PERSLEY 132KV SUPPLY AREA - STRATEGIC DEVELOPMENT PLAN

Our network serving communities across Aberdeen City and Aberdeenshire area

August 2025

Scottish & Southern Electricity Networks

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1. EXECUTIVE SUMMARY

Scottish and Southern Electricity Networks (SSEN) is taking a strategic approach to 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) incorporate stakeholder feedback on future energy needs through to 2050 and translate these insights into strategic spatial plans for the future distribution network requirements. This enables us to transparently present our future conceptual plans and facilitate discussion with local authorities and other stakeholders. The overall methodology and how this fits into our wider strategic planning process is presented in the Strategic Development Plan Methodology (Strategic Development Plan Methodology - January 2025).

The focus area of this SDP is that supplied by Clayhills, Craigiebuckler, Dyce, Persley, Redmoss, Rothienorman, Tarland, Willowdale and Woodhill Grid Supply Points (GSPs) that partly make up the Persley 132kV supply area. These GSPs supply customers covering parts of Aberdeenshire and Aberdeen City council. Kintore GSP is also supplied via Persley 132kV substation and has an individual SDP.

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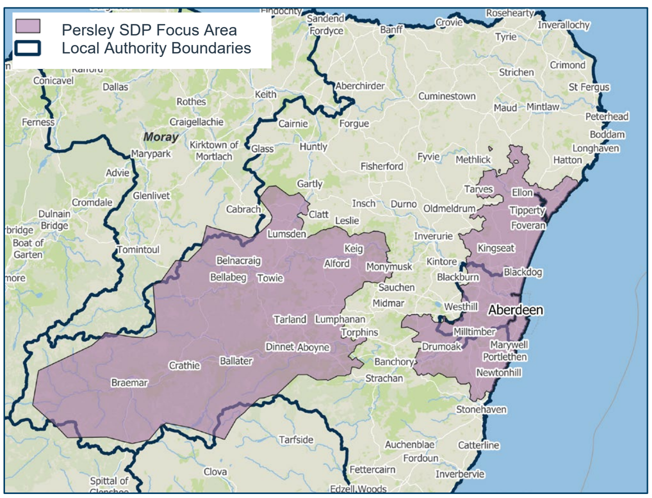

Figure 1: Geographic area covered by this report.

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 Aberdeen City and Aberdeenshire area have been considered in preparation of 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 link with other stakeholder views in the area to provide a robust evidence base for load growth out to 2050 across the Persley 132kV supply area– including Clayhills, Craigiebuckler, Dyce, Persley, Redmoss, Rothienorman, Tarland, Willowdale and Woodhill Grid Supply Points (GSP). 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 1**. This report was produced in alignment with SSEN's Strategic Development Plan methodology.[1] The methodology report outlines the process that we follow in the rollout of our Strategic Development Plans and should be referred to alongside this report.

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 off 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 under four different scenarios as we move towards the national 2050 net zero target. These scenarios are summarized in **Figure 2** SSEN use Consumer Transformation as the central case scenario following stakeholder feedback during the RIIO-ED2 development process. This position is reviewed annually. The 2024 DFES outlines three new pathways (Holistic Transition, Electric Engagement, and Hydrogen Evolution) that achieve net zero by 2050 against a Counterfactual and further detail on DFES 2024 can be found in **Appendix B** and in the DFES 2024 reports.

Commented [MM2]: National Energy System Operator - NESO

Recently, we have seen significant customer connection requests across the Persley SDP focus area. Where this demand has not been captured in the DFES we have considered this to ensure that the projected load more accurately reflects that we expect to see in the future.

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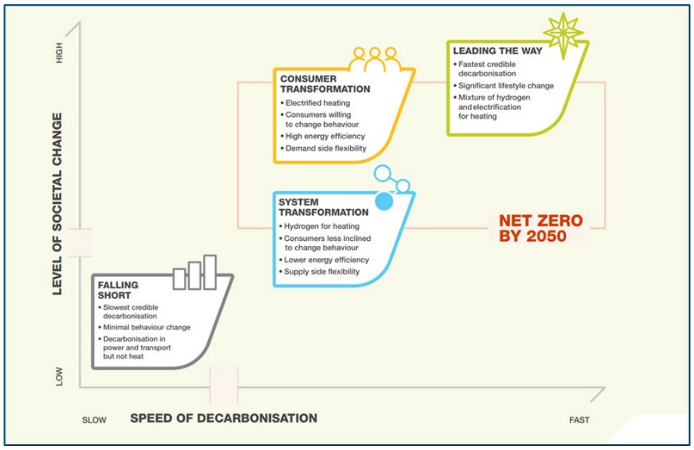

Figure 2: Future Energy Scenarios adopted for the DFES. *Source: ESO FES*

1 Strategic Development Plan Methodology - January 2025

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 provides more detailed optioneering for each of these reinforcements, ensuring stakeholder visibility of the strategic planning process. Opportunities for procurement of flexibility are also highlighted in the DNOA, to cultivate the flexibility markets.

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The main local authorities that are within the Persley SDP focus area is Aberdeenshire Council and Aberdeen City Council, 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.

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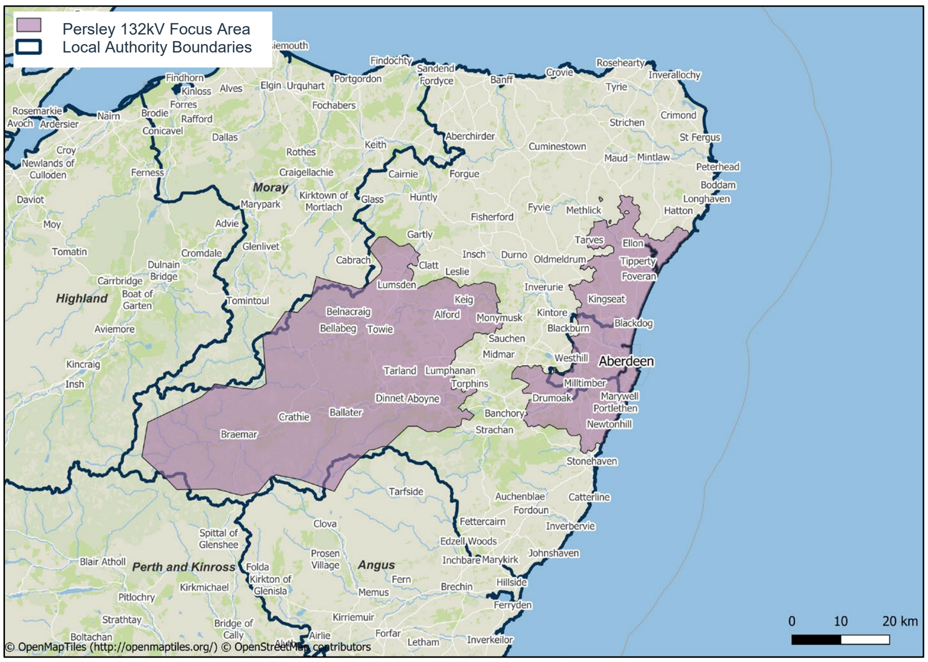

Figure 3: Persley 132kV Supply Area and Local Authority Boundaries

3.1.1. Aberdeenshire Council

Persley 132kV supplies parts of Aberdeenshire Council. Some of the areas within the marked region on the map lie within Cairngorms National Park, including Braemar and Ballater. This area is largely rural, featuring notable sites such as Royal Lochnager distillery, Balmoral Castle and Lecht Ski Centre. There are also parts of Aberdeenshire, both north and south of Aberdeen City in scope of this SDP, including the towns of Ellon and Westhill.

Aberdeenshire has an estimated population of 264,320[2] (0.2% increase from the year before), making it the 6th highest population out of all 32 council areas in Scotland. Aberdeenshire Council aims to reach net zero by 2045, in line with Scotland's national target. Aberdeenshire Council has developed a 'Route Map to 2030 and Beyond' which sets out their plans to decarbonise 75% of its emissions by the end of 2030 and to net zero by 2045.

Aberdeenshire was the first local authority in Scotland to develop and approve a carbon budget in 2017/18. The carbon budget is set in February each year and is monitored throughout the year by the Sustainability Committee. The Council have committed to identifying funding opportunities to support decarbonisation[3]. In July 2024, it was announced that the Scottish Government will be providing over £7 million across Aberdeenshire Council, Aberdeen City, Moray Council, The Highland Council and Dundee City Council[4].

3.1.2. Aberdeen City Council

Aberdeen City had an estimated population of 224,190 in 2022; the city is the third largest in Scotland[5]. The Council aims to achieve net zero by 2045 through its Net Zero Aberdeen Routemap. There are six enabling strategies which sit alongside the Routemap, including Mobility, Buildings and Heat, Circular Economy, Energy Supply, Natural Environment and Empowerment Strategies.

The H2 Aberdeen initiative has been launched to advance hydrogen technology, establishing the city as a centre of excellence for hydrogen and fuel cell innovation[6]. Additionally, a Low Emission Zone (LEZ) was enforced in June 2024, with surplus fines reinvested into city centre improvements, including greening Union Street, expanding bicycle rental schemes, and enhancing pedestrian access.

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3.2. Whole System Considerations

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Commented [RC6R5]: Complete

SSEN has strong working relationships with stakeholders across Aberdeenshire and Aberdeen City. We have met with both Councils to discuss local area energy planning and have engaged with Scottish Government's LHEES Forum, Community Energy Scotland, Transport Scotland, and the Scottish Futures Trust. This engagement has helped SSEN to stay informed about planning and development that will impact local communities' use of the network.

SSEN is developing SeaChange, an innovative project designed to help ports map out their pathways to decarbonisation. The insights gathered from this initiative are shaping our strategic network planning process, ensuring a more sustainable future.

Aberdeen Port is a key transport and trade hub and plays a vital role in fishing, offshore energy, cargo, and ferry operations. It consists of North Harbour and the recently expanded South Harbour, which underwent a £420 million investment to enhance capacity and infrastructure. While the port remains a major player in the oil and gas sector, it is actively positioning itself as a leading hub for offshore wind projects, driving forward the transition to clean energy. Aberdeen City is home to Aberdeen International Airport, a key transport hub that serves commercial and business flights as well as offshore energy operations. The airport hosts one of the world's

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2 Population statistics - Aberdeenshire Council

3 Aberdeenshire's decarbonisation plans for 2030 and beyond - Aberdeenshire Council

4 Over £7 million to support electric vehicle infrastructure | Transport Scotland

5 Statistics.gov.scot | Aberdeen City

6 Net Zero Aberdeen | Aberdeen City Council

busiest commercial heliports, facilitating helicopter services to North Sea oil and gas rigs. Aberdeen City is home to leading energy companies such as BP, Shell, TotalEnergies and Harbour Energy. The area is also known for food production, life sciences and agriculture, including BrewDog in Ellon, key life science institutes such as Rowett Research Institute and Macaulay Institute, as well as University of Aberdeen and Robert Gordon University.

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3.2.1 Transmission Interactions

SSEN regularly engages with Scottish and Southern Electricity Networks Transmission (SSENT) to understand the interactions between the distribution and transmission networks in the Aberdeen City and Aberdeenshire area. Currently, there are several notable SSENT projects under way in the city[7]. While primarily driven by asset health considerations, these projects also play a key role in ensuring a reliable and future-ready energy system.

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Willowdale GSP Transmission Reinforcement
SSENT is in the early development stages of upgrading Willowdale substation with modern indoor technology. The proposed site is also expected to accommodate the existing Clayhills substation, as space constraints at the current Clayhills site limit future upgrade opportunities. Both substations were originally constructed in the late 1960s and are now approaching end-of-life. Planned works include the replacement of four grid transformers, installation of a new indoor 132 kV switchboard, and upgrades to associated control systems.

Redmoss to Clayhills UG Cable Replacement
This project is in its penultimate stage and is currently under construction. It involves the replacement of the existing double 132 kV circuits between Redmoss and Clayhills substations. The new 5 km route will make use of an existing underground duct network to minimise traffic disruption and excavation works. These cables are the last gas-filled circuits within Aberdeen's ring network and are reaching the end of their operational life.

3.2.2 Flexibility Considerations

The estimation of available flexibility in this area is particularly difficult due to the need to make assumptions about domestic and commercial flexibility participation rates and capacity in the northern part of the Scottish Mainland. Current flexibility services in this part of Scotland have been primarily achieved through Maximum Demand (MD) contracted Customers and Distributed Generation, but there is extremely limited embedded generation in the area in question. There is limited data on which to base estimations of domestic and commercial demand side response for such areas.

There are flexibility opportunities in Persley and the broader Aberdeenshire area. We are actively promoting flexibility services to help balance and manage the electricity grid. This includes the ability to adjust power generation and consumption in areas like Aberdeenshire, where capacity constraints may arise.

We regularly seek to procure flexibility services from distributed energy resources (DERs) such as energy storage systems, renewable generation, and demand-side solutions like electric vehicle aggregation. These services are often targeted in areas known as Constraint Managed Zones (CMZs), where local capacity is tight.

In these flexibility markets, providers can earn revenue by participating in different schemes, adjusting their consumption or generation to help relieve network stress. SSEN has trailed various services, and future bidding rounds for flexibility providers are open.

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7 Project Map - SSEN Transmission

Areas across Persley SDP focus area where flexibility potential is being assessed is shown below in **Figure 4**. SSEN Flexibility Procurement Register

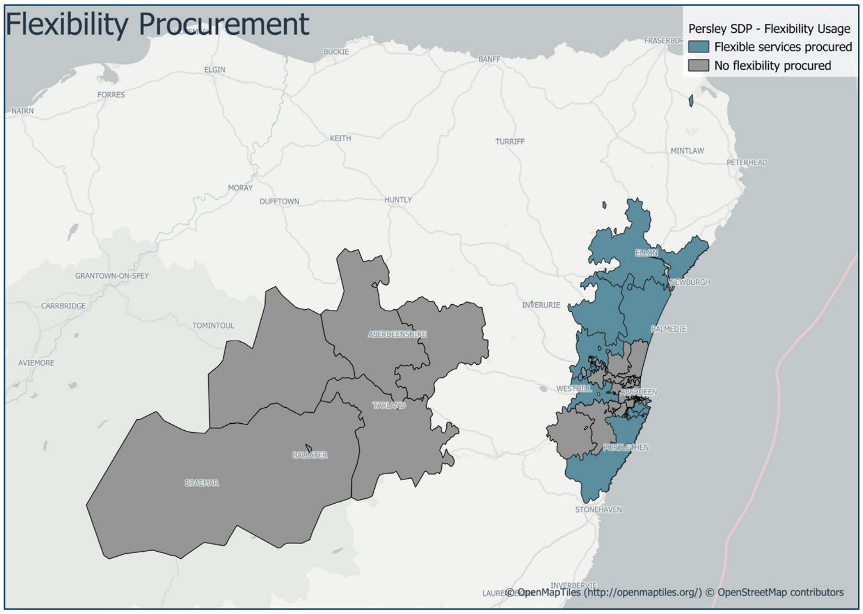

Figure 4 2: Flexibility Procurement Map

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Commented [GB14R12]: Have added this in.

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Commented [GB18R16]: All up to date

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Persley 132kV Supply Area Context

The Persley 132kV supply area is made up of 33kV, 11kV, and LV circuits. The network is a mix of rural and urban circuits spanning across both Aberdeen City and Aberdeenshire council regions. **Table 1** shows number of customers and peak demands for the Grid Supply Points (GSPs) in the Persley SDP supply area; for information on primary substations (PSSs) please see **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 primary to sum to that at the GSPs). Please note that Rothienorman has recently been commissioned, therefore there are currently no customer served figures or maximum MVAs associated with the site.

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Commented [MB20]: This says max MVA and the tables labelled as MW? Which one is it?

Grid Supply Point	Number of Customers Served	2023/24 Net Maximum demand in MVA (Winter)
Clayhills	14,065	27.48
Craigiebuckler	18,288	22.25
Dyce	16,481	32.86
Persley	28,889	38.75
Redmoss	19,409	38.73
Tarland	10,237	17.43
Willowdale	22,592	23.97
Woodhill	28,559	35.15

Table 1: Customer number breakdown and GSP peak demand readings (2023/24)

4.2. Current Network Topology

Figure 5 below highlights the existing 33kV network topology in the Persley 132kV supply area. The SSEN Transmission network supplies the distribution network at various GSP sites. It is then distributed to the primary substations via the 33kV distribution network.

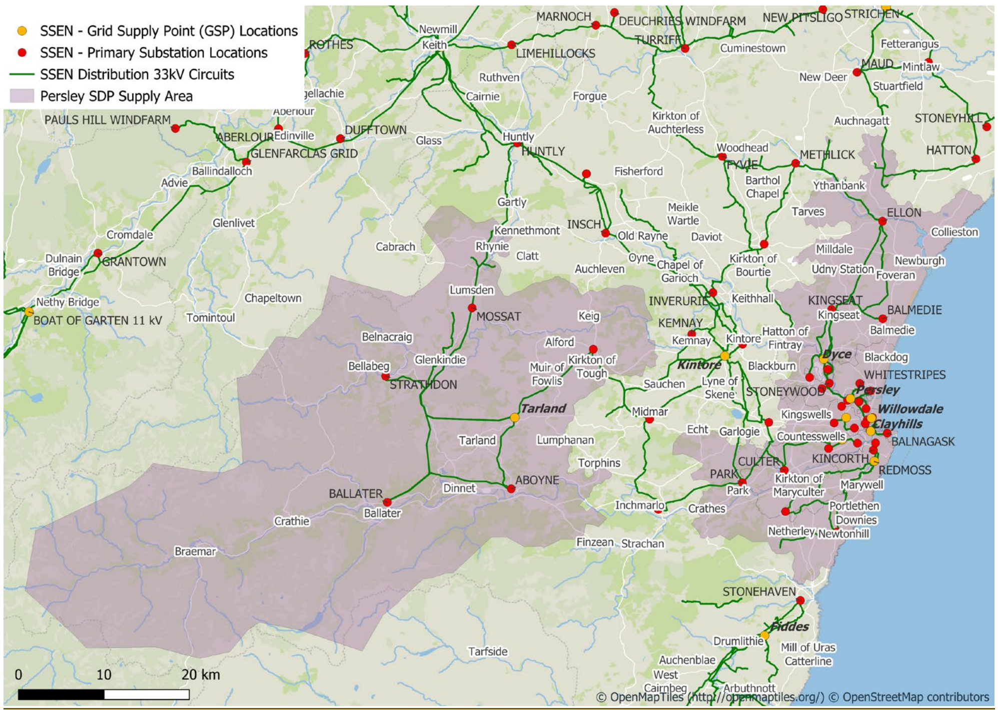

Figure 3: Persley 132kV Supply Area Geographic Information System (GIS) View

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Commented [NW22R21]: Hi Sean, can you re create this GIS view with a correct legend and with every GSP label visible, thank you.

Commented [SH23R21]: Sorted

4.3. Current Network Schematic

The existing 33kV network at Clayhills, Craigiebuckler, Dyce, Persley, Redmoss, Tarland, Willowdale and Woodhill GSPs is shown below in **Figures 6-9**. Rothienorman GSP is currently undergoing 33kV wider network integration works, and updated schematics will be provided in subsequent versions of this SDP.

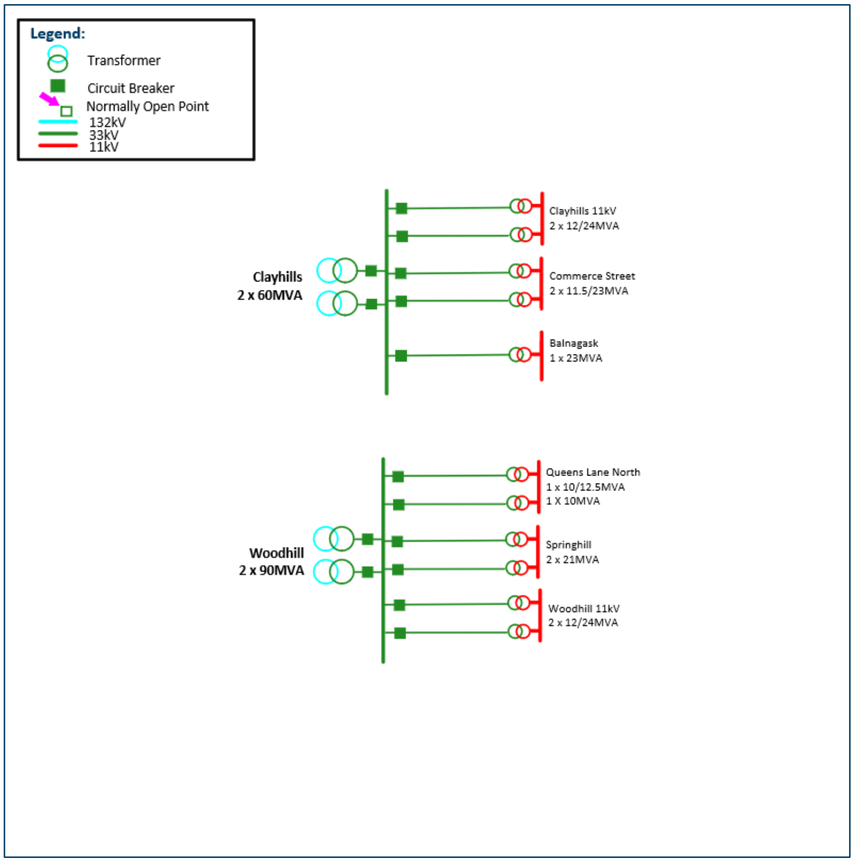

Figure 4: Clayhills and Woodhill GSP Existing 33kV Network

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Commented [MB26]: Floating CB next to AECC, Gen with no label between Balmedie and Ellon, AECC has no 33kV tx CBs, Harvest Avenue also has no 33kV tx CBs, this whole drawing needs the PSS's checked to remove 33kV CB's where there shouldn't be any. NOP at Ellons filled in rather than white in the centre, theres crossed lines at bridge of don, and the circuit from persley to stoney wood, unclear if its crossing or actually interconnected.

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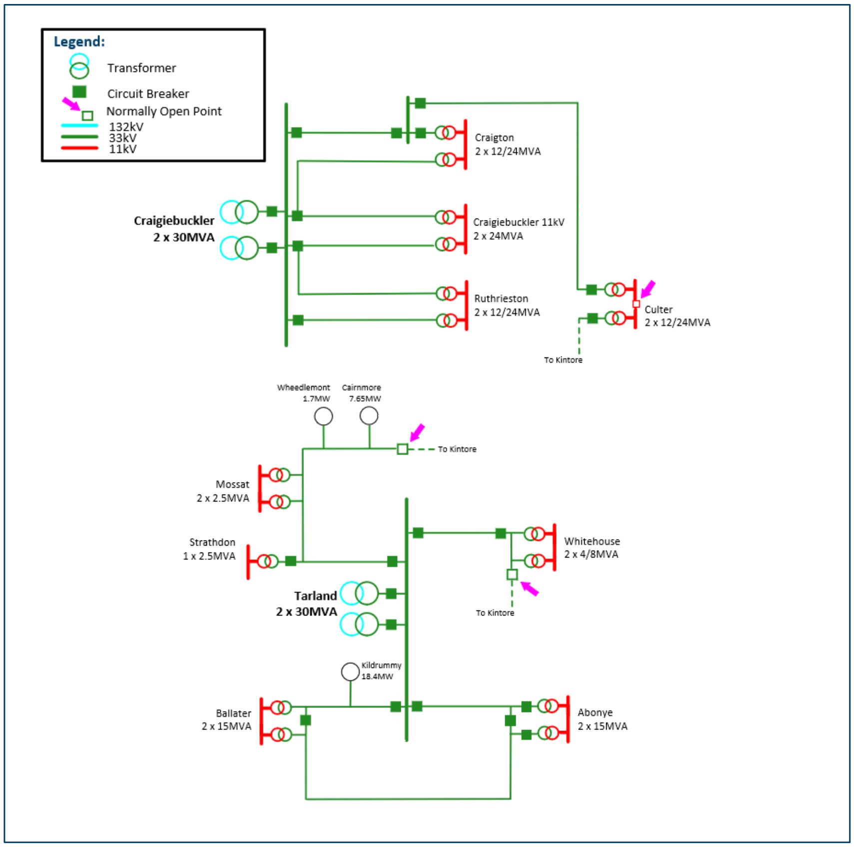

Figure 5: Craigiebuckler and Tarland GSP Existing 33kV Network

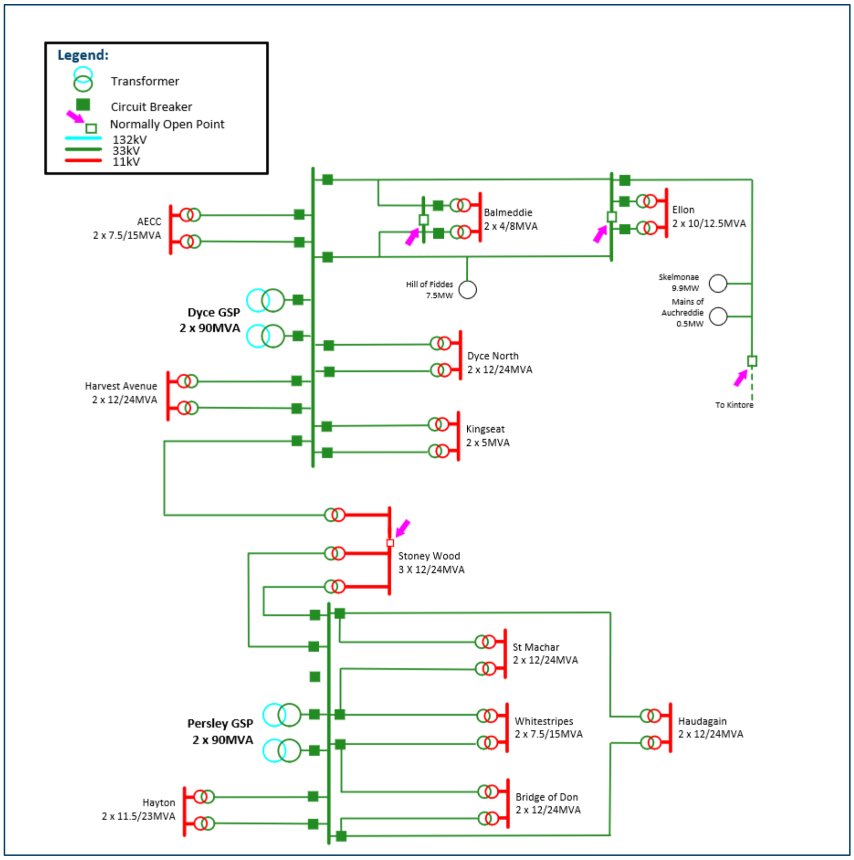

Figure 6: Dyce and Persley GSP Existing Network

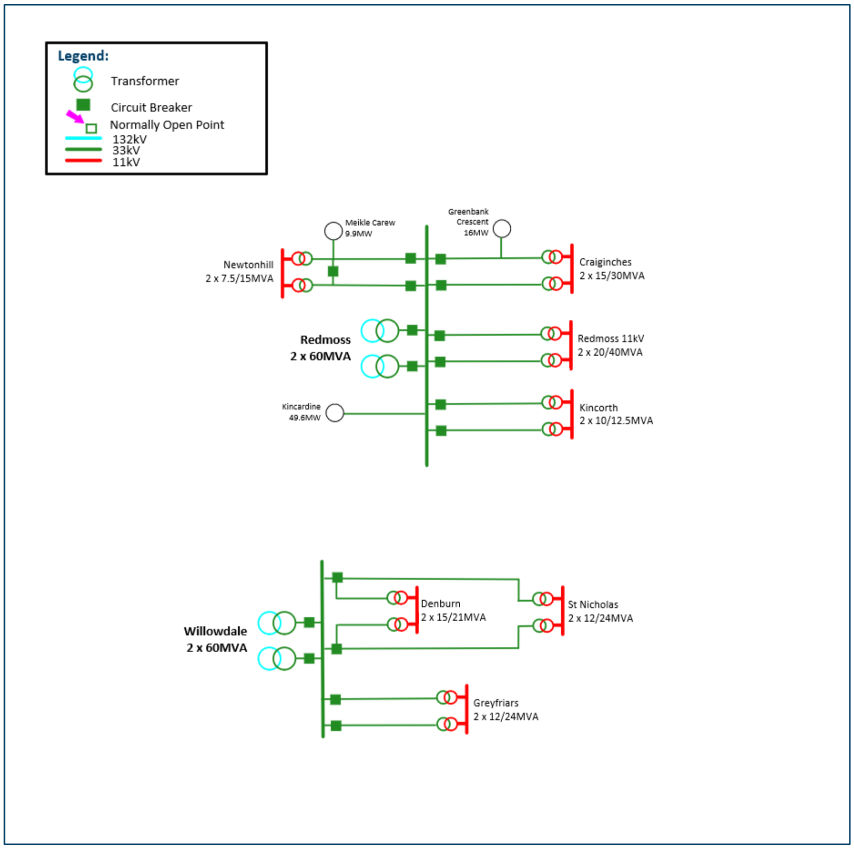

Figure 7: Redmoss and Willowdale GSP Existing 33kV Network

5. FUTURE ELECTRICITY LOAD FOR THE PERSLEY 132KV SUPPLY AREA

The following section details load growth across the technologies projected in the Distribution Future Energy Scenarios (DFES). 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.** It should also be noted that the detailed analysis suggested as part of this report will be carried out using DFES 2024.
- This SDP and the analysis conducted has been completed ahead of any changes arising from Clean Power 2030.
- These projections relate to the focus area highlighted in **Figure 3** 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 estimate the coincident maximum demand of the entire system rather than the total sum of all demands. This accounts for the fact that not all demand load connected to the network peaks at the same time.

For future iterations of the DFES, additional work should be carried out to ensure that the demand projections are rationalised against any developing LAEPs across the study area.

5.1. Distributed Energy Resource

In the Persley 132kV supply area, onshore wind generation serves as a large-scale renewable energy resource on the distribution network, due to Aberdeenshire's strong and consistent wind conditions along the northeast coast of Scotland. These projects contribute substantial generation capacity to the electricity grid, with current installed capacity reaching 130MW and projections indicating an increase to 340MW by 2050, under the Consumer Transformation scenario. Other generation in the area include offshore wind and solar, with a combined installed capacity of 67 MW. This is projected to increase to 420 MW by 2050 under the Consumer Transformation scenario.

There is a significant amount of industry work reforming the approach to generation and storage connections and the connections queue. Initiatives such as CP2030 and Connections Reform have the potential to change our current forecasts. We will look to provide updated projections as the outputs of these programmes are understood.

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5.1.1. DFES Projections

Generation

The baseline value for solar PV is 17.7MW, onshore wind is 130MW and offshore is 49.6MW. Based on the DFES projections, under the Consumer Transformation scenario, renewable generation across Persley GSP will increase significantly from approximately 283MW in current connected baseline to 829MW by 2050, as shown in **Figure 10.** We can see onshore wind and solar PV accounting for most of the distributed generation increase from 2025 onwards.

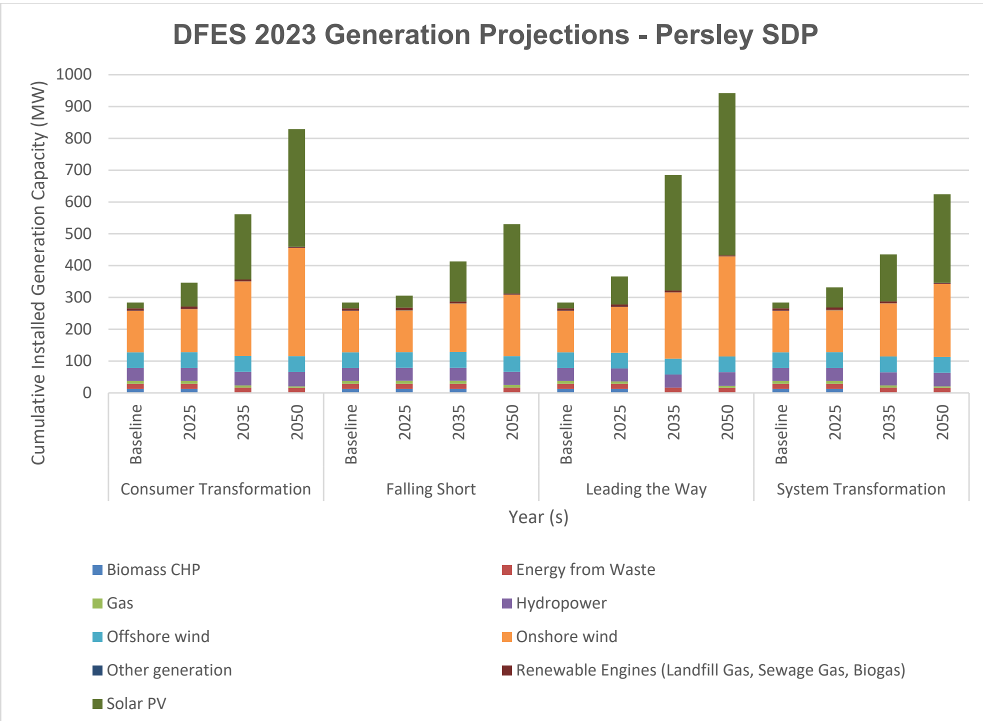

Figure 10: Projected Cumulative Generation Capacity Persley 132kV Supply Area (MW). Source SSEN DFES 2023

Storage

Multiple storage technologies have projected uptake modelled in DFES. The most significant increase is in standalone grid services, which are energy assets or technologies that provide specific services to support grid stability and operation but do not directly supply electricity to end consumers. These services are forecasted to equate 170MW by 2050 under the Consumer Transformation scenario. This is illustrated in **Figure 11.**

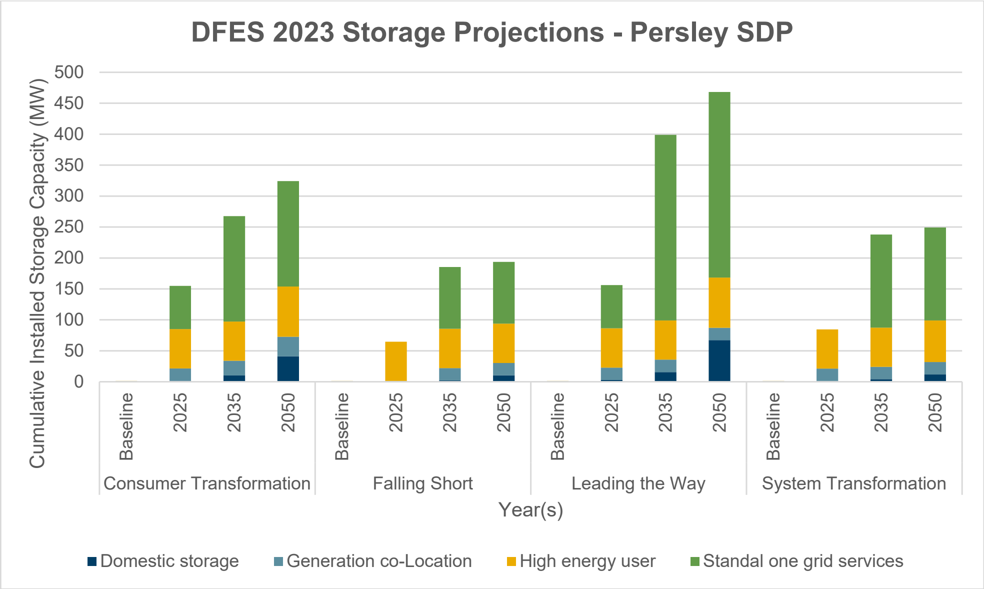

Figure 11: Projected Cumulative Storage Capacity Persley 132kV Supply Area (MW). Source SSEN DFES 2023

5.2. Transport Electrification

The shift to electrified transport is likely to be a large source of electricity load growth across Persley and will be a key consideration for strategic planning. As introduced earlier, Aberdeenshire and Aberdeen local authority have significant plans to decarbonise transport. While the decarbonisation of specific sites is significant on a local, regional, and national level, Persley GSP group currently does not have any large demand connections related to transport.

5.2.1 DFES Projections

SSEN's DFES analysis projected that there could be over 80,500 domestic off-street chargers for electric vehicles in the Persley area by 2035 under Consumer Transformation, from the baseline of 1,287. The projected growth will reach an estimated 92,500 units by 2050, which aligns with Aberdeen City and Aberdeenshire's ambitious commitments.

Regarding non-domestic chargers, the current baseline is 9.8MW, with projections estimated to be 232MW by 2050. The most significant increases are observed in domestic on-street chargers, which currently have a baseline of 0.534MW and projected to reach 128MW under Consumer Transformation by 2050. There is also a notable increase in enroute and local charging stations, which has a baseline of 2.5MW and projected to increase to 31.5MW by 2050. This is illustrated in **Figure 12.**

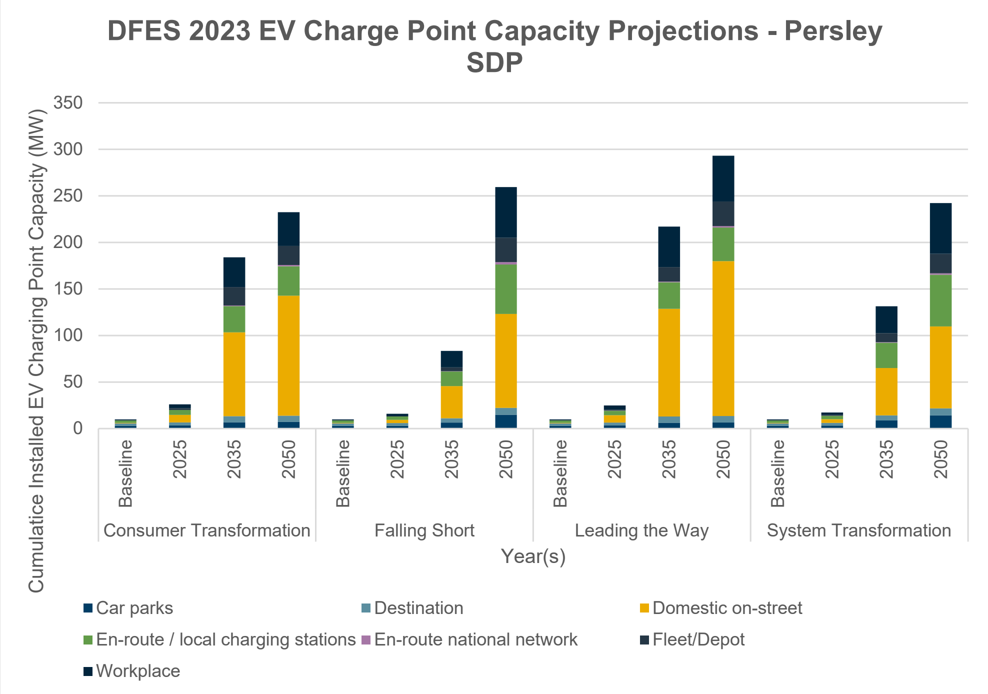

Figure 12: Projected EV Charge Point Capacity across Persley 132kV Supply Area. Source: *SSEN DFES 2023*

5.3. Electrification of Heat

The decarbonisation of space heating technologies in homes and businesses will have a significant impact on the future energy system in Aberdeenshire and Aberdeen City. In Scotland, heating accounts for approximately 50% of energy consumption, underscoring the significance of transitioning to low-carbon heating solutions[8].

Commented [MM29]: Not sure what is meant here. Do you mean energy consumption in 2050?

Commented [NW30R29]: Think she meant energy consumed by end users, will take out final.

Currently, a substantial proportion of households in these regions rely on gas for heating. In Aberdeen City, 23% of households are in fuel poverty, with 5% expecting extreme fuel poverty, highlighting the challenges associated with energy costs[9]. The shift towards low-carbon heating technologies, such as heat pumps and district heating networks, is influenced by various factors, including government legislation and consumer behaviour. This transition is expected to increase electricity demand, as these technologies predominantly utilise electrical energy. Projections indicate that by 2050, peak electricity demand in Scotland on a peak winter weekday could exceed 10GW, depending on the uptake of electric-based heating solutions[10].

Currently, the presence of heat networks is considered through the DFES analysis using heat network project pipelines[11] in the near term and DESNZ opportunity areas for district heating networks[12] in the longer term. This is aligned to targets for heat networks to serve 20% of domestic heating from the current 3% by 2050[13]. This impacts the projections through an increase in domestic and non-domestic heat pumps and a decrease in domestic direct electric heating. While heat networks do not have a standalone technology projection in the current DFES, this will be carefully considered with the possibility of inclusion in further iterations.

5.3.1 DFES Projections

Under the Consumer Transformation scenario, there is an increase of domestic heat pumps, from a baseline of 1,344 in 2023 to 71,110 by 2035 and 123,309 by 2050. Aberdeen City and Aberdeenshire are projected to have the highest number of new homes by 2050. This, combined with energy efficiency standards and new build regulations, supports the UK Governments targets of 600,000 heat pump installations per year by 2028. It also aligns with Scottish Government policies promoting low-carbon heat. By 2050, around 700,000 homes are expected to use some form of heat pump, reflecting a large-scale rollout across the housing stock.

Non-domestic heat pumps installations are projected to rise significantly, from the 1,007 baseline to 7,084 by 2050. Currently, heating in these buildings relies on gas-fired central heating, resistive electric heating and air conditioning. The shift to heat pumps is driven by the higher operational costs of existing systems, making heat pumps a more cost-effective long-term solution. This trend is illustrated in **Figure 13.**

8 Decarbonising Scottish heat demand: implications for electricity networks – CREDS

9 Aberdeen Key Facts - Deprivation.pdf

10 Electrification of Heat and the Impact on the Scottish Electricity System

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

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

13 About Heat Networks

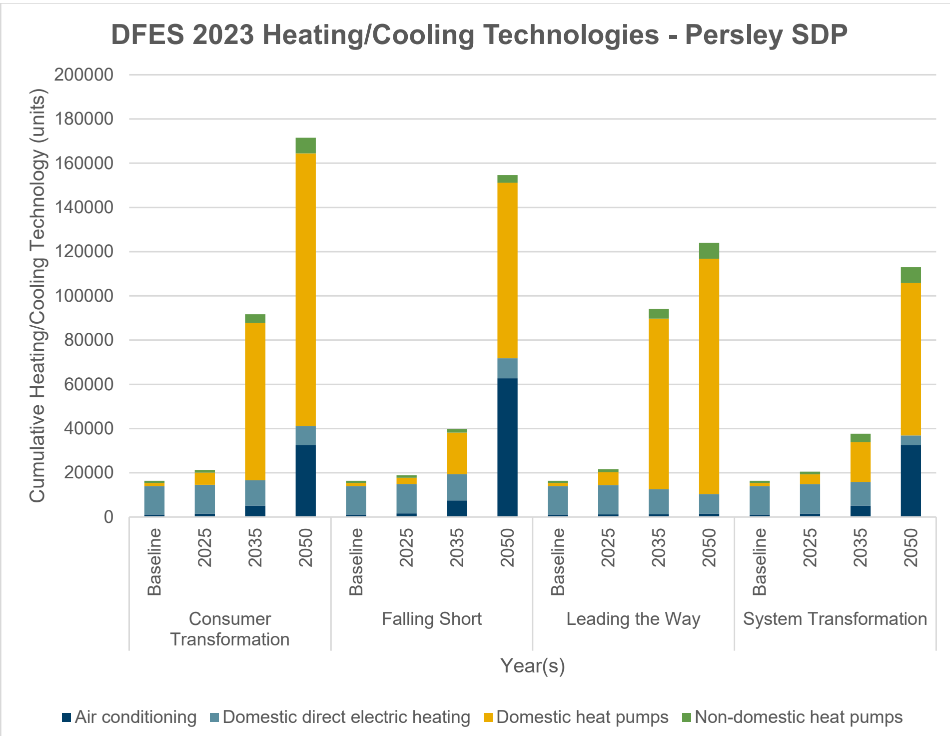

Figure 13: Projected number of Hear Pumps across Persley Substation Supply Area. Source: *SSEN DFES 2023*

5.4. New building developments

The new development modelling within the DFES is based on direct engagement with local authority planning departments and an analysis of local planning documents submitted to Regen.

5.4.1. DFES Projections

In the Persley GSP area, 28,766 new domestic homes are projected to be built by 2050 under Consumer Transformation. In addition to domestic development, the DFES also projects the cumulative floorspace of non-domestic new development. **Figure 14** shows that the two building classifications contributing to the largest floorspace growth are factory and warehouse development, and new office space.

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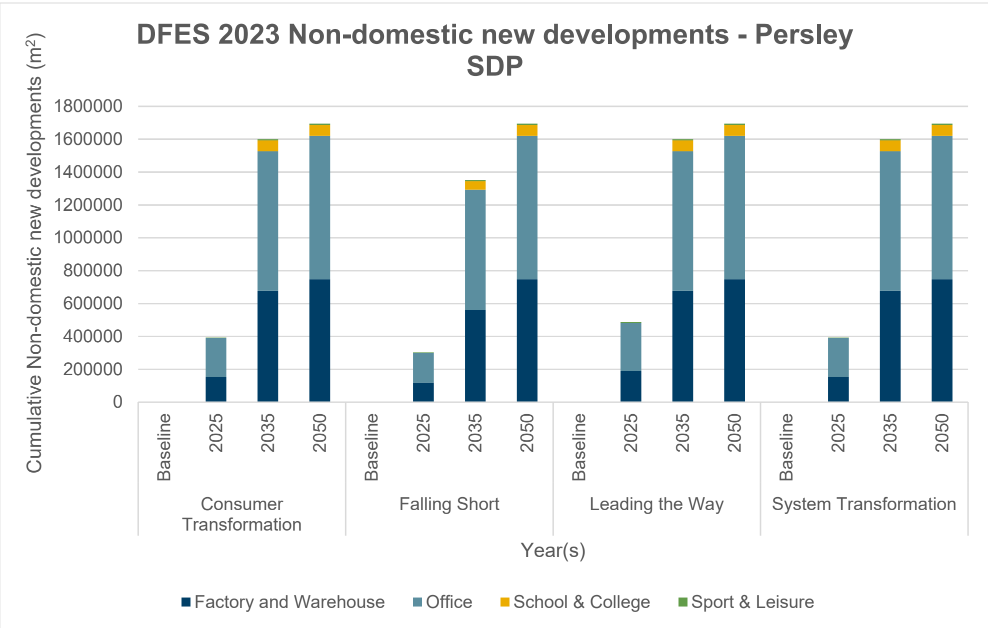

Figure 14: Projected new non-domestic development across Persley Substation Supply Area. Source: *SSEN DFES 2023*

5.5. Commercial and industrial electrification

5.5.1. Distilleries

Aberdeenshire and Aberdeen City is home to several distilleries, primarily focusing on whisky production. Some notable ones include, Glen Garioch Distillery, located in Oldmeldrum, which is one of Scotland's oldest distilleries, dating back to 1797 and The Royal Lochnagar Distillery, situated near Balmoral Castle. In addition to whisky, there are some newer gin distilleries emerging in Aberdeenshire, such as Deeside Distillery, which produces gin and craft spirit.

The distillation process required substantial and continuous high-temperature heat, traditionally sourced from fossil fuels. Transitioning to electrified systems could significantly increase the demand capacity on the distribution network, leading to distilleries becoming one of the largest sources of electricity demand in the region.

The distilling process has significant and constant high-temperature heat demand which is largely met by fossil fuel combustion at present. The wider whisky industry has made progress towards decarbonisation, with non-fossil fuels making up 20% of its energy use in 2018, up from only 3% in 2008[14]. Regen engagement with the Scotch Whisky Association (SWA) highlighted that their 2023 to 2025 strategy includes commitments to achieving net zero emissions in their own operations by 2040[15]. A Ricardo report commissioned by the SWA in 2019 investigated how carbon reduction in the distillery industry could be achieved[16]. The Regen analysis provided qualitative information on the distilleries.

The timeframe of possible electricity load growth is heavily linked to the timeline of individual distilleries changing their energy sources. This timeline is currently difficult to quantify due to uncertainties around technology readiness.

5.5.2. Port industry

Commented [AW32]: Need to reference Seachange project?

We note the importance of the maritime industry in the area of study for this report. Understanding of the potential electricity demands arising from the maritime industry will be key to appropriate sizing of assets and network development in the area. SSEN's SeaChange innovation project has been funded through the Strategic Innovation Fund.[14] This project involves building a 'Navigating Energy Transitions' (NET) tool, which will help ports to plot their most viable pathways for decarbonisation. This tool will then give network operators like SSEN visibility of the predicted electrical load arising from ports. These insights will improve the quality of demand forecasting for subsequent DNOAs and SDP updates.

Aberdeen City is actively pursuing the decarbonisation of their port operations, aligning with broader sustainability goals. The Port of Aberdeen, one of the key maritime hubs in the region, has committed to achieving net zero emissions by 2040. This ambitious goal includes a £55 million investment in reducing emissions, introducing alternative fuels, and providing clean shore power for vessels. The port's strategy focuses on reducing direct emissions, providing low carbon energy options, and supporting energy transitions in partnership with industry leaders.

14 SeaChange, SSEN Innovation Project, 10/2024, SSEN's nature and shipping innovation projects win £1m in new development funding - SSEN

15 Heriot Watt University, 2021. Distilleries need blend of green energy and storage for net zero.

16 Scotch Whisky Association, 2021. The Scotch Whisky Industry Sustainability Strategy.

17 Scotch Whisky Association (Ricardo), 2020. Scotch whisky pathway to net zero.

The timeframe of possible electricity load growth is heavily linked to the timeline of individual vessel propulsion systems being changed or replaced. This timeline is currently difficult to quantify due to uncertainties around technology readiness. However, partial, or full electrification (as opposed to ammonia or biomethane) is being considered, particularly for smaller scale roll on/roll off ferries.

As such, the associated use of shore power to charge these vessels could equate to a significant load at each of the relevant ferry terminals. In addition to their shore power requirements, the ferries charging profiles and ports' abilities to charge EVs will be major considerations for any network reinforcement.

6. PROJECTS IN PROGRESS

6.1. Ongoing works in the Persley 132kV Supply Area

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 the Persley 132kV supply area, 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 network considered for long term modelling is shown in **Table 2**. Summary of existing works shown below:

Ref	Substation	Description	Driver	Forecast completion	Fully resolves future strategic needs to 2050?
(1)	Clayhills GSP	• Replace the existing 2 x 60MVA transformers with 2 x 120MVA. • Relocate the Clayhills GSP to Willowdale GSP to accommodate the required transformer upgrades and board extensions.	Reinforcement	2031/32	
(2)	Willowdale GSP	• Replace the existing 2 x 60MVA transformers with 2 x 120MVA. • Upgrade to an indoor 132kV switchboard.	Reinforcement	2030/31	
(3)	Stoneywood PSS (Persley GSP)	• Upgrade the two existing 33kV UG cables from Stoneywood PSS to Persley GSP.	DNOA process	2029/30	
(4)	Ellon PSS (Dyce GSP)	• Replace the existing 2 x 12.5MVA transformers with 2 x 20/40MVA. • Existing conductor re-specified at 65c to avoid thermal overloads. • Construct a new switchroom and switchboard. • Install a 4MVAR STATCOM at Ellon PSS. • Modify the normal running arrangement by closing the normal open point on the Ellon PSS bus.	DNOA process	2027/28	

Commented [NW33]: Doms Section 6 needs a serious review, will liaise with Scott P (SP patch)

Commented [AW34R33]: From what I can make out Scott has reviewed but the changes still need to be made.

Commented [SP35]: This should read as Clayhills rather than Clayhill.

Commented [SP36]: Stoneywood is one word.

Commented [NB37]: Stoneywood T1&T2 Circuits - Persley EJP V4.docx

Commented [MM38]: Include PSS acronym meaning for first instance

Commented [NW39R38]: Mentioned in previous sections

Commented [NB40]: ssecom.sharepoint.com/teams/WholeSystemRegister/Shared Documents/Forms/AllItems.aspx?fromShare=true&ga=1&id=%2Fteams%2FWholeSystemRegister%2FShared Documents%2FGeneral%2FDNOA%2FDNOA Outcomes Reports%2F1%2E Approved EJP%27s %28DO NOT MOVE FILES%29%2F1%2E

(5)	Mossat PSS (Tarland GSP)	• Replace the existing 2 x 2.5MVA transformers with 2 x 8MVA transformers and new 33kV switchgear.	DNOA process	2028/29	
(6)	Aboyne/ Ballater/ new Braemar PSSs (Tarland GSP)	• Extend existing GSP switchroom to accommodate 2 x CBs. • Isolate Aboyne PSS from the existing ring circuit arrangement with Ballater PSS, by installing two new cable circuits, and close the ring to the west of Aboyne • Upgrade the switchboard at Ballater PSS and include 2 x STATCOMs. • Establish a new PSS at Braemar by repurposing an existing 11kV OHL from Ballater PSS to 33kV, and the addition of a new 33kV UG cable.	DNOA process	2028/29	
(7)	New Ruthven PSS (Tarland GSP)	• Construct a new 8MVA primary substation between Ballater PSS and Tarland GSP.	DNOA process	2028/29	
(8)	Springhill PSS (Woodhill GSP)	• Replace the existing 2 x 21MVA transformers with 20/40MVA transformers.	DNOA process	2027/28	
(9)	Queens Lane North PSS (Woodhill GSP)	• Replace the existing 10/12.5MVA and 10MVA transformers with 15/30MVA transformers.	DNOA process	2029/30	
(10)	Newtonhill PSS (Redmoss GSP)	• Replace the existing 2 x 7.5/15MVA transformers with 15/30MVA transformers and new 33kV switchgear.	DNOA process	2029/30	
(11)	Kingseat PSS (Dyce GSP)	• Replace the existing 2 x 5MVA transformers with 7.5/15MVA transformers.	Reinforcement	2025/26	
(12)	Bridge of Don PSS (Dyce GSP)	• Upgrade the two existing 33kV UG oil-filled cables from Stoneywood PSS to Persley GSP. • Third cable laid for a possible future third transformer, as well as a plinth.	Reinforcement	2025/26	
(13)	Rothienorman GSP	• Construction of GSP completed, and the wider network integration works are now under way.	Reinforcement	2027/28	

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

It should be noted that particular asset interventions sized for 2050 will not necessarily ensure that the full remaining system is rated accordingly. When considering the further works identified in this report, the holistic plans provide capacity across the GSPs for 2050. Alongside these asset solutions being deployed, flexibility solutions are also being used to release additional capacity.

Commented [NB41]: Tarland Interconnection Circuits - Justification Paper Tarland Interconnection Circuits v3.docx

Commented [SP42]: Typo, should read Aboyne.

Commented [NB43]: https://ssecom.sharepoint.com/:w:/r/teams/WholeSystemRegister/Shared%20Documents/General/DNOA/DNOA%20Outcomes%20Reports/1.%20Approved%20EJP%27s%20(DO%20NOT%20MOVE%20FILES)/1.%20SHEPD%20(North)/Springhill%20Primary%20TX%20Replacement%20%26%20FL%20Assessment%20-%20Woodhill%20(Springhill%20Substation)%20EJP%20V3.docx?d=w0bb1348d3a444a929f8724becf6d5713&csf=1&web=1&e=LddES6

Commented [NB44R43]: Scott?? What is the progress update with this? In EJP, delivery date stated as 2025, is this still the case?

Commented [NB45]: Queens Lane North 33-11kV Transformer - Woodhill (QLN Substation) EJP V4.docx

Commented [NB46]: Queens Lane North 33-11kV Transformer - Woodhill (QLN Substation) EJP V4.docx

Commented [SP47]: Both old and new should be transformers plural.

Commented [NW49R48]: Don't think other SDPs have this?

Commented [SP50]: Do we need to call out that the interventions here do not necessarily ensure that the full system resolves future strategic need out to 2050? i.e. if we change transformers, then the circuits are not necessarily rated sufficiently. Ellon is a perfect example. From memory I don't think the circuit re-rating will get us to 2050.

Commented [NW51]: Done

6.2. Network Schematic (following completion of above works)

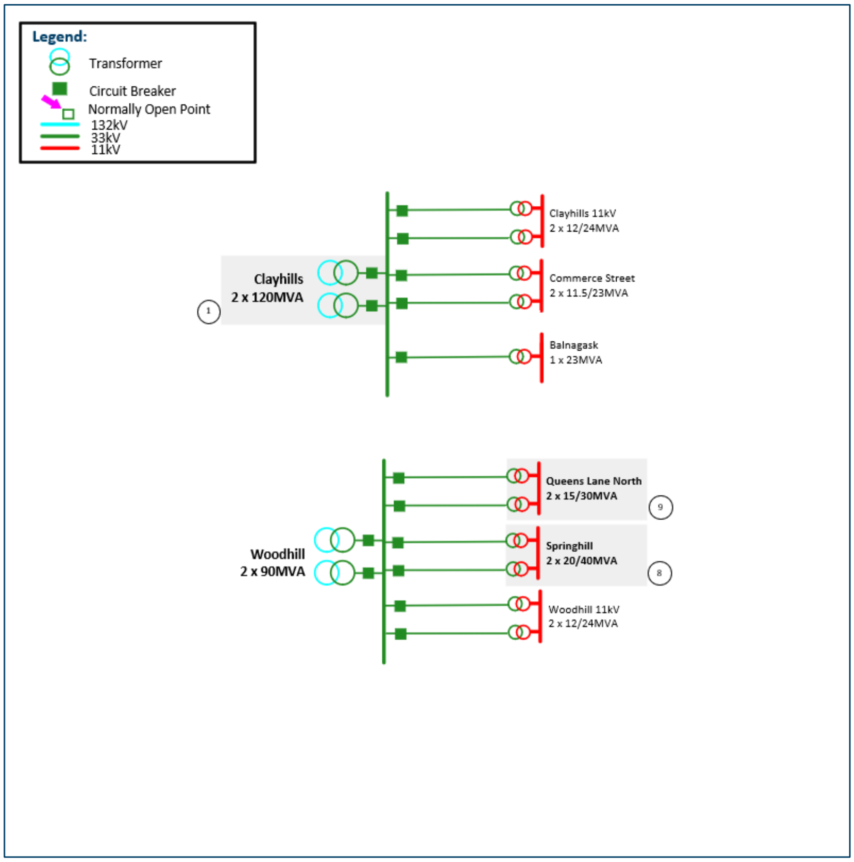

Figure 15: Clayhills and Woodhill GSP Future 33kV Network.

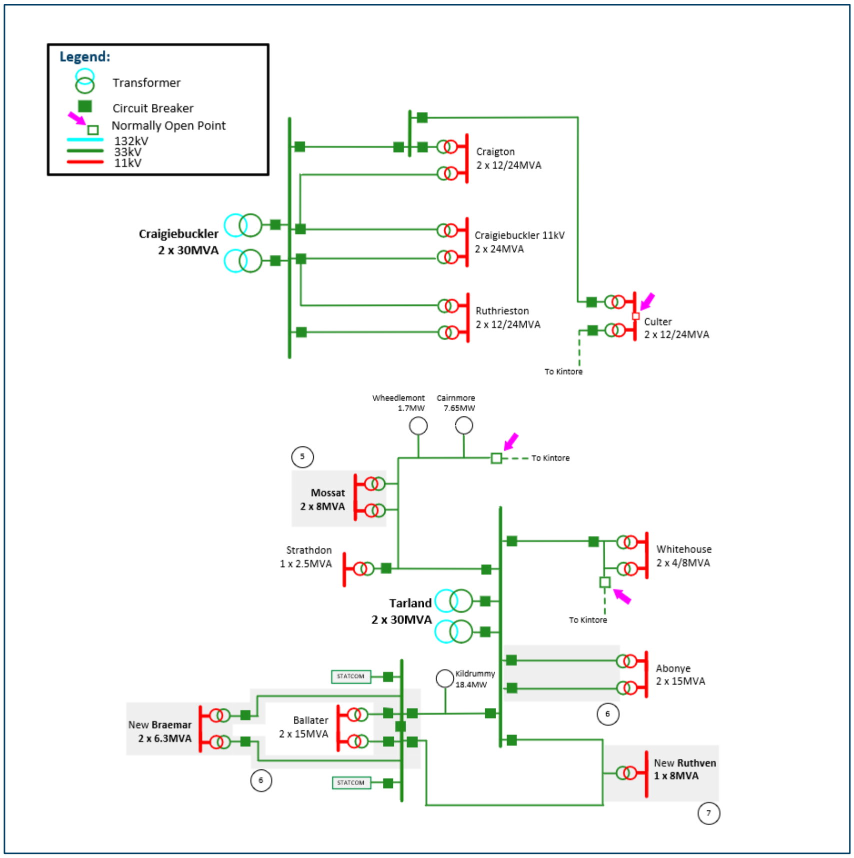

Figure 16: Craigie Buckler and Tarland GSP Future 33kV Network

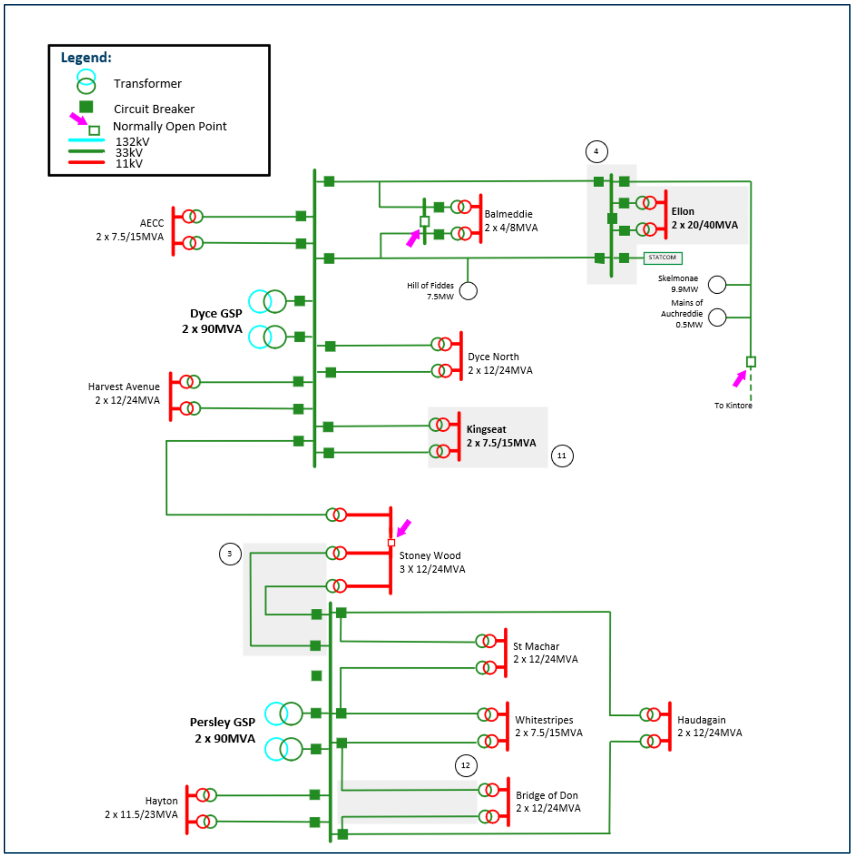

Figure 17: Dyce and Persley GSP Future 33kV Network

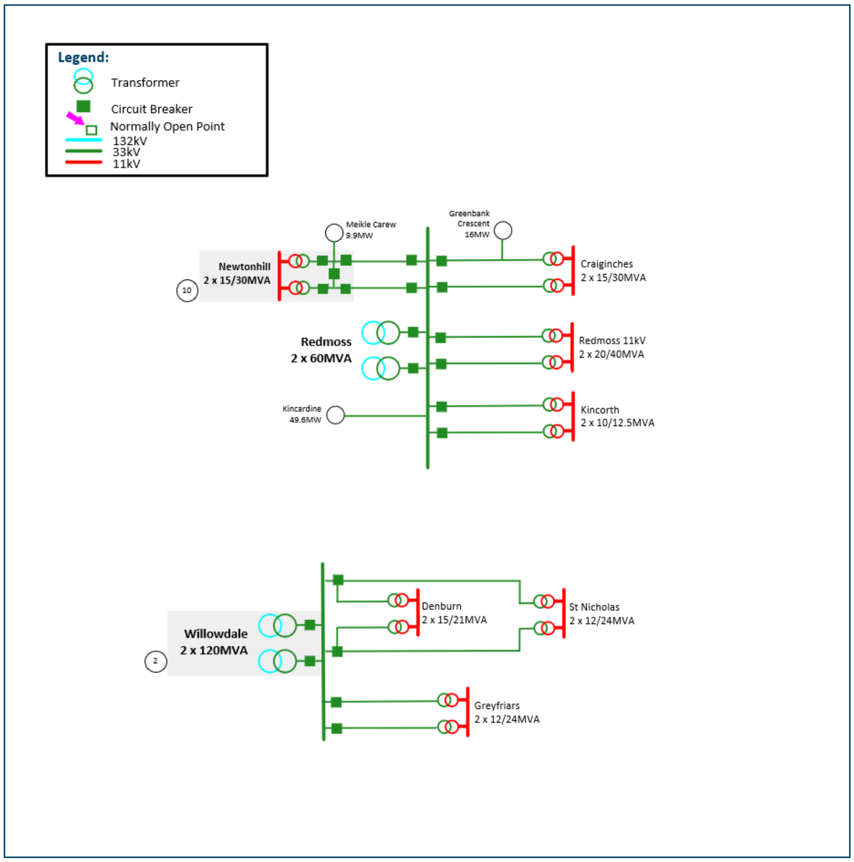

Figure 18: Redmoss and Willowdale GSP Future 33kV Network

7. SPATIAL PLANS OF FUTURE NEEDS

The previous section summarised Persley 132kV supply area forecast future demand and generation requirements. We have used this information to understand what this means for the local networks in the Aberdeen City and Aberdeenshire area. Initially this is developed through the creation of a spatial plan of future system needs.

We have created spatial plans at a primary substation level (33/11kV) and secondary substation level (11kV/LV). Snapshots are provided below for 2028, 2033, 2040, and 2050 enabling clear visualisation of future system needs beyond the network capacity following completion of triggered works. They are currently based on 2023 DFES Consumer Transformation forecasts.

7.1. EHV / HV spatial plans

The EHV/HV spatial plan shown below in **Figure 19** shows the projected headroom or capacity shortfall due to demand increases at primary substations across the Persley SDP study area. Darker purple shades indicate that there is a projected capacity shortfall whereas lighter shades indicate that there is headroom capacity based on current projections. EHV/HV spatial plans for the other DFES scenarios are presented in **Appendix C**. The values are taken from the Network Scenario Headroom report (NSHR), part of the Network Development plan (NDP). It should be noted that the NSHR is produced annually and last published in May 2025 where work has been triggered between this date and the time of publication of this report, future capacity may not be reflected.

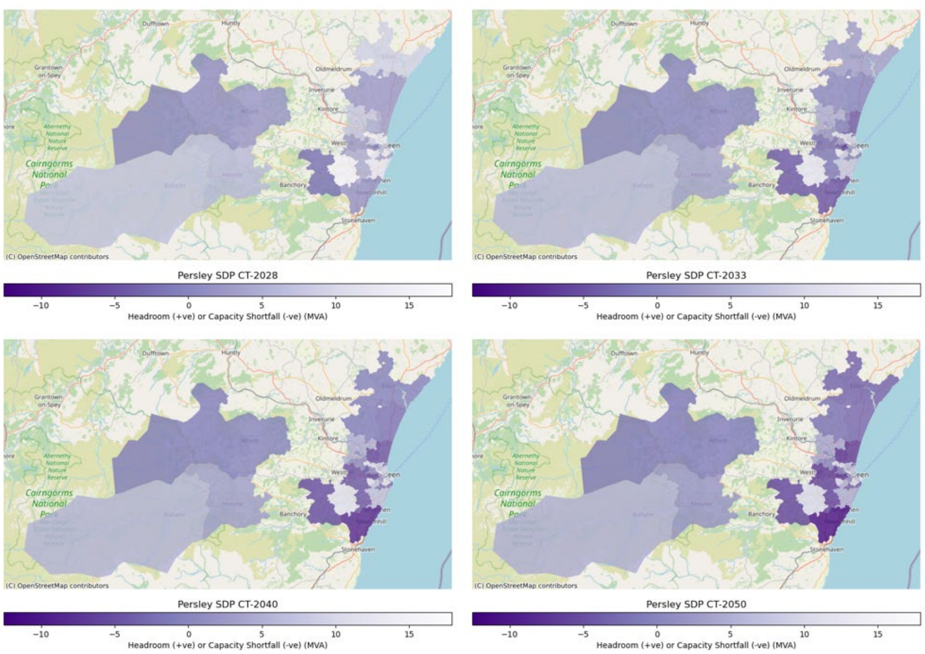

Figure 19: Persley 132kV Supply Area Plans for 2028, 2033, 2040 and 2050

7.2. HV/LV spatial plans

To identify areas where load is growing at a finer granularity, we have used information from the SSEN load model, produced by SSEN's Data and Analytics team. The secondary transformer projected percentage loadings for each of the four DFES scenarios are highlighted below in **Figure 20** and **Appendix D**. As shown in the legend, the points are coloured based on their percentage loading with green being low percentage loading, and darker reds indicate higher percentage loading (see legend for details on loading bands and colouring).

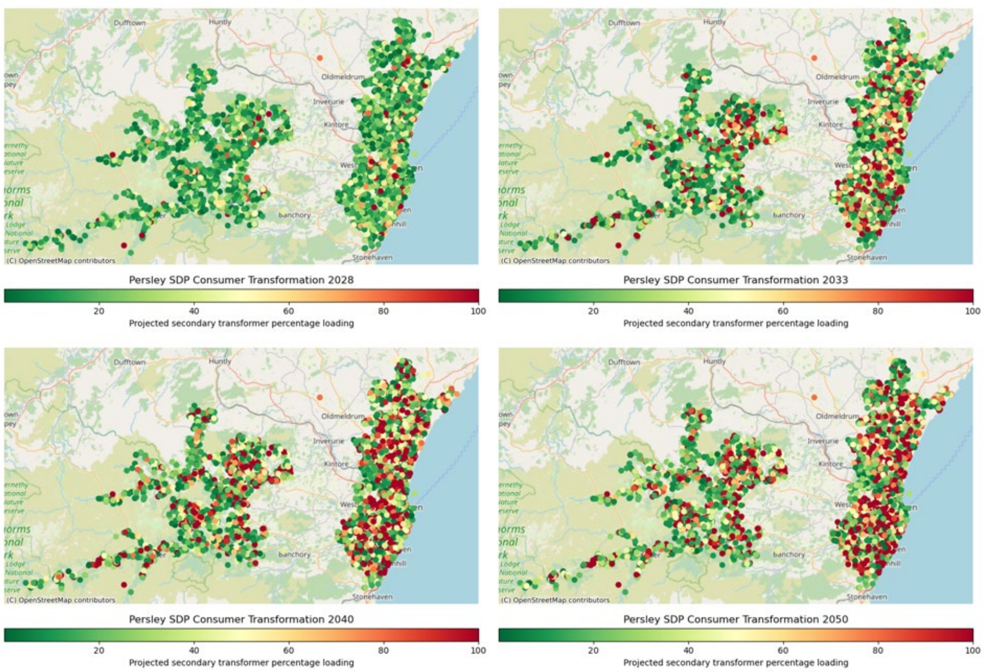

Figure 20: Persley 132kV Supply Area HV/LV spatial plans for 2028, 2033, 2040, and 2050

8. SPECIFIC SYSTEM NEEDS AND OPTIONS TO RESOLVE

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

- Future EHV system needs to 2035 – 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 will recommend these are progressed through the DNOA process. In all cases we are proposing solutions that meet the projected requirements for 2050. We also provide a summary of more strategic elements that also need to be considered in these timeframes.

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

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

8.1. Overall dependencies, risk and mitigations

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

Dependency: Some of the works proposed here are dependent on the completion of works carried out by SSEN Transmission.
Risks: Works delay potential interventions downstream and/or do not provide flexibility of future investment.
Mitigation: Continue productive engagement with SSEN Transmission to enable planning and a better understanding of when capacity will be released in the Persley 132kV supply area.

Dependency**:** Connections reform process, which is taking place this year, is likely to change the number and composition of generation/storage projects currently in the connections queue.
Risks**:** The reinforcements currently planned, that have been triggered by generation connections, may not be necessary if the generation projects drop out of the connections queue. This could also risk subsequent dependent projects.
Mitigation**:** Works triggered by generation projects that have a level of uncertainty have not been included in the works in the progress or the network modelling. This assumes these works will not release capacity so network can be planned for worst-case scenario in terms of these works going ahead. Network models will be rerun when there is more clarity.

Dependency: Growth of generation in the area may begin to cause reverse power flow on the network. It should be ensured that the assets currently on the network are able to handle the projected levels of reverse power flow and increased fault level.
Risks: Further reinforcement than identified here is required to enable connection of generation. Increasing fault levels may lead to damaged distribution network assets.

Commented [AW52]: I think its now 10 years.

Commented [SP53]: Mitigation actions

Commented [SP54]: Is there a risk here that subsequent dependencies will be affected?

Commented [AW55]: Is this an approach we've taken elsewhere? I'm not sure its correct and would be good to understand more.

Commented [NW56R55]: Aligned with Beauly and Fort Augustus

Commented [SP57]: May lead to.

Mitigation: We should further assess the near-term generation requirements to ensure that we are in a position to facilitate the Clean Power 2030 targets set by DESNZ. Consideration of future fault level to prevent the risk of damaged assets should be considered when designing future schemes.

Dependency: The future works described in this section are only indicative and further detailed study through the DNOA will be required when delivery of the work needs to be initiated.
Risks: Changes in forecasts and/or practical considerations may result in changing the scope of the high-level solutions detailed here.
Mitigation: The purpose of this section is to highlight the long-term requirements based on current forecasts, annual update of the SDP and more detailed assessment in the DNOA will ensure proposed work that is passed from DSO to the asset owner is appropriate.

Commented [AW58]: I'm not sure this is a risk. More a function of the process.

Commented [NW59R58]: This is aligned with Beauly and Fort Augustus.

Dependency: Procurement of flexibility services is required to optimise load related needs.
Risks: Insufficient flexibility in the relevant area to resolve system reinforcement need.
Mitigation: Flexibility viability assessments are carried out as part of the DNOA process. Last build date identified to allow time for traditional reinforcement if procurement for flexibility services is not successful in procuring the required capacity.

8.2. Future EHV System Needs to 2035.

The following outputs of power system analysis, as shown in **Table 3**, show where we may observe the need for further intervention on the distribution network. This could be through asset solutions or flexibility services. Whilst projects are in delivery access products may potentially be used to enable connection of projects ahead of reinforcement delivery. In some cases, the need has been projected to arise ahead of 2035 in these cases we will recommend that the projects enter more detailed study through the DNOA process.

Ref	Intervention	CT Year	ST Year	LW Year	FS Year	Worst case asset loading (%)	Network State	Comment
1	Circuits to Dyce North PSS (Dyce GSP)	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	105	N-1 outage for 1L5 or 2L5.	Subsequent and prior versions of DFES suggest the overload won't occur until beyond 2033; however, options to resolve constraints could include: - Upgrade of existing transformers and circuit cables (space for an additional transformer unlikely at existing PSS site). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Stoneywood and Harvest Avenue PSS).
2	Dyce North PSS Transformers (Dyce GSP)	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	110	N-1 outage for either PSS Transformer.	

Commented [MM60]: Include wording of PSS acronym for first use

Commented [NW61R60]: Mentioned in previous sections

3	Circuit to Balmedie and Ellon PSS (Dyce GSP)	Ahead of 2030.	2030-2035	Ahead of 2030.	2030-2035	101 and low voltage.	N-1 outage for the loss of 10L5 (fed by 9L5)	Options to resolve constraints could include: - Upgrade existing OHL conductor to resolve both thermal and voltage constraints (re-specifying conductor operating temperature could help capacity but will not help low voltage) - Procurement of flexibility services. - Loadshedding on the 11kV network (two notable interconnections with Kingseat PSS). - Addition of a new 33kV feeder to isolate Balmedie and Ellon PSS under this outage.
4	Balmedie PSS Transformers (Dyce GSP)	2030-2035	2035-2040	2030-2035	2040-2045	109	N-1 outage for either PSS Transformer.	Options to resolve constraint could include: - Upgrade existing transformers. - Procurement of flexibility services. - Several notable interconnections with Ellon and Kingseat PSS, which are both due to have transformer upgrades, 11kV load shedding as an option is therefore likely.
5	Bridge of Don Transformers and CBs (Persley GSP)	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	Ahead of 2030.	101	N-1 outage for either PSS Transformer.	Subsequent and prior versions of DFES suggest the overload won't occur till 2031 under the CT scenario; however, options to resolve constraints could include: - Upgrade existing transformers and circuit breakers or consider the addition of a third transformer. The existing 33kV UG cable feeds at Bridge of Don were upgraded, and an additional cable was laid for future efficiencies, along with the provision of a spare transformer plinth. - Procurement of flexibility services. - Loadshedding on the 11kV network (several notable interconnections with at least 4 PSSs).
6	Whitestripes PSS Transformers and 8L5 CB (Persley GSP).	2030-2035	2035-2040	2030-2035	2040-2045	105	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrade existing transformers and CBs. - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Dyce North and Bridge of Don). - Upgrading the transformers at just Bridge of Don or Whitestripes would enable the other PSS to offload demand onto the 11kV network (there are five notable 11kV interconnections between them) and could potentially remove the need to upgrade both sets of transformers.

Commented [MM62]: Conductor thermal capacity?

Commented [SP63]: We should include the possibility of a 3rd circuit and transformer here as asset management added a 3rd circuit in the ground when they replaced the cables recently

Commented [SP64]: Whitestripes.

7	Circuits to Craiginches PSS (Redmoss GSP)	Ahead of 2030.	2030-2035	Ahead of 2030.	2030-2035	102	N-1 outage for 3L5 or 4L5.	Options to resolve constraints could include: - Upgrade existing cables. - Procurement of flexibility services (large 33kV generation and demand customers on either circuit). - Load shedding on the 11kV network (several interconnections with Kincorth and Balnagask PSS).
8	Kincorth PSS Transformers (Redmoss GSP)	2030-2035	2035-2040	2030-2035	2040-2045	101	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrade existing transformers or an additional transformer (land for development available near PSS). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Craiginches and Balnagask PSS). - Balnagask PSS currently has a single transformer. The addition of a second transformer, along with 11kV load reconfiguration, could help alleviate thermal constraints on the Craiginches and Kincorth networks.
9	Circuit to Newtonhill PSS (Redmoss GSP)	2030-2035	2035-2040	2030-2035	2040-2045	108 and low voltage	N-1 outage for the loss of 6L5 (fed by 5L5)	Options to resolve constraints could include: - Upgrading existing OHL sections to resolve thermal and voltage constraints (re-specifying conductor operating temperature could help capacity but will not help low voltage) . - Procurement of flexibility services (large 33kV generation and demand customers on either circuit). - Loadshedding on the 11kV network (several interconnections with Redmoss PSS). -SSEN DSO has previously identified Portlethen as a potential site for a new primary substation to address thermal and voltage constraints on the Newtonhill networks. The long 11kV feeders in the area are also subject to similar constraints.
10	Circuit to Newtonhill PSS (Redmoss GSP)	2030-2035	2035-2040	2030-2035	2040-2045	Low voltage	N-1 outage for the loss of 5L5 (fed by 6L5)	
11	Circuits to Springhill PSS (Woodhill GSP)	2030-2035	2035-2040	2030-2035	2035-2040	105	N-1 outage for 1L5 or 2L5.	Options to resolve constraints could include: - Upgrading existing cables. - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Queens Lane North and Harvest Avenue PSS).

12	Woodhill PSS Transformers (Woodhill GSP)	2030-2035	2035-2040	2030-2035	2035-2040	108	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (PSS does not have enough space for an additional transformer). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Haudagain and Queen Lane North PSS). - Northfield switching station previously operated as a primary substation. Given its existing interconnections with the Woodhill and Springhill 11kV networks, it could potentially be reinstated to avoid the need for multiple transformer replacements at those sites and additional land acquisition.
13	Ruthrieston PSS Transformers (Craigiebuckler GSP)	2030-2035	2040-2045	2030-2035	2040-2045	101	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (limited space at the existing PSS site makes installation of an additional transformer unlikely). - Procurement of flexibility services. - Loadshedding on the 11kV network (several notable interconnections with at least 4 other PSS's).
14	Whitehouse PSS Transformers (Tarland GSP)	2030-2035	2035-2040	2030-2035	2040-2045	102	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrade of existing transformers or addition of a new transformer (farmland near existing PSS site) - Procurement of flexibility services. - Loadshedding on the 11kV network (several notable interconnections with Kemnay and Mossat PSS).

Table 3: Summary of system needs identified in this strategy through to 2035 along with indicative solutions

8.3. Future EHV System Needs to 2050.

Additional system needs have been identified in **Table 4** that the DFES 2023 indicates may need addressing ahead of 2050. These have been identified through thermal power system analysis. There is significant uncertainty with forecasts in this period and works need to be considered alongside the strategies described in the previous section. As the likelihood of these demands being realised increases, the necessary mitigations through asset or flexible solutions should be implemented.

2050	Intervention	CT Year	ST Year	LW Year	FS Year	Worst case asset loading (%)	Network State	Comment
1	Circuit to Craigton and Culter PSS (Craigiebuckler GSP)	2035-2040	2045-2050	2030-2035	2045-2050	102	N-1 outage for the loss of 3L5 (fed by 4L5).	Options to resolve constraints could include: - Upgrade existing cables or create a dedicated 33kV feed. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with at least 4 PSSs) or 33kV network (Culter PSS has a NOP with Kintore GSP).
2	Circuits to Ruthrieston PSS (Craigiebuckler GSP)	2035-2040	-	2030-2035	2045-2050	103	N-1 outage for 2L5 or 5L5.	Options to resolve constraints could include: - Upgrade existing cables. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with at least 4 PSSs).
3	Denburn PSS Transformers (Willowdale GSP)	2035-2040	-	2030-2035	2040-2045	103	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (limited space at the existing PSS site makes installation of an additional transformer unlikely). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Greyfriars, Clayhills and Queens Lane North PSS).
4	Greyfriars PSS Transformers (Willowdale GSP)	2035-2040	2045-2050	2030-2035	2045-2050	102	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (limited space at the existing PSS site makes installation of an additional transformer unlikely). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with 4 other PSSs). - Upgrading the transformers at Greyfriars PSS would enable Commerce and Denburn PSS to offload demand onto the 11kV network (each have two interconnections with Greyfriars PSS) and could potentially remove the need to upgrade both sets of transformers.

5	Circuits to Queens Lane North PSS (Woodhill GSP)	2035-2040	2045-2050	2035-2040	2045-2050	100	N-1 outage for 7L5 or 8L5.	Options to resolve constraints could include: - Upgrade existing cables. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with at least 4 other PSSs). - An additional primary substation is proposed in Table 3, Row 12, to alleviate constraints at Woodhill and Springhill PSS. It could also provide support to Queens Lane North, as all three PSSs are interconnected. This may reduce the need for further reinforcement through 11kV network reconfiguration.
6	Springhill PSS Transformers (Woodhill GSP)	2035-2040	2045-2050	2035-2040	2045-2050	104	N-1 outage for either PSS Transformer.	Springhill transformers are due to be upgraded; design and delivery teams should be consulted to determine if there is a need and possibility to accommodate larger transformers than initially planned, to address the increase in load growth. Additionally, Table 3, Row 12 highlights the possibility of Northfield Switch station reverting back as a PSS to alleviate thermal constraints experienced by the Woodhill and Springhill 33kV networks.
7	Redmoss PSS Transformers (Redmoss GSP)	2035-2040	2035-2040	2030-2035	2045-2050	103	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (limited space at the existing PSS site makes installation of an additional transformer unlikely). - Procurement of flexibility services. - Loadshedding on the 11kV network (several notable interconnections with Newtonhill). - As noted in Table 3, Row 10, thermal and voltage constraints on the Newtonhill 33kV network could be alleviated by the addition of a new primary at Portlethen. This, in turn, could mitigate thermal constraints at Redmoss PSS through 11kV network reconfiguration.
8	Craiginches PSS Transformers (Redmoss GSP)	2035-2040	2035-2040	2030-2035	2045-2050	103	N-1 outage for either PSS Transformer.	As noted in Table 3, Row 8, the thermal constraints experienced at Craiginches 33kV network can be alleviated by the addition of a second transformer at Balnagask and 11kV network reconfiguration.
9	Circuits to Bridge of Don PSS (Persley GSP)	2035-2040	2035-2040	2035-2040	-	105	N-1 outage for 3L5 or 8L5.	As noted in Table 3, Row 5, the thermal constraints experienced by Bridge of Don 33kV network can be alleviated by the addition of a third transformer and the utilisation of an existing spare 33kV UG cable.
10	Circuits to Whitestripes PSS (Persley GSP)	2035-2040	2049	2035-2040	2045-2050	102	N-1 outage for 5L5 or 8L5.	As noted in Table 3, Row 6, the thermal constraints experienced on Whitestripes and Bridge of Don 33kV networks can be alleviated by upgrading either set of PSS transformers and 11kV network reconfiguration.

11	St Machar PSS Transformers (Persley GSP)	2035-2040	-	2035-2040	2045-2050	103	N-1 outage for either PSS Transformer.	Options to resolve constraints could include: - Upgrading existing transformers (limited space at the existing PSS site makes installation of an additional transformer unlikely). - Procurement of flexibility services. - Loadshedding on the 11kV network (several interconnections with Greyfriars, Bridge of Don and St Nicholas).
12	Haudagain PSS Transformers (Persley GSP)	2045-2050	-	2035-2040	-	101	N-1 outage for either PSS Transformer.	Reinforcements likely to be avoided with flexibility procurement or 11kV load shedding.
13	Circuits to St Machar PSS (Persley GSP)	2045-2050	-	2040-2045	-	101	N-1 outage for 5L5 or 6L5	Reinforcements likely to be avoided with flexibility procurement or 11kV load shedding.
14	Commerce Street PSS Transformers (Clayhills GSP)	2035-2040	2035-2040	2030-2035	2045-2050	100	N-1 outage for either PSS Transformer.	As Noted in Table 4, Row 4, upgrading the transformers at Greyfriars PSS would enable Commerce and Denburn PSS to offload demand onto the 11kV network (each have two interconnections with Greyfriars PSS) and could potentially remove the need to upgrade both sets of transformers.
15	Circuits to Commerce Street PSS (Clayhills GSP)	2045-2050	2040-2045	2030-2035	-	101	N-1 outage for 3L5 or 7L5.	Reinforcements likely to be avoided with flexibility procurement or 11kV load shedding.
16	Rothienorman GSP	-	-	-	-	-	-	After the completion of the Rothienorman integration works, further network modelling studies should be conducted with correctly forecasted load growth data to understand whether there are future system needs.

Table 4: Future EHV system needs projected to arise between 2035 and 2050

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

Our HV/LV spatial plans reveal that while secondary network overloading is predominantly observed in areas with high population density, no consistent trends are apparent within these regions. We are therefore adopting a forecast volume-based planning approach. This section provides additional context regarding this approach, addressing the high voltage and low voltage network requirements for Persley 132kV supply area through to 2050.

8.4.1. High Voltage Networks

In addition to the EHV system needs outlined in the previous section, the growing integration of low carbon technologies (LCTs) into the distribution network is expected to drive increased demands on both the High Voltage (HV) and Low Voltage (LV) networks. To assess the impact of these technologies on the distribution network, we have utilised a load model developed by SSEN's Data and Analytics team.

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 all the primary substations supplied by Persley 132kV supply area, 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 21** demonstrates how this percentage changes under each DFES scenario from now up 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.

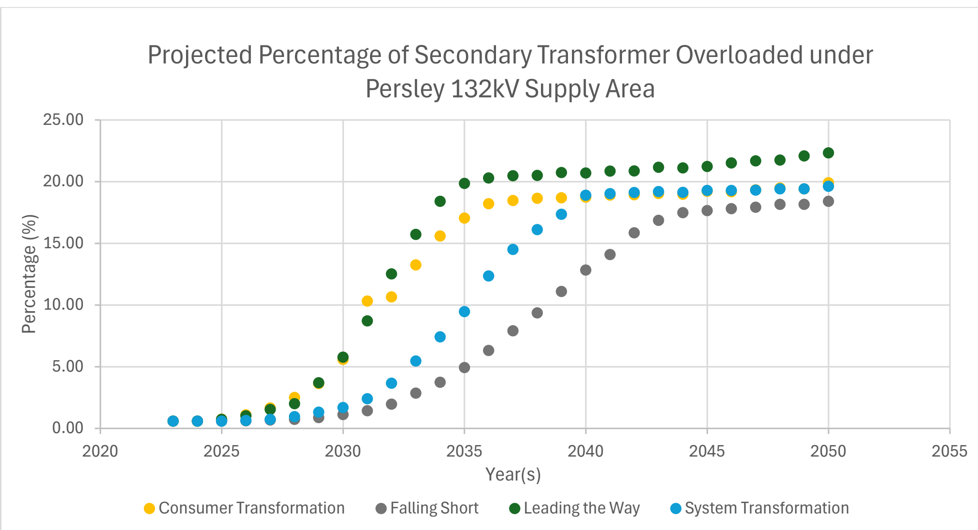

Figure 21: Persley 132kV supply area projected secondary transformer loading. Source: SSEN Load Model

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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.[17] This work groups Lower layer Super Output Areas (LSOAs)[18] 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.**

Commented [MM66]: Include LSOA acronym meaning for first use

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 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.

Table 5: VFES Groupings

To understand the vulnerability groupings across Persley 132kV 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 22.**

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

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

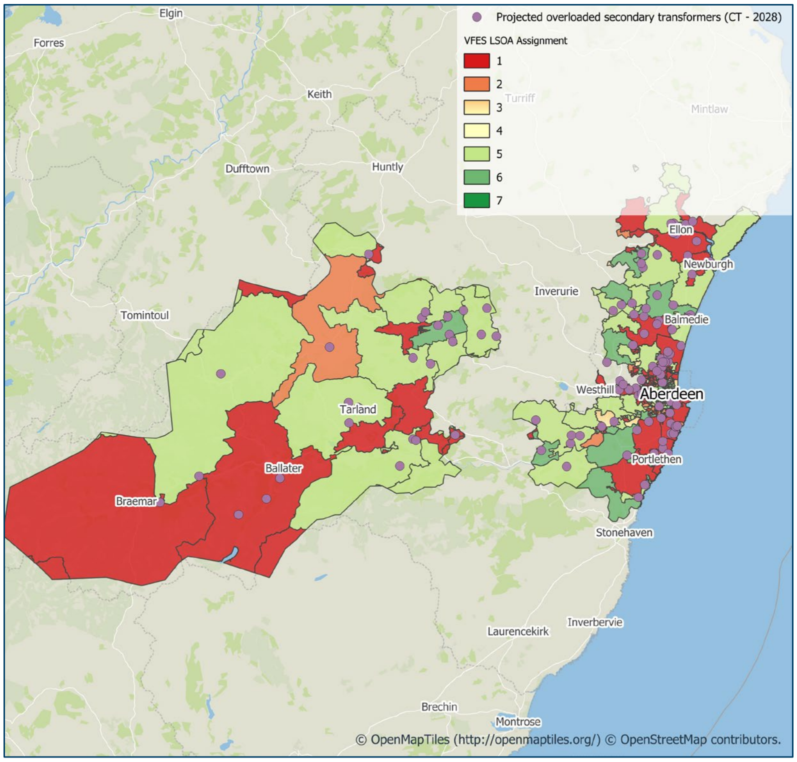


Figure 22: Persley 132kV Supply Area VFES Outputs with secondary transformer overlay

The majority of the area falls within group 5 – lower levels of vulnerability. This low level of vulnerability is driven down by lower level of bad health and disability/mental health benefit claimants, increased by moderate elderly population levels and household sizes. However, there are several LSOAs that fall into the higher categories of vulnerability (groups 1, 2, and 3), this high vulnerability classification is driven up by higher levels of poor health and disability/mental health benefit claimants.

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 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.

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

Commented [NB67]: Update this and update the % of grouping!! Implications of said grouping

8.4.2. Low Voltage Networks

Drivers for interventions in low voltage networks may be either capacity related or be driven by voltage requirements. We are progressing options to resolve both 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 Persley 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 11% of low voltage feeders may need intervention by 2035 and 15% by 2050 under the CT scenario as shown in **Figure 23**. 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.

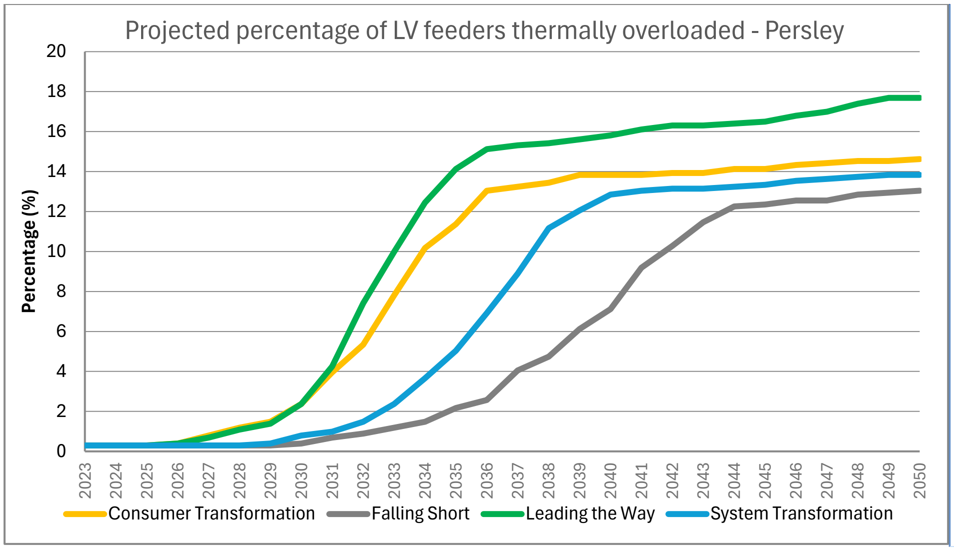


Figure 23: Percentage of LV feeders projected to be overloaded in the Persley Supply Area.

Commented [AW68]: Question; given this chart covers rural areas, is it applicable for Persley or do we need a separate chart?

Commented [NW69R68]: Valid point - so far SHEPD SDPs have only had this example but would be sensible to have an urban Scottish example. Wider action required.

Commented [MM70R68]: Updated with Persley specific graph

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2023 DFES analysis provides a robust evidence base for load growth across Persley 132kV supply area in both the near and longer term. Drivers for load growth across the area arise from multiple sectors and technologies. These drivers impact not only our EHV network but will drive system needs across all voltage levels.

Across the Persley 132kV supply area, a significant volume of work has already been triggered through the DNOA process and published in DNOA Outcomes Reports. This delivers a significant amount of additional capacity in the area over the next decade. These interventions are driven by customer connections and system needs that will arise this decade but are being developed to meet 2050 needs.

Commented [SP71]: These interventions….

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

1) System needs that have been identified at earlier timescales (ahead of 2035) should be studied in more detail and these should be progressed through the DNOA process. This relates to the assets tabulated in **Section 8.2** and notable suggestions that have been consulted with DSO System Planning include:
   a) The addition of a third transformer at Bridge of Don PSS (which will utilise an existing spare 33kV UG cable and transformer plinth) along with appropriate 11kV reconfiguration to assist in the thermal constraints experienced by Bridge of Don PSS transformers/CBs, Whitestripes PSS transformers, Bridge of Don 33kV circuits (post-2035) and Whitestripes 33kV circuits (post-2035).
   b) The addition of a second transformer at Balnagask PSS with appropriate 11kV reconfiguration to assist the thermal constraints experienced by Kincorth PSS transformers, Craiginches 33kV circuits and its associated PSS transformers (post-2035).
   c) A new PSS at Portlethen to address the thermal and voltage constraints experienced by Newtonhill 33kV circuits and Redmoss PSS transformers (post 2035). This could also help resolve 11kV low voltage issues in the region and potentially support any constraints arising at Fiddes GSP — to be detailed in the Tealing SDP.
   d) The potential to reinstate Northfield switching station as a PSS to assist in alleviating the thermal constraints experienced by Woodhill PSS transformers, Springhill 33kV circuits, Springhill PSS transformers (post 2035) and Queens Lane North 33kV circuits (post 2035).

   It should be noted that not all 33kV circuit and transformer reinforcements may be required, due to the advantage provided by the high degree of 11kV interconnectivity between constrained PSSs. These interconnections enable load redistribution, allowing reinforcement to be targeted at a single PSS where appropriate. A coordinated, whole system planning approach is recommended to optimise network utilisation.

2) Considering the significant generation growth expected across Persley 132kV supply area, engagement with SSEN Transmission and NESO should be proactive, creating a long-term plan for the area which incorporates the outputs of CP2030 and connections reform. More detailed network studies should also be carried out to determine how growth in generation will impact the network, especially in summer minimum demand maximum generation conditions.

3) Understanding how rural decarbonisation could impact load on the network. Specifically, the electrification of distilleries and ports along the east coast of the area and how to capture those plans in load forecasts. It will also be important to understand how substations covered by security of supply derogations will be affected by increased demand.

4) The connection of low carbon technologies across the HV and LV networks will result in significant demand growth. Where it has been identified that there are overloads projected, mitigations will need to be put in place. There is no clear pattern to low voltage load growth in the Persley 132kV supply area, so this should be taken on a volume driver approach. This needs to be based on strategic modelling of LV networks to understand the volume of work needed.

Appendix A: Primary Substation Customer Numbers

Grid Supply Point	Primary Substation	Number of Customers Served (approximate)	2023 Substation Maximum demand in MVA (Winter)
Clayhills	BALNAGASK	2323	3.98
Clayhills	CLAYHILLS	9658	12.45
Clayhills	COMMERCE STREET	2084	12.28
Craigiebuckler	CRAIGIEBUCKLER	4101	6.06
Craigiebuckler	CRAIGTON	3513	5.97
Craigiebuckler	CULTER	4099	5.79
Craigiebuckler	RUTHRIESTON	6575	7.76
Dyce	BALMEDIE	2246	3.21
Dyce	DYCE GRID	3	N/A
Dyce	DYCE NORTH	3635	12.08
Dyce	ELLON 11 kV	7453	11.67
Dyce	HARVEST AVENUE	121	3.67
Dyce	KINGSEAT	2387	4.06
Dyce	STONEYWOOD	636	N/A
Persley	BRIDGE OF DON	7177	13.23
Persley	HAUDAGAIN	6754	6.38
Persley	ST MACHAR	7063	7.49
Persley	STONEYWOOD	2921	N/A
Persley	WHITESTRIPES	4974	6.86
Redmoss	CRAIGINCHES	4063	11.56
Redmoss	KINCORTH	4086	6.35
Redmoss	NEWTONHILL	4905	9.82
Redmoss	PARK	1120	2.02
Redmoss	REDMOSS	5233	17.02

Redmoss	REDMOSS GRID	2	N/A
Tarland	ABOYNE	3240	6.18
Tarland	BALLATER	2476	5.71
Tarland	MOSSAT	1347	1.65
Tarland	STRATHDON	450	0.91
Tarland	TARLAND GRID	4	N/A
Tarland	WHITEHOUSE	2720	4.26
Willowdale	DENBURN	5969	11.82
Willowdale	GREYFRIARS	7182	8.05
Willowdale	HAYTON	4927	3.42
Willowdale	ST NICHOLAS	4514	5.82
Woodhill	QUEENS LANE NORTH	7547	9.01
Woodhill	SPRINGHILL	11286	13.55
Woodhill	WOODHILL	9726	12.57

Table 5: Customer number breakdown and primary substation peak demand readings (2023)

Appendix B: DFES 2024 Projections

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 pathways framework is shown below in **Figure 24.**

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

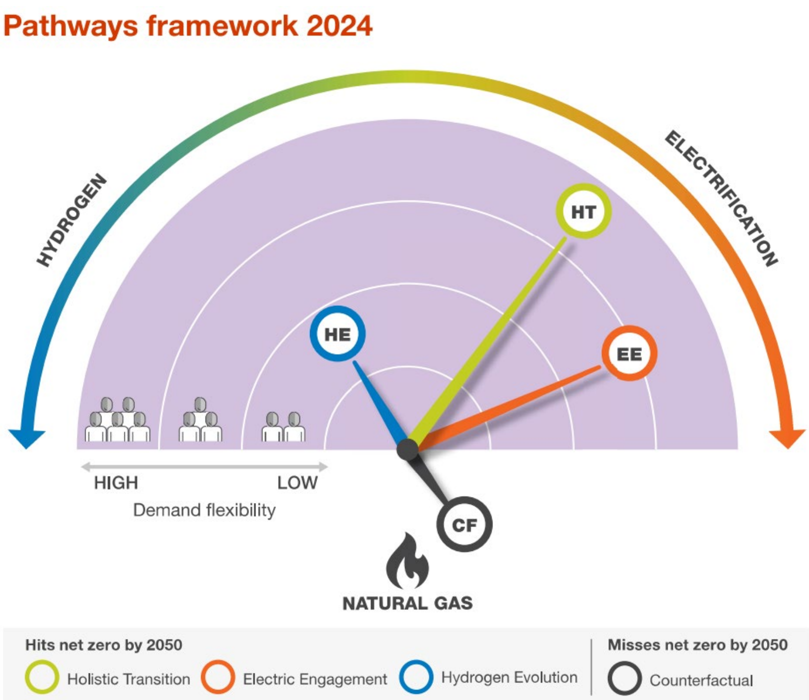


Figure 24: The FES 2024 scenario framework (source: NESO)

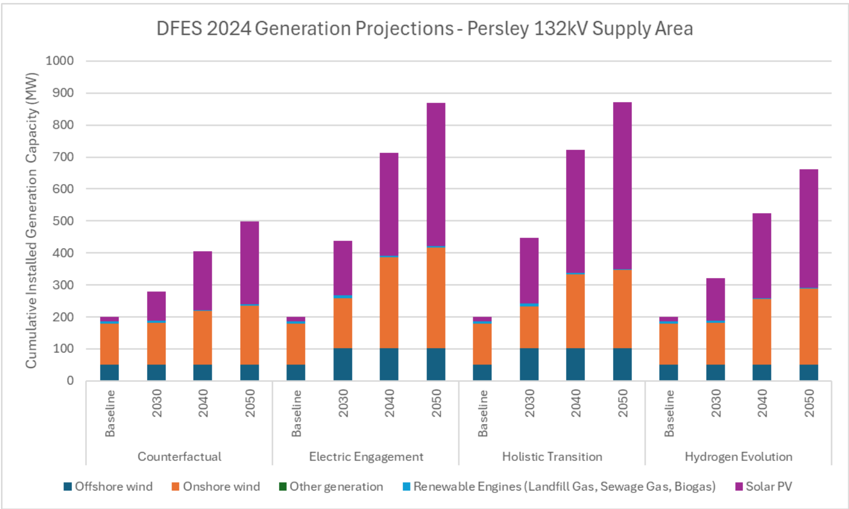


Figure 25: 8 Projected cumulative distributed generation capacity across the Persley 132kV Supply Area. *Source: SSEN DFES 2024*

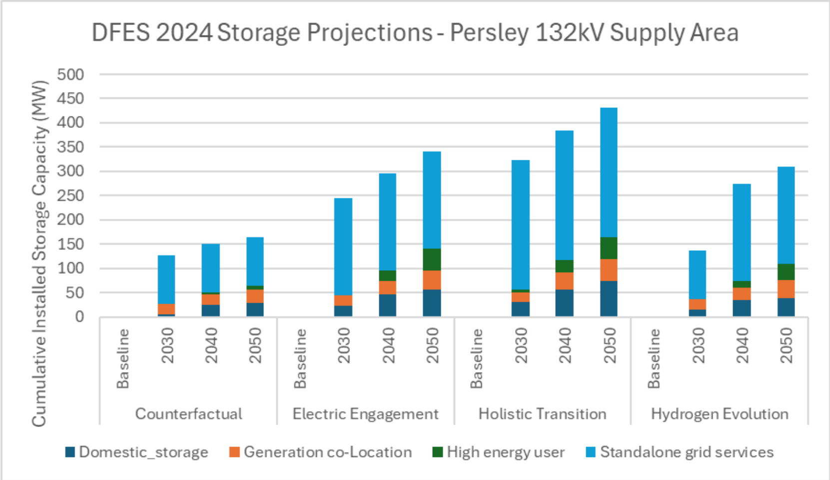


Figure 26: Projected battery storage capacity across the Persley 132kV Supply Area. Source: *SSEN DFES 2024*

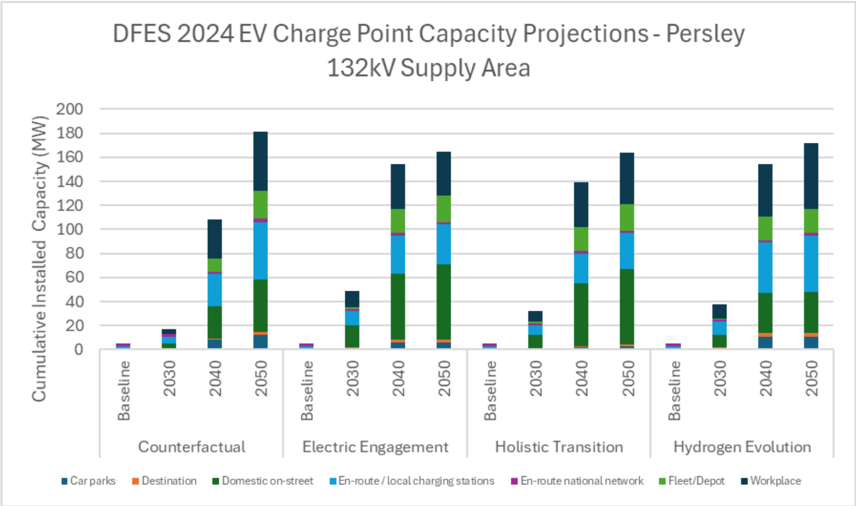


Figure 927: Projected EV charge point capacity across the Persley 132kV Supply Area. *Source: SSEN DFES 2024*

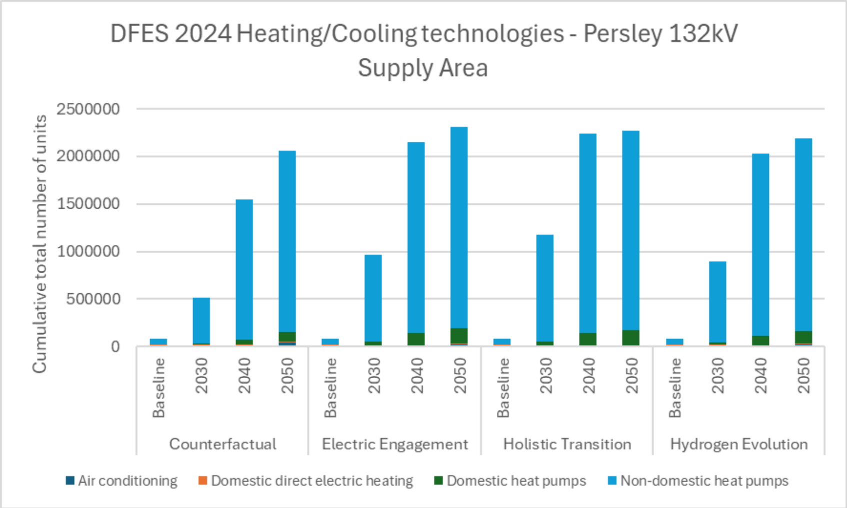


Figure 28: 10 Projected number of heating/cooling technologies across the Persley 132kV Supply Area. *Source: SSEN DFES 2024*

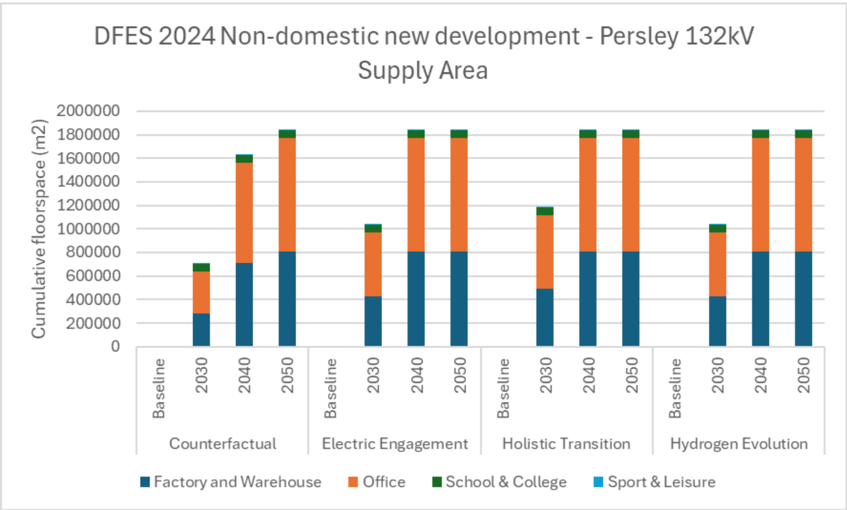


Figure 29: Projected non-domestic new development across the Persley 132kV Supply Area. *Source: SSEN DFES 2024*

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

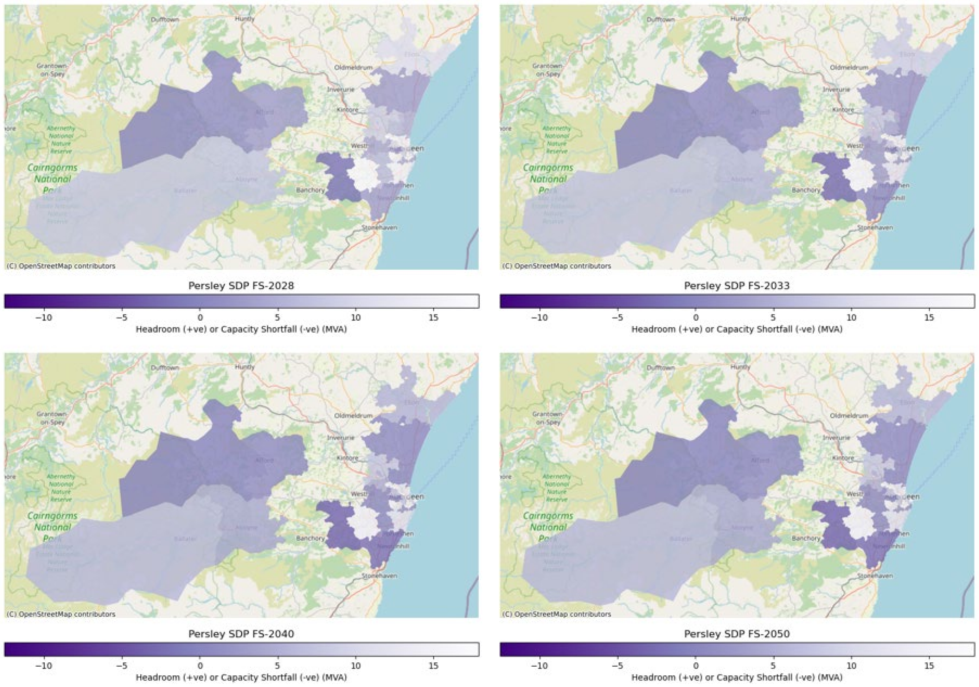


Figure 30: Persley 132kV Supply Area - EHV/HV Spatial Plan – Falling Short

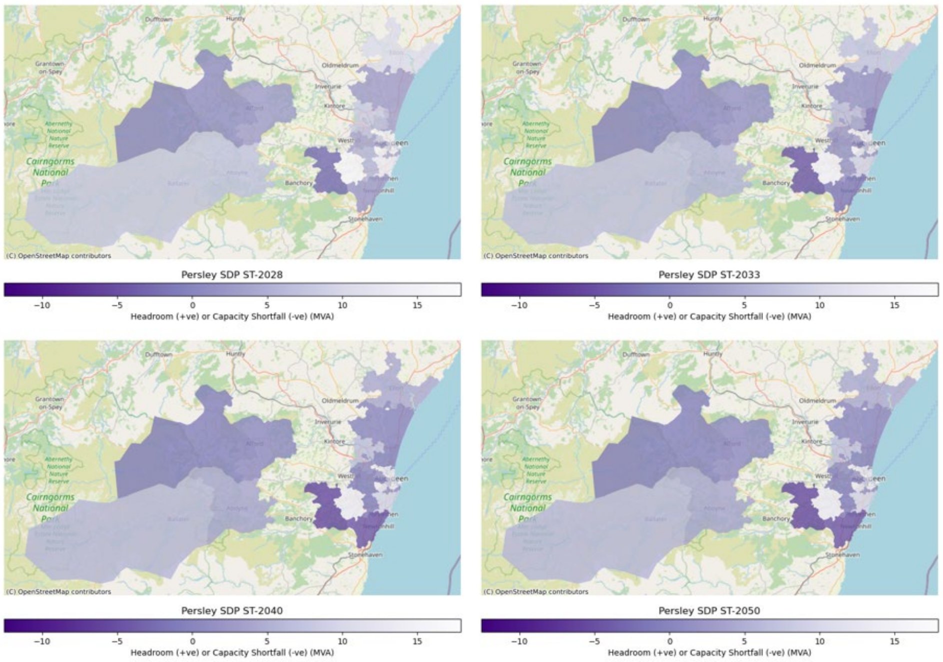


Figure 31: Persley 132kV Supply Area - EHV/HV Spatial Plan – System Transformation

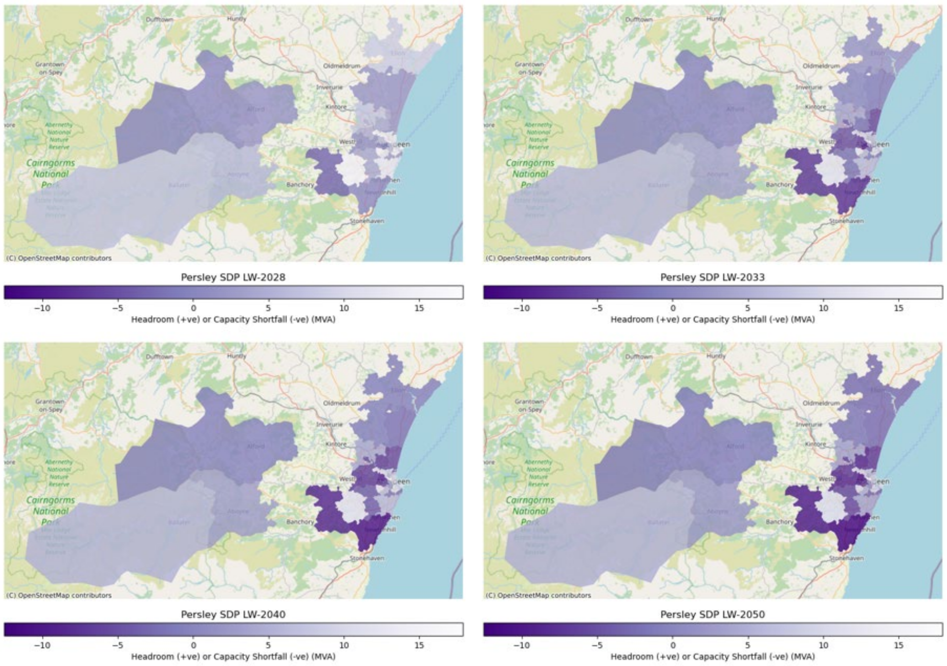


Figure 32: Persley 132kV Supply Area - EHV/HV Spatial Plan – Leading the Way

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

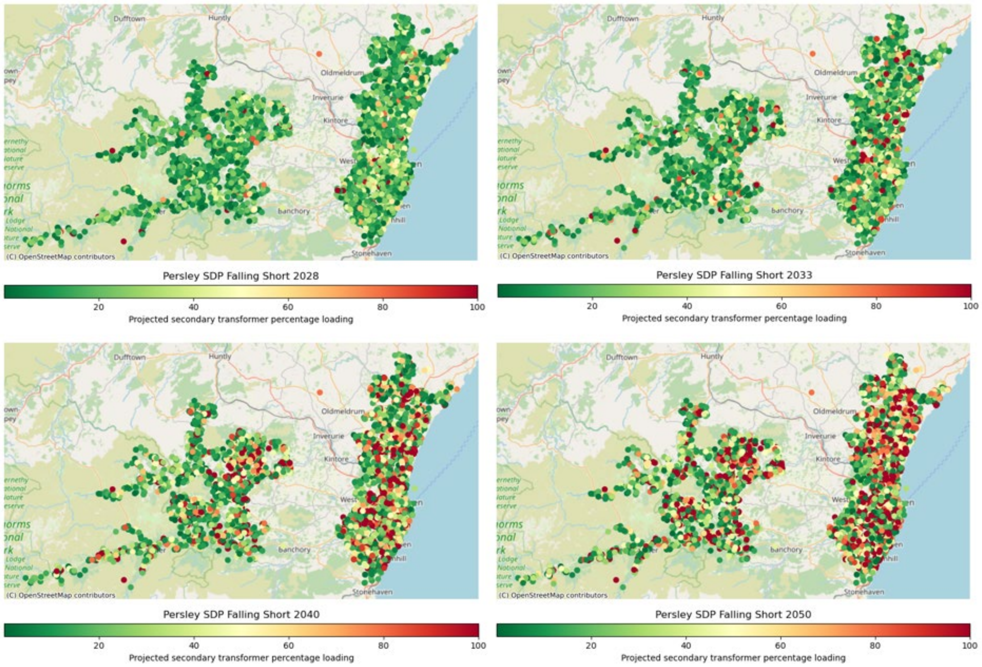


Figure 33: Persley 132kV Supply Area - HV/LV Spatial Plan – Falling Short

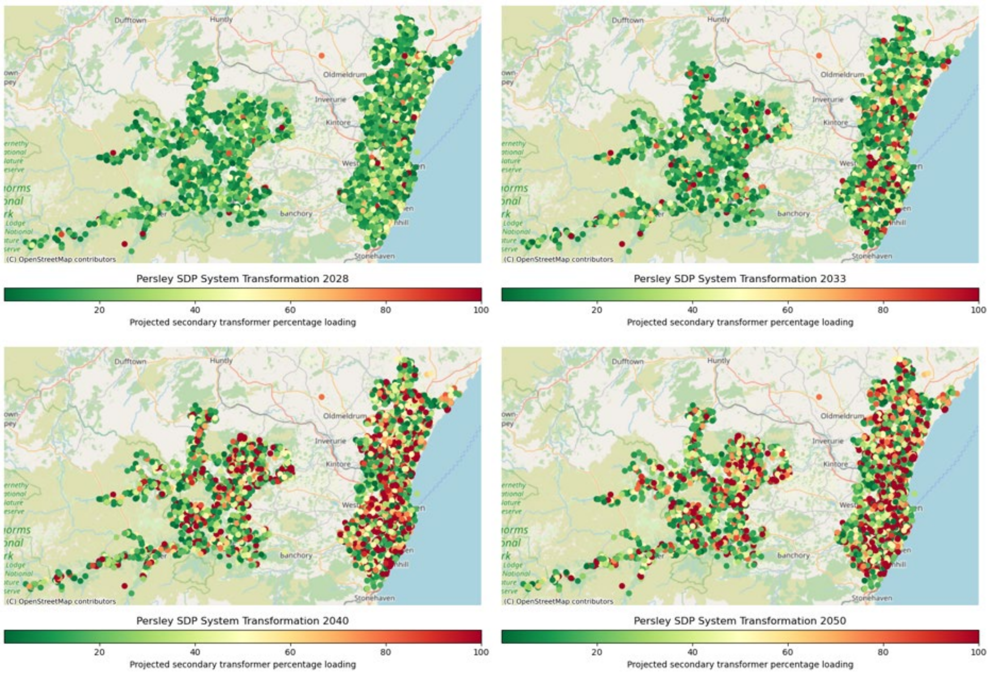


Figure 34: Persley 132kV Supply Area - HV/LV Spatial Plan – System Transformation

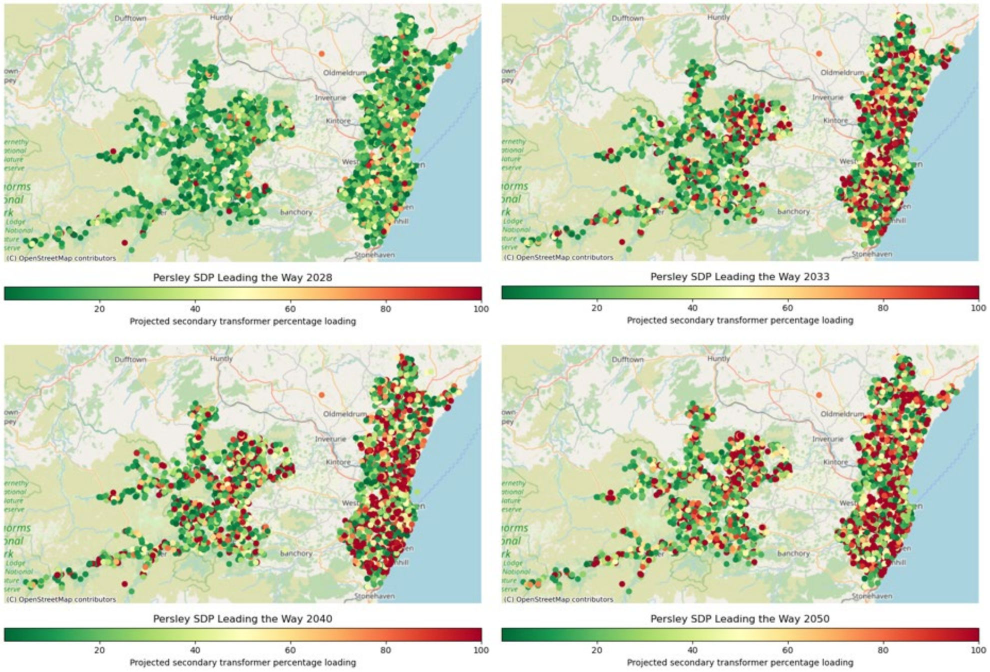


Figure 35: Persley 132kV Supply Area - HV/LV Spatial Plan – Leading the Way

Appendix E: 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
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
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 Network
ST	System Transformation
UM	Uncertainty mechanism
VFES	Vulnerability Future Energy Scenarios
WSC	Worst Served Customers

Table 6: Glossary

Appendix F: DNOA Outcome Report

DNOA Outcome Report

Ellon
(Ellon PSS)

Scheme description
- The reinforcement of the Ellon PSS will increase capacity in the northeast Aberdeenshire area. Postcode(s): AB41, AB42.
- Local authority: Aberdeenshire
- Load related – substation and circuit thermal overload and low voltage issues in FCO conditions due to forecasted demand growth.

Proposed option
- Smart/Asset Solution: Reinforcement of existing 2 x 33/11kV transformers and reconfiguration/re-rating of the 33kV circuits including installation of voltage regulating equipment.
- Flexibility was unable to be utilised due to it not being suitable to address the constraint type.
- This option addresses the thermal overload at Ellon PSS out to 2034.
- Capacity released: 8.99MVA

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				

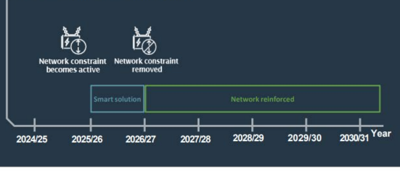
Indicative flexibility price (if available):
- Availability price: N/A
- Utilisation price: N/A

Reinforcement timeline
- Reinforcement delivery by the end of 2025/26.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	0.3	- (1.3)	- (2.4)	- (3.4)	- (4.6)	- (5.9)
ST	-	-	- (0.3)	- (0.8)	- (1.2)	- (1.9)	- (2.8)
LTW	0.3	0.9	- (1.9)	- (3.0)	- (4.0)	- (5.4)	- (7.2)
FS	-	-	-	- (0.4)	- (0.6)	- (1.1)	- (1.8)

Constraint management timeline



9 | Scottish and Southern Electricity Networks Distribution | **DNOA Outcomes Report November 2024 – Ref. 1124-02**

DNOA Outcome Report

Aberdeen (Springhill PSS)
Ref. 0724-01

Scheme description
- Springhill primary is located in Aberdeen, Scotland. Postcode(s): AB10, AB11, AB12, AB14, AB15, AB16, AB21, AB22, AB23, AB24, AB25, AB32, AB42, AB54, PH1.
- Load Related - thermal overloading of Springhill primary substation under FCO conditions.

Proposed option
- Procure flexibility solutions in 2024/25 to manage constraint followed by asset solution: 2 x 33/11kV primary transformers upgrade (2024-25).
- The option provides the economic benefit of deferral through flexibility and accommodates for future demand growth.
- Capacity released: 6.4MVA

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				

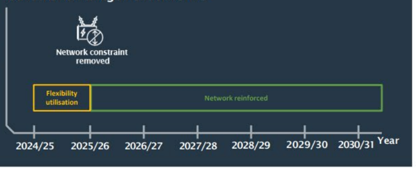
Indicative flexibility price (if available):
- Availability: £150/MW/h
- Utilisation: £200/MWh

Reinforcement timeline
- Flexibility utilisation in 2024/25.
- Reinforcement delivery by 2025/26.

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	2.18	- (2.58)	- (3.38)	- (4.18)	- (5.28)	-(6.38)	- (7.18)
ST	1.98	- (2.18)	- (2.68)	- (3.18)	- (3.58)	- (4.28)	- (9.68)
LTW	2.58	- (3.08)	- (4.08)	- (5.28)	- (6.68)	- (8.28)	- (4.78)
FS	1.68	- (1.88)	- (2.18)	- (2.38)	- (2.68)	- (2.98)	- (3.38)

Constraint management timeline



10 | Scottish and Southern Electricity Networks Distribution | **DNOA Outcomes Report July 2024**

DNOA Outcome Report

Newtonhill (Newtonhill PSS)
Ref. 0724-05

Scheme description
- This reinforcement will increase capacity in the Newtonhill area. Postcodes: AB12, AB15, AB39, DD10.
- Load related – substation thermal overload in FCO conditions due to forecasted demand growth.

Proposed option
- Procure flexibility solutions to defer reinforcement followed by asset solutions: installation of new transformers, followed by circuit upgrades in ED3.
- Ensures compliance of Newtonhill primary substation. The ED3 circuit upgrades ensure demand growth is met to 2050.
- Capacity released: 15MVA

System need requirement

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

DNOA History

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

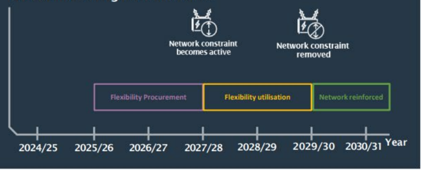
Indicative flexibility price (if available):
- Availability: £108/MW/h
- Utilisation: £133/MWh

Reinforcement timeline
- Flexibility utilisation in 2027/28 and 2028/29.
- Reinforcement delivery by 2029/30.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	0.36	1.36	- (3.06)	- (3.96)
ST	-	-	-	-	-	- (1.36)	- (1.96)
LTW	-	-	0.46	1.46	2.96	- (5.36)	- (6.96)
FS	-	-	-	-	-	-	- (0.14)

Constraint management timeline



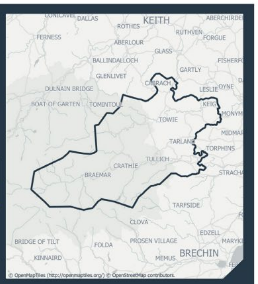
14 | Scottish and Southern Electricity Networks Distribution | **DNOA Outcomes Report July 2024**

DNOA Outcome Report

Tarland, Aboyne and Ballater

Scheme description
- Tarland Grid Supply Point is located within Aberdeenshire, Scotland. Postcode areas: AB31, AB33-AB36, AB39, AB45, AB49, AB51, AB52
- Load related constraint – Work required due to short term voltage issues and longer-term thermal issues.

Proposed option
- Asset solution: Reinforcement of existing assets and the addition of new assets. The option to use flexibility was assessed as not possible due to the nature of the customer base and the particular network configuration.
- Capacity released: 15.6 MVA.



Sysem need requirement

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

DNOA History

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

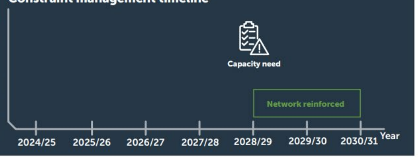
Indicative flexibility price (if available):
- Availability: N/A
- Utilisation: N/A

Reinforcement timeline
- Reinforcement delivery by the end of 2027/28.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	-	- (0.10)	- (0.31)
ST	-	-	-	-	-	- (0.01)	- (0.21)
LTW	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-

Constraint management timeline



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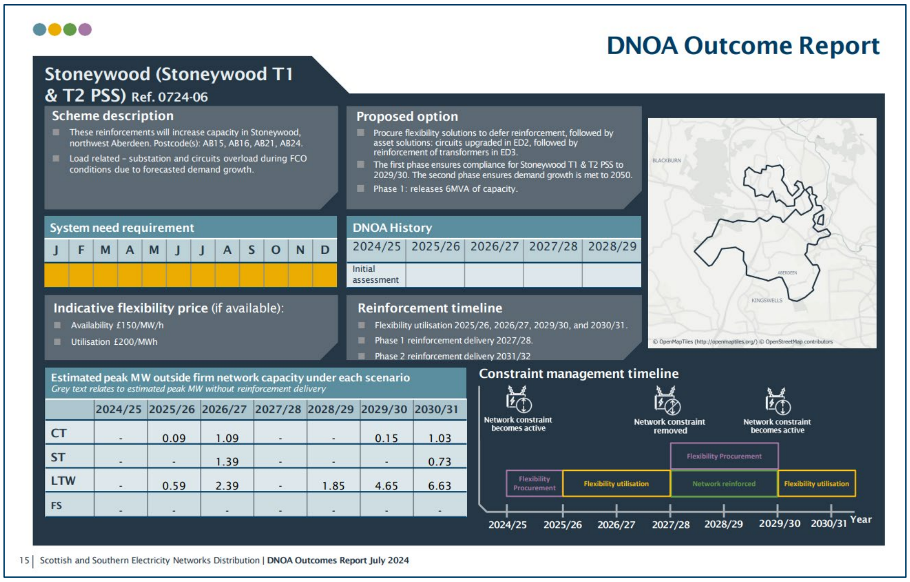

DNOA Outcome Report

Stoneywood (Stoneywood T1 & T2 PSS) Ref. 0724-06

Scheme description

- These reinforcements will increase capacity in Stoneywood, northwest Aberdeen. Postcode(s): AB15, AB16, AB21, AB24.
- Load related - substation and circuits overload during FCO conditions due to forecasted demand growth.

Proposed option

- Procure flexibility solutions to defer reinforcement, followed by asset solutions: circuits upgraded in ED2, followed by reinforcement of transformers in ED3.
- The first phase ensures compliance for Stoneywood T1 & T2 PSS to 2029/30. The second phase ensures demand growth is met to 2050.
- Phase 1: releases 6MVA of capacity.

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 2025/26, 2026/27, 2029/30, and 2030/31.
- Phase 1 reinforcement delivery 2027/28.
- Phase 2 reinforcement delivery 2031/32

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	0.09	1.09	-	-	0.15	1.03
ST	-	-	1.39	-	-	-	0.73
LTW	-	0.59	2.39	-	1.85	4.65	6.63
FS	-	-	-	-	-	-	-

Constraint management timeline

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