridge PSS to Houndmills PSS.</td></tr>
<tr><td>Circuit from Basingstoke T1B & T2B to Overton PSS.</td><td>Ahead of 2030</td><td>Ahead of 2030</td><td>Ahead of 2030</td><td>Ahead of 2030</td><td rowspan="2">N-1: Loss of the other circuit feeding Overton PSS.</td></tr>
<tr><td>Circuit from Overton PSS to Down Grange PSS.</td><td>Ahead of 2030</td><td>Ahead of 2030</td><td>Ahead of 2030</td><td>Ahead of 2030</td></tr>
<tr><td>Houndmills PSS transformers</td><td>2030-2034</td><td>2030-2034</td><td>2030-2034</td><td>2030-2034</td><td>N-1: Loss of one of the transformers.</td></tr>
<tr><td>Circuits from Basingstoke T3 & T4 BSP to Houndmills PSS.</td><td>2030-2034</td><td>2035-2039</td><td>2030-2034</td><td>2040-2044</td><td>N-1: Loss of one of the circuits from Basingstoke T3 & T4 BSP.</td></tr>
<tr><td>Oakridge PSS transformers</td><td>2040-2044</td><td>No Issue</td><td>2040-2044</td><td>No Issue</td><td>N-1: Loss of one of the transformers or circuits.</td></tr>
<tr><td>Circuits from Basingstoke T3 & T4 BSP to Oakridge PSS.</td><td>2040-2044</td><td>No Issue</td><td>2045+</td><td>No Issue</td><td>N-1: Loss of one of the circuits from Basingstoke T3 & T4 BSP.</td></tr>
<tr><td rowspan="4">5</td><td>Trash Green PSS transformers</td><td>2035-2039</td><td>2035-2039</td><td>2035-2039</td><td>2040-2044</td><td>N-1: Loss of one of the transformers.</td><td rowspan="4">Under Trash Green PSS, the DFES project a large increase in load associated with EV charging on national highways. This should be considered separately to the rest of the demand load under Trash Green PSS, and this will likely require a separate primary substation.
Option a:
Add a third transformer at Mortimer PSS.
Build a new direct circuit from Burghfield Reserve BSP to Mortimer PSS.
Transfer load from Trash Green PSS to Mortimer PSS and Padworth PSS.
Option b:
At Trash Green PSS, replace and uprate the two existing transformers.
At Mortimer PSS, replace and uprate the two existing transformers.
Add a new circuit from Trash Green PSS to Mortimer PSS.
Replace and uprate the existing circuits from Burghfield Reserve BSP to Trash Green PSS, Padworth PSS and Mortimer PSS.</td></tr>
<tr><td>Mortimer PSS transformers</td><td>2035-2039</td><td>2040-2044</td><td>2035-2039</td><td>2045+</td><td>N-1: Loss of one of the transformers.</td></tr>
<tr><td>Circuits from Burghfield Reserve BSP to Trash Green PSS, Padworth PSS, Mortimer PSS and the Pingewood PSS NOP.</td><td>2030-2034</td><td>2035-2039</td><td>2030-2034</td><td>2035-2039</td><td>N-1: Loss of one of the two circuits from Burghfield feeding the four PSS.</td></tr>
<tr><td>Circuit from Trash Green PSS to Padworth PSS and Mortimer PSS tee.</td><td>2040-2044</td><td>No Issue</td><td>2035-2039</td><td>2045+</td><td>Intact conditions</td></tr>
</table>

							Option c: • At Trash Green PSS, add a third transformer. • At Mortimer PSS, add a third transformer. • Add a direct circuit from Burghfield Reserve BSP to Mortimer PSS.
6	Whitley Wood PSS transformers	2030-2034	2045+	2030-2034	2040-2044	N-1: Loss of one of the transformers or circuits.	Option a: • Transfer load from Whitley Wood PSS to Green Park PSS. Option b: • Replace and uprate the existing transformers. • Add two new circuits from Burghfield Main BSP to Whitley Wood PSS and remove the tee with Courages PSS.
	Circuits from Burghfield Main BSP to Whitley Wood PSS and Courages PSS.	2035-2039	2030-2034	Ahead of 2030	2030-2034	N-1: Loss of one of the circuits from Burghfield Main BSP.	
7	Woodcote PSS transformers.	2040-2044	2040-2044	2035-2039	2045+	Intact conditions	Option a: • Transfer load from Woodcote PSS to Kidmore End PSS, Goring PSS or Pangbourne PSS. • Replace and uprate the existing circuits or add additional circuits from Burghfield Reserve BSP to Pangbourne 33kV busbar. • Replace and uprate the existing circuits from Reading BSP and Burghfield Reserve BSP to Kidmore End PSS or replace the existing circuits with two circuits from Reading BSP. Option b: • Replace the transformer at Woodcote PSS with two transformers and add a second circuit from the Pangbourne 33kV busbar. This would add additional security of supply to Woodcote PSS which is currently a single transformer site. • Transfer load from Kidmore End PSS to Woodcote PSS. • Add two new circuits from Burghfield Reserve BSP to Pangbourne PSS.
	Circuits from Burghfield Reserve BSP to Pangbourne PSS and teed points to Goring PSS, Woodcote PSS and Kidmore End PSS NOP.	2035-2039	2035-2039	2030-2034	2035-2039	N-1: Loss of one of the circuits. from Burghfield Reserve BSP.	
	Circuit from the tee point with Burghfield BSP and Pangbourne PSS to Kidmore End PSS NOP.	2035-2039	2040-2044	2035 - 2039	2045+	N-1: Loss of the normal circuit or transformer feeding Kidmore End PSS.	
	Circuit from Reading BSP to Kidmore End PSS.	2035-2039	2045+	2035 - 2039	2045+	Intact conditions	
8	Kentwood Hill PSS transformers	2035 - 2039	2045+	2035 - 2039	2045+	N-1: Loss of one of the transformers or circuits.	Option a: • Build a new primary station fed by 33kV circuits from Burghfield Main BSP. • Transfer load from Kentwood Hill PSS, Wilson Road PSS and Southcote Road PSS to the new substation. Option b: • Build a new primary substation fed by 33kV circuits from Burghfield Main BSP. • Transfer load from Kentwood Hill PSS and Wilson Road PSS.
	Circuits from Burghfield Main BSP to Kentwood Hill PSS.	2035 - 2039	2045+	2035 - 2039	2045+	N-1: Loss of one of the circuits from Burghfield Main BSP.	
	Wilson Road PSS transformers	2035 - 2039	No Issue	2035 - 2039	2045+	N-1: Loss of one of the transformers or circuits.	

	Circuits from Burghfield Main BSP to Wilson Road PSS.	2035 - 2039	2045+	2035 - 2039	2045+	N-1: Loss of one of the circuits from Burghfield Main BSP.	• At Southcote Road PSS, add a third transformer and add a third circuit from Burghfield Reserve BSP. Option c: • At Kentwood Hill PSS, replace the existing transformers. Replace and uprate the existing circuits from Burghfield Main BSP. • At Wilson Road PSS, add a third transformer or replace and uprate both existing transformers. Add a third circuit from Burghfield Main BSP or replace and uprate the existing circuits. • At Southcote Road PSS, add a third transformer or replace and uprate the existing transformers. Add a third circuit from Burghfield Reserve BSP or replace and uprate the existing circuits.
	Southcote Road PSS transformers	2035 - 2039	2045+	2035 - 2039	2045+	N-1: Loss of one of the transformers or circuits.	
	Circuits from Burghfield Reserve BSP to Southcote PSS and Theale PSS.	2035 - 2039	2035 - 2039	2030 - 2034	2040-2044	N-1: Loss of one of the circuits from Burghfield Main BSP.	
9	Arborfield PSS transformers	Ahead of 2030	2030-2034	Ahead of 2030	2030-2034	N-1: Loss of one of the transformers.	Option a: • Build a new primary substation fed by 33kV circuits from Reading BSP. • Transfer load from Arborfield PSS and Little Hungerford PSS to the new primary substation. Option b: • At Arborfield PSS, add a third transformer and add a third circuit from Reading BSP. • At Little Hungerford PSS, replace the existing transformers with four transformers and split the primary substation. Add a fourth circuit from Reading BSP. • Transfer load from Arborfield PSS to Little Hungerford PSS. Option c: • At Arborfield PSS, replace the two existing transformers with three transformers and add a third circuit from Reading BSP. • For Little Hungerford PSS, replace the existing transformers with four transformers and split the primary. Add a fourth circuit from Reading BSP.
	Little Hungerford PSS transformers	2035 - 2039	2045+	2035 - 2039	2045+	N-1: Loss of one of the transformers.	
	Circuits from Reading BSP to Little Hungerford PSS and tee point to Arborfield PSS.	Ahead of 2030	Ahead of 2030	Ahead of 2030	Ahead of 2030	N-1: Loss of one of the circuits from Reading BSP to Little Hungerford PSS.	
	Circuits between Little Hungerford PSS and Arborfield PSS.	Ahead of 2030	Ahead of 2030	Ahead of 2030	Ahead of 2030	N-1: Loss of part of the circuits feeding Arborfield PSS.	
10	Reading PSS transformers	2030 - 2034	2035-2039	2030 - 2034	2040-2044	N-1: Loss of one of the transformers.	Option a: • Build a new primary substation fed by 33kV circuits from Reading BSP. • Transfer load from Reading PSS, Twyford PSS and Henley PSS to the new substation. Option b:
	Twyford PSS transformers	2030 - 2034	2035 - 2039	Ahead of 2030	2030 - 2034	N-1: Loss of one of the transformers.	
	Circuit from Reading BSP to Twyford PSS	2035 - 2039	No issue	2035 - 2039	No issue		

	Circuit from Maidenhead BSP to Knowl Hill PSS	2040 - 2044	2045+	2035 - 2039	2045+	N-1: Loss of a circuit feeding Twyford PSS.	• At Reading PSS, replace the existing transformers with four transformers and split the primary substation. • At Henley PSS, invest ahead of need and add a third transformer and a third circuit from Reading BSP. • Transfer load from Twyford PSS to Reading PSS and Henley PSS. Option c: • At Reading PSS, replace the existing transformers with four transformers and split the primary substation. • At Twyford PSS, replace and uprate the existing transformers and the existing circuits from Maidenhead BSP and Reading BSP. • Transfer load from Henley PSS to Twyford PSS and Reading PSS.
	Back feed circuit from Knowl Hill PSS to Twyford PSS	2040-2044	No issue	2035 - 2039	2045+		
	Henley PSS transformers	2035 - 2039	No Issue	2035 - 2039	No Issue	N-1: Loss of one of the transformers or circuits from Reading BSP.	
	Circuits from Reading BSP to Henley PSS	2045+	No Issue	No Issue	No Issue	N-1: Loss of one of the circuits.	
11	Circuits from Reading BSP to Silver Street PSS	2035 - 2039	No Issue	2035 - 2039	2045+	N-1: Loss of one of the circuits.	There is a constraint seen on the transformers at Silver Street PSS under the Leading the Way scenario (see Section 8.2.2). The possibility of this constraint arising should be considered when the circuit constraints are assessed as part of the DNOA process. Option a: • Replace and uprate the existing circuits.

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

8.2.2. System needs out to 2050

Constraint ID	Location of proposed intervention	CT Year	ST Year	LW Year	FS Year	Network state	Comments and potential options to resolve the system need
132kV Network							
12	Basingstoke T1B & T2B transformers	2045+	No issue	No issue	No issue	N-1: Loss of one of the transformers.	Option a: • Transfer load from Basingstoke T1B & T2B BSP to Basingstoke T1A & T2A BSP and/or Basingstoke T3 &T4 BSP. Option b: • Transfer load from Basingstoke T1B & T2B BSP to Alton BSP through Down Grange PSS. Option c: • Add a third transformer at Basingstoke T1B & T2B BSP.
33kV Network							
13	Northumberland Avenue PSS transformers	2045+	No issue	2045+	No issue	N-1: Loss of one of the circuits from Reading BSP.	Option a: • Add a third transformers and a third circuit from Reading BSP. Option b: • Replace and uprate both existing transformers. • Replace and uprate the existing circuits from Reading BSP.
	Circuits from Reading BSP to Northumberland Avenue PSS.	2040-2044	No issue	2040 - 2044	No issue	N-1: Loss of one of the transformers or circuits.	
14	Courages PSS transformers	No issue	2040-2044	No issue	No issue	N-1: Loss of one of the transformers or circuits.	Option a: • Add a third transformer and a third circuit from Burghfield Main BSP. Option b: • Replace and uprate both existing transformers.
15	Silver Street PSS transformers	No issue	No issue	2045+	No issue	N-1: Loss of one of the transformers or circuits.	Option a: • Add a third transformer and a third circuit from Reading BSP. Option b: • Replace and uprate both existing transformers.

Table 4 – Summary of system needs identified in this strategy out to 2050 along with indicative solutions.

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

Our HV/LV spatial plans have shown that there while the overloading of the secondary network is mostly apparent around areas of high population density, within these areas there is no clear trend. We are therefore planning on a forecast volume basis, and this section provides further context on this work for both the Bramley – Basingstoke high voltage and low voltage network needs to 2050.

8.3.1. 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, we have used the load model that is produced by SSEN's Data and Analytics team[12].

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 by the DFES to highlight the projected impact of LCTs on the network.

For all the primary substations supplied by Bramley – Basingstoke 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 17 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.

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

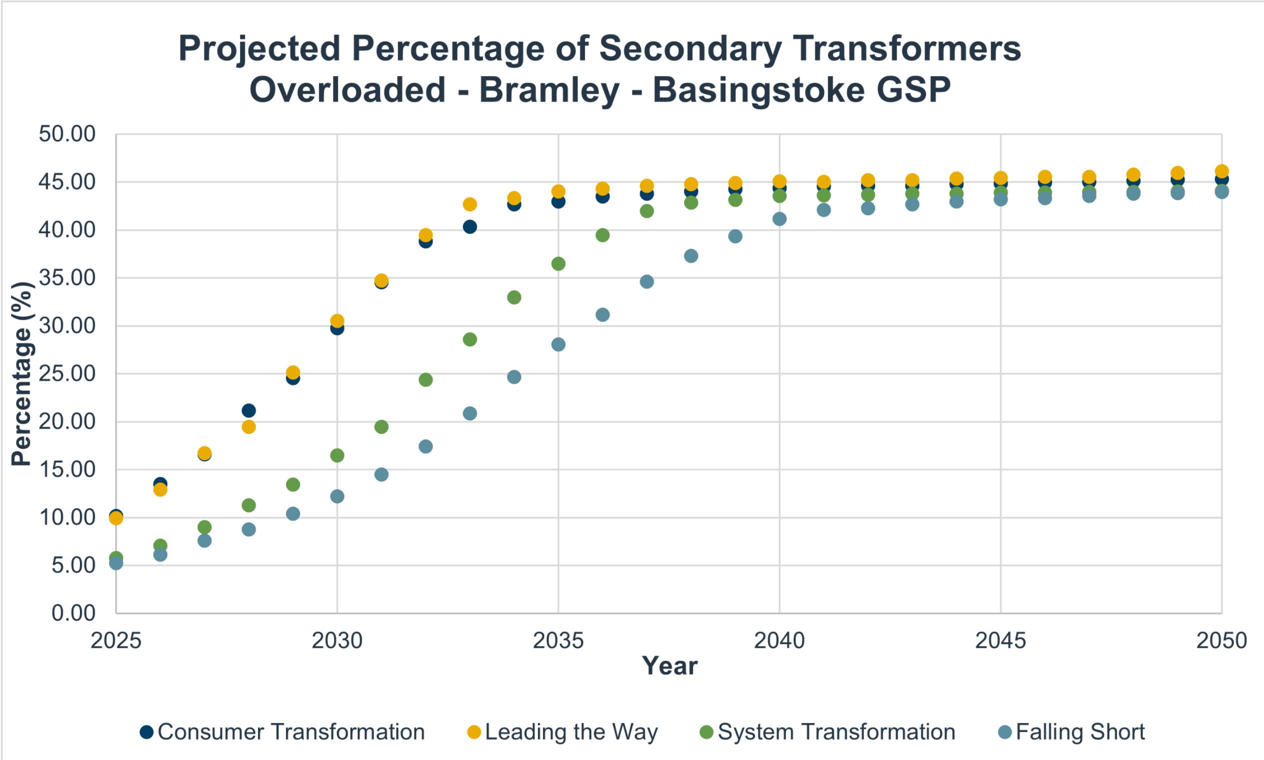


Figure 17 - Bramley – Basingstoke GSP projected secondary transformer loading. Source: SSEN Load Model

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 foresighting 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. Inclusion of the use of the VFES also acts as an example of how this data can be used more broadly by SSEN as well as other organisations for spatial planning. For example, it can help us identify areas where energy efficiency mechanisms could help reduce the need for network investment.

One of the outputs from this innovation project was the report produced by the Smith Institute[13]. This work groups LSOAs[14] 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 Table 5.

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

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

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.
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 levels 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.

Table 5 - VFES groupings

To understand the vulnerability groupings across Bramley – Basingstoke GSP supply area we have visualised the LSOA categorisation for the study area. By overlaying secondary transformers that are projected to be overloaded by 2028 (under the Consumer Transformation scenario), we begin to understand the crossover between network capacity needs and areas categorised as high vulnerability through the VFES work. This is shown below in Figure 18.

The majority of the Bramley – Basingstoke GSP area falls into category 6 with low vulnerability. Within the Bramley – Basingstoke GSP area, there are two large towns: Reading and Basingstoke – both of which see a notable number of projected overloaded secondary transformers by 2028 under CT as well as specific areas of very high vulnerability (category 1).

By overlaying the point locations of secondary transformers projected to be overloaded (in 2028 under the Consumer Transformation scenario) we identify areas that are categorised as more vulnerable and also may have capacity shortfalls at the secondary network level. More vulnerable groups may have a lower level of adoption of LCTs and therefore provide less ability to manage overloads through flexibility services. Further they may point towards areas of social housing where there could be a more sudden rollout of LCTs such as heat pumps in the future. They may also highlight areas where there is an evidential need for energy efficiency measures.

We recommend the use of these insights to prioritise work in heavily loaded areas of our network ensuring the network remains secure, stable, and resilient in the areas where vulnerable customers would be most disadvantaged by power outages.

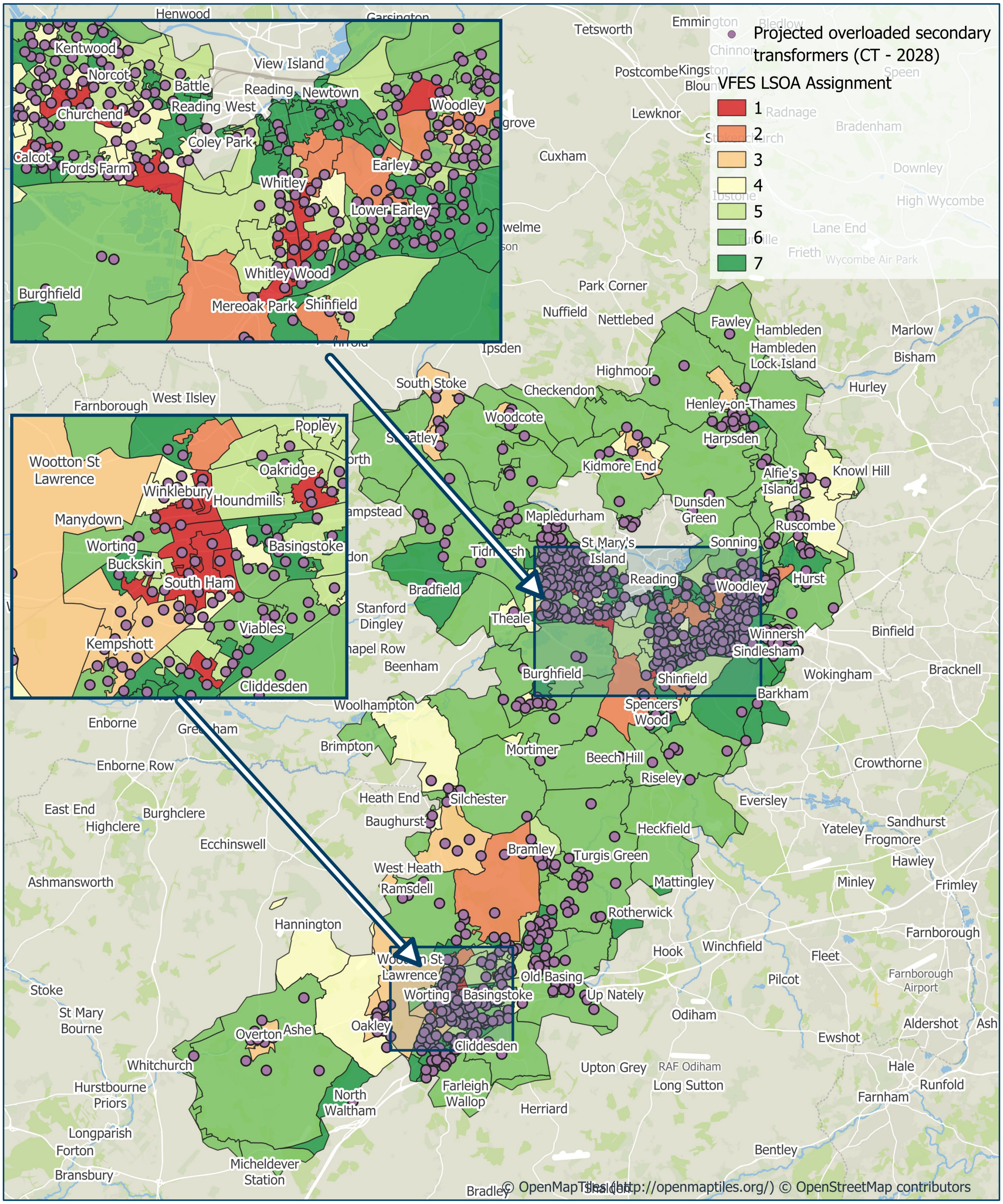


Figure 18 - Bramley – Basingstoke GSP VFES heat map with overloaded secondary transformers.

8.3.2. 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 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.

Initial analysis indicates that across Bramley – Basingstoke GSP, 23% of low voltage feeders may need intervention by 2035 and 26% by 2050 under the CT scenario as shown in Figure 19. 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.

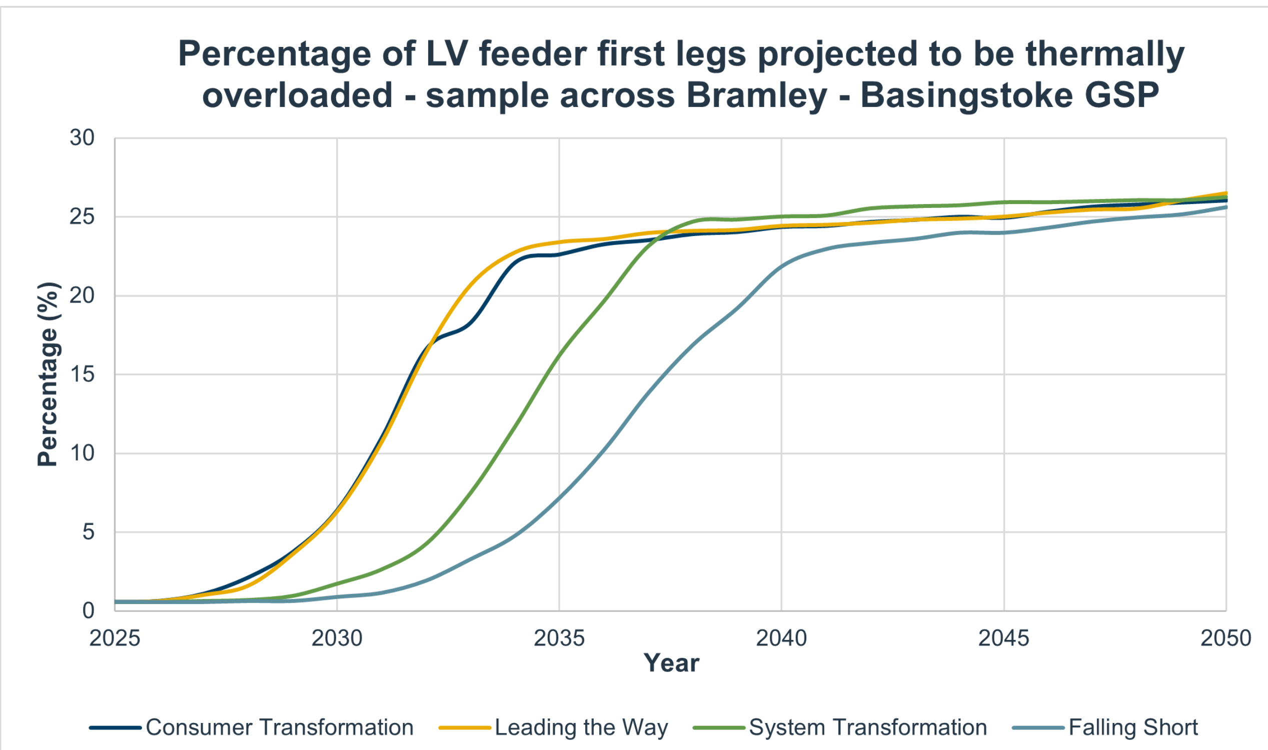


Figure 19 - Percentage of LV feeders projected to be overloaded under Bramley – Basingstoke GSP.

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2023 DFES analysis provides a robust evidence base for load growth across Bramley – Basingstoke GSP in both the near and longer term. Drivers for load growth across Bramley – Basingstoke GSP arise from multiple sectors and technologies. These drivers impact not only our EHV network but will drive system needs across all voltage levels.

There are 4 key recommendations from this report:

1. Where we have identified work that is required in the next 10 years, this should be progressed through the DNOA process. Through detailed study we will understand the network requirements in more detail and progress these where appropriate. This includes the following system needs which are forecasted to arise ahead of 2030:
    a. Circuits from Basingstoke T1B & T2B BSP to Overton PSS and Down Grange PSS.
    b. Arborfield PSS transformers.
    c. Circuits from Reading BSP to Little Hungerford PSS and tee point to Arborfield PSS.
    d. Circuits between Little Hungerford PSS and Arborfield PSS.

    It is possible that some of the above constraints may not have a near term system need based on actual load growth and therefore will not initially result in a DNOA outcome. Annual reassessment will enable us to confirm whether these system needs are likely to arise. When carrying out this annual reassessment the delivery timelines of the work should be considered alongside the potential for flexibility services to manage network capacity.

2. Due to the interconnection of Bramley – Basingstoke GSP and Fleet GSP, the load growth of Bramley – Basingstoke GSP should be considered alongside long-term planning for Fleet GSP. Continued engagement with NESO and NGET on the strategic planning of this area is necessary for alignment on the long-term plan for load growth in Bramley – Basingstoke GSP as well as neighbouring and future GSPs.

3. The DFES 2023 indicates there is the potential for significant load growth at Motorway Service Areas in Bramley – Basingstoke GSP. Further engagement to refine their future energy needs as well as the needs of other large energy users which may sit outside of the DFES building blocks should be carried out to continuously improve our forecasts which feed into our system planning processes.

4. Constraints on secondary transformers are primarily concentrated around Reading and Basingstoke – further investigation into these requirements as well as possible efficient solutions is recommended to ensure capacity of the HV/LV network.

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: Primary substation existing network.

Substation Name	Site Type	Number of Customers Served (approximate)	2023-2024 Substation Maximum MVA
Basingstoke T1A & T2A BSP			
Basingstoke	Primary Substation	5,300	13.1
Jays Close	Primary Substation	8,300	17.9
Basingstoke T1B & T2B BSP			
Bramley Green	Primary Substation	2,900	4.3
Chineham	Primary Substation	5,700	11.8
Down Grange	Primary Substation	16,500	18.0
Overton	Primary Substation	3,300	14.9
Basingstoke T3 & T4 BSP			
Brook Street	Primary Substation	4,400	11.4
Houndmills	Primary Substation	4,600	14.9
Oakridge	Primary Substation	8,700	9.2
Burghfield BSP			
Courages	Primary Substation	2,000	13.3
Goring	Primary Substation	2,200	5.5
Green Park	Primary Substation	50	8.7
Kentwood Hill	Primary Substation	15,900	17.1
Mortimer	Primary Substation	5,000	7.2
Padworth	Primary Substation	800	3.0
Pangbourne	Primary Substation	3,800	8.7
Southcote	Primary Substation	6,300	7.2
Theale	Primary Substation	1,900	7.9
Trash Green	Primary Substation	4,000	9.6
Whitley Wood	Primary Substation	8,800	14.1
Wilson Road	Primary Substation	10,900	13.4
Woodcote	Primary Substation	1,600	3.8
Reading BSP			
Reading	Primary Substation	15,300	22.9
Arborfield	Primary Substation	4,400	10.3
Henley	Primary Substation	8,900	15.4
Kidmore End	Primary Substation	4,600	7.2

Little Hungerford	Primary Substation	16,000	22.6
Northumberland Avenue	Primary Substation	5,800	13.0
Silver Street	Primary Substation	11,000	15.7
Twyford	Primary Substation	7,200	12.7

Table 6 - Customer number breakdown and substation peak demand readings (2023-2024) for the primary substations in the Bramley – Basingstoke SDP area.

Appendix B: DFES 2024 Projections

DFES 2024 Scenarios

NESO publishes the FES framework annually, and this is adopted for the DFES. The 2024 edition outlines three new pathways (Holistic Transition, Electric Engagement, and Hydrogen Evolution) that achieve net zero by 2050 against a Counterfactual. The scenario framework is shown below in Figure 20.

The following charts show the latest DFES 2024 projections similar to those in Section 5 with the updated pathways.

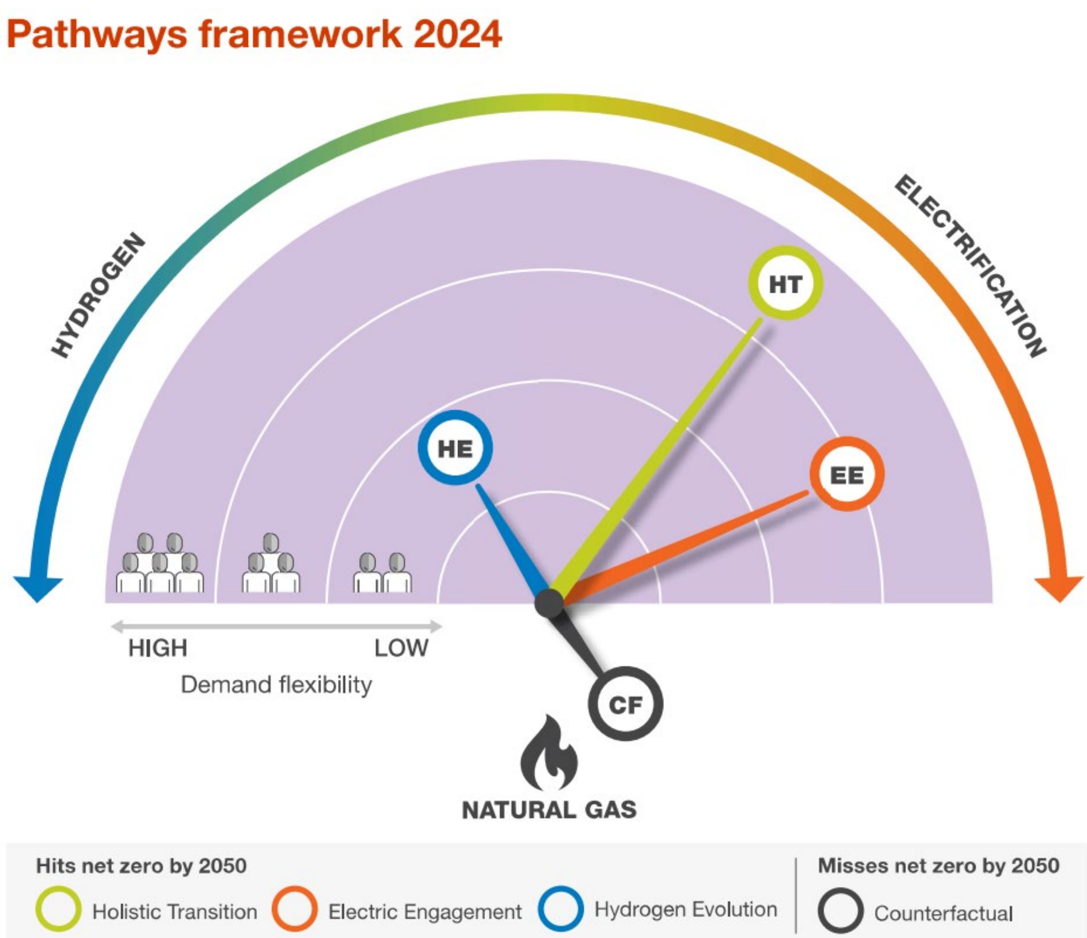


Figure 20 - The FES 2024 scenario framework (source: NESO)

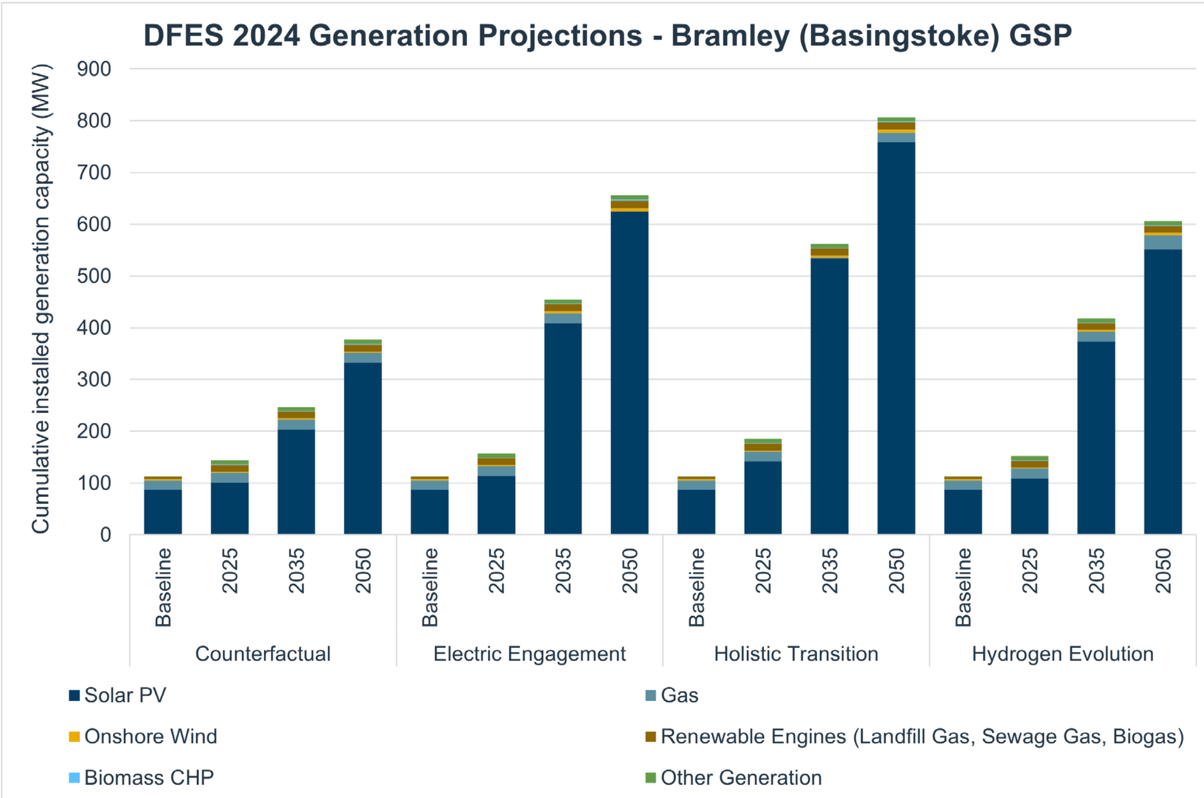


Figure 21 - Projected cumulative distributed generation capacity across Bramley - Basingstoke GSP (MW). Source: SSEN DFES 2024

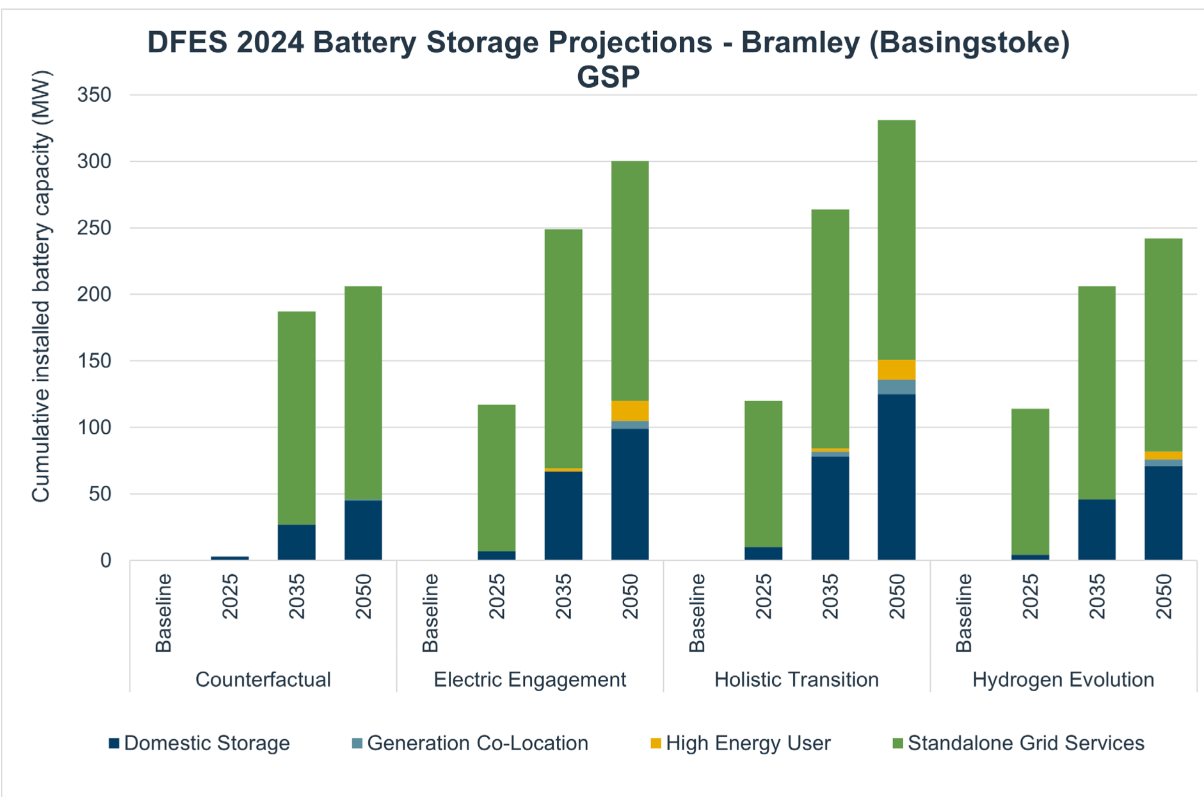


Figure 22 - Projected cumulative battery storage capacity across Bramley - Basingstoke GSP (MW). Source: SSEN DFES 2024

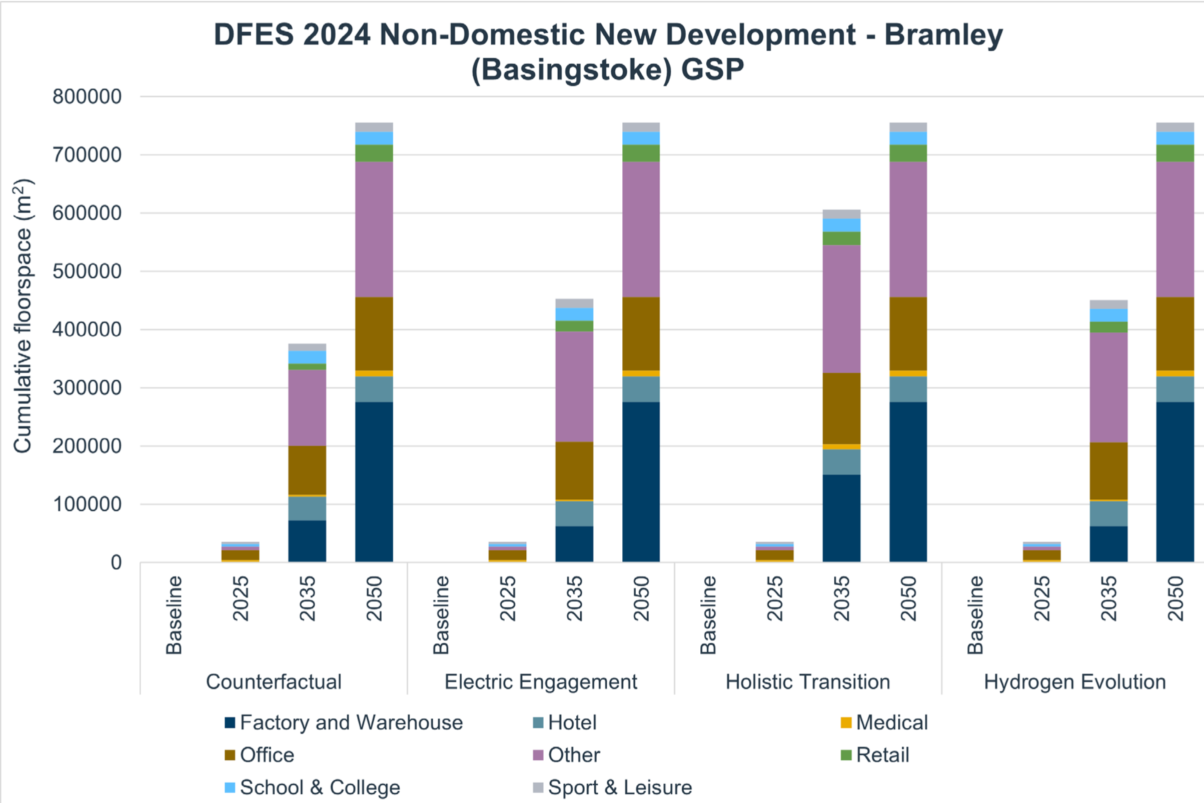


Figure 23 - Projected non-domestic development across Bramley - Basingstoke GSP (m^2). Source: SSEN DFES 2024

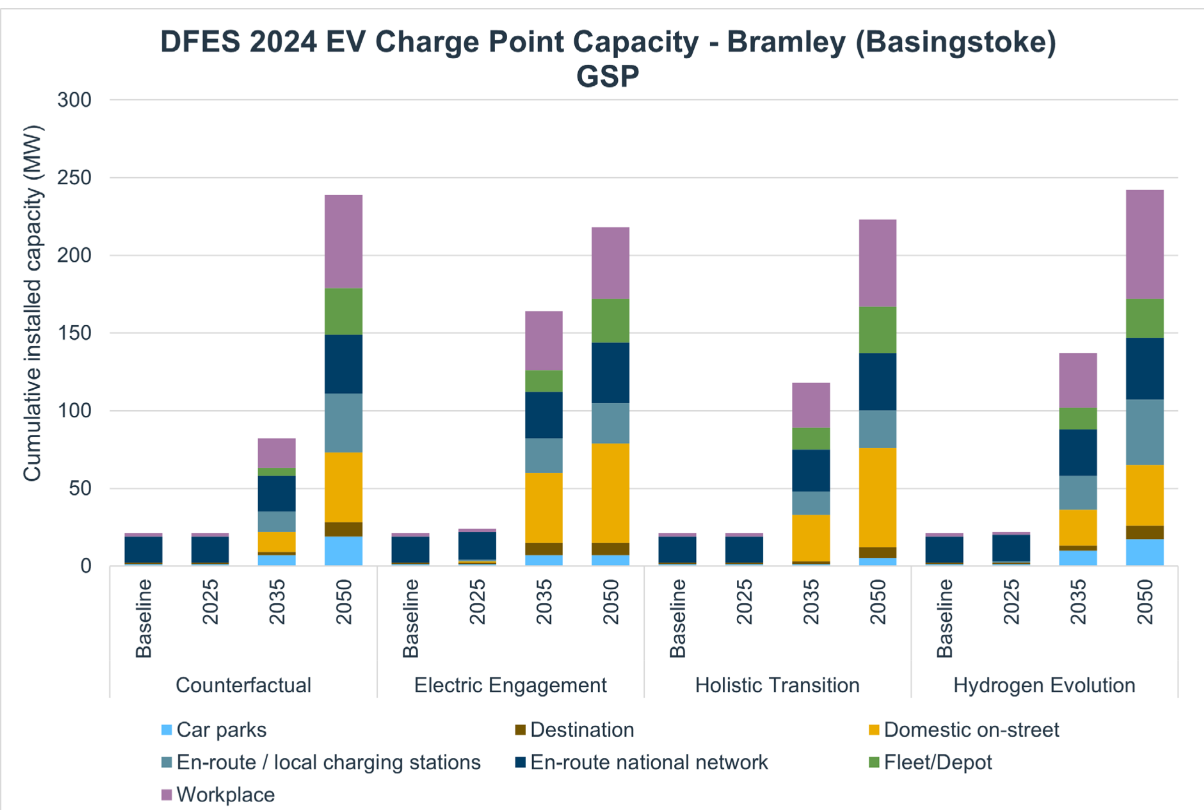


Figure 24 - Projected cumulative installed EV charge point capacity across Bramley - Basingstoke GSP (MW). Source: SSEN DFES 2024

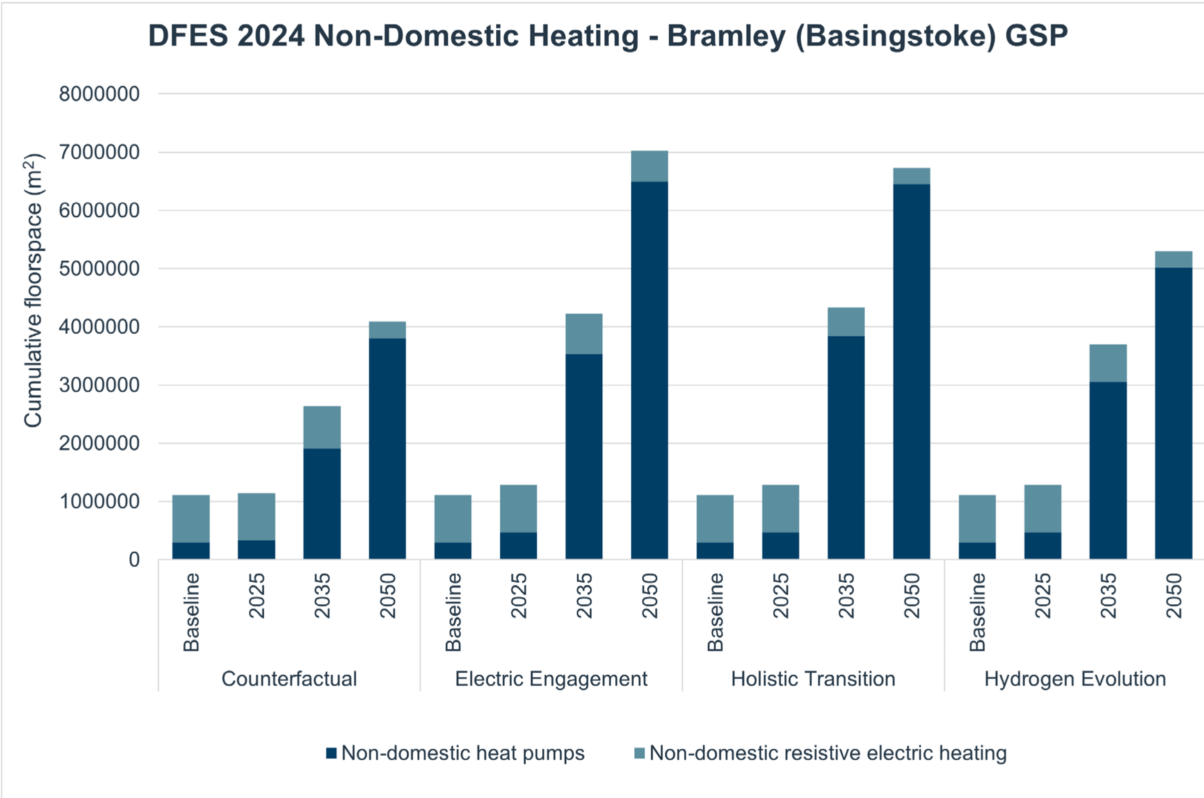


Figure 25 - Projected number of non-domestic heating technologies across Bramley - Basingstoke GSP. Source: SSEN DFES 2024

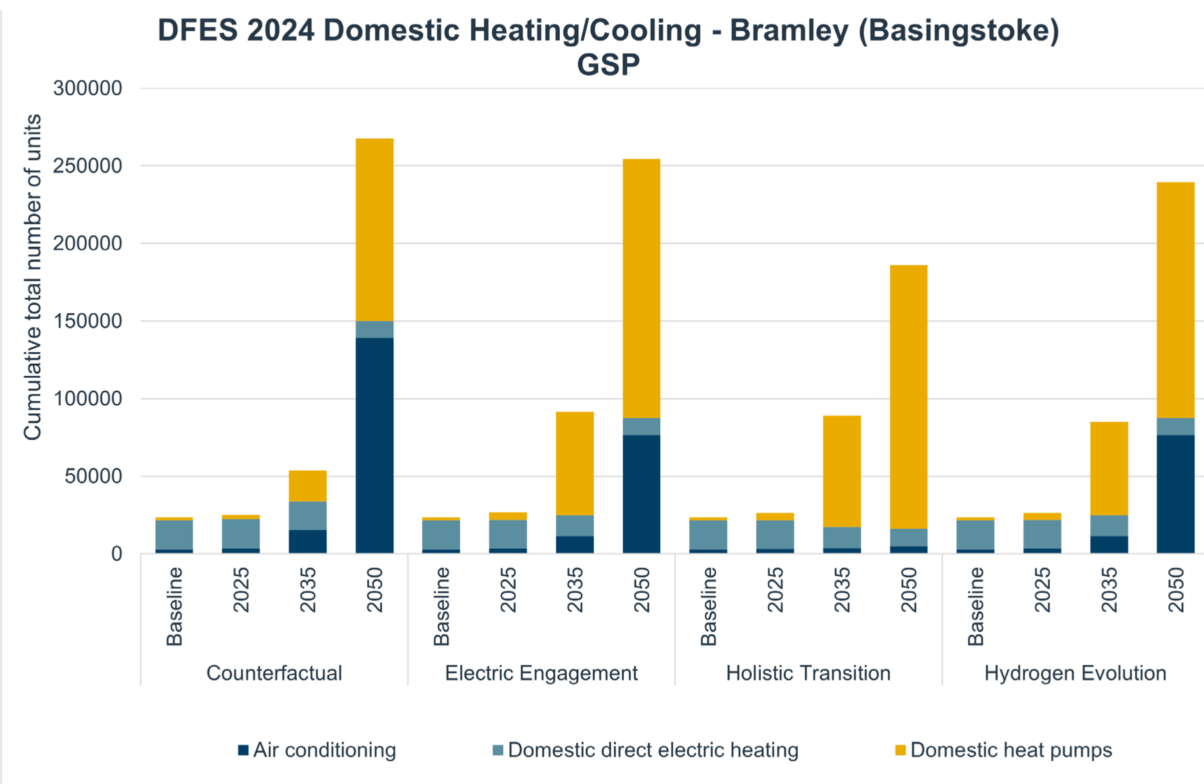


Figure 26 - Projected number of domestic heating/cooling technologies across Bramley - Basingstoke GSP. Source: SSEN DFES 2024

Appendix C: 33kV existing network schematics

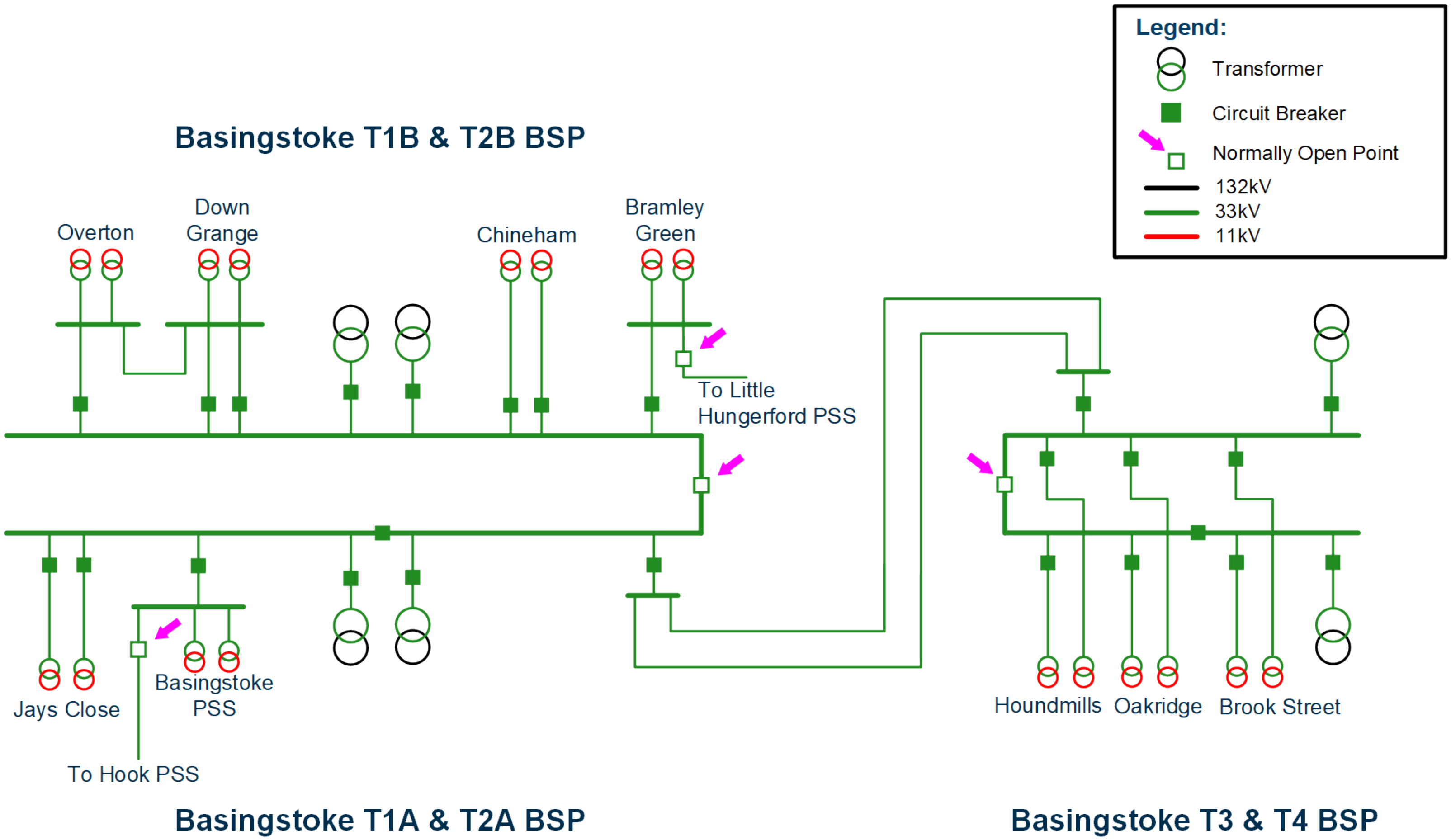


Figure 27 - Basingstoke T1A & T2A BSP, Basingstoke T1B & T2B BSP, and Basingstoke T3 & T4 BSP - Existing network schematic

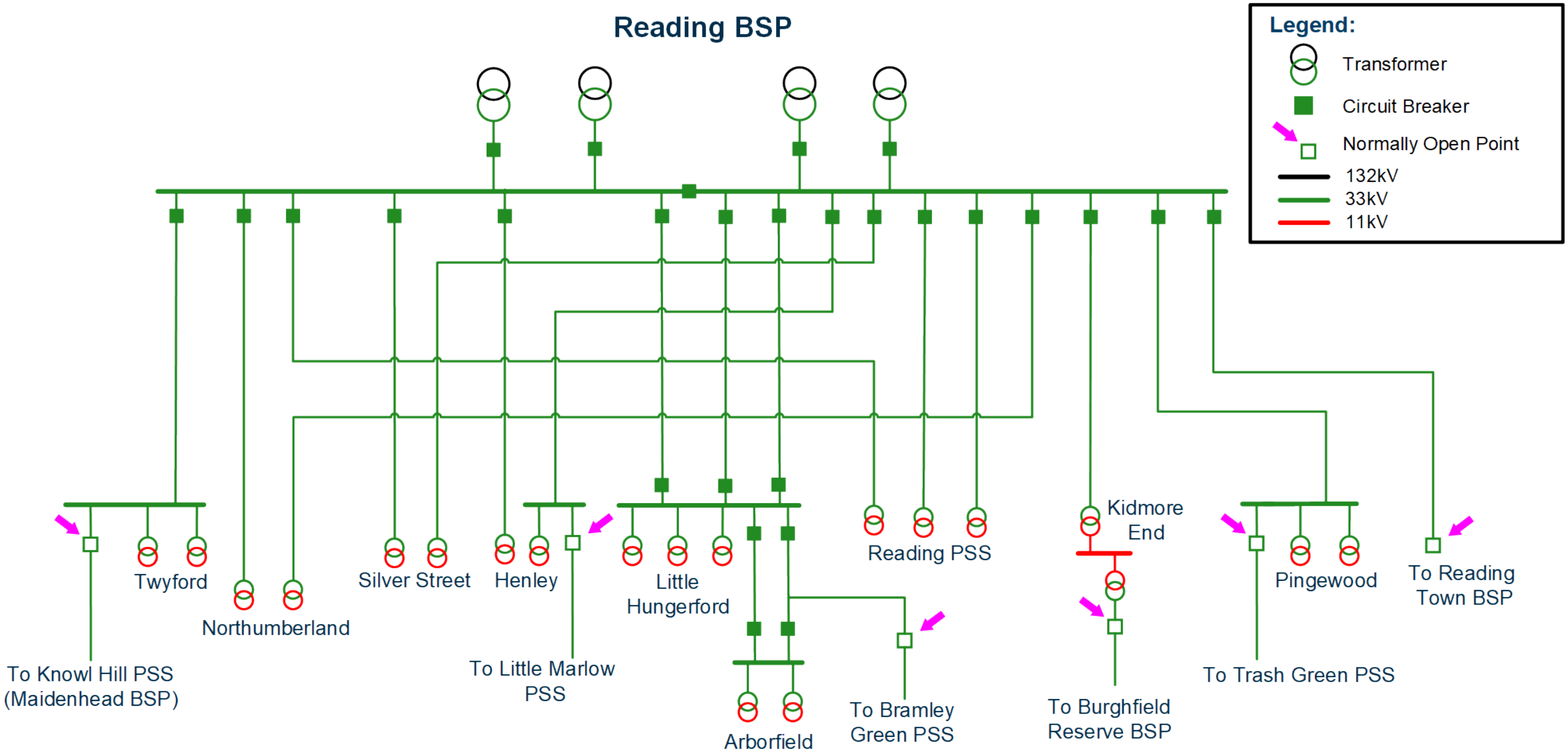


Figure 28 - Reading BSP - Existing network schematic

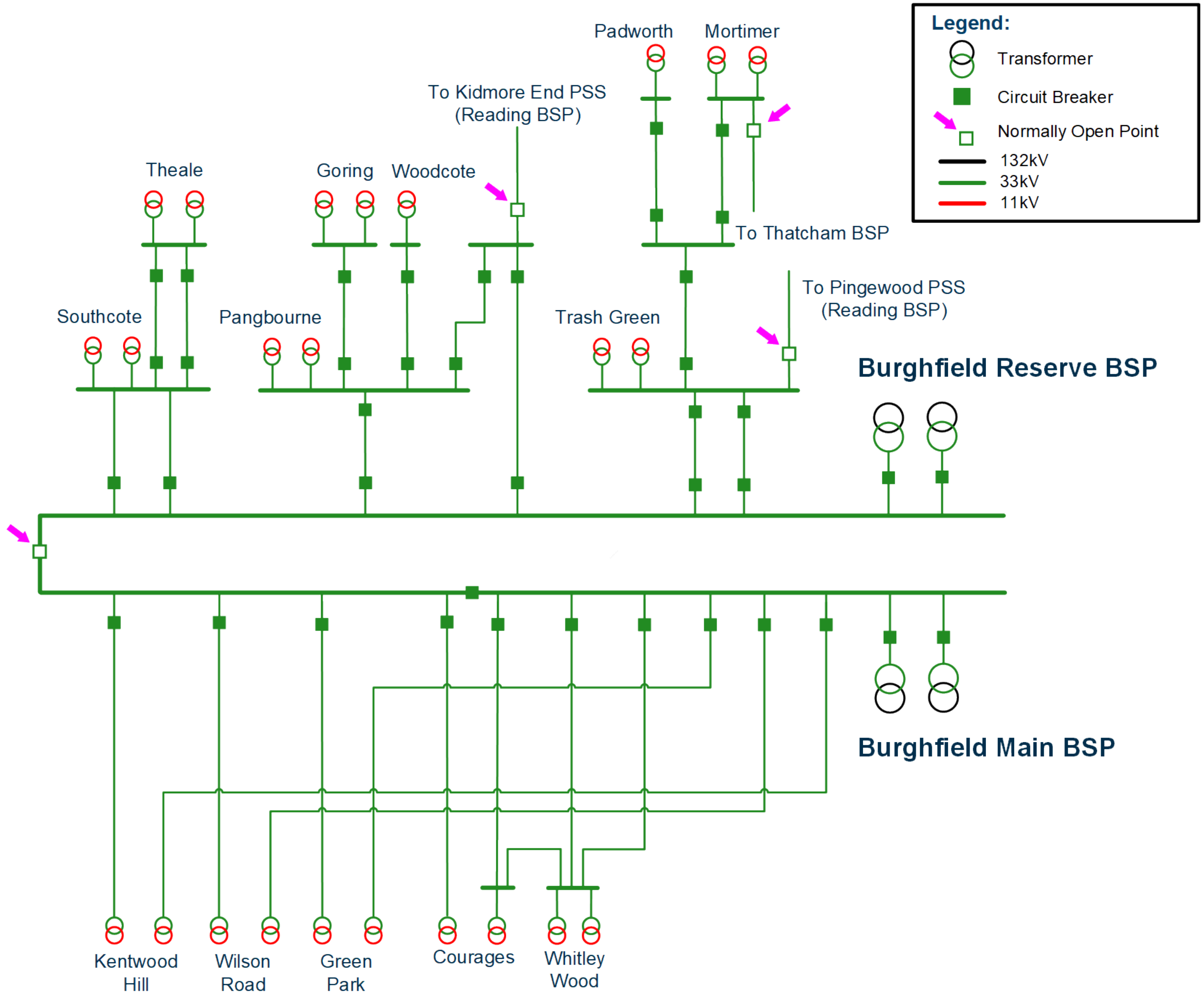


Figure 29 - Burghfield Main BSP and Burghfield Reserve BSP - Existing network schematic

Appendix D: 33kV works in progress network schematics

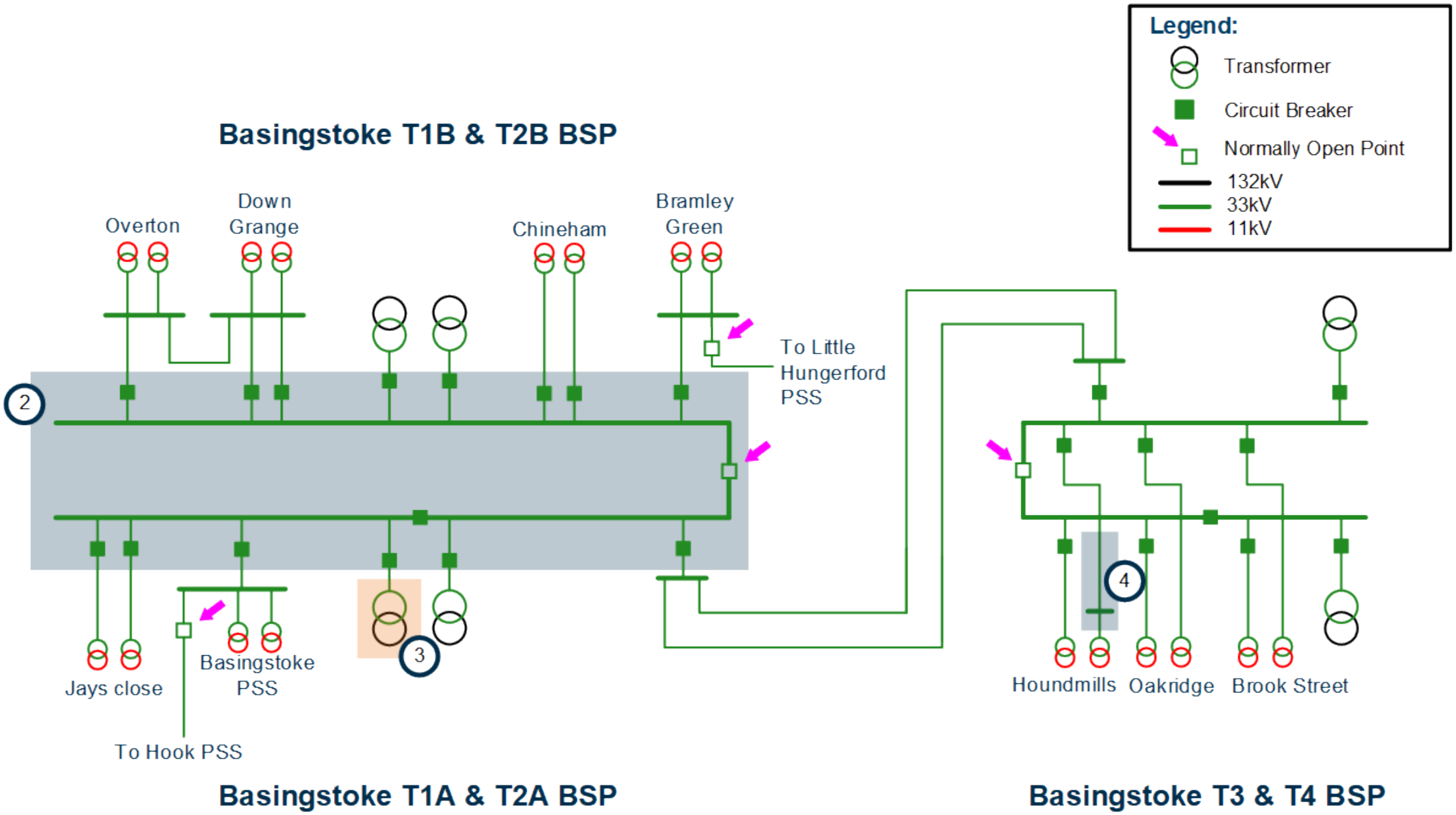


Figure 30 - Basingstoke T1A & T2A BSP, Basingstoke T1B & T2B BSP, and Basingstoke T3 & T4 BSP - Future network schematic

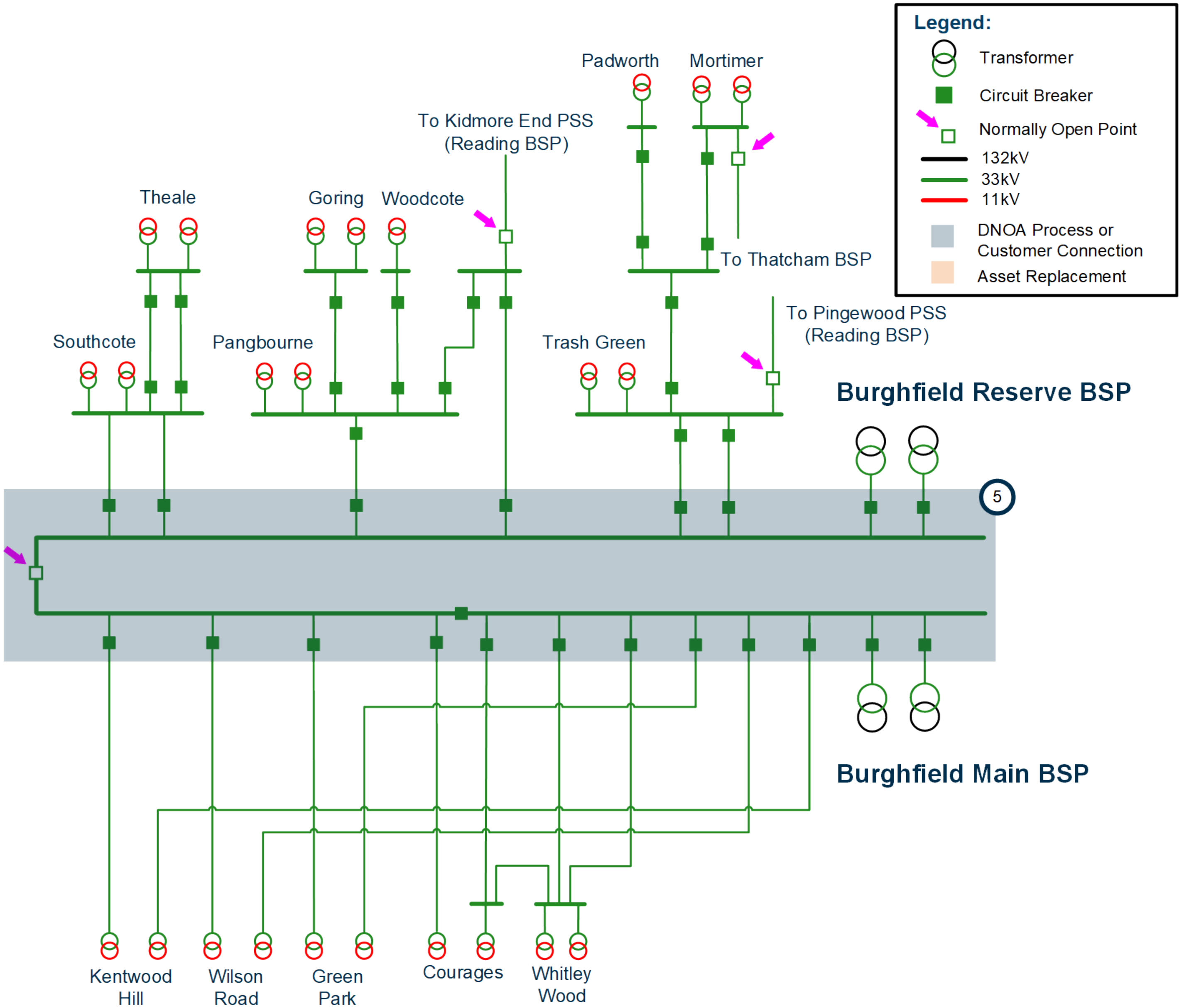


Figure 31 - Burghfield Main BSP and Burghfield Reserve BSP - Future network schematic

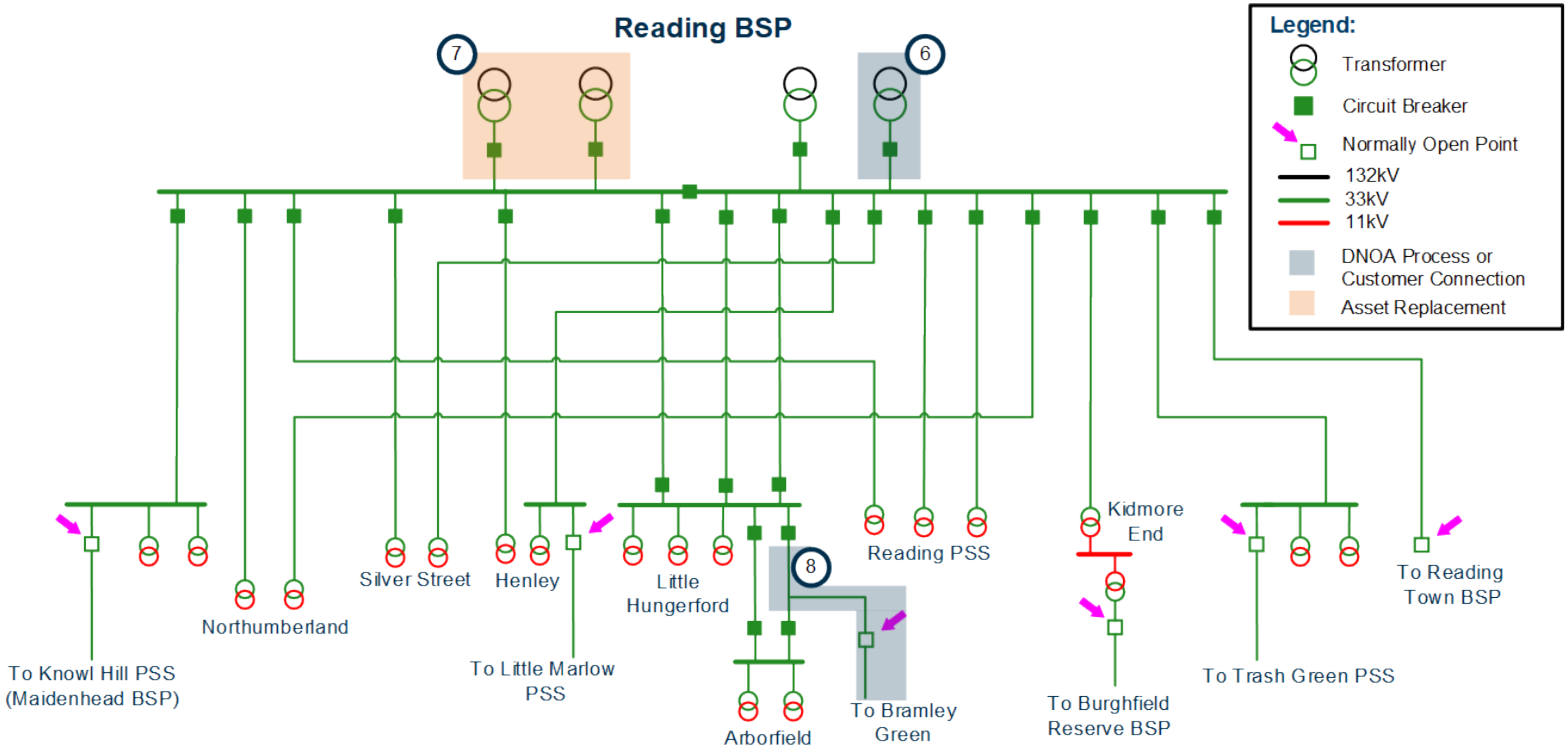


Figure 32 - Reading BSP - Future network schematic

Appendix E: EHV/HV plans for other DFES scenarios

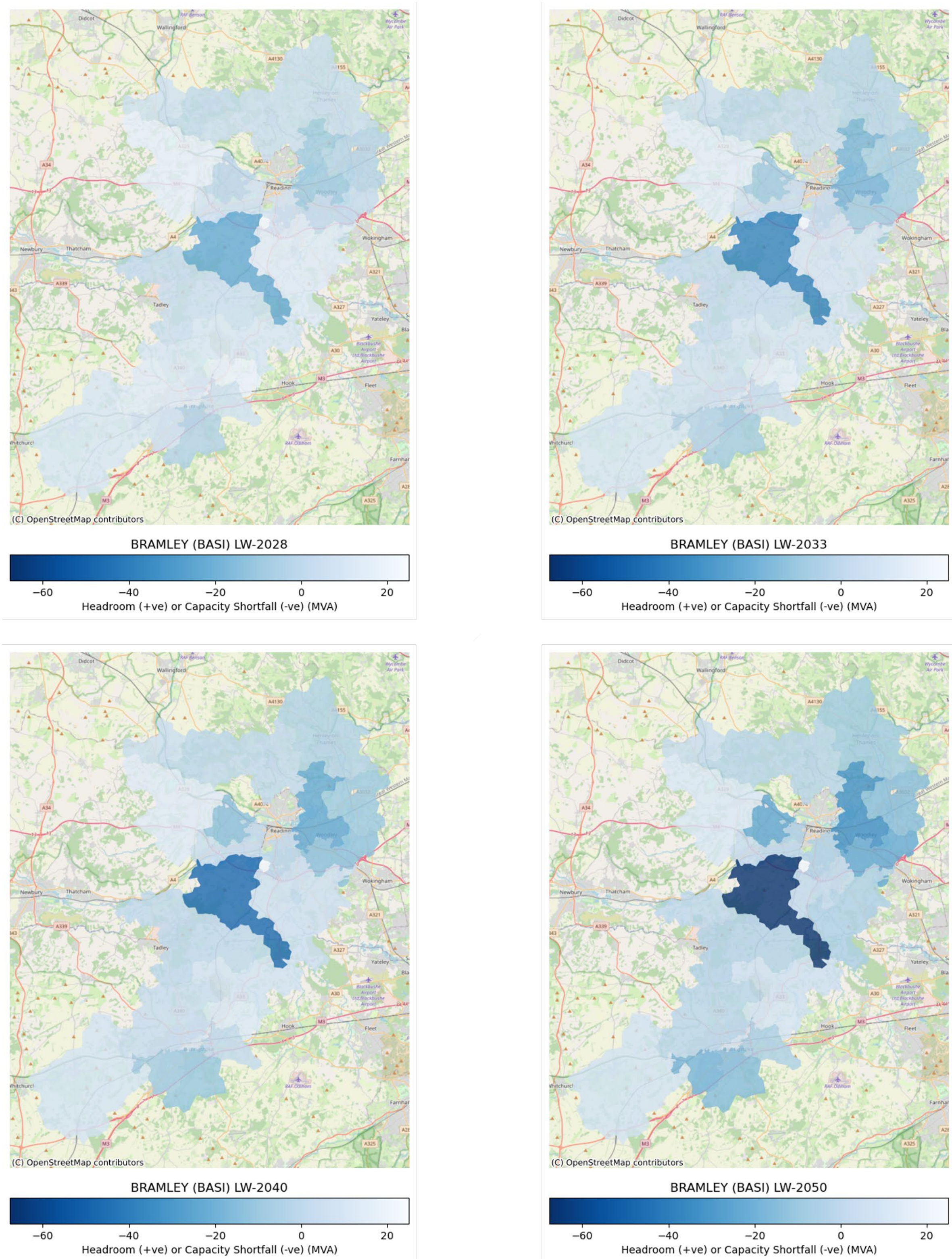


Figure 33 - Bramley - Basingstoke GSP - EHV/HV Spatial Plan - Leading the Way

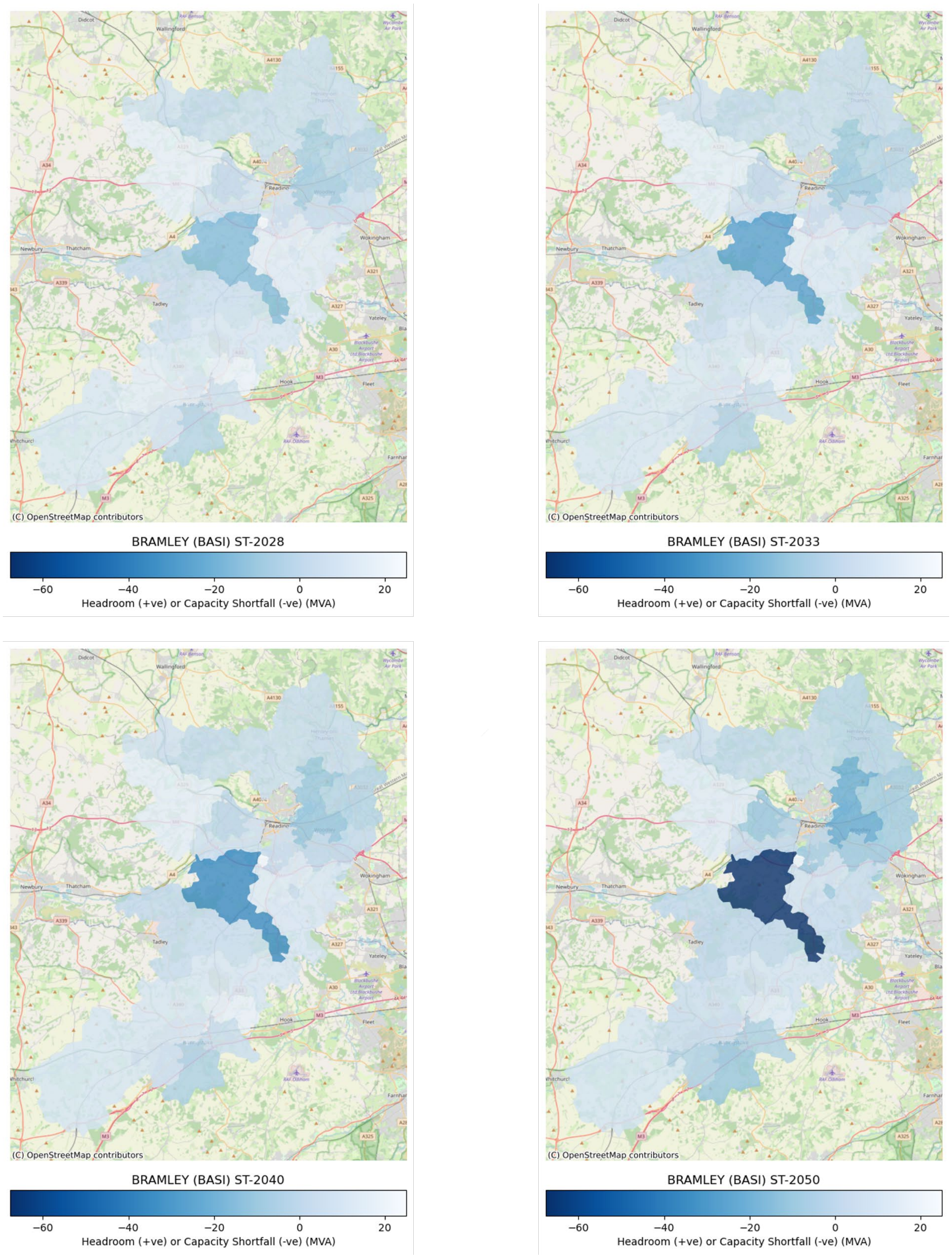


Figure 34 - Bramley - Basingstoke GSP - EHV/HV Spatial Plan - System Transformation

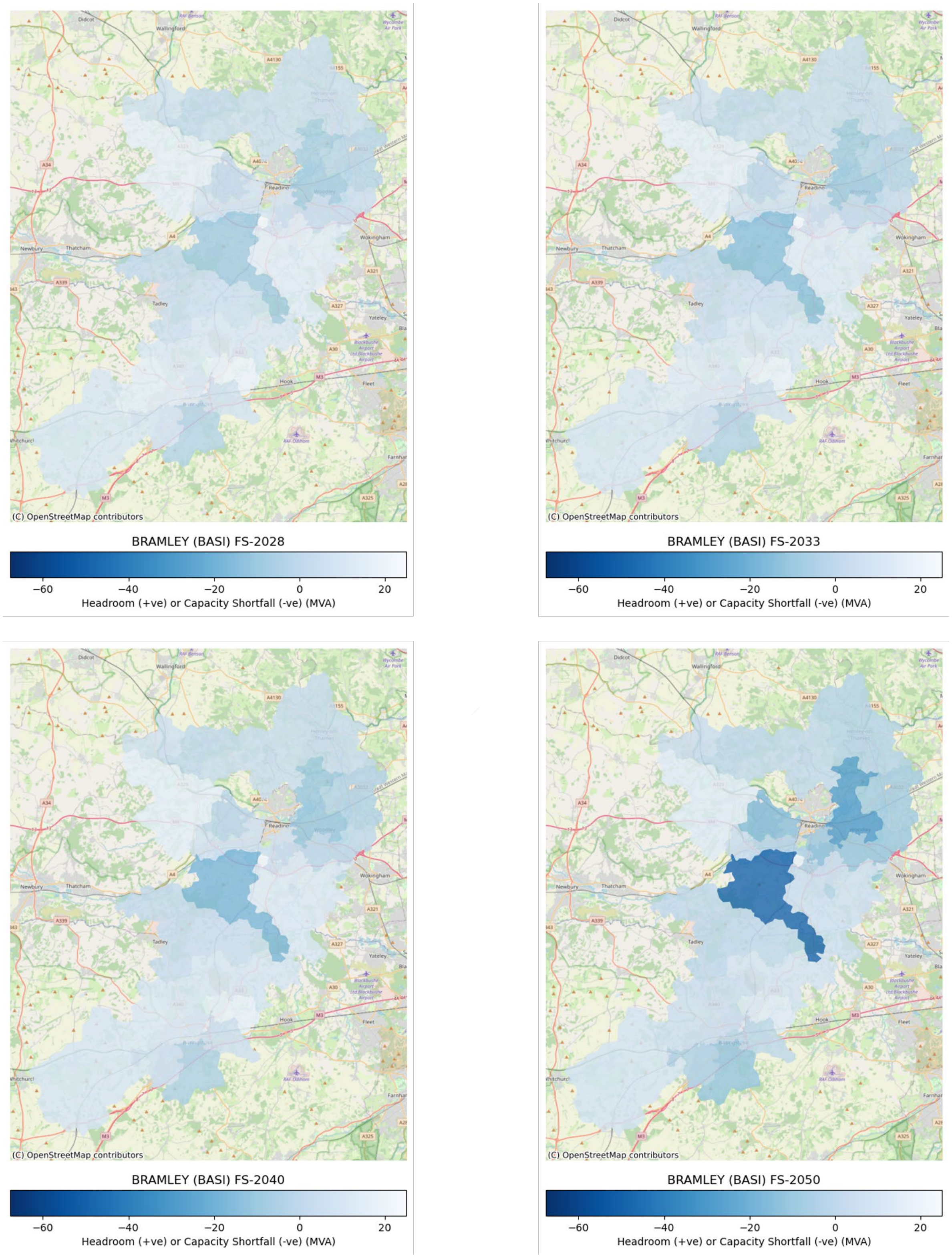


Figure 35 - Bramley - Basingstoke GSP - EHV/HV Spatial Plan - Falling Short

Appendix F: HV/LV plans for other DFES scenarios

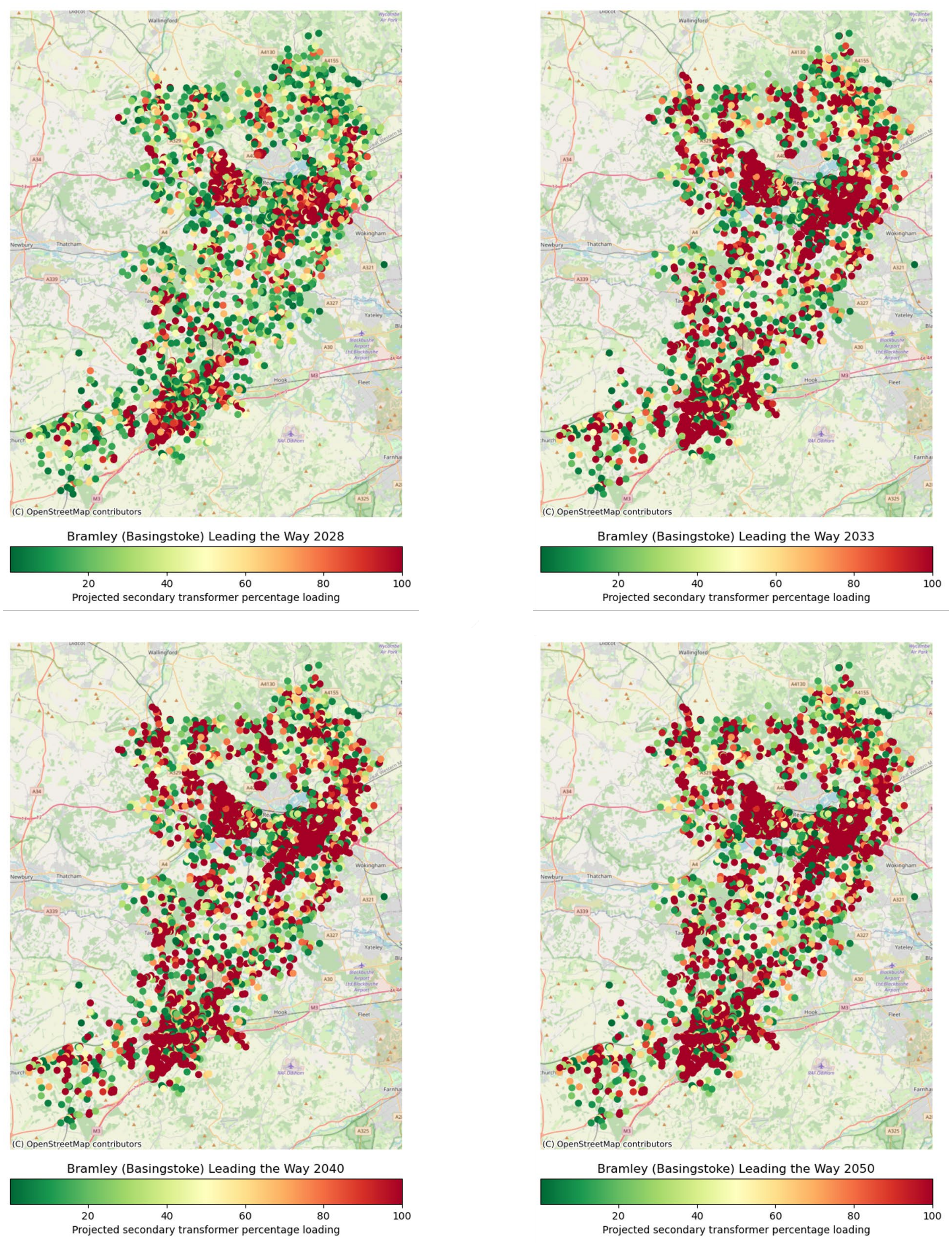


Figure 36 - Bramley - Basingstoke GSP - HV/LV Spatial Plan - Leading the Way

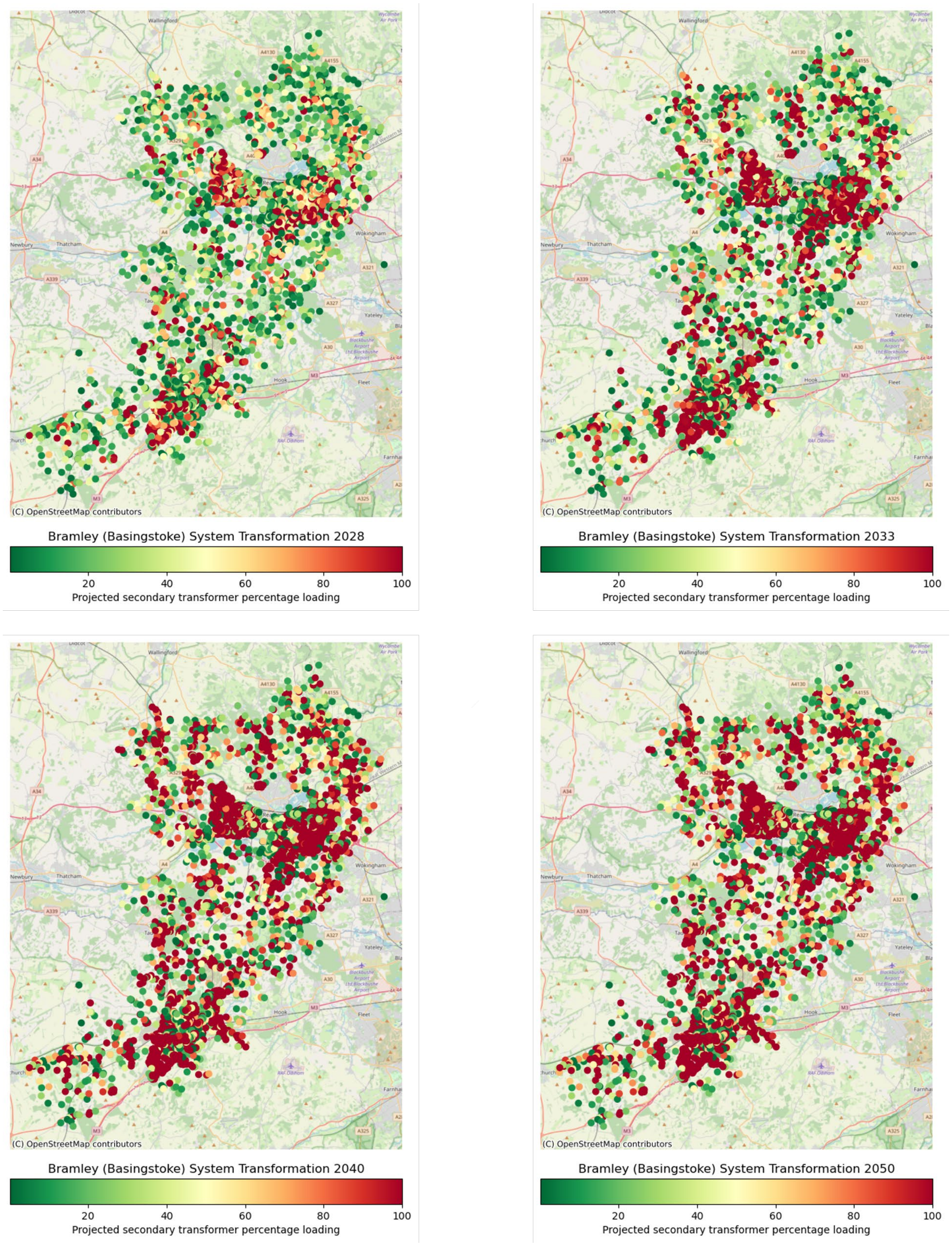


Figure 37 - Bramley - Basingstoke GSP - HV/LV Spatial Plan - System Transformation

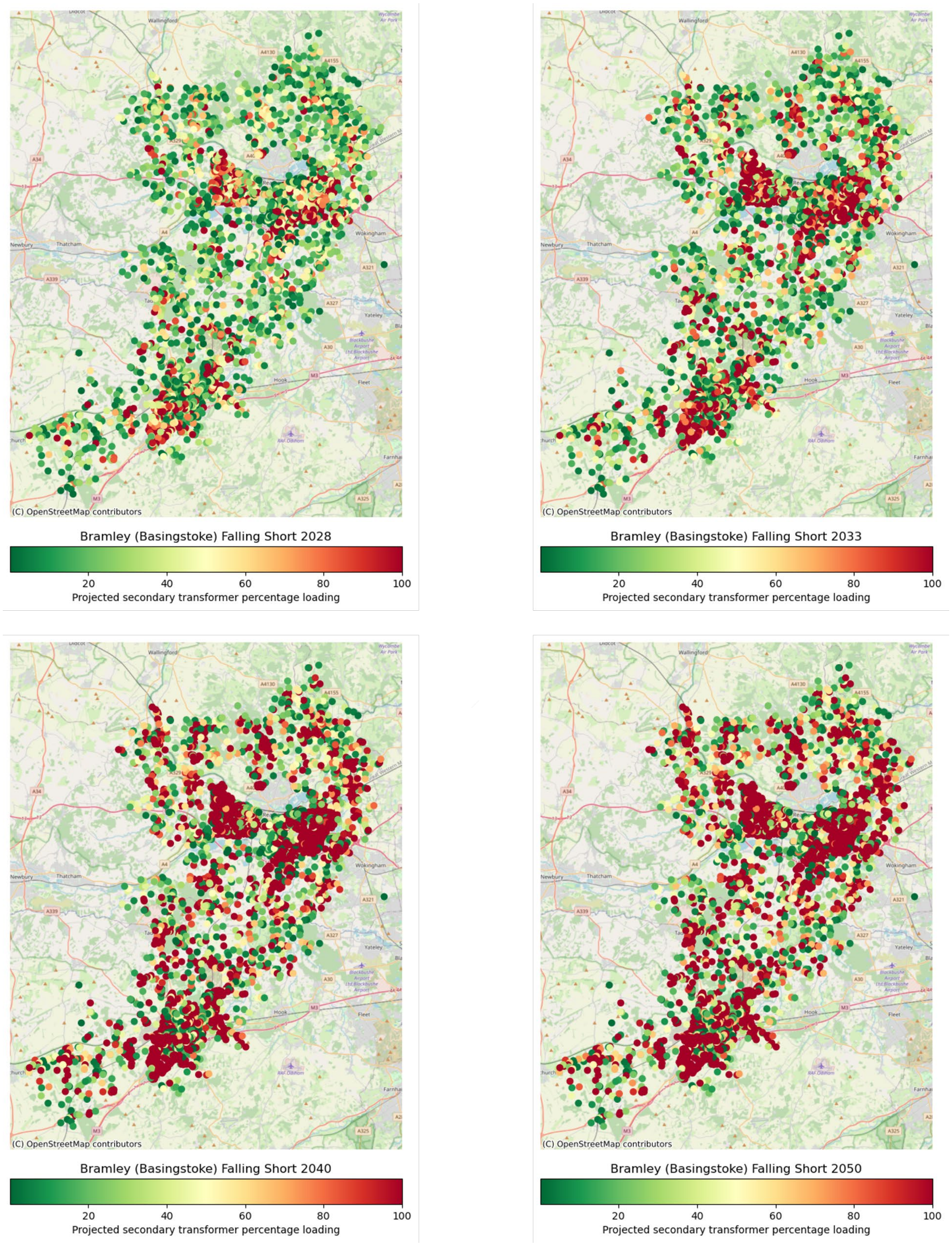


Figure 38 - GSP - HV/LV Spatial Plan - Falling Short

Appendix G: Relevant DNOA Outcome Reports

July 2024 DNOA Report

DNOA Outcome Report

Berkshire & Hampshire (Fleet – Bramley GSP) Ref. 0724-17

Scheme description

- The Fleet-Bramley GSP feeds a large area across Berkshire and Hampshire. Postcode(s): GU7-GU21, GU24-GU35, GU51-GU52, RG1-RG2, RG4-RG10, RG12, RG23-RG31, RG40-RG42, RG45, RH12-RH14, RH20, SL4-SL6, SO21, SO24.
- Load related – Fleet-Bramley GSP group thermal overload in FCO conditions due to forecasted demand growth in the area.

Proposed option

- Procure 3 years of flexibility solutions followed by asset solutions: will split the Fleet/Bramley GSP group into two GSP groups. including works at Bramley GSP, Burghfield Bulk Supply Point (BSP), Reading BSP, Wokingham BSP and on the Fleet-Burghfield Tee-Reading circuit.
- The option provides the economic benefit of reinforcement deferral, ensures network compliance, and sets up future works.

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: £150/MW/h
- Utilisation: £200/MWh

Reinforcement timeline

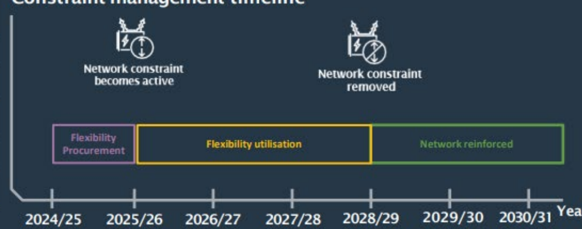
- Flexibility utilisation in 2025/26, 2026/27 and 2027/28.
- Reinforcement delivery by 2028/29.

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	-	8.5	11.2	28.6	- (158.6)	- (218.6)	- (305.6)
ST	-	-	-	-	- (34.4)	- (59.8)	- (89.1)
LTW	6.9	52.4	67.8	90.2	- (237)	- (307.3)	- (387.1)
FS	-	-	-	-	- (14.1)	- (35.5)	- (62.9)

Constraint management timeline



Appendix H: Glossary

Acronym	Definition
AIS	Air Insulated Switchgear
ANM	Active Network Management
ARC	Advanced Research Computing
BAU	Business as Usual
BSP	Bulk Supply Point
CB	Circuit Breaker
CBA	Cost Benefit Analysis
CER	Consumer Energy Resources
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
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
HV	High Voltage
kV	Kilovolt
kWp	Peak power in kilowatts
LAEP	Local Area Energy Planning
LCT	Low Carbon Technology
LENZA	Local Energy Net Zero Accelerator
LEO	Local Energy Oxfordshire
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-ED2/3	Revenue = Incentives + Innovation + Outputs, Electricity Distribution 2 / 3 (Regulatory price control periods RIIO-ED2 and RIIO-ED3)
SDP	Strategic Development Plan
SEPD	Southern Electric Power Distribution
SLC	Standard Licence Condition
SSEN	Scottish and Southern Electricity Networks
ST	System Transformation
UKPN	UK Power Networks
UM	Uncertainty mechanism
VFES	Vulnerability Future Energy Scenarios
WSC	Worst Served Customers
ZCOP	Zero Carbon Oxfordshire Partnership

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Scottish & Southern Electricity Networks