KEITH 132KV SUPPLY AREA: STRATEGIC DEVELOPMENT PLAN

Our network serving communities across Aberdeenshire and Moray in northeast Scotland.

Draft for consultation

October 2025

Scottish & Southern Electricity Networks

CONTENTS

1. EXECUTIVE SUMMARY

SSEN is taking a strategic approach in the development of its distribution networks. This will help to enable the net zero transition at a local level to the homes, businesses, and communities we serve. Our Strategic Development Plans (SDPs) 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 Elgin, Keith and MacDuff Grid Supply Points (GSPs) that make up the Keith 132kV supply area. These GSPs supply customers located in the in the Aberdeenshire and Moray area of northeast Scotland area, as shown below.

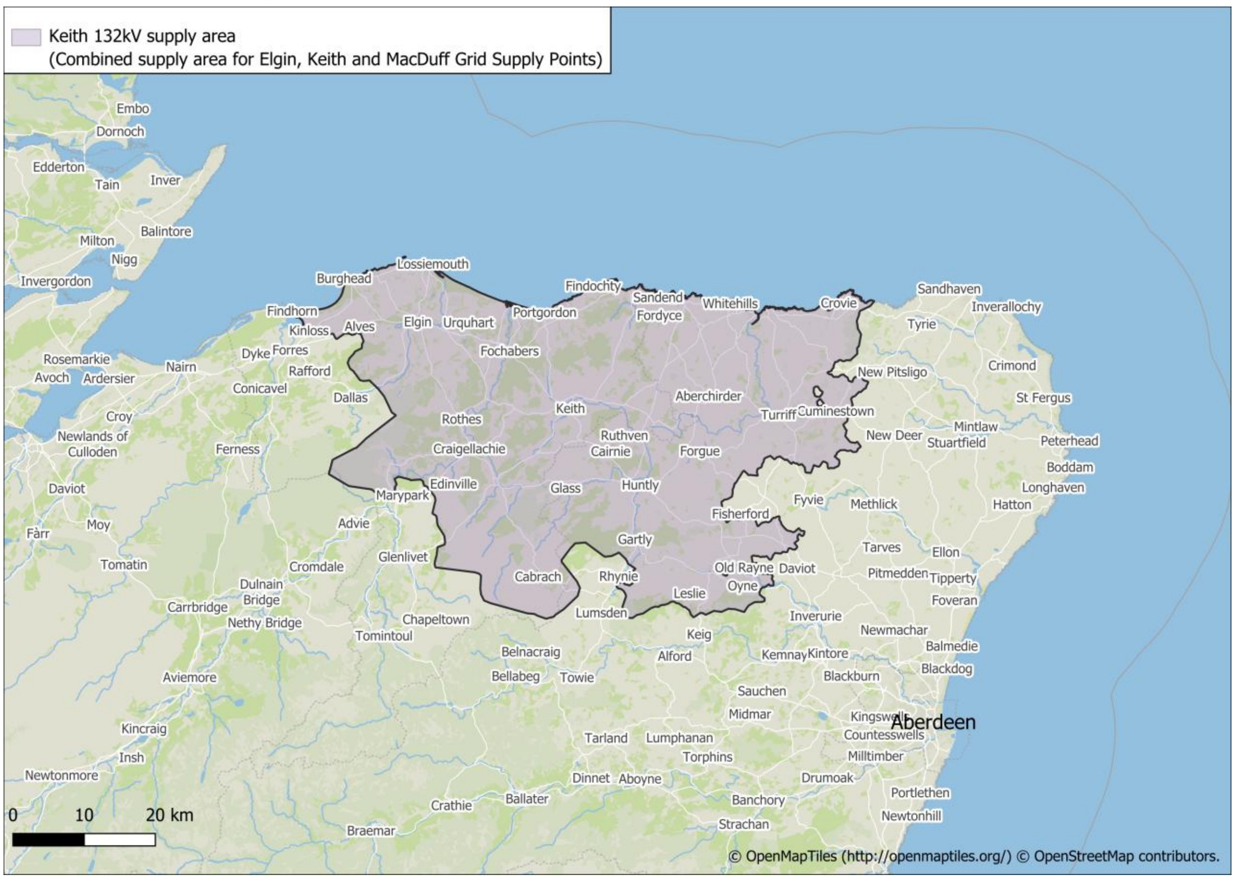

Figure 1 Area of focus for this SDP

This report documents the stakeholder led plans that are driving net zero and growth in the local area, the resulting electricity demands, and the network needs arising from this. Plans across the Northeast Scotland 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 utilizes the Distribution Future Energy Scenarios (DFES) to understand the pathway to a 2050 network that can support net zero and growth in the local economy. Recommendations from this report outline the initial steps that we believe should be taken on that pathway to develop the network in an efficient and stakeholder-led way.

2. INTRODUCTION

The aim of this report is to demonstrate how local, regional, and national targets align with stakeholder perspectives in the area to provide a robust evidence base for load growth out to 2050 across the Elgin, Keith and MacDuff (GSPs) that make up the Keith 132kV supply area.. A GSP is an interface point with the national transmission system where SSEN Distribution then takes power to local homes and businesses within a geographic area. Context for the area this represents is shown above in **Figure 1**.

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

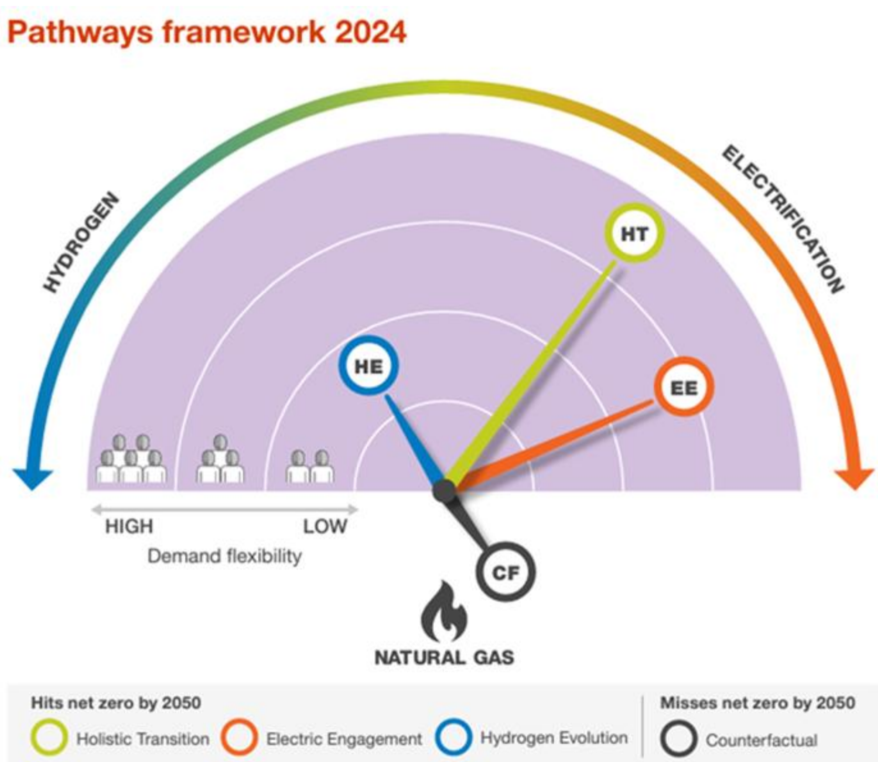

Figure 2: The FES Scenario framework (source: NESO)

Using the DFES, power system analysis has been carried out to identify the future system needs of the electricity network. These needs are summarised by highlighting the year the need is identified under each of the scenarios, and the projected 2050 load. System needs are identified through power system analysis using the Holistic Transition Pathway scenario, in alignment with evidence gathered in preparation for the SSEN ED2 business plan. We also model across the other scenarios to understand when these needs arise and what demand projections should be planned for in the event each scenario is realised.

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

New Pathway	Previous Scenario	Focus
Holistic Transition	**Leading the Way**	Balanced innovation: hydrogen + electrification with high ambition.
Electric Engagement	**Consumer Transformation**	Strong consumer engagement driving electrification.
Hydrogen Evolution	**System Transformation**	Infrastructure-led, hydrogen-heavy solutions for challenging sectors.
Counterfactual	**Falling Short**	Limited progress and continued reliance on fossil fuels.

Table 1 DFES Transition from Scenarios to Pathways

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The electrical network covered by this SDP supplies two local authorities: Aberdeenshire Council and Moray Council. This report focuses on the area shown in **Figure 3** below.

The local authority development plans will significantly impact the potential future electricity load growth on SSEN's distribution network. Therefore, it is crucial for SSEN to engage with these plans when carrying out strategic network investments.

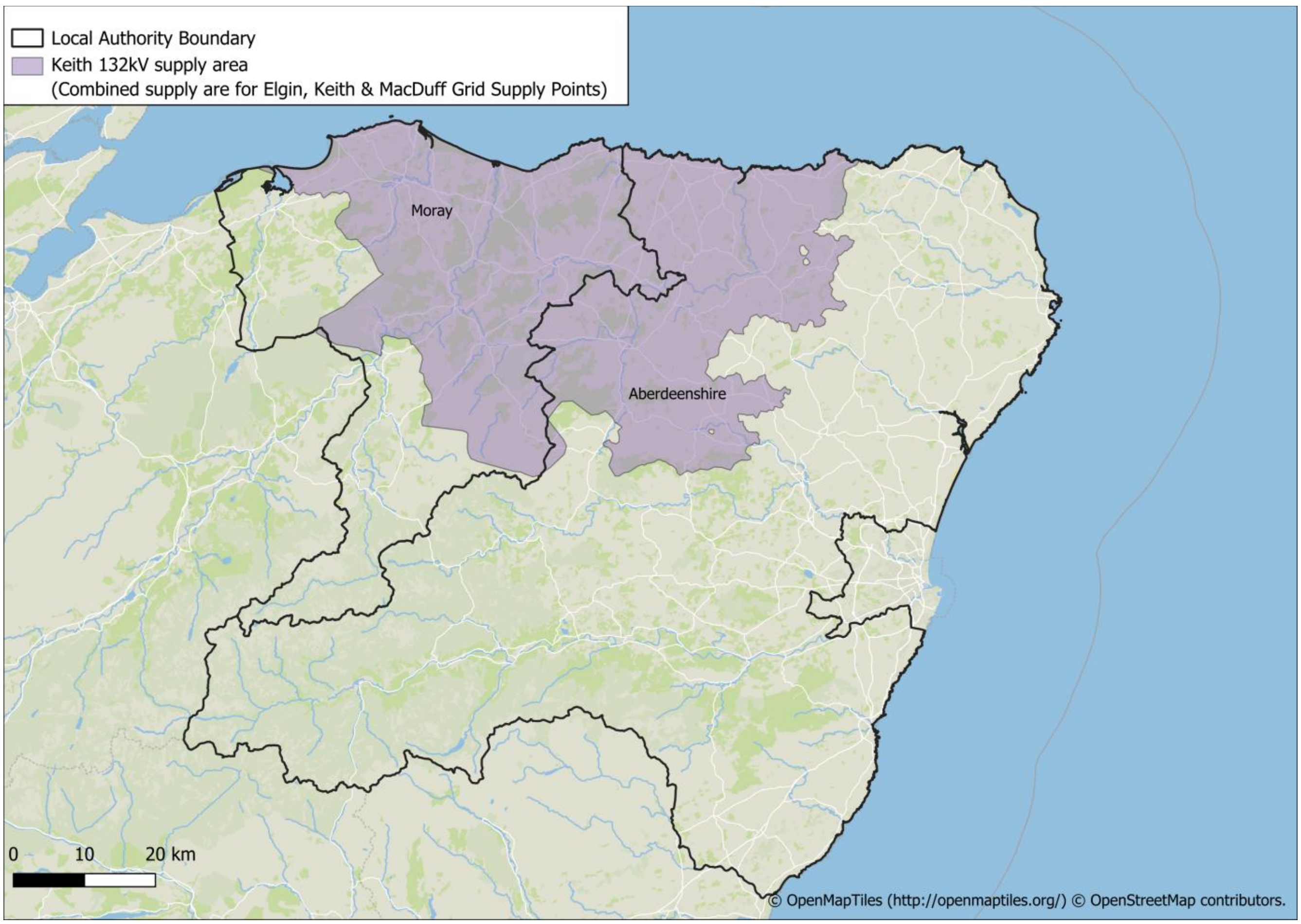

Figure 3 Keith 132kV supply area and local authority boundaries

3.1.1. Aberdeenshire Council

As of 2024, Aberdeenshire had a population of 265,080, reflecting an approximate 0.2% increase from 2023. It is the fourth-largest local authority area in Scotland by land area. The region is predominantly rural, with its largest towns including Peterhead, Inverurie, Fraserburgh, Westhill, Stonehaven, and Ellon.

Aberdeenshire Council has a target of 75% reduction in emissions by 2030 (from its 2010 – 2011 baseline), and aims to reach net zero by 2045, in alignment with the Scottish Government's national target. The Council published their Local Heat and Energy Efficiency Strategy (LHEES) in July 2024 and are currently preparing their LHEES delivery plan. The LHEES sets out the Council's long-term plans for decarbonising heat in buildings and improving energy efficiency across the local authority area. The Council has also developed a 'Route Map to 2030 and Beyond', which sets out the requirements and investment needed to reach the net zero by 2045 ambition. The North of Scotland, encompassing Aberdeen City, Aberdeenshire, Moray, and Highland Councils, have been awarded £6.86 million in grant funding from the £30 million Scottish Government Electric Vehicle Infrastructure Fund, effective from Spring 2025.

The Council continues to expand the electric vehicle charging network across the region and is assessing the feasibility for heat pumps, solar PV, and battery storage installations on council-owned buildings. Grants for Air Source Heat Pumps are available through April 2026 to residents across rural Aberdeenshire whose properties are oil or LPG heated. The Council's 2023 Local Development Plan includes a goal of one EV charge point per 25 employees in workplace parking sites.

3.1.2. Moray Council

In the 2011 Census, the population of Moray was estimated to be 93,000. The 2017 Mid-Year estimate was 95,780, representing a slight increase[1]. This report covers Elgin, Keith, Buckie and Cullen which are key hubs in Moray.

Moray Council has an ambition to reach net zero carbon emissions by 2030, as outlined by the Council's Climate Change Plan and Routemap to Net Zero. Progress towards this target is reported annually, with the most recent update in 2024[2]. The target will be reviewed in 2025, taking into consideration the current policy and funding landscape. Between 2022/23 and 2023/24, the Council reported a 29% reduction in emissions, predominately due to the NESS Energy from Waste facility[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]. The Council have also launched the Bus Revolution project, which aims to increase reduce the environmental impact of transport in Moray, as well as a LED streetlamp programme.

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1 Facts and Figures - Moray Council

2 moray.gov.uk/downloads/file159012.pdf

3 Climate Change - Moray Council

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

3.2. Whole System Considerations

SSEN has strong working relationships with stakeholders across Aberdeenshire and Moray. We have met with Aberdeenshire and Moray Council to discuss local area energy planning. We have engaged with Scottish Government's LHEES Forum, Community Energy Scotland, Transport Scotland, Highlands and Islands Enterprise (HIE) 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. Moray and Aberdeenshire have been onboarded to SSEN's LENZA platform.

3.2.1. Load Managed Areas (LMAs)

Historically we have managed demand in this area using Load Managed Areas (LMAs). These have relied on the use of radio teleswitches to optimise residential heating demand. Moving forwards, we will continue to value this use of flexibility to manage demand, and we are in the process of transitioning to a market-based solution with SSEN having committed to removing LMAs during ED2 and ED3.

The percentage of customers subject to LMA rulings are outlined in **Table 2** below.

Substation Name	Site Type	% of RTS customers
Elgin	Grid Supply Point	7.06%
Keith	Grid Supply Point	8.04%
MacDuff	Grid Supply Point	9.08%

Table 2 Number of LMA customers subject to RTS (2024)

3.2.2. Transmission Interaction

Due to the significant potential for renewable energy resources across the North of Scotland, and the Keith 132kV supply area there are several contracted generation connections due to connect to the transmission network. To facilitate this, SSEN Transmission currently have a strong presence in northeast Scotland, with a large portfolio of works to be delivered in order to facilitate these connections and support the drive towards net zero. The portfolio of projects ranges from those already delivered or underway to those in various stages of planning and development.

Building on the strong historic relationship, there remains an open dialogue between SSEN Distribution and Transmission regarding the portfolio. As the future plans pass through strategic planning and development processes, this open dialogue will be a key component in a successful whole system solution for the Northeast of Scotland. SSEN Distribution will continue to engage with SSEN Transmission regarding the evolution of their plans for the network covered by this SDP.

The supply area covered by this SDP forms part of the overall SSEN Transmission Strategy. The Transmission Strategy consists of two projects that are relevant to the Keith 132kV supply area:

- Keith Substation Upgrade[5]
- Elgin GSP

5 Keith Substation Upgrade - SSEN Transmission

Keith Substation Upgrade

The existing substation at Keith supplies part of the distribution network in Moray and was constructed in the mid-1960s. SSEN Transmission plan to replace equipment that has reached the end of its operational life, which will provide a network capable of the demands of the county's Net Zero ambitions.

The works will comprise:

- Offline replacement of two 132kV circuit bays including circuit breakers
- In-situ replacement of one 132kV circuit bay
- In-situ replacement of two busbar disconnectors and three busbar sections
- Installation of two new cable sealing end compounds and associated 132kV cable circuits to connect these to the new circuit bays
- Removal of three existing overhead line towers
- Installation of protection associated with the new bays

This Project is currently in delivery and is projected to be completed in 2026.

Elgin GSP

The existing substation at Elgin supplies part of the distribution network in Moray. SSEN Transmission plan to replace equipment that has reached the end of its operational life with the two existing 90MVA grid transformers being replaced with 120MVA units, providing a network capable of the demands of the county's Net Zero ambitions. This project formed part of the SSEN Transmission RIIO-T3 submission which with a targeted completion date in 2030.

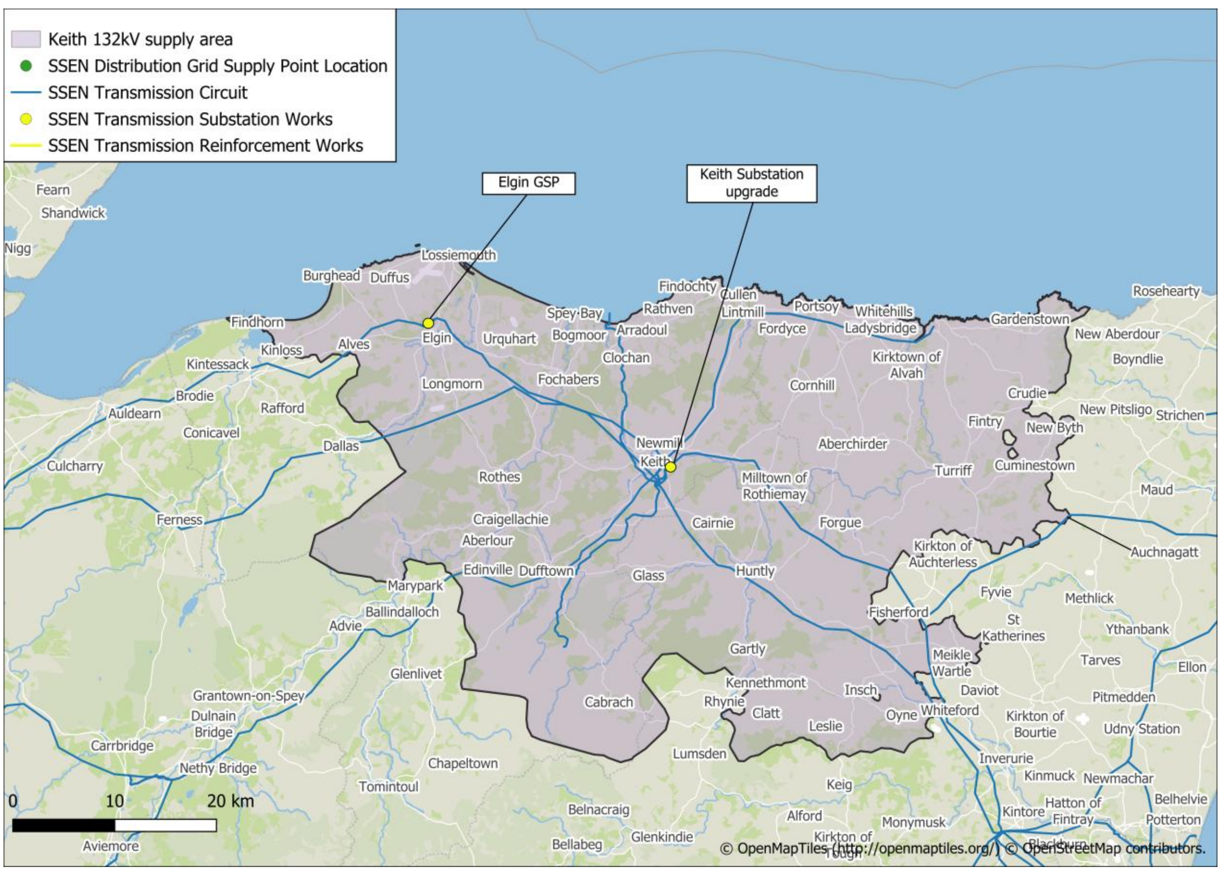


Figure 4 Transmission Infrastructure planned within the Keith132kV supply area

3.2.3. Security of Supply

Engineering Recommendation P2/8 requires Distribution Network Operators to maintain security of supply to its connected customers in line with the standards laid out in that document, depending on the total demand of the substation. Scottish Hydro Electric Power Distribution (SHEPD) electricity distribution network includes a number of networks that were installed in the period 1950 - late 1980s to provide the first mains electricity supplies to rural communities. These networks were installed on a minimum cost basis and did not meet the standards laid out in Engineering Recommendation P2/8. It was previously considered uneconomic to improve them and these were therefore determined to be exempt from the Engineering Recommendation P2/8. In the context of decarbonisation and increased reliance on electricity, as demand rises in these areas, this position will be reviewed for larger demand groups and where justified the exemption will be removed.

3.3. Flexibility Considerations

SSEN procures Flexibility Services from owners, operators, or aggregators of Distributed Energy Resources (DERs) or Consumer Energy Resources (CERs), which can be generators, storage, or demand assets. These services are needed in areas of the network which have capacity constraints at particular times or under certain circumstances. SSEN purchases Flexibility Services from all types of providers (e.g. domestic or commercial). Information on the process of procurement and how to participate are published on the Flexibility Services website and information on real time decision making on which providers are dispatched can be found in the Operational Decision-Making document.[6,7]

SSEN regularly recruits new Flexibility Services providers and increases the procured Flexibility Services with the latest bidding round for long term requirements held in September 2025..

Areas across the Keith 132kV supply area where flexibility has previously been procured is shown below in **Figure 5**. This map shows all Flexibility Services procured, which covers requirements beyond those identified for managing the deferral of reinforcement. At present, flexibility has only been procured within the Elgin GSP electrical supply area.

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

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

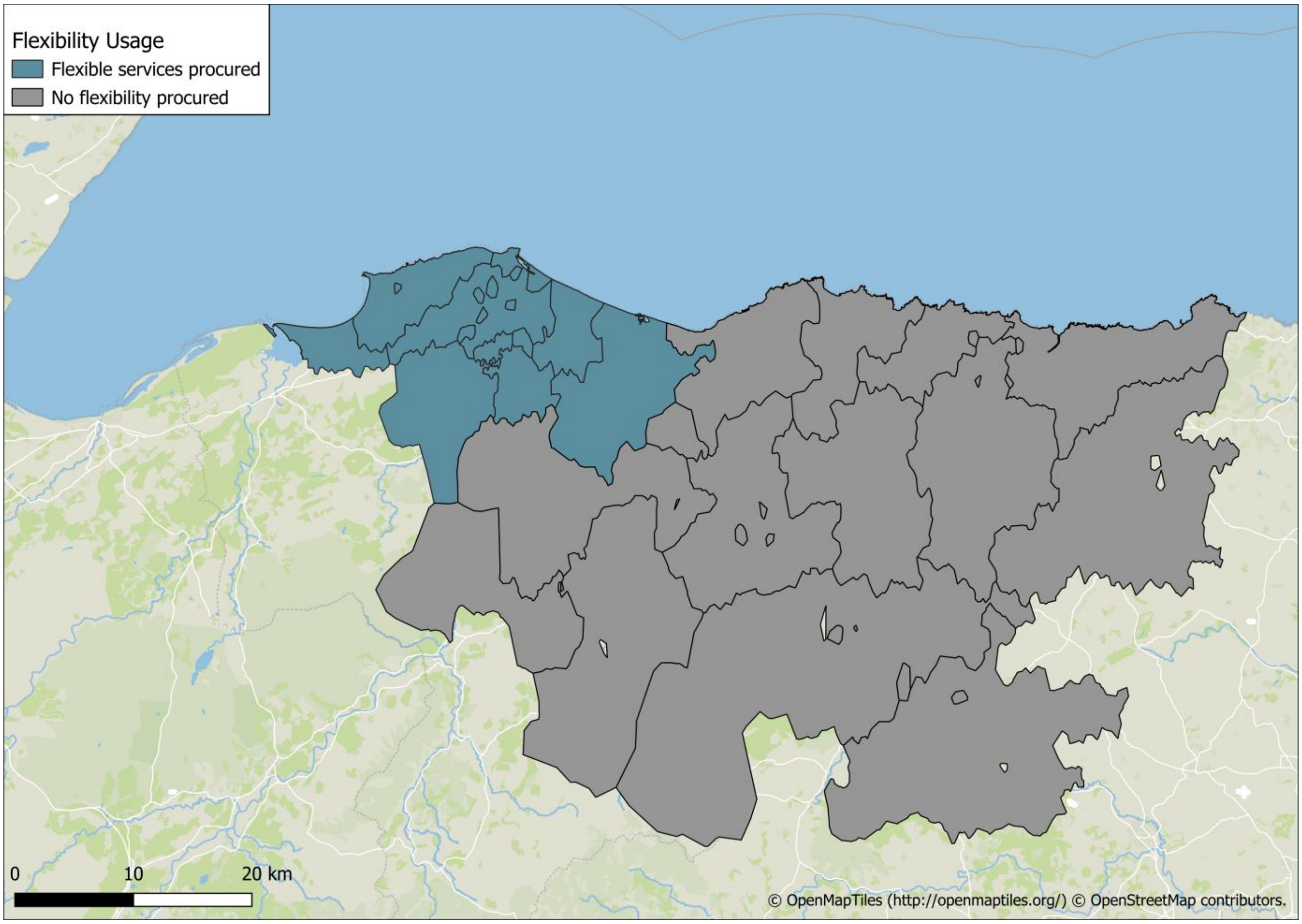


Figure 5 Flexibility procurement areas across Keith 132kV supply area

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Keith 132kV Supply Area Context

The Keith 132kV substation network is made up of 33kV, 11kV, and LV circuits. It is a mix of rural and urban network spanning across the northeast Scotland region. While much of the land is used for agricultural purposes, there is a mix of residential, commercial, and industrial land, which is located throughout the supply area. In total, the Keith 132kV supply area supplies approximately 65,000 customers with the breakdown for each Grid Supply Point shown in **Table 3** below. A further breakdown by primary substation can be found in **Appendix A**.

Substation Name	Site Type	Number of Customers Served	2023/24 Substation Maximum MVA (Season)
Elgin	Grid Supply Point	26,364	45.42 (Winter)
Keith	Grid Supply Point	26,381	89.24 (Winter)
MacDuff	Grid Supply Point	12,509	20.43 (Winter)
TOTAL		65,254	155.09 (Winter)

Table 3 Customer number breakdown and substation peak demand readings (2023)

4.2. Current Network Topology

The **Figure 6** below highlight the existing 33kV network topology within the Keith 132kV supply area. The SSEN Transmission network supplies the distribution network at three Grid Supply Point (GSP) sites. It is then distributed to the 22 Primary Substations via the 33kV distribution network.

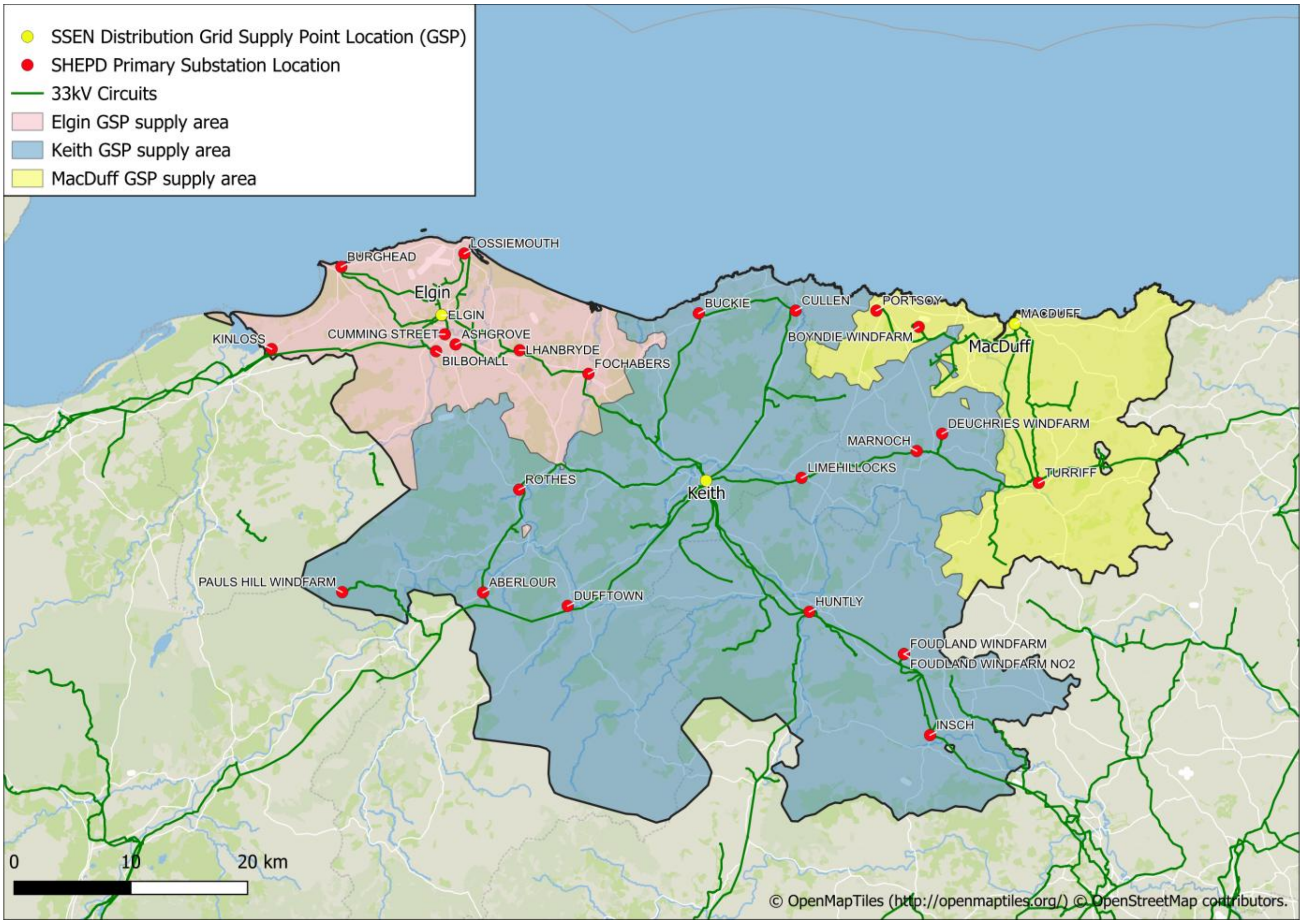


Figure 6 Keith 132/33kV network by GSP supply area- Geographic Information System (GIS) View

4.3. Current Network Schematic

The network schematics in Figures 7-9 (below) depict the existing 33kV distribution network at Elgin, Keith and MacDuff GSPs

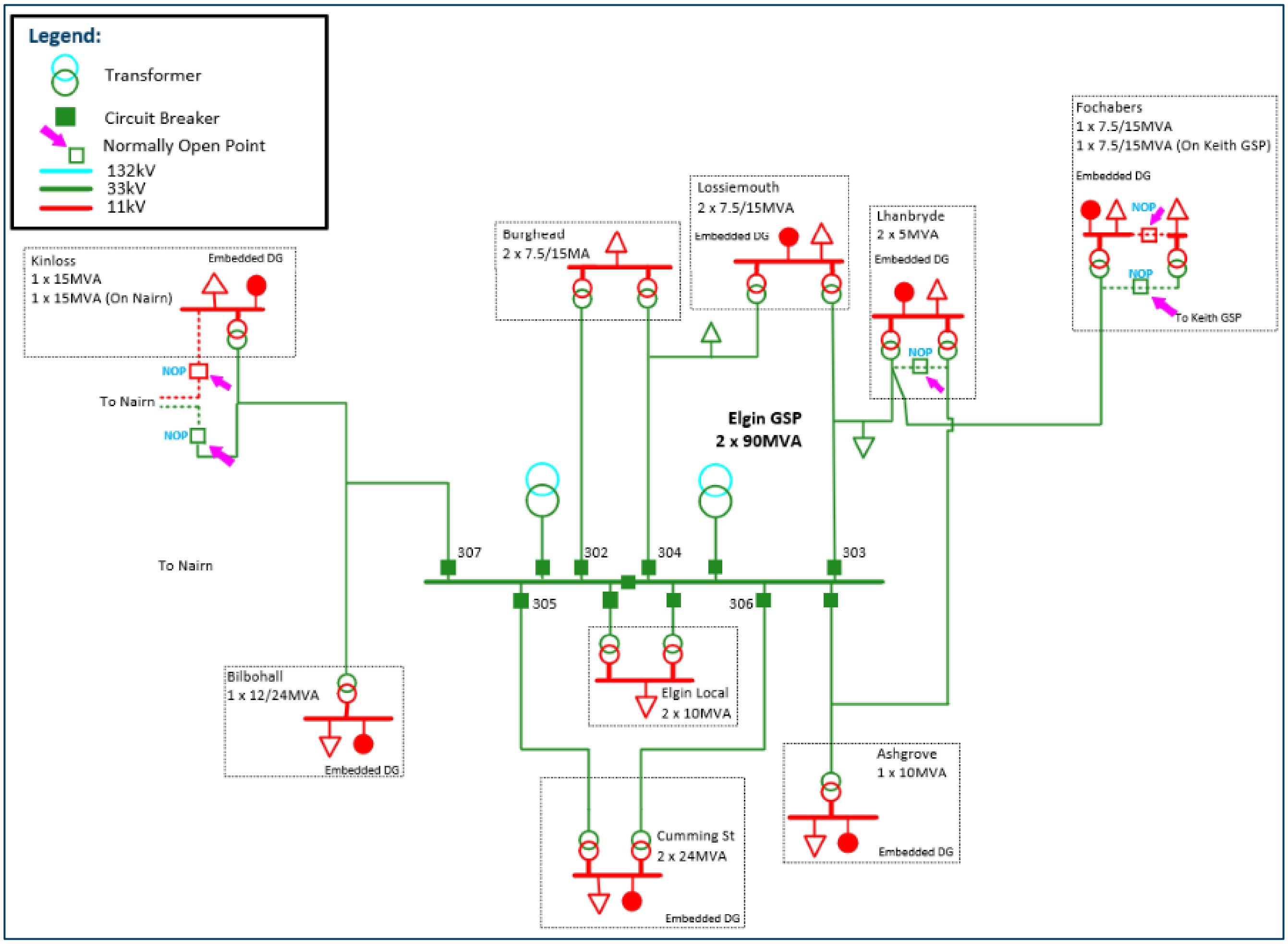


Figure 7 Existing Elgin GSP 33kV network schematic

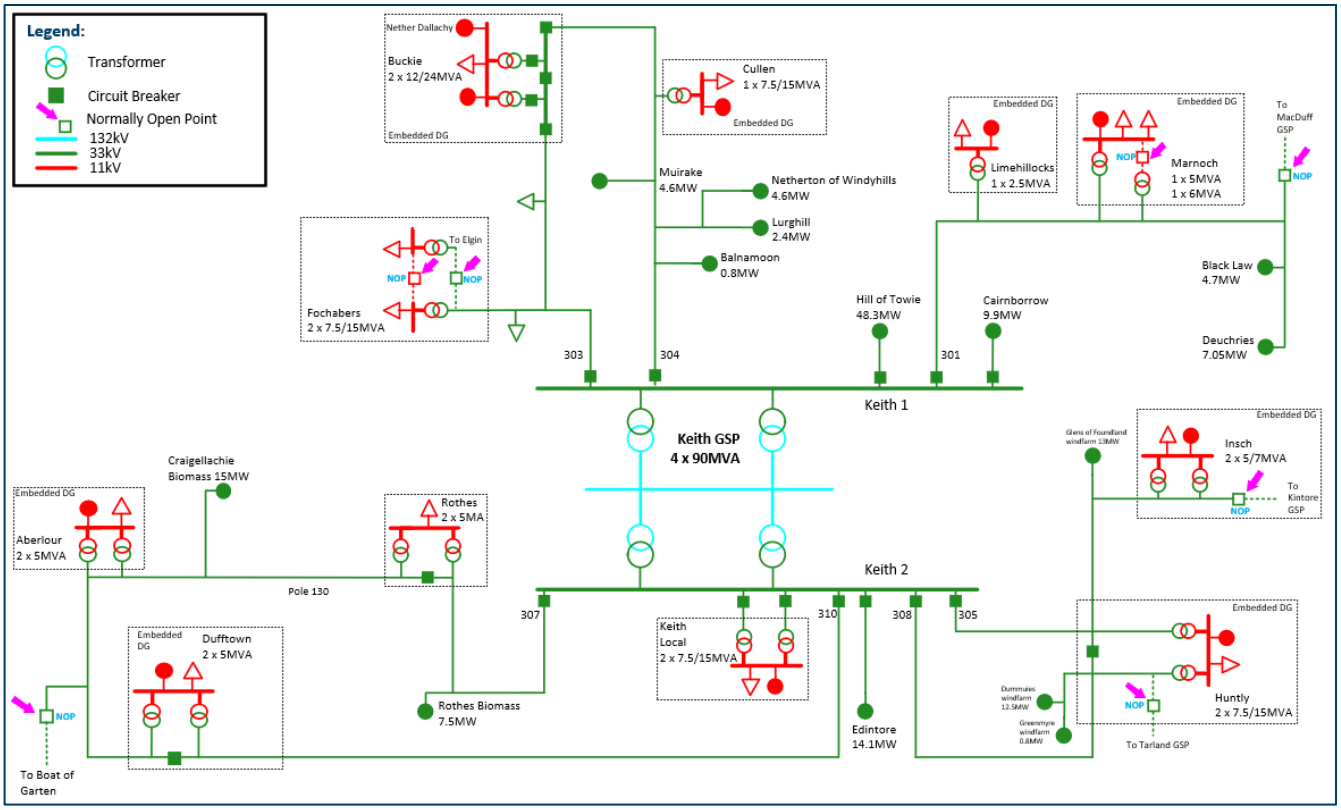


Figure 8 Existing Keith GSP 33kV network schematic

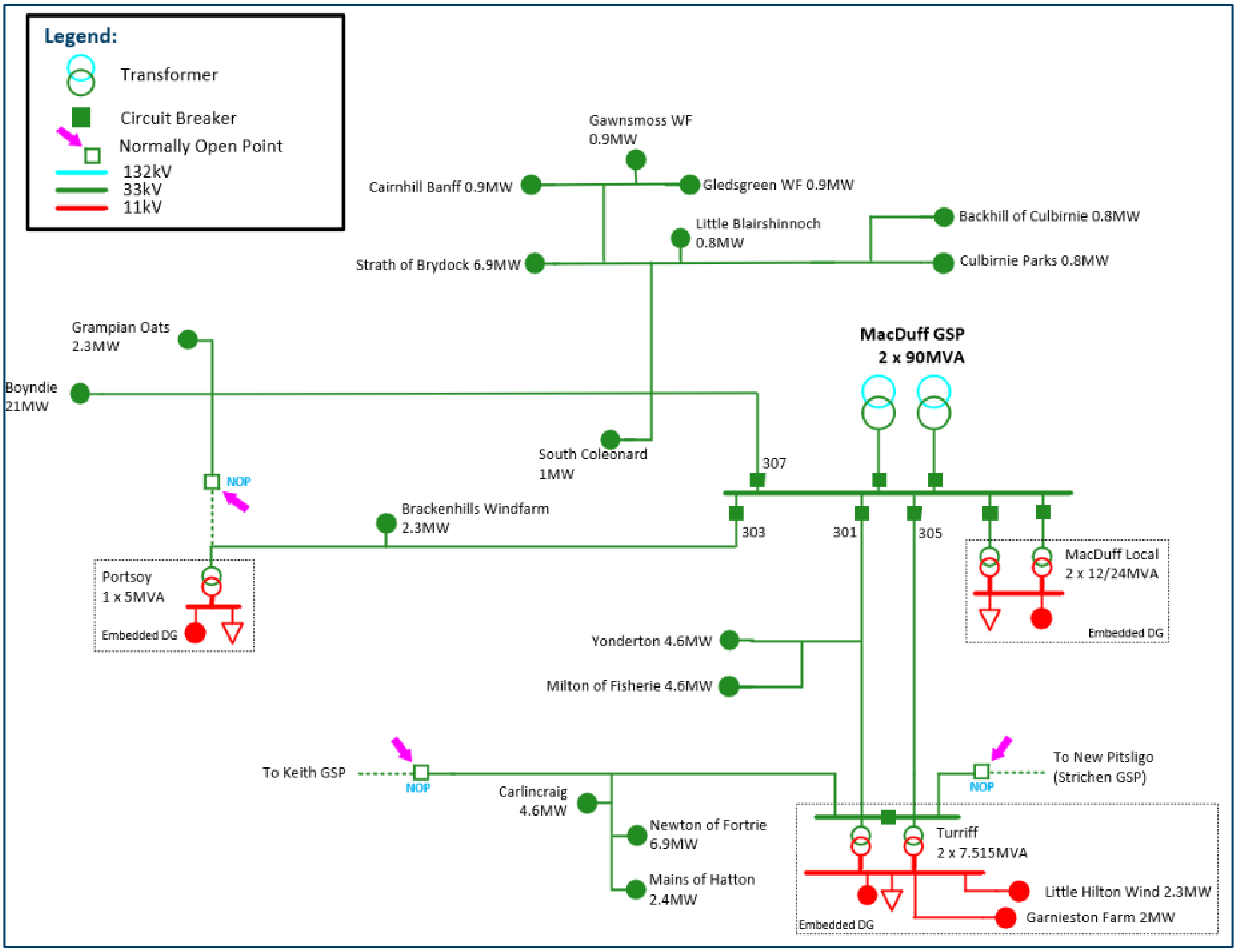


Figure 9 Existing MacDuff GSP 33kV network schematic

5. FUTURE ELECTRICITY LOAD AT KEITH 132KV SUBSTATION

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:

- This SDP and the analysis conducted has been completed ahead of any changes arising from Clean Power 2030.
- These projections relate to the 132kV supply area highlighted in **Figure 6** and are not directly aligned to a particular local authority.
- Where MW values are presented in this section, they represent **total installed capacity.** When conducting network studies these values are appropriately diversified to reflect the likely peak demand experienced on the network. Diversifying load values accounts for the fact that not all demand load connected to the network peaks at the same time and so provides a more realistic total expected peak power.
- For projections specific to individual primary substations or local authorities, please refer to our online dashboard.[8]

5.1. Generation and Electricity Storage

DFES Scenario	Generation capacity (MW)				Electricity storage capacity (MW)			
	Baseline	2030	2040	2050	Baseline	2030	2040	2050
Holistic Transition	457MW	776MW	1,270MW	1,520MW	0MW	356MW	423MW	454MW
Electric Engagement		946MW	1,409MW	1,643MW		275MW	320MW	361MW
Hydrogen Evolution		802MW	1,077MW	1,336MW		194MW	223MW	255MW
Counterfactual		792MW	956MW	1,116MW		139MW	151MW	170MW

Table 4 Generation and Electricity Storage projections in Keith 132kV supply area. Source: SSEN DFES 2024

8 SSEN DFES Technology Projections - Microsoft Power BI

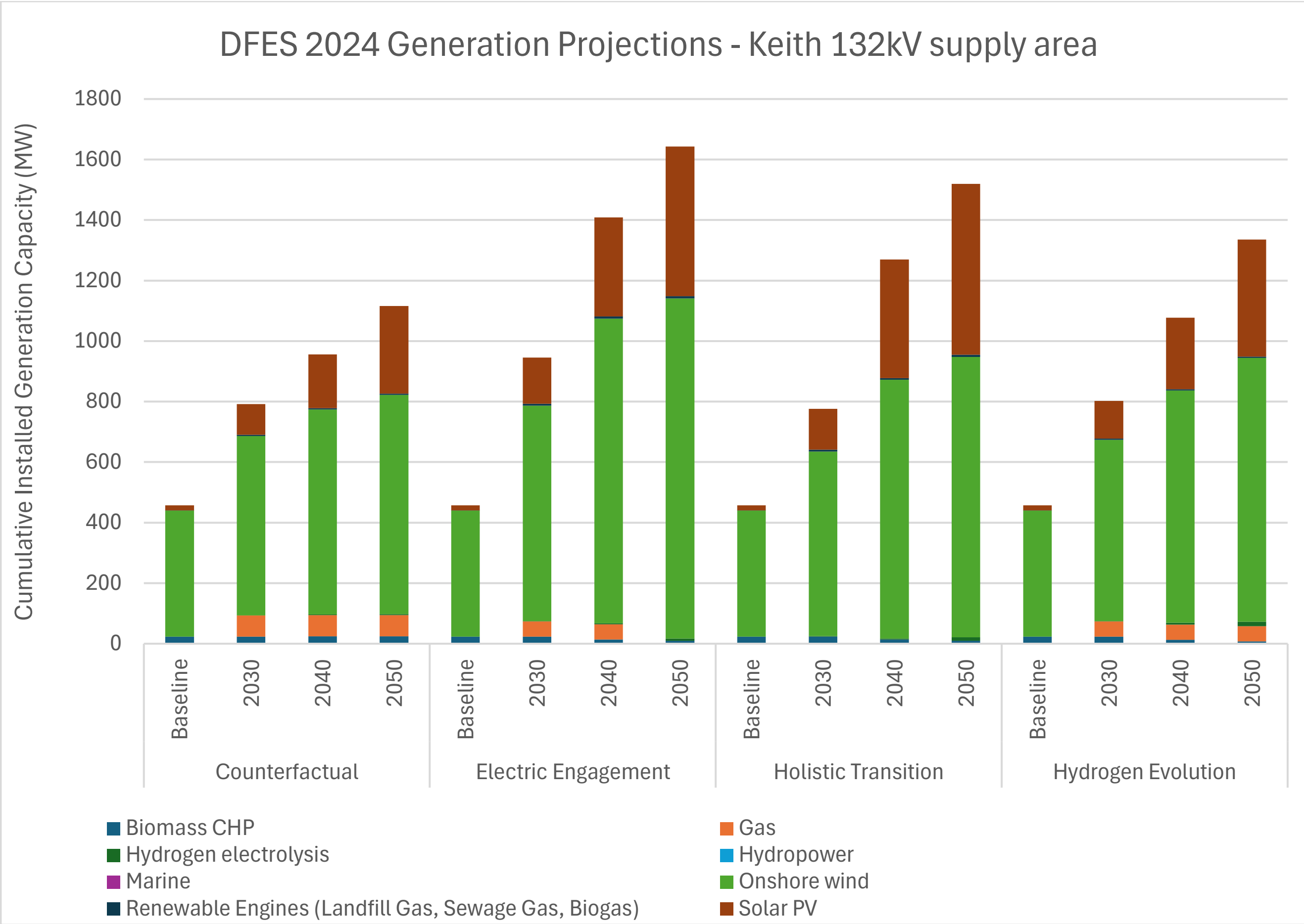


Figure 10 Projected Cumulative Distributed Generation Capacity Keith 132kV supply area (MW). Source: SSEN DFES 2024

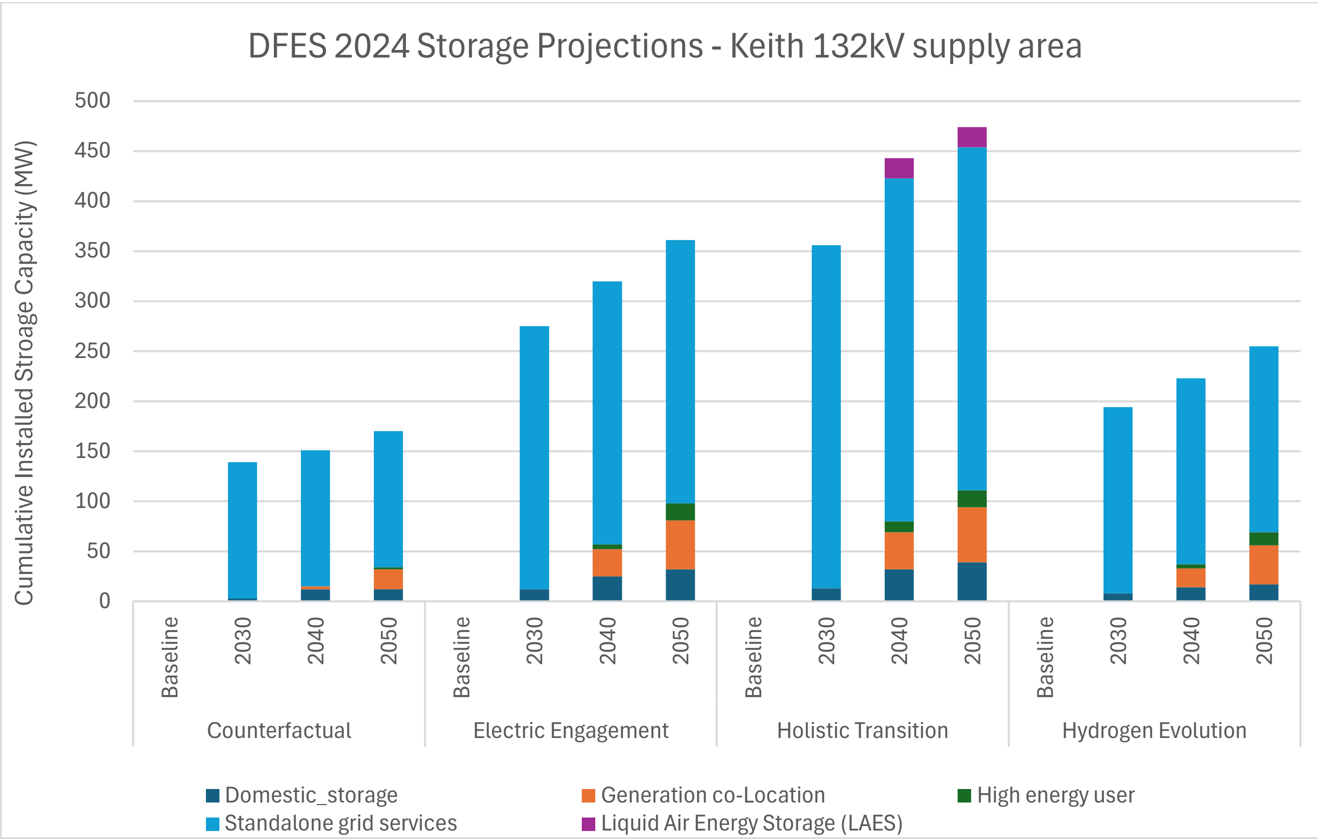


Figure 11 Projected Cumulative Storage Capacity Keith 132kV supply area (MW). Source: SSEN DFES 2024

5.2. Electric Vehicle Charging

DFES Scenario	Domestic EV chargers – off-street (number of units)				Non-domestic EV chargers & domestic on-street EV chargers (MW)			
	Baseline	**2030**	**2040**	**2050**	**Baseline**	**2030**	**2040**	**2050**
Holistic Transition	1,934	17,648	67,740	72,590	0MW	2MW	37MW	44MW
Electric Engagement		26,673	76,850	67,868		6MW	38MW	42MW
Hydrogen Evolution		17,724	68,148	80,324		3MW	44MW	50MW
Counterfactual		14,910	60,330	80,255		2MW	26MW	49MW

Table 5 Electric vehicle charging projections in Keith 132kV supply area. Source: SSEN DFES 2024

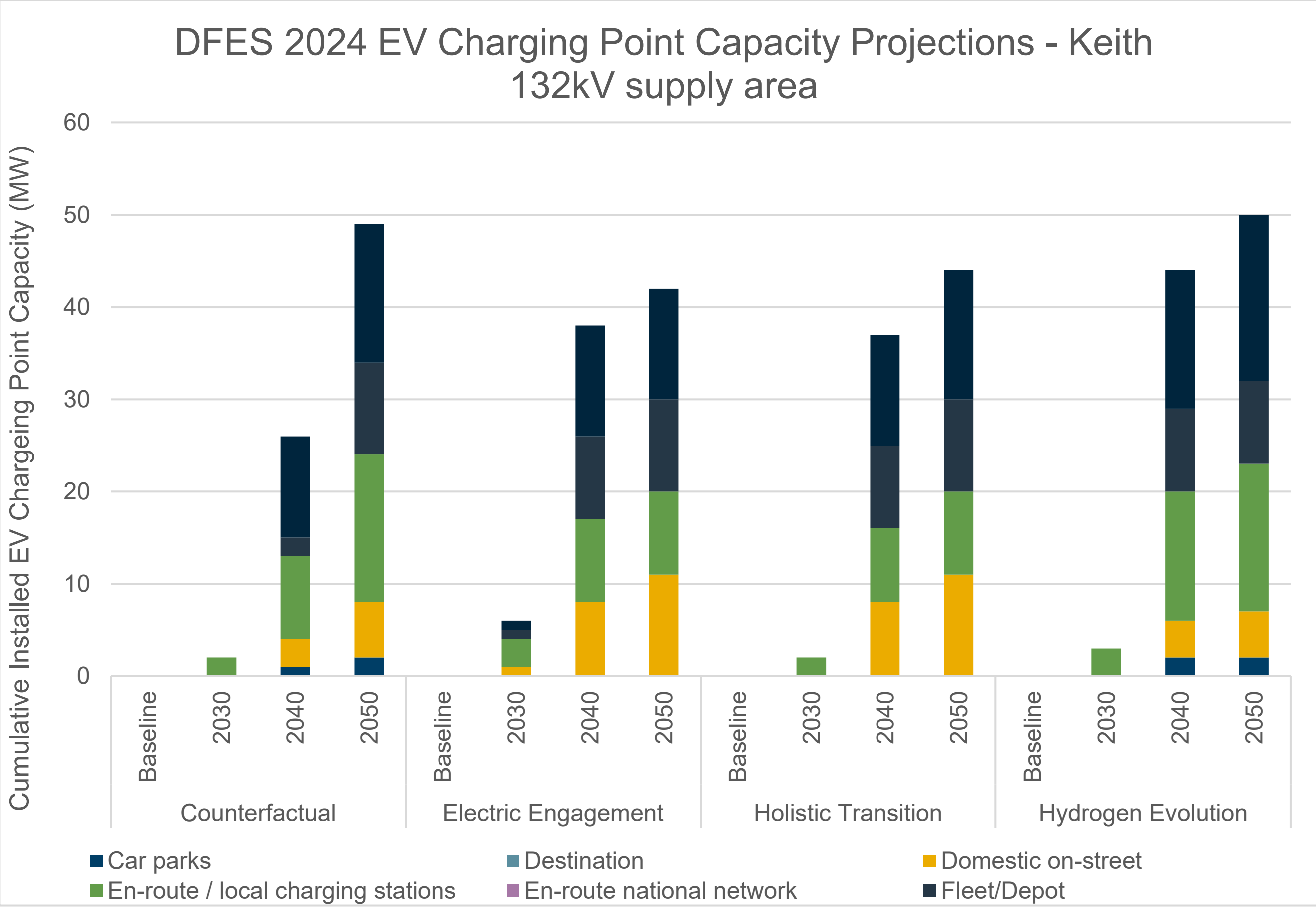


Figure 12 Projected Cumulative EV Charging Point Capacity Projections Keith 132kV supply area (MW). Source: SSEN DFES 2024

5.3. Electrification of heat

DFES Scenario	Non-domestic heat pumps and resistive electric heating (m² of floorspace)				Domestic heat pumps (number of units)			
	Baseline	2030	2040	2050	Baseline	2030	2040	2050
Holistic Transition	0m²	782384m²	2021162m²	2021162m²	3,960	18,949	54,734	63,651
Electric Engagement		673484m²	2048870m²	2048870m²		18,097	53,782	63,105
Hydrogen Evolution		673484m²	2048870m²	2048870m²		13,414	43,248	57,149
Counterfactual		360512m²	1507660m²	1866884m²		9,387	23,602	45,800

Table 6 Electrification of heat projections in Keith 132kV supply area. Source: SSEN DFES 2024

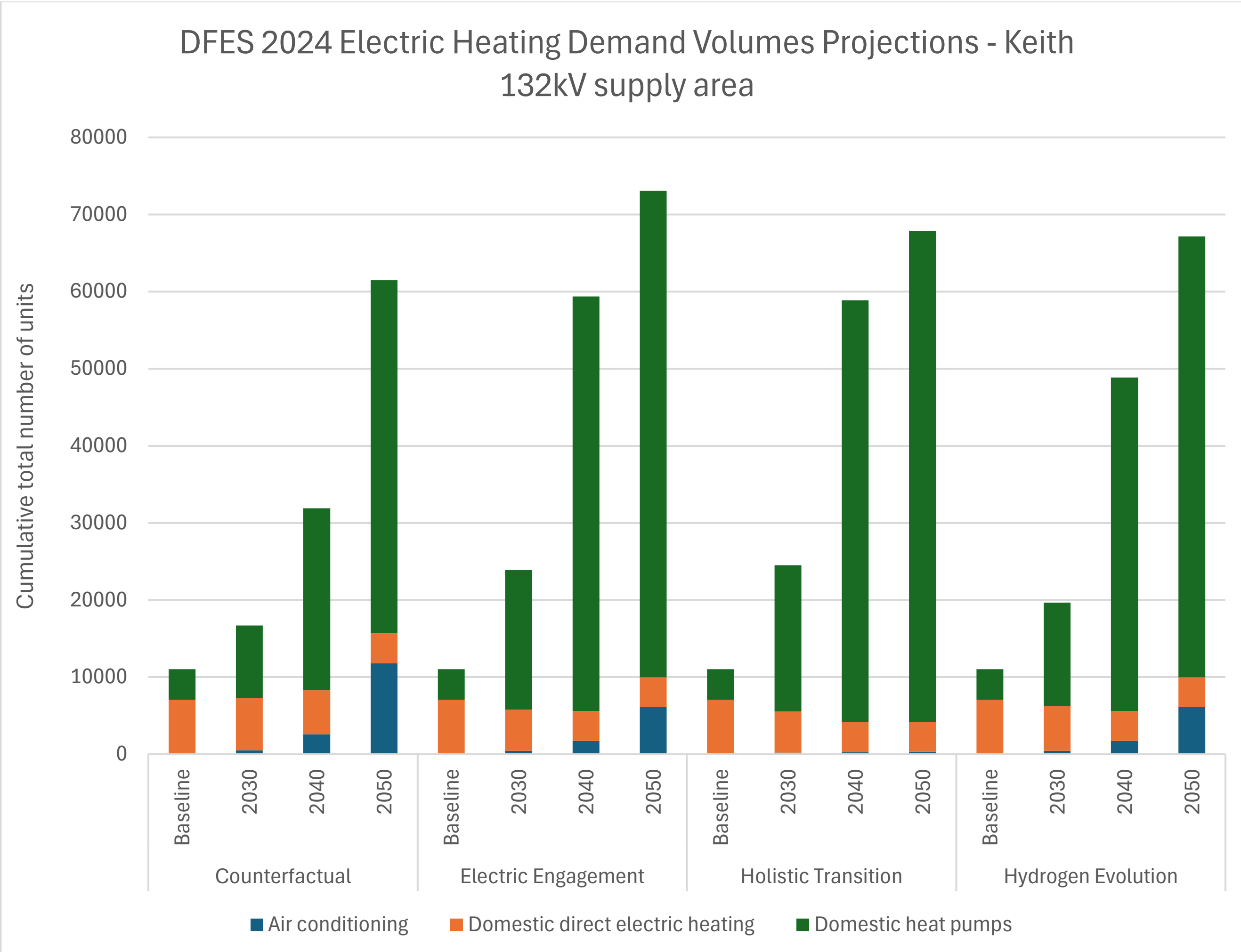


Figure 13 Projected Electric Heating Demand Volumes Projections Keith 132kV supply area (units). Source: SSEN DFES 2024

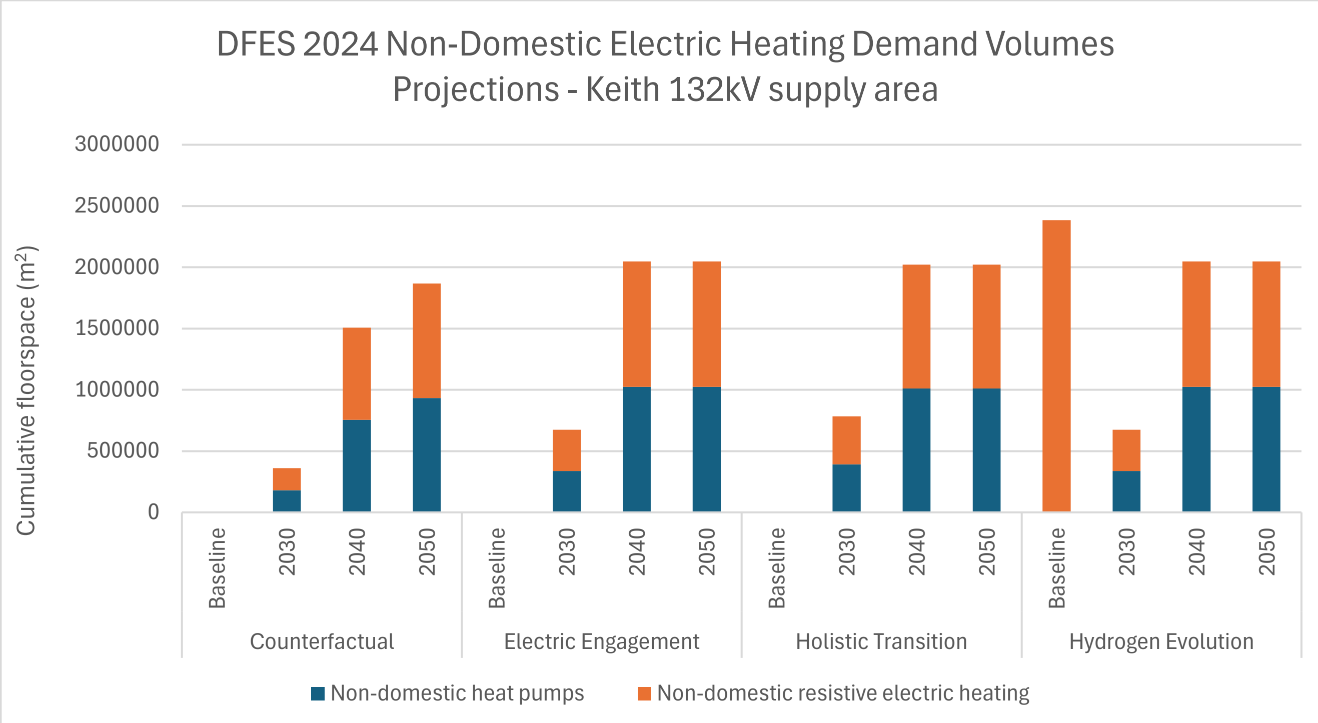


Figure 14 Projected Non-Domestic Electric Heating Demand Volumes Projections Keith 132kV supply area (units). Source: SSEN DFES 2024

5.4. New building developments

DFES Scenario	New domestic development (number of homes)			New non-domestic development (m^2)		
	2030	**2040**	**2050**	**2030**	**2040**	**2050**
Holistic Transition	3,380	9,892	11,531	635,938m^2	1,293,644m^2	1,293,644m^2
Electric Engagement	3,223	9,465	11,439	552,109m^2	1,293,644m^2	1,293,644m^2
Hydrogen Evolution	3,335	8,718	10,703	552,109m^2	1,293,644m^2	1,293,644m^2
Counterfactual	2,856	8,095	10,570	371,833m^2	1,075,386m^2	1,293,644m^2

Table 7 New building development projections in Keith 132kV supply area. Source: SSEN DFES 2024

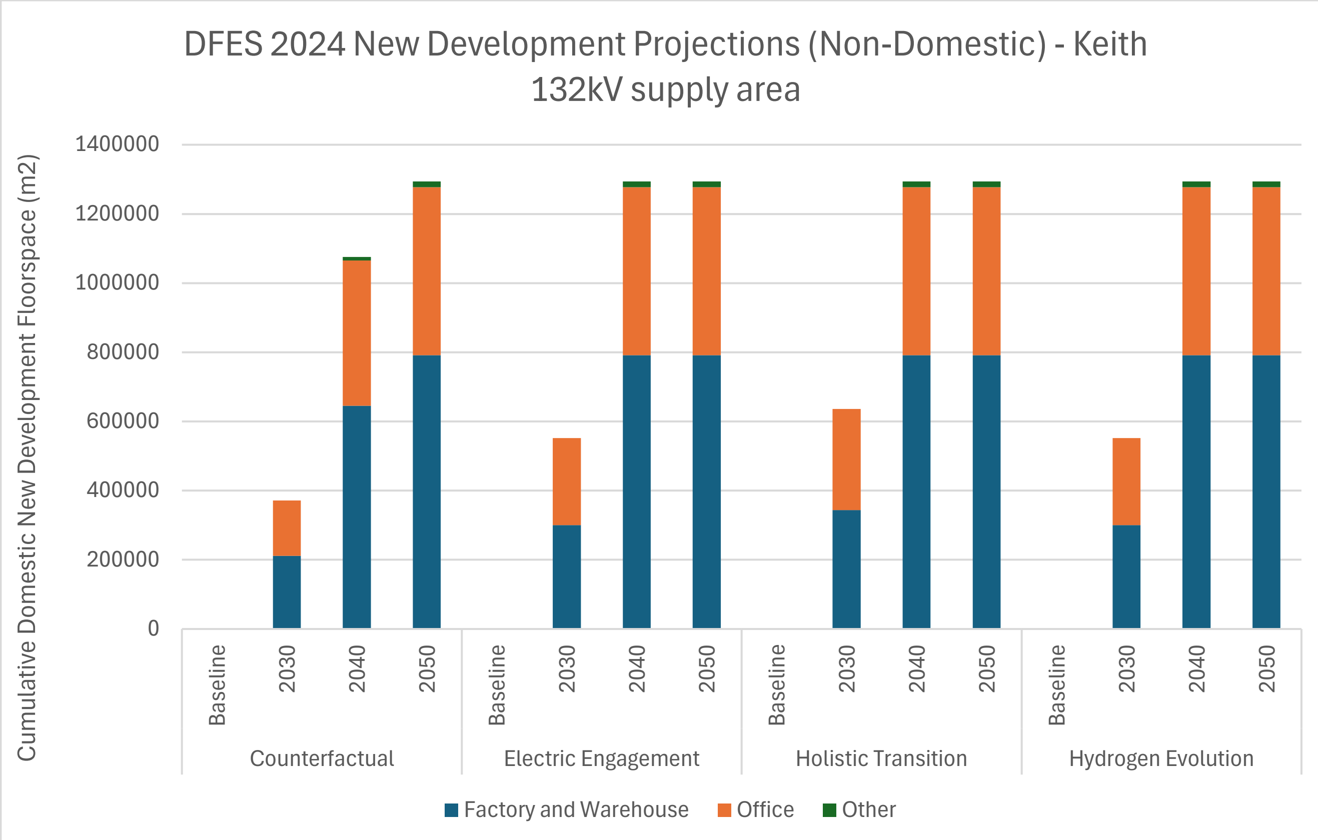


Figure 15 Projected Cumulative Non-Domestic New Development floorspace Keith 132kV supply area (m^2). Source: SSEN DFES 2024

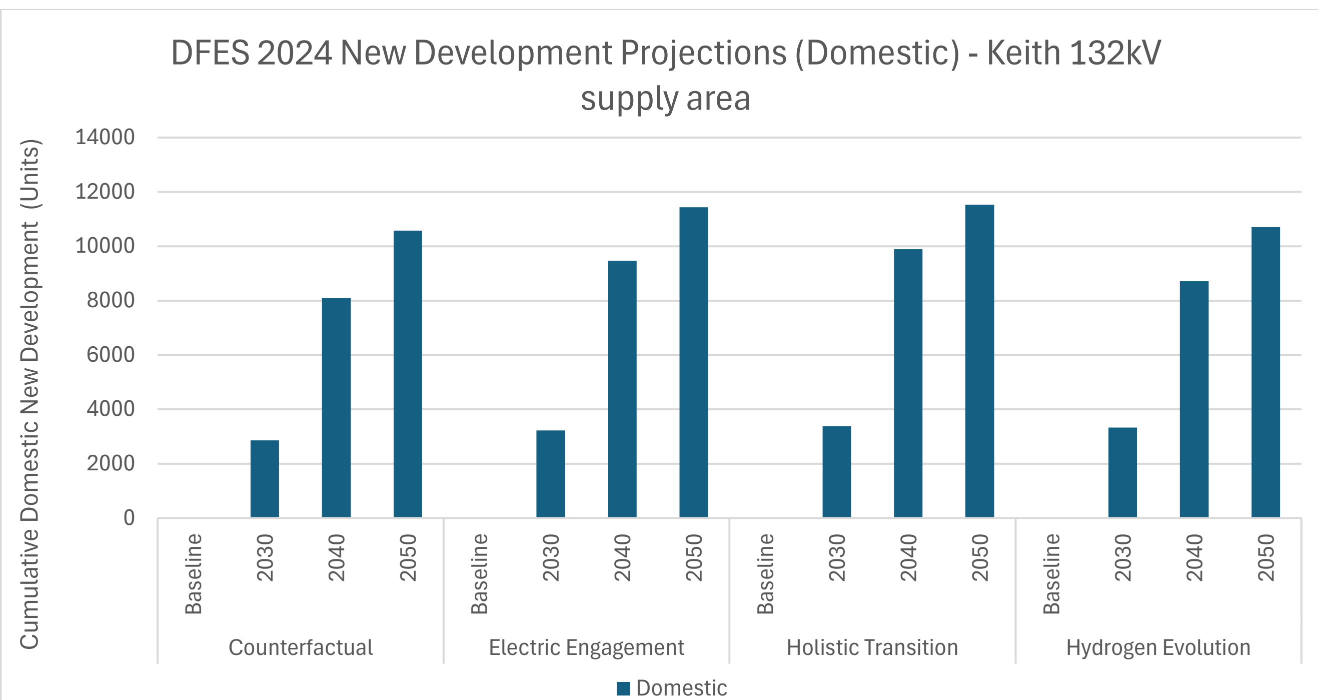


Figure 16 Projected Cumulative Domestic New Developments Keith 132kV supply area (Units). Source: SSEN DFES 2024

5.5. Commercial and industrial electrification

The Keith 132kV supply area has a varied commercial and industrial base, with key sectors including whisky production, agriculture, forestry, and tourism. The region is internationally recognised for its whisky industry, hosting numerous distilleries along the Speyside route. Defence also plays a significant role in the local economy, with RAF Lossiemouth being one of the UK’s main air force bases.

The area also supports significant food and textile manufacturing, with companies such as Walkers Shortbread, Baxters Food Group, and Johnstons of Elgin. Buckie Harbour plays a strategic role in the renewable energy sector, providing operations and maintenance support to offshore wind developments in the Moray Firth.
We have identified distilleries and ports as areas of potential significant future industrial demand growth for the region. Below we summarise these findings and the impacts on our analysis work.

5.5.1. Distilleries

The current and future energy demand of the distilling industry within the Keith 132kV supply area is significant. Speyside in Moray is home to the greatest concentration of whisky distilleries in Scotland with over 55 in the region. Most of these distilleries rely on fossil fuels for heat production. Decarbonisation of distilleries could significantly increase demand on local distribution networks and in the case of the Keith 132kV supply area, the electrification of distilleries is likely to significantly impact the overall demand on distribution networks. The Scotch Whisky Association (SWA) has set an ambitious target to achieve net zero emissions across the Scotch whisky industry by 2040, aligning with broader climate goals and driving sustainability throughout its supply chain.

SSEN have been approached by a number of whisky production companies in the area to request upgraded 33kV supplies to electrify their distilling processes. The primary driver for this transition is to meet evolving regulatory requirements around carbon intensity. Target completion timelines for these upgrades span from the mid-2020s into the 2030s.

Our preliminary findings suggest that the additional load from whisky decarbonisation could rise by up to 90MVA, significantly impacting the supply area.

SSEN are actively engaging with distilleries in the Speyside region to understand their future demand projections. This included a workshop in August 2025, in collaboration with the Scotch Whisky Association, setting out SSEN's strategic planning process and upcoming SDPs to feed into. We are considering information provided by distilleries in our network planning processes and will continue to engage with distilleries to understand their future capacity requirements.

The Scotch Whisky Association (SWA) member distilleries within the Keith 132kV supply area are shown in **Figure 17** below:

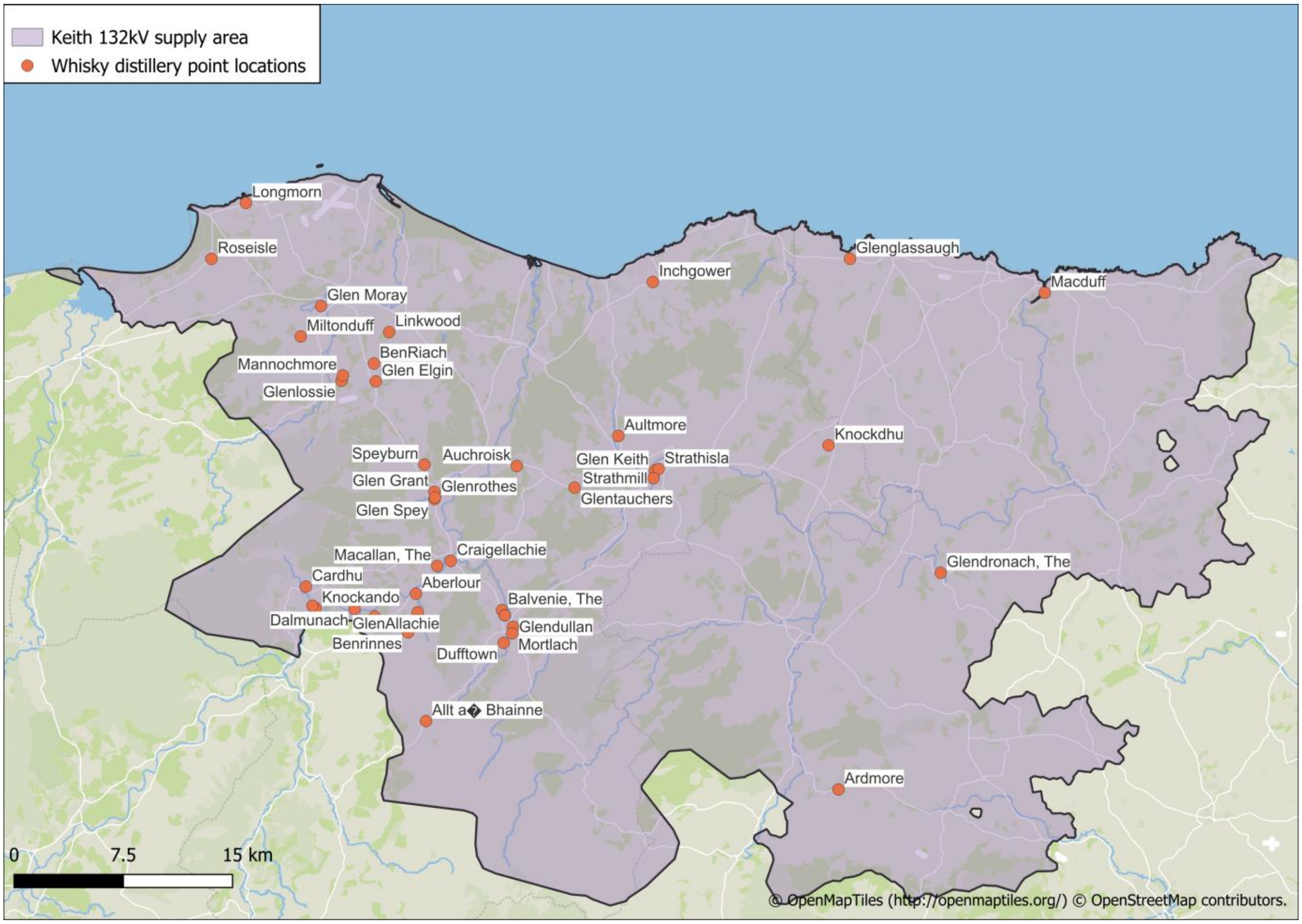


Figure 17 Keith 132kV substation supply area SWA whisky distillery location map

5.5.2. Ports

Ferries are a primary mode of maritime transport across the Scottish Highlands and Islands. As such, the associated use of shore power to charge these vessels could equate to a significant load increase 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. There are 15 ports or harbours operating within the Keith 132kV supply area. Buckie port is the most significant of the group, providing operations and maintenance to offshore wind farms in the Moray Firth. The ports and harbour location map is shown in **Figure 18** below.

The 'Seachange' Project is a joint initiative with European Marine Energy Centre (EMEC), the Power Networks Demonstration Centre (PNDC), Ricardo and SSEN Distribution which will develop a replicable port level investment model to explore net-zero transition scenarios. This model will not only be used to help identify key network investment requirements, but also to inform and enable ports and their users to plot their most viable decarbonisation pathways enabling their net-zero future. The umbrella of 'Ports' encompasses several other offshore and seafaring industries such as cruise liners, the fishing industry and the offshore wind, oil and gas industries.

We are developing a methodology in alignment with the 'Seachange project' to forecast the electrical demand for ports within the Keith 132kV supply area, which will form part of the system needs in future analysis.

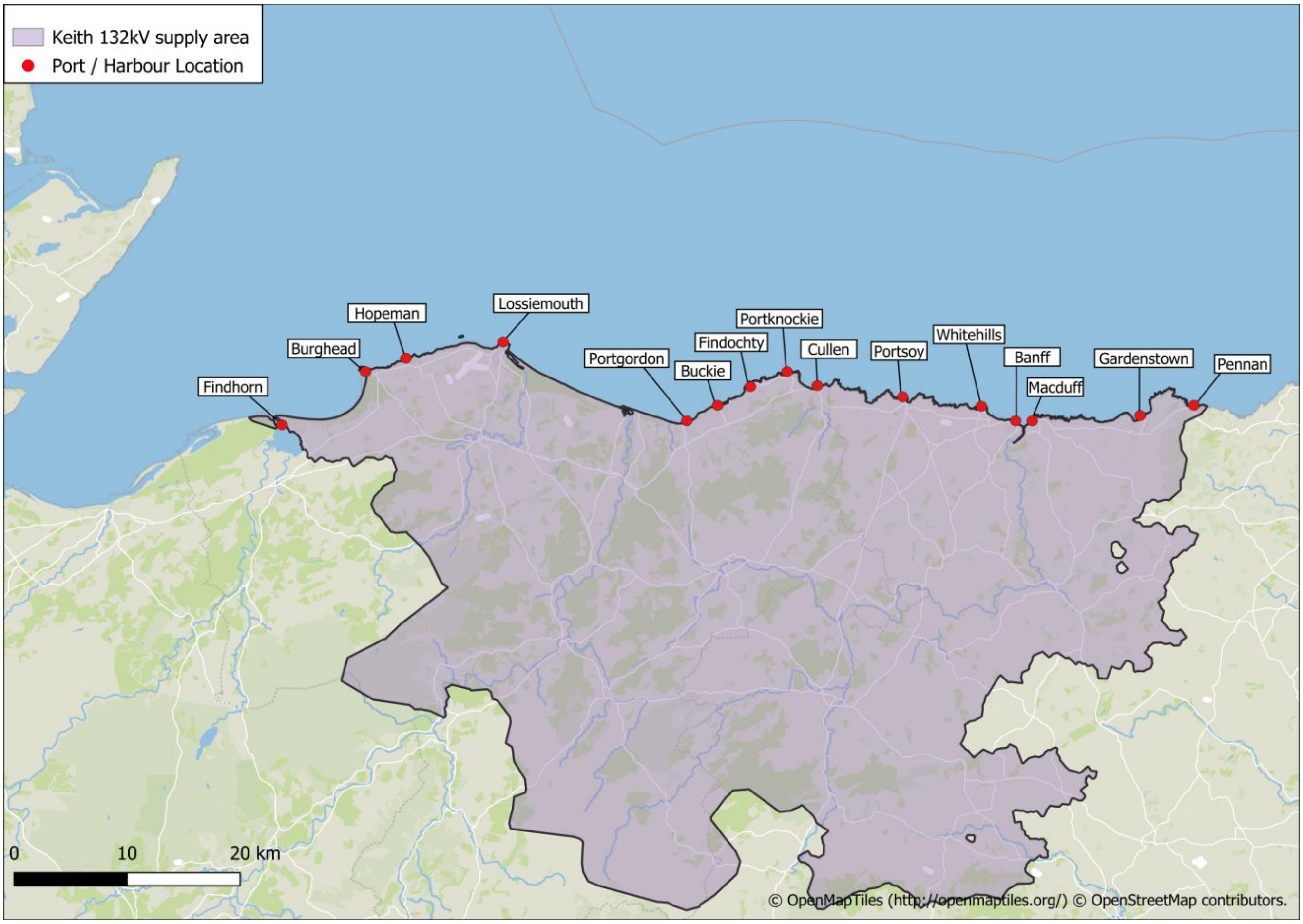


Figure 18 Keith 132kV supply area ports and harbours location map

5.5.1. Agriculture

Decarbonisation of the agricultural sector is an important consideration in this geographic area. SSEN leads the innovation project 'Future Agricultural Resilience Mapping' (FARM)[9] which aims to understand the future energy requirements and means of decarbonising the domestic farming industry. This sector is currently still largely dependent on fossil fuels, and the project will support its investigations into the impact of food production on the electricity distribution system, to work out where reinforcement is needed. A data-driven tool to inform network planning will be devised and through this work, FARM will address the gap between the energy demands for food production and future network planning.

9 FARM | SSEN Innovation

6. WORKS IN PROGRESS

Network interventions can be caused by a variety of different drivers. Examples of common drivers are load-related growth, specific customer connections, and asset health. Across the Keith 132kV supply area, these drivers have already triggered network interventions that have progressed to detailed design and delivery. For works to be delivered within the RIIO-ED2 timeframe, these works are assumed to be complete, with any resulting increase in capacity considered to be released.

This report highlights ongoing capital works to meet the demand and generation requirements for the northeast Scotland area supplied via the Keith 132kV substation. A summary of existing works is shown in **Table 8** below and further information on the schemes which have recently been through our DNOA process can be found in **Appendix E**. The network considered for long-term modelling is shown below in **Figures 19-24**.

ID (Schematic Reference)	Substation	Description	Driver	Forecast completion	Fully resolves future strategic needs to 2050?
		Elgin GSP			
1	**Elgin GSP and Ashgrove PSS.**	Works include: • Upgrade existing Ashgrove PSS transformer from 10MVA to 20/40MVA. • Addition of a second 20/40MVA transformer at Ashgrove PSS. • Upgrade of 33kV switchboard at Ashgrove PSS. • Upgrade and extend 33kV switchboard at Elgin GSP. • Addition of 2x 33kV dedicated UG cable circuits from Elgin GSP to Ashgrove Primary substation, including pilot wire for comms.	DNOA process	2028	
2	**Elgin GSP and Bilbohall PSS.**	Works include: • Addition of a second 12/24MVA transformer at Bilbohall PSS. • Addition of a 33kV UG cable circuit from Bilbohall and Cumming Street PSS. • Existing fault thrower replaced with 2 x CBs.	DNOA process	2028	
3	**Elgin GSP**	Reinforce multiple sections on the Elgin 304 circuit, which includes: • Replacing OHL up to P17 with 630mm2 Al UG cable. • Replacing OHL from P17-37 with 150mm2 HDCu running at 75deg C.	DNOA process	2029	
		Keith GSP			
4	**Insch PSS**	Works include: • 33kV network reconfiguration to transfer Insch PSS and associated 33kV network to the new Rothienorman GSP (including	DNOA process	2027	

		Dummuies, Greenmyre and glens of Foundland windfarms). • Upgrade existing transformers from 5/7MVA to 7.5/15MVA. • Upgrade of 33kV switchboard.			
5	**Marnoch PSS**	Works include: • Upgrade existing transformer T2 from 5MVA to 2050 DFES demand (to be confirmed) and replace fault thrower with a circuit breaker. • Replace circuit breaker at T1.	Asset Replacement	2030	
6	**Keith GSP**	Reinforce multiple sections on the Keith 304 circuit, which includes: • Replacing UG Cable up to P1 with 500mm2 Al. • Replacing OHL from P1-95 with 150mm2 HDCu running at 75deg C.	Customer Connection	2029	
7	**Keith GSP & Buckie PSS (Circuit 303 and 304)**	The relocation/installation of a new PSS to replace the existing Buckie PSS consisting of: • 2 x 20/40 MVA transformers. • Building for 11kV and 33kV switchgear. • Installation of 2 x 2.5MVar shunt reactors and PSS batteries. Circuit reconfiguration and reinforcement works: • New dedicated 33kV feed using 100mm2 Al UG Cable to Buckie PSS. • Replacement of existing 303 OHL circuit with 100mm2 Al UG Cable. • Dismantle existing 33kV OHL and cable section from Keith GSP 3L5 circuit breaker – P242 on circuit 303. • Rebuild 33kV OHL circuit from P242 – Buckie with 150mm2 HDCU conductor (12km). Including 33kV cable sections to be overlaid with 630mm2 CU cable. • Dismantle and abandon OHL up to P242 on the 303 circuit. • Replacing OHL upstream of P242 on the 303 circuit with 150mm2 HDCu running at 75deg C. • Replacing OHL upstream of P95 on the 304 circuit with 150mm2 HDCu running at 75deg C.	DNOA process	2029	
8	**Keith 2 GSP 33kV circuits**	Works include: • Enhanced customer connection to upgrade 8MVAr STATCOM to 12MVAr, required to address voltage issues.	DNOA process	2027	
9	**Dufftown Primary Substation**	Works include: • Upgrade existing transformer from 5MVA to 7.5/15MVA.	DNOA process	2030	

Table 8 Works already triggered through customer connections and the DNOA process.

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

Alongside these asset solutions being deployed, flexibility solutions are also being used to release additional capacity to manage distribution network constraints through the delivery period of the planned reinforcement works in the Keith 132kV supply area.

6.1. Network Schematic following completion of above works

The network considered for long-term modelling is shown below in Error! Reference source not found.**20**.

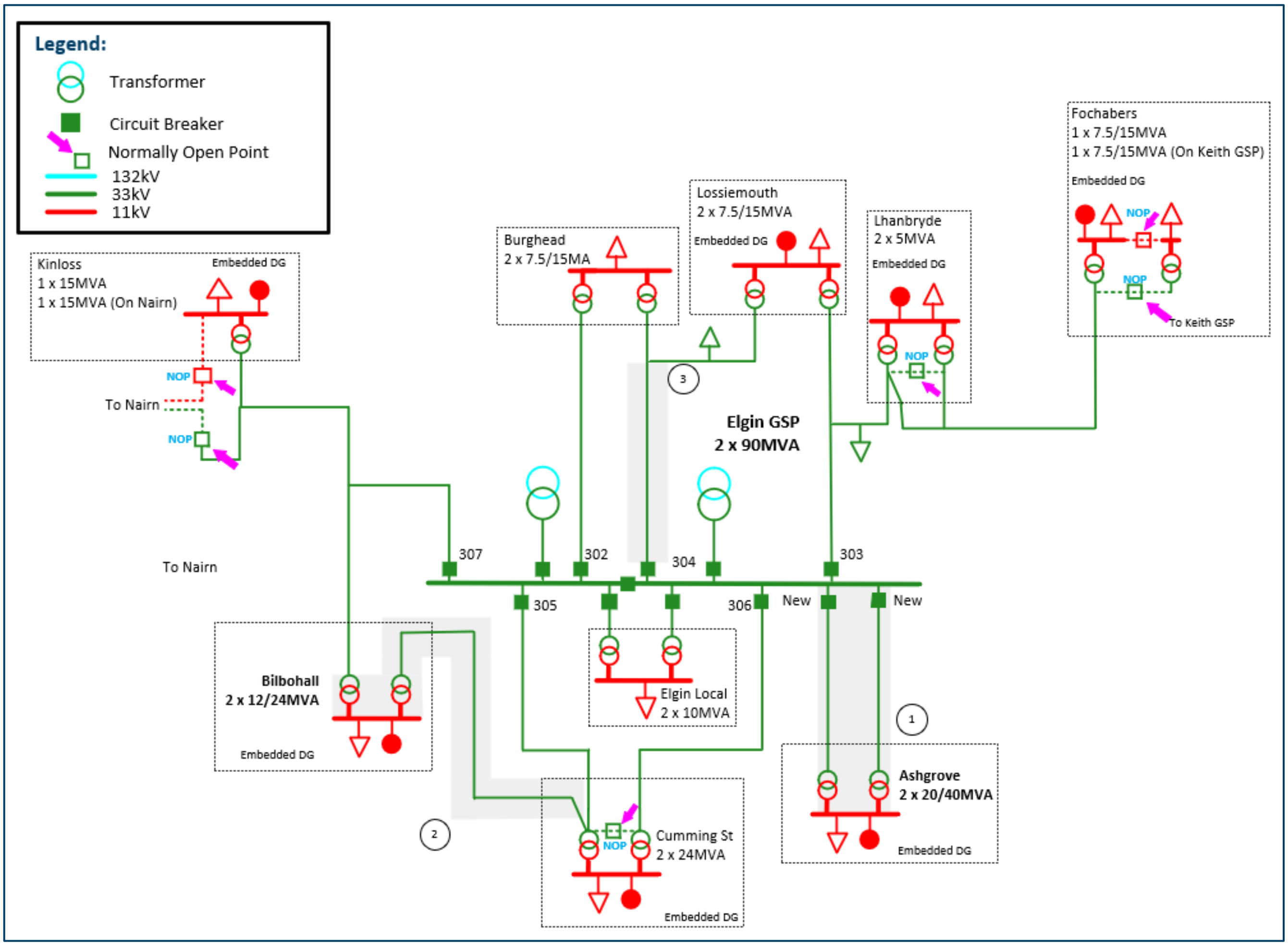


Figure 19 Future Network Development around Elgin GSP

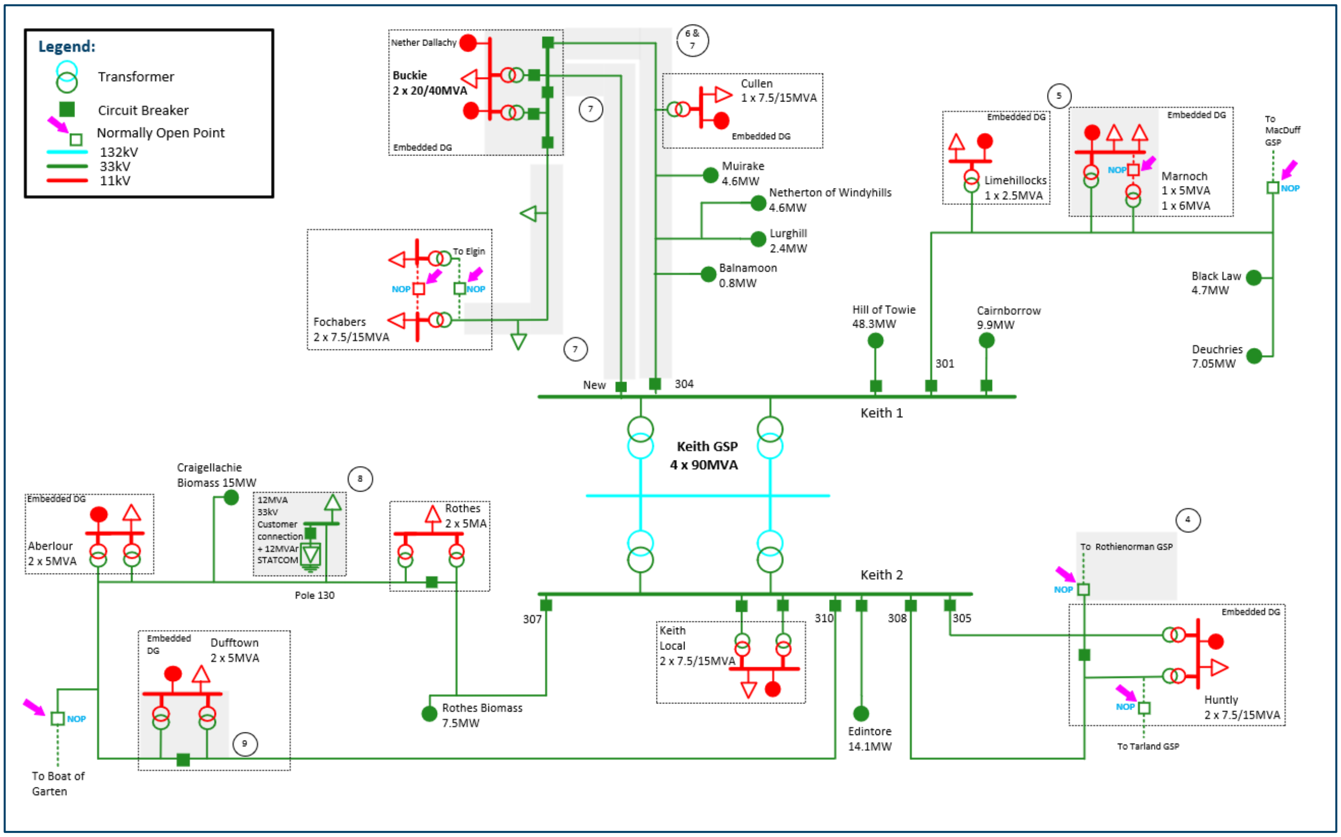


Figure 20 Future Network Development around Keith GSP

7. SPATIAL PLANS OF FUTURE NEEDS

7.1. Extra High Voltage / High Voltage spatial plans

The EHV/HV spatial plan shown below in **Figure 21** shows the projected headroom or capacity shortfall due to demand increases at primary substations across the Keith 132kV supply 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 B** and **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 was 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.

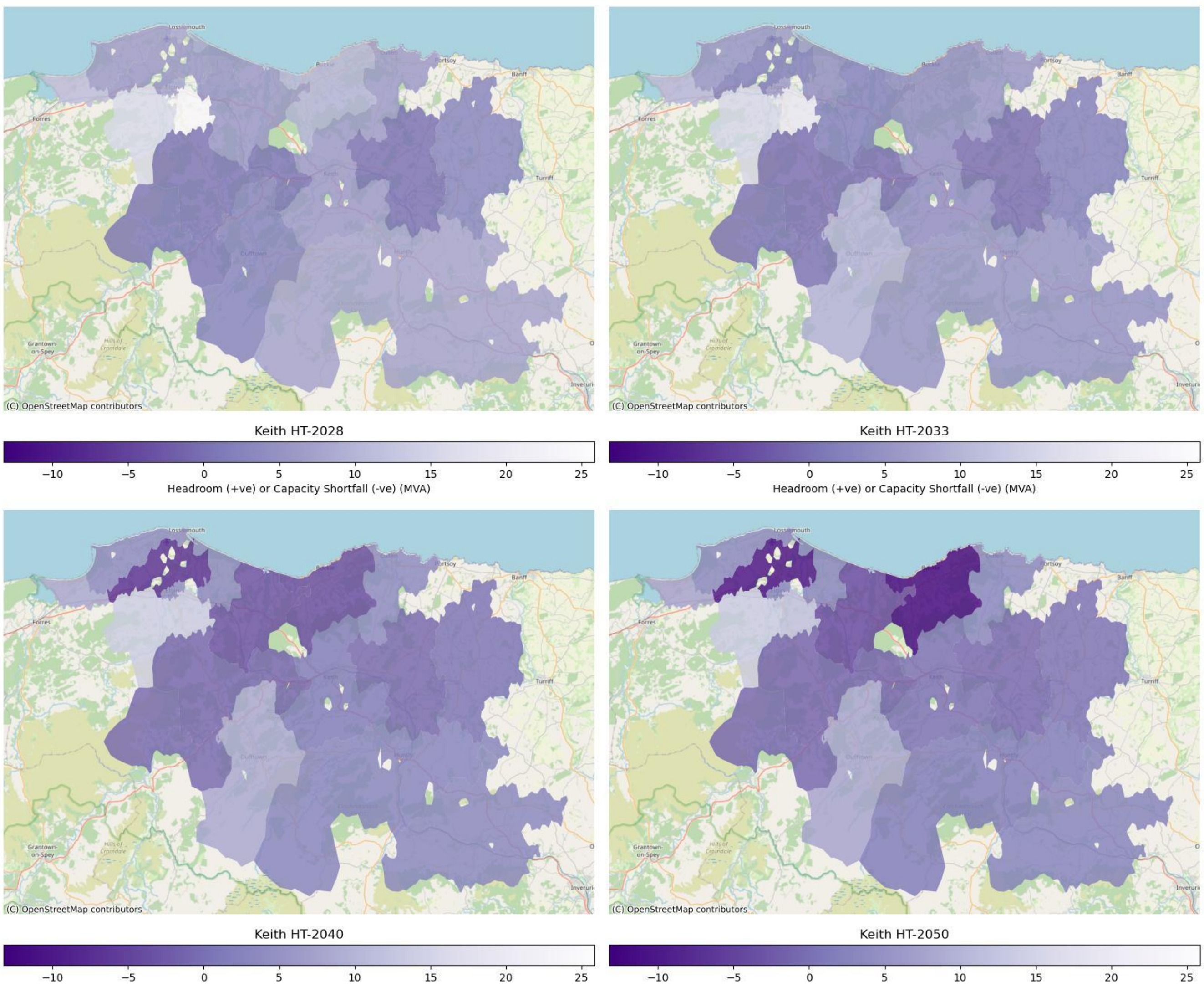


Figure 21 Keith 132kV supply area EHV network spatial plans for HT 2028, 2033, 2040, and 2050

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 22** and **Appendix C**. 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).

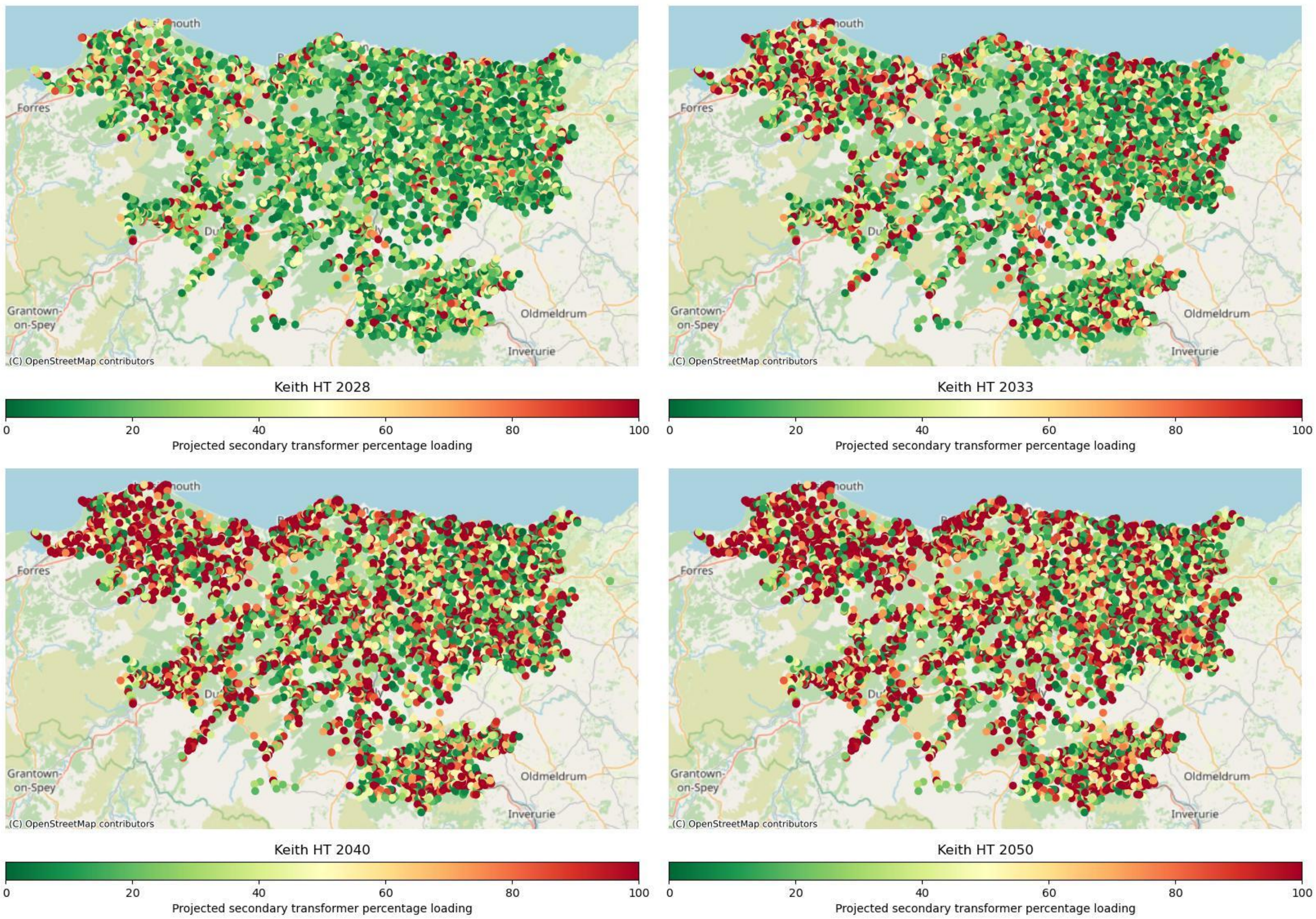


Figure 22 Keith 132kV supply area HV/LV network spatial plans for HT 2028, 2033, 2040, and 2050

8. OPTIONS TO RESOLVE SPECIFIC SYSTEM NEEDS

The relevant spatial plans provide offer a strategic view of future system needs. We have reviewed these through power system analysis studies to understand the specific requirements of our EHV networks up to 2050. This analysis has been based on the insights developed from the 2024 DFES alongside other information including known connection applications. Initial needs have been identified using the DFES Holistic Transition background with sensitivity analysis undertaken against the other three DFES backgrounds.

The options consider scenarios for both summer and winter to ensure the varying demand and support from local generation combinations are all accounted for.

In this section we summarise the more specific needs arising from our future spatial plans. We also propose some initial options to resolve the network constraints. 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:

1. 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 recommend that 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.

2. 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.

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

8.1. Overall dependencies, risks, and mitigations

There are a number of overarching risks which could impact the delivery of our strategic plan. Below we outline these risks alongside proposed mitigating actions. We will work with stakeholders to develop these mitigating actions 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 Keith 132kV supply area.

Dependency: Additional transmission works must be triggered before capacity is released for new generation customers.

Risks: In some cases, generation customers must wait for reinforcement to be complete before they are able to connect to the network.
Mitigation: Engagement with SSEN Transmission should be proactive so that the Transmission and Distribution networks can be planned in parallel, enabling efficient capacity release at both levels. This should include development of strategic plans to manage future demand and generation growth and should also include the development of policy to unlock the ability of local and community-based generation to connect.

Dependency**:** The connections reform process 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.
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 leads to damaged distribution network assets.
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.

Dependency: SSEN has committed to removing Load Managed Areas (LMAs) during the ED2 and ED3 price control period.
Risks: Participation in flexibility markets is not as high as expected or the rollout of smart meters to replace radio tele switching is slower than expected.
Mitigation: Detailed network studies are undertaken for areas most impacted by the removal of LMAs to determine whether reinforcements will be required.

Dependency: Procurement of new land and consents across the supply area is likely to be necessary.
Risks: Long lead timescales in terms of land consents, procurement and the challenge of finding suitable sites/routes.
Mitigation: Identify need ahead of time to allow long timescales for procurement of land.

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. Options to resolve future EHV System Needs to 2035.

The following table details the near-term to medium-term distribution network system needs that have been identified through power system analysis. While asset solutions are described in the table below it is important to note that the use of flexibility will be evaluated for all schemes to ensure the best possible solution is progressed. For the projects shown in **Table 9** we recommend that these are progressed through the DNOA process so that there is sufficient time for solutions to be designed and delivered.

ID	Location of proposed intervention	EE Year	HE Year	HT Year	CF Year	Network state	Comments
Elgin GSP							
1	Elgin Local PSS (2x 33kV Transformers)	2033	2034	2033	2037	N-1 outage of either PSS transformer.	Thermal Constraint: Thermal overload of Elgin primary transformers under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing primary transformers. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Establish a new primary substation and transfer some 11kV load from the existing Elgin Local PSS. • Assess options for procuring flexibility services.
Keith GSP							
2	Rothes PSS 33kV transformer	2034	2033	2034	2039	N-1 outage of either PSS transformer.	Thermal Constraint: Thermal overload of Rothes primary transformer under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing primary transformer. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Establish a new primary substation and transfer some 11kV load from the existing Rothes PSS. • Assess options for procuring flexibility services.
3	Aberlour PSS 33kV transformers	2026	2026	2026	2026	N-1 outage of either PSS transformer.	Thermal Constraint: Thermal overload of Aberlour primary transformers under N-1 conditions.

							Potential options to resolve this constraint are: • Reinforcement of existing primary transformer. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Establish a new primary substation and transfer some 11kV load from the existing Aberlour PSS. • Assess options for procuring flexibility services.
4	Insch PSS 33kV transformers	2028	2029	2028	2030	N-1 outage of either PSS transformer.	Thermal Constraint: Thermal overload of Insch primary transformers under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing primary transformers. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Establish a new primary substation and transfer some 11kV load from the existing Insch PSS. • Assess options for procuring flexibility services.
5	Keith 33kV 7L5 / 10L5 ring circuit (Keith GSP - Rothes, Aberlour, Dufftown PSS)	2037	2035	2039	2042	N-1 Outage of Keith 10L5 circuit	Thermal Constraint: Thermal overload of 33kV circuit 7L5 / 10L5 ring circuit (Keith GSP - Rothes, Aberlour, Dufftown PSS under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of the existing Keith 7L5 / 10L5 ring circuit. • Installation of 2x new dedicated 33kV circuits (Keith GSP – Rothes PSS) to remove Rothes from the existing ring circuit. • Assess options for procuring flexibility services.
MacDuff GSP							
6	Turrif PSS (2x 33kV transformers)	2031	2031	2031	2033	N-1 Outage of MacDuff 1L5 circuit (Turrif 2 circuit)	Thermal Constraint: Thermal overload of Turrif primary transformers under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing primary transformer.

							• Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Establish a new primary substation and transfer some 11kV load from the existing Turrif PSS. • Assess options for procuring flexibility services.
7	MacDuff 33kV circuit 5L5 (MacDuff GSP - Turriff PSS)	2032	2033	2032	2036	N-1 Outage of MacDuff 1L5 circuit (Turrif 2 circuit)	Thermal Constraint: Thermal overload of 33kV circuit 5L5 (Macduff GSP –Turrif) under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of the existing MacDuff 5L5 circuit. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations. • Assess options for procuring flexibility services.

Table 9 Future EHV system needs projected to arise ahead of 2035.

8.3. Options to resolve future EHV System Needs to 2050.

Additional system needs identified in the DFES 2024 may need addressing ahead of 2050, as highlighted through power system analysis. There is significant uncertainty with forecasts in this time 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 deployed.

ID	Location of proposed intervention	EE CT Year	HE ST Year	HT LW Year	CF FS Year	Network state	Comments
				Elgin GSP			
8	Cumming Street PSS (33kV Transformers)	2045	-	2044	-	N-1 Outage of Elgin 6L5 circuit N-1 Outage of Elgin 5L5 circuit	Thermal Constraint: Thermal overload of Cumming Street primary transformers under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing primary transformer. • Assess options for transfer of some 11kV load onto adjacent interconnected primary substations.

							• Establish a new primary substation and transfer some 11kV load from the existing Cumming Street PSS. • Assess options for procuring flexibility services.
9	Elgin 33kV circuit 5L5 (Elgin GSP – Cumming Street, Bilbohall)	2036	2038	2036	2044	N-1 outage of Elgin 6L5 circuit	Thermal Constraint: Thermal overload of 33kV circuit 5L5 (Elgin GSP – Cumming Street) under N-1 conditions. Note that there are potential future thermal overloads of Cumming Street PSS 33kV transformers in 2044. Potential options to resolve this constraint are: • Reinforcement of existing Elgin 33kV 5L5 circuit. • Installation of new direct 33kV circuit (Elgin GSP – Bilbohall PSS) • Installation of a new 33kV circuit to transfer Bilbohall transformer 2 onto the existing 7L5 circuit. Assess options for procuring flexibility services.
10	Elgin 33kV circuit 6L5 (Elgin GSP – Cumming Street)	2038	2041	2037	2048	N-1 Outage of Elgin 5L5 circuit	Thermal Constraint: Thermal overload of 33kV circuit 6L5 (Elgin GSP – Cumming Street) under N-1 conditions. Note that there are potential future thermal overloads of Cumming Street PSS 33kV transformers in 2044. Potential options to resolve this constraint are: • Reinforcement of existing Elgin 33kV 6L5 circuit. • Assess options for transfer of some Cumming Street PSS 11kV load onto adjacent interconnected primary substations. Assess options for procuring flexibility services.
11	Elgin 33kV circuit 3L5 (Elgin - Lossiemouth, Lhanbryde, Fochabers)	2037	2039	2038	2046	N-1 Outage of Elgin 1L5 circuit / Burghead PSS Transformer 2	Thermal Constraint: Thermal overload of 33kV circuit 3L5 (Elgin GSP – Lossiemouth, Lhanbryde, Fochabers PSS) under N-1 conditions. Potential options to resolve this constraint are: • Reinforcement of existing Elgin 33kV 3L5 circuit.

							• Installation of a new 33kV circuit (Elgin GSP – Lossiemouth PSS), to remove Lossiemouth from the existing 3L5 circuit. • Installation of a new 33kV circuit (Elgin GSP – Fochabers PSS), to remove Fochabers from the existing 3L5 circuit. Assess options for procuring flexibility services.

Table 10 Options to resolve system needs between 2035-2050

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

Our HV/LV spatial plans have shown that there is no clear pattern to future demands on these lower voltage networks. We are therefore planning on a forecast volume basis. This section provides further context on the work for the Keith 132kV supply areas high voltage and low voltage network needs up to 2050.

8.4.1. High Voltage Networks

As well as the EHV system needs identified in the previous section, increased integration of low carbon technologies (LCTs) connecting to the distribution network will result in system needs on the High Voltage (HV) and Low Voltage (LV) networks. To provide a view on the impact of these technologies on the distribution network, we have used the load model produced 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 insights 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 primary substations supplied by the Keith 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 27** demonstrates how this percentage changes under each DFES scenario from now to 2050.

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

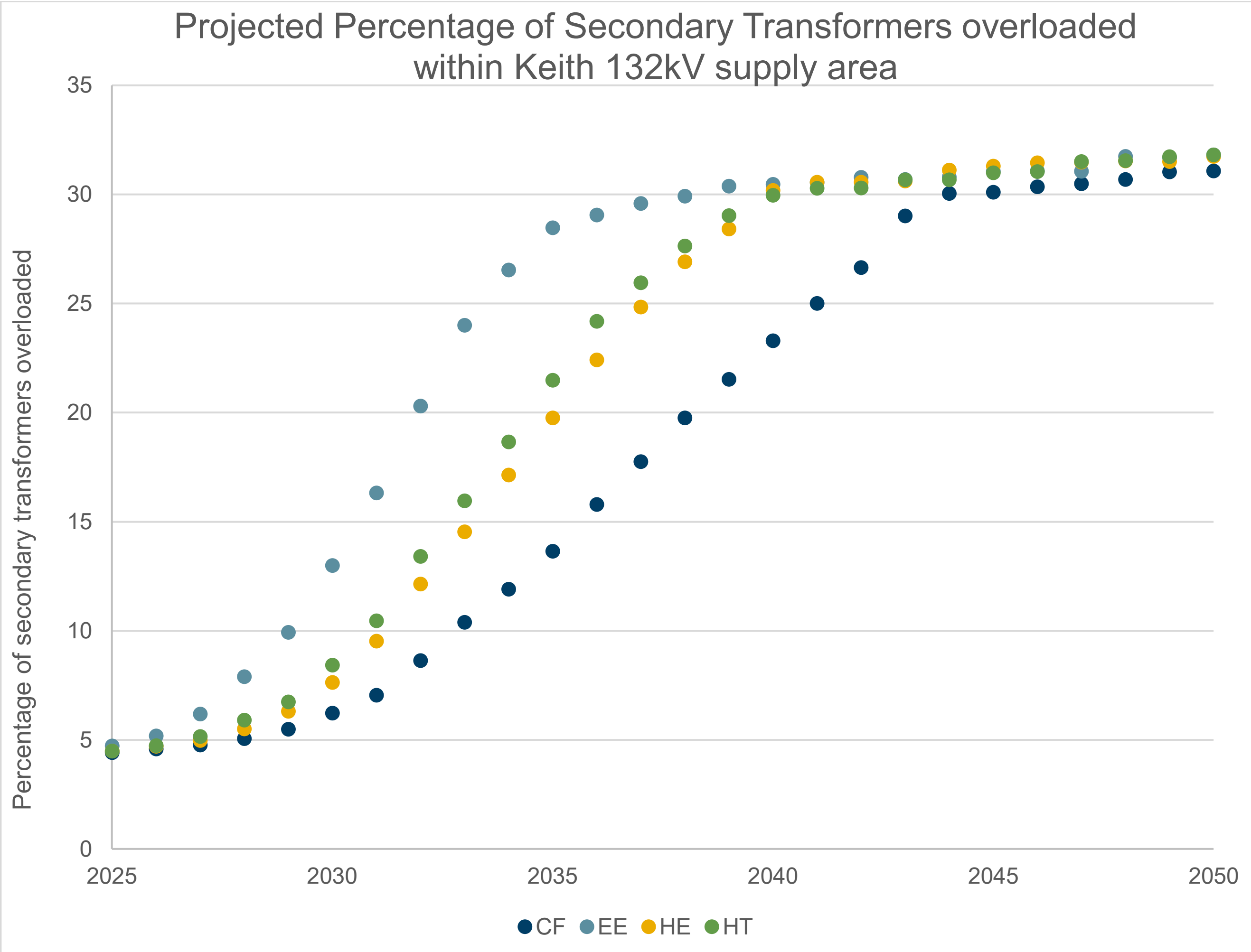


Figure 23 Keith 132kV supply area Projected Secondary Transformer Loading. Source: SSEN Load Model

Considering the Just Transition in HV Development

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

One of the outputs from this innovation project was the report produced by the Smith Institute.[10] This work groups Lower layer Super Output Areas (LSOAs)[11] 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 11**.

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

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

Group Number & Level of Vulnerability	Description of Group
1 – Very high	Driven up by higher levels of poor health and disability/mental health benefit claimants, reduced by smaller household sizes.
2 – High	Driven up by larger household sizes, reduced by lower elderly population levels.
3 – High	Driven up by larger elderly population levels, reduced by lower levels of disability and mental health benefit claimants.
4 – Slightly higher than average	Driven up by larger elder population levels and moderately higher provision of care, reduced by smaller household sizes.
5 – Slightly lower than average	Driven down by lower elderly population levels and larger levels of ethnic diversity, increased by higher household sizes and greater provision of care.
6 – Low	Driven down by lower 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 11 VFES Groupings

To understand the vulnerability groupings across the Keith 132kV substation 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 Hollistic Transition pathway), 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 24**.

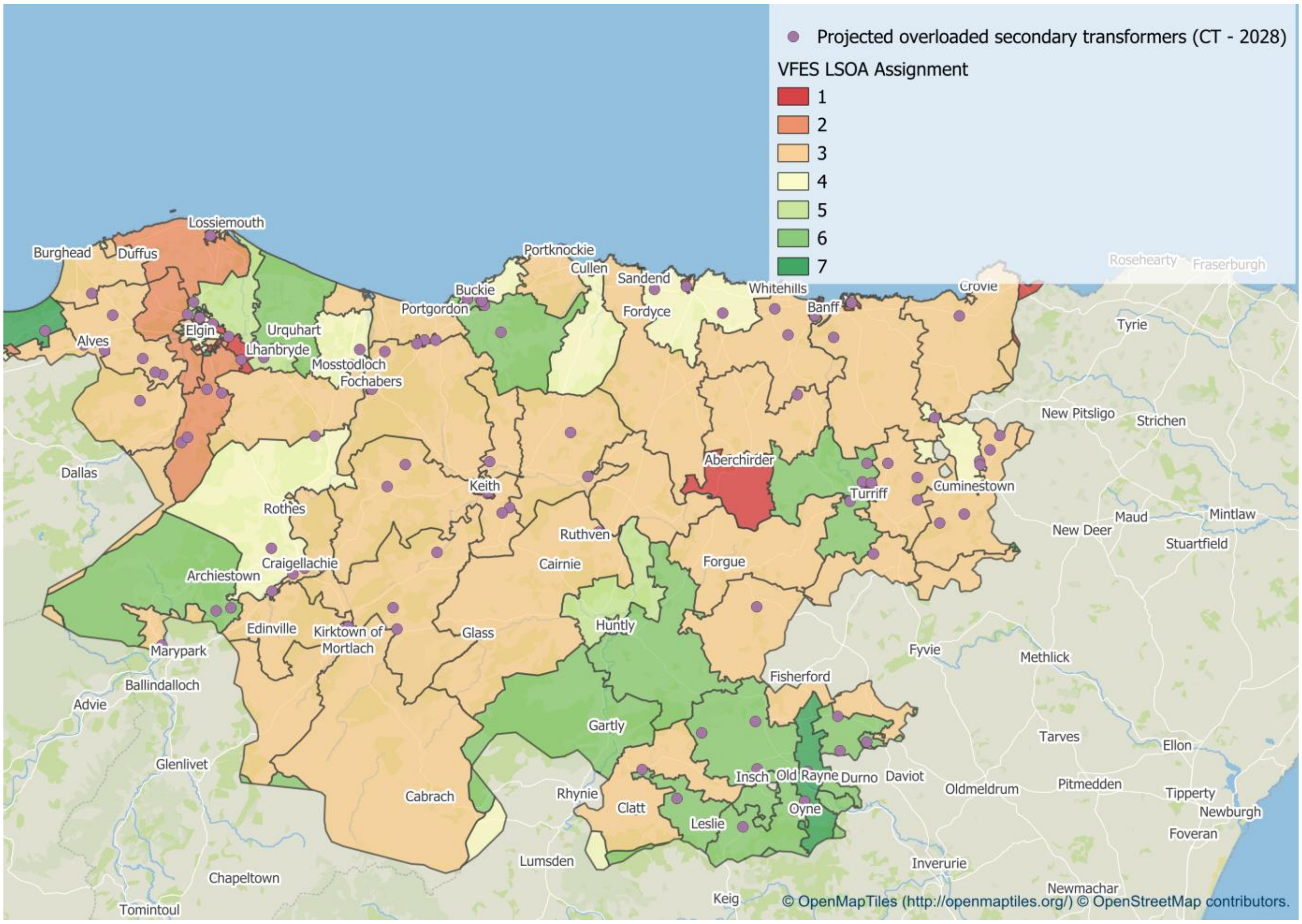


Figure 24 Keith 132kV substation supply area VFES Output with secondary transformer overlay.

We can see that the majority of the area falls within group 3, indicating high levels of vulnerability. This high level of vulnerability is driven up by a larger elderly population, reduced by lower levels of disability and mental health benefit claimants. In the Keith 132kV supply area there are several LSOAs that fall into the higher categories of vulnerability (groups 1, 2, and 3). We also see several LSOA area's falling into the group 1 – very high vulnerability, around Aberchirder and Elgin. This very high vulnerability classification is driven up by higher levels of poor health and disability/mental health benefit claimants, reduced by smaller household sizes.

By overlaying the point locations of secondary transformers projected to be overloaded (in 2028 under the Hollistic Transition pathway), 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.

8.4.2. Low Voltage Networks

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

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

Initial analysis indicates that across the study area, 22.53% of low voltage feeders may need intervention by 2035 and 38.07% by 2050 under the CT scenario as shown in **Figure 25**. The need is unlikely to be triggered until 2028 onwards. However, due to the timeline to grow the workforce (with jointing skills taking typically four 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.

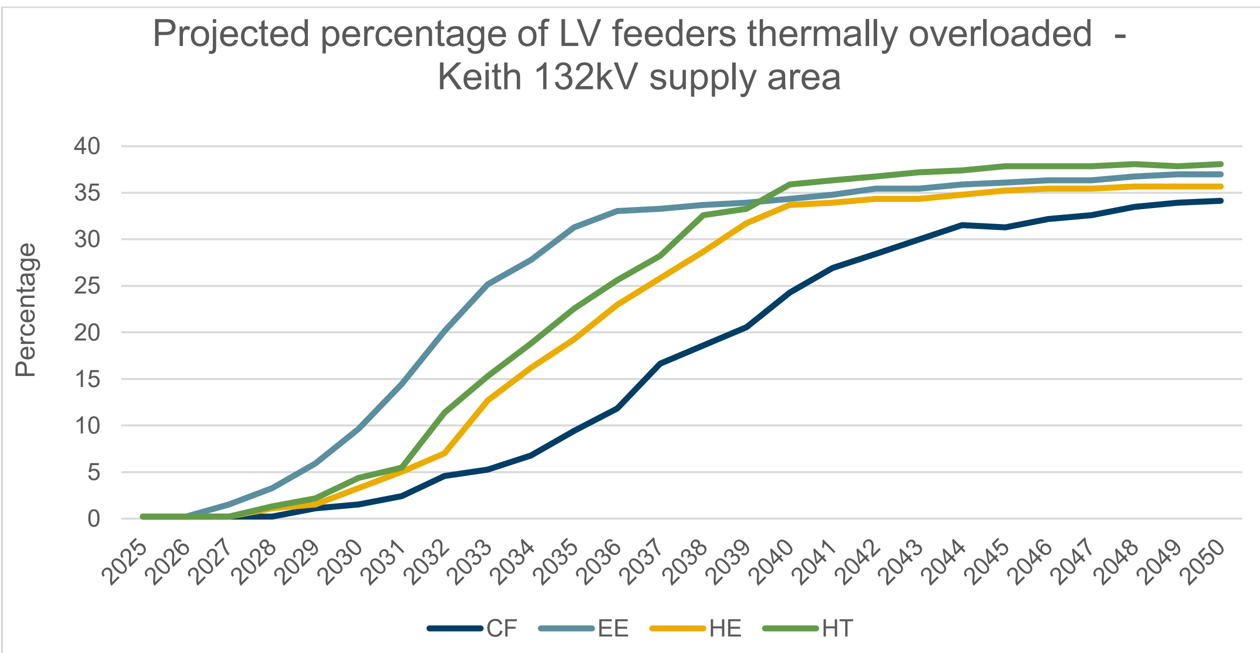


Figure 25 Percentage of LV feeders projected to be overloaded under Keith 132kV supply area.

9. RECOMMENDATIONS

The stakeholder engagement insights and the SSEN 2023 DFES analysis provides a robust evidence base for load growth across the Keith 132kV supply area in both the near and longer term. Load growth across Northeast Scotland is driven by multiple sectors and technologies, impacting not only our EHV network but also driving system needs across all voltage levels.

Across the Keith 132kV supply area, a variety of works have already been triggered through the DNOA process and published in the DNOA Outcomes Report. These are driven by customer connections and system needs that will arise this decade but are being developed to meet 2050 needs. The findings from this report have provided evidence for 6 key recommendations:

1. System needs that have been identified at earlier timescales (ahead of 2035) should be studied in more detail. Work in these timescales should be progressed for more detailed assessment through the DNOA process. This relates to the assets tabulated in section 8.2.

2. SSEN should ensure an open channel of communication is present between SSEN Distribution, SSEN Transmission and NESO regarding the following:
    - The creation of a long-term plan for the area so that alongside the delivery of any future SSEN Transmission works highlighted in section 3.2.2., we can plan the distribution network in parallel. This will enable efficient capacity release at both Transmission and Distribution level and should incorporate the outputs of CP2030 and connections reform.
    - The development of policy to unlock the ability of local and community-based generation to connect.
    - Co-ordination between prospective ANM schemes and the impact of T-D limits at GSPs.

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

4. Understanding how rural decarbonisation could impact load on the network. Specifically, the electrification of distilleries within the Keith 132kV supply area and how to capture those plans in load forecasts. This should be done through further stakeholder engagement with distilleries and the Scotch Whisky Association.

5. As the move away from LMAs develops, continued work should take place to understand the impact of households not participating in flexibility markets and the network reinforcements triggered by this. The move away from radio tele switching (RTS) to smart meters should also be supported if technical difficulties arise.

6. 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 Keith 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.

Actioning these recommendations will allow SSEN to develop an electricity network that supports local net zero ambitions and enables growth in the local economy.

Appendix A PRIMARY SUBSTATION CUSTOMER NUMBERS BREAKDOWN

Substation Name	Site Type	Number of Customers Served (approximate)	2024 Substation Maximum demand in MVA (Winter)
ELGIN GSP			
ASHGROVE	Primary Substation	4,906	6.74
BILBOHALL	Primary Substation	1,567	3.23
BURGHEAD	Primary Substation	2,455	7.62
CUMMING STREET	Primary Substation	4,515	11.48
ELGIN	Primary Substation	3,732	4.57
FOCHABERS	Primary Substation	2,689	6.41
KINLOSS	Primary Substation	1,333	3.29
LHANBRYDE	Primary Substation	1,348	1.49
LOSSIEMOUTH	Primary Substation	3,632	3.74
KEITH GSP			
BUCKIE	Primary Substation	6,520	9.72
CULLEN	Primary Substation	2,096	2.47
LIMEHILLOCKS	Primary Substation	885	1.77
MARNOCH	Primary Substation	1,798	3.26
ABERLOUR	Primary Substation	1,133	5.10
DUFFTOWN	Primary Substation	1,693	5.26
HUNTLY	Primary Substation	3,628	5.76
INSCH	Primary Substation	3,383	6.29
KEITH	Primary Substation	3,615	7.30
ROTHES	Primary Substation	1,432	4.90
MACDUFF GSP			
MACDUFF	Primary Substation	6,692	9.65
PORTSOY	Primary Substation	1,233	2.80

TURRIFF	Primary Substation	4,537	9.83

Appendix B EHV/HV spatial plans for other DFES scenarios

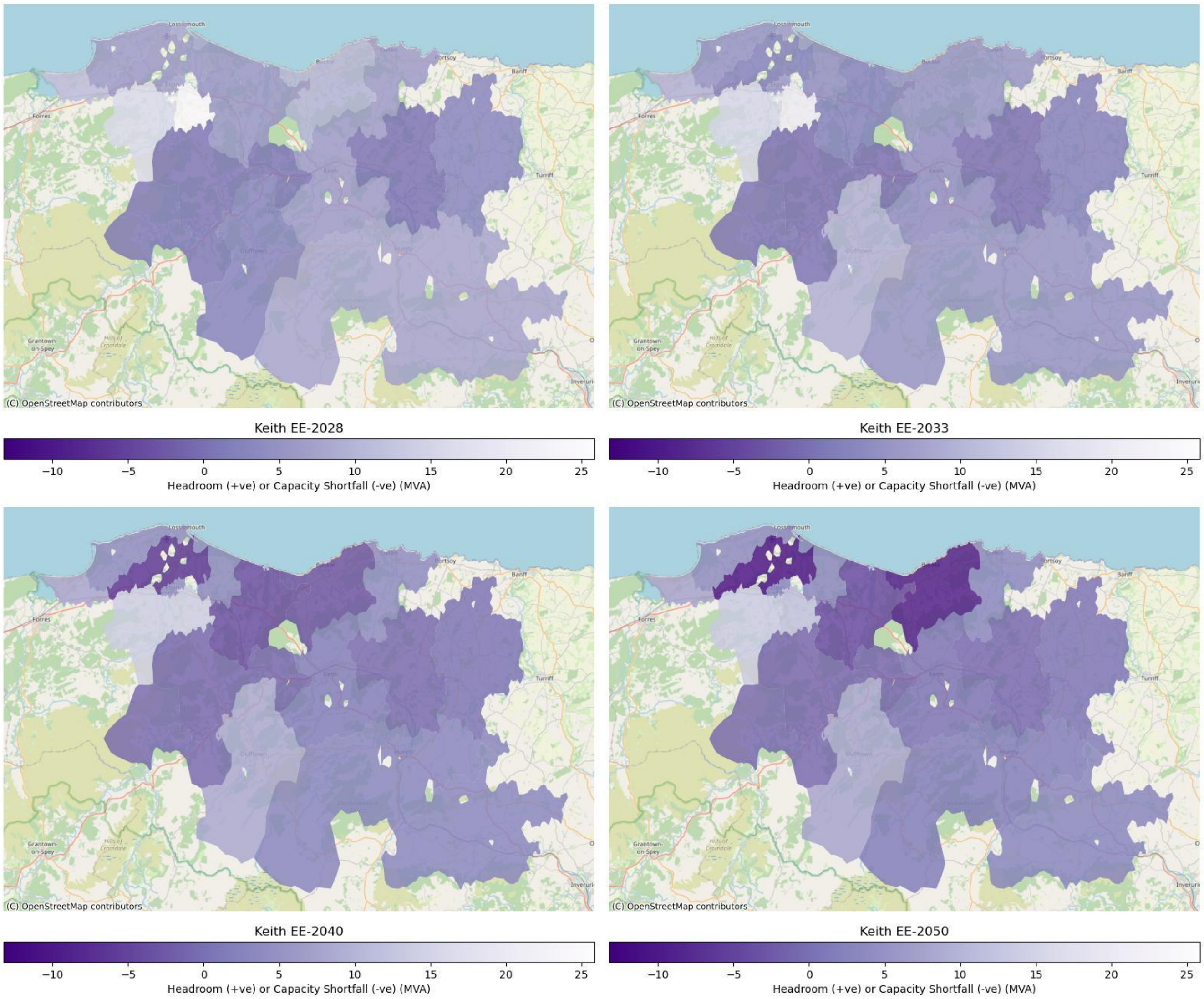


Figure 25 Keith 132kV supply area EHV network spatial plans for EE 2028, 2033, 2040, and 2050

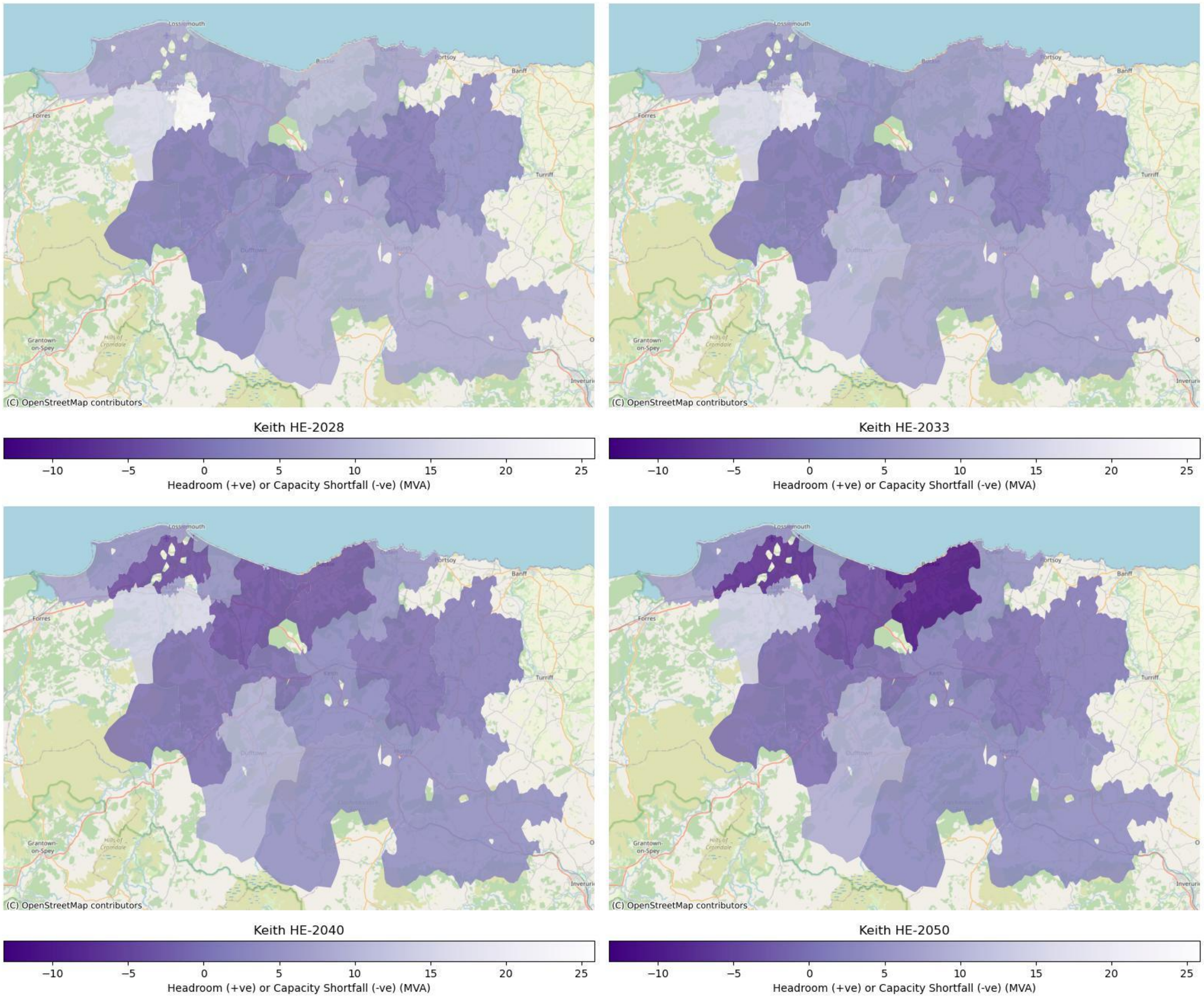


Figure 26 Keith 132kV supply area EHV network spatial plans for HE 2028, 2033, 2040, and 2050

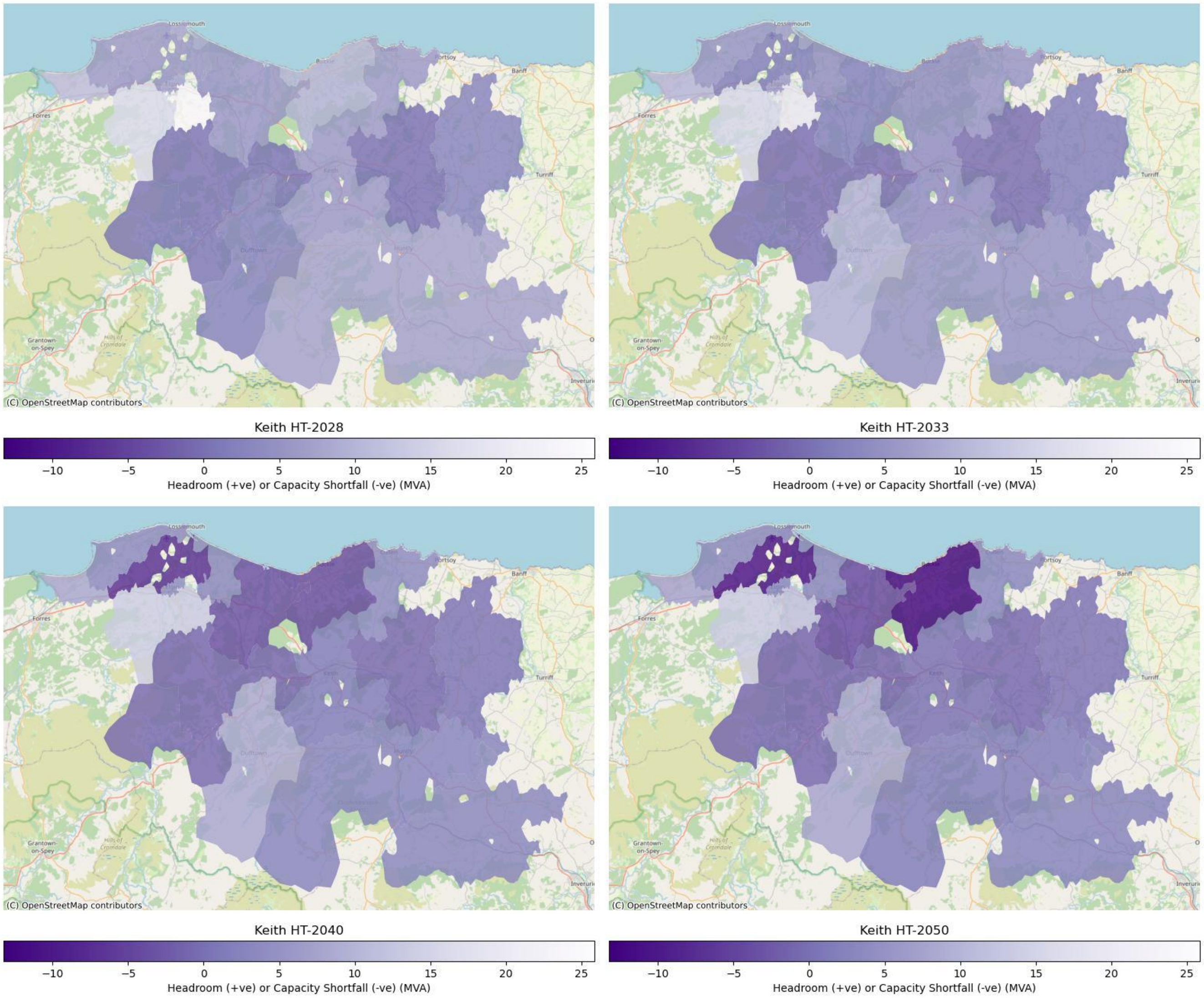


Figure 27 Keith 132kV supply area EHV network spatial plans for HT 2028, 2033, 2040, and 2050

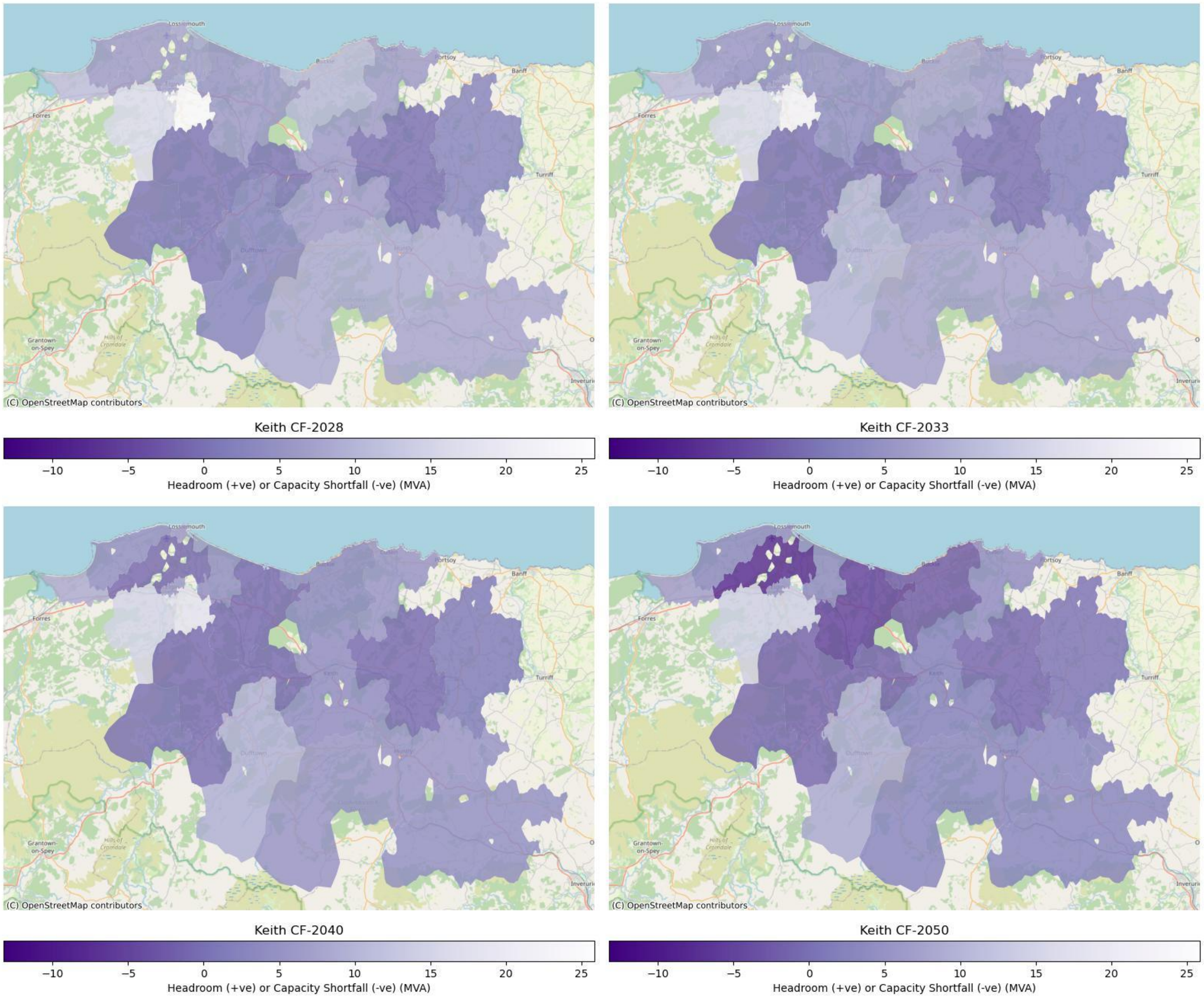


Figure 28 Keith 132kV supply area EHV spatial plans for CF 2028, 2033, 2040, and 2050

Appendix C HV/LV spatial plans for other DFES scenarios

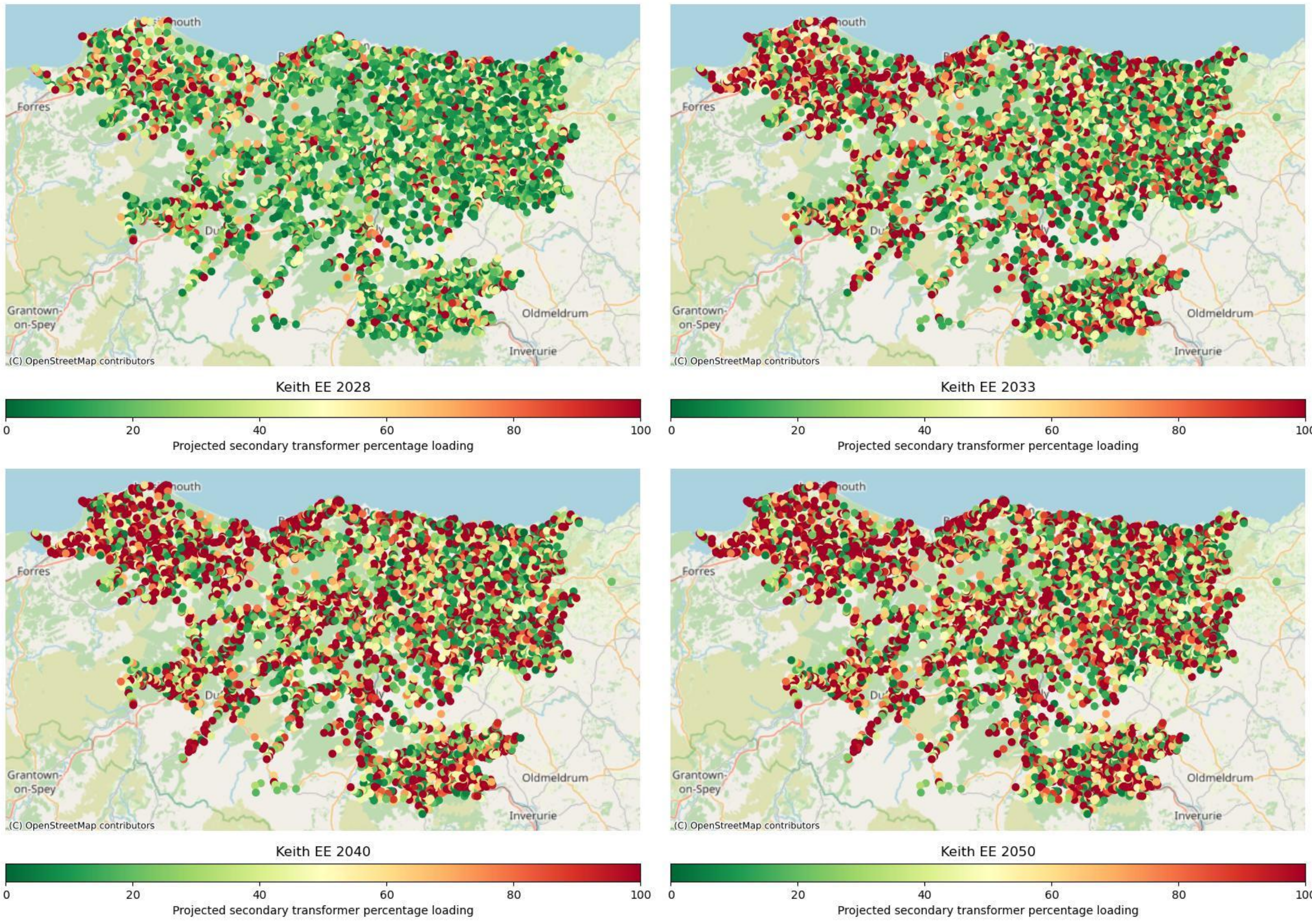


Figure 29 Keith 132kV supply area HV/LV EE spatial plans for 2028, 2033, 2040, and 2050

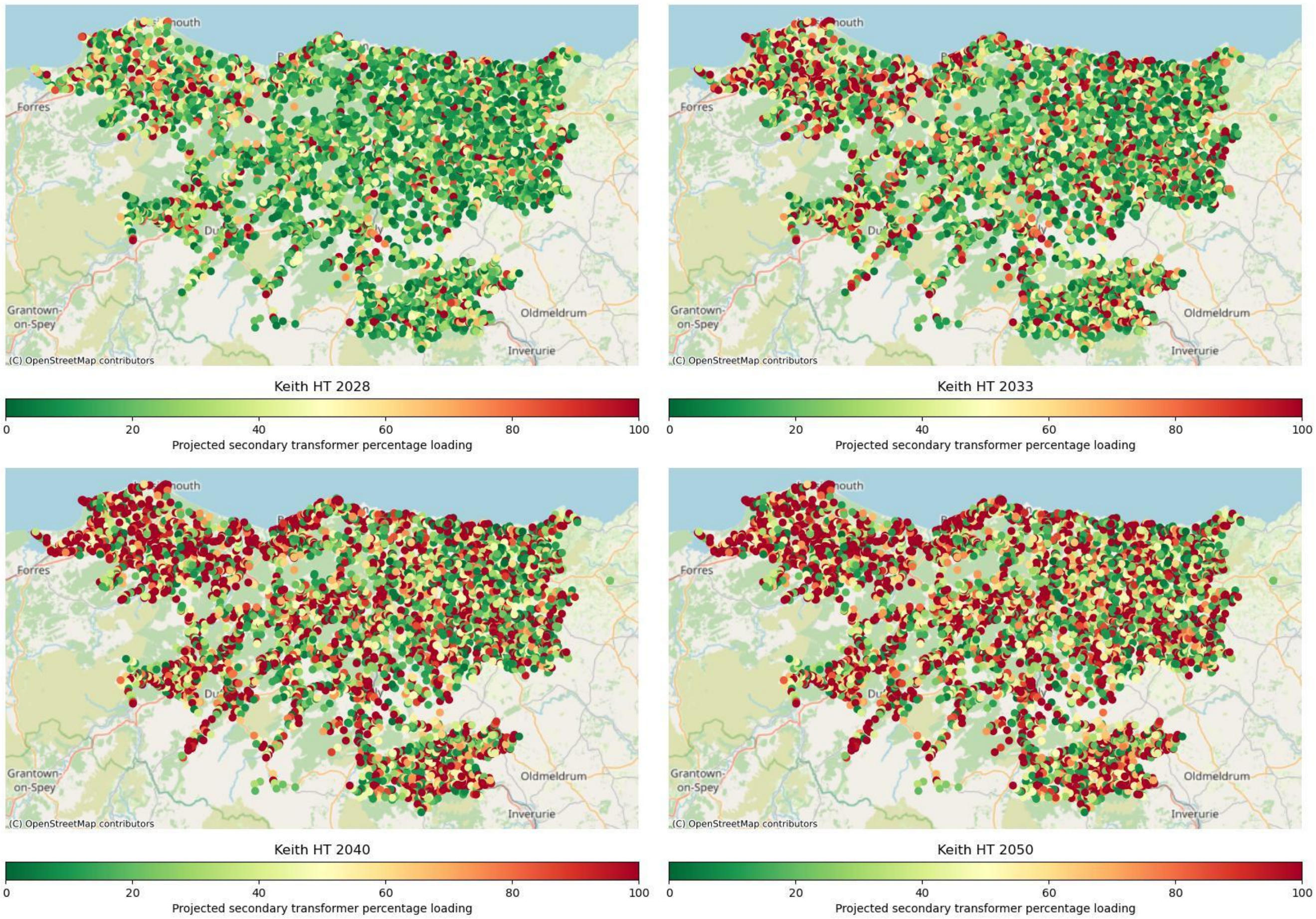


Figure 30 Keith 132kV supply area HV/LV HT spatial plans for 2028, 2033, 2040, and 2050

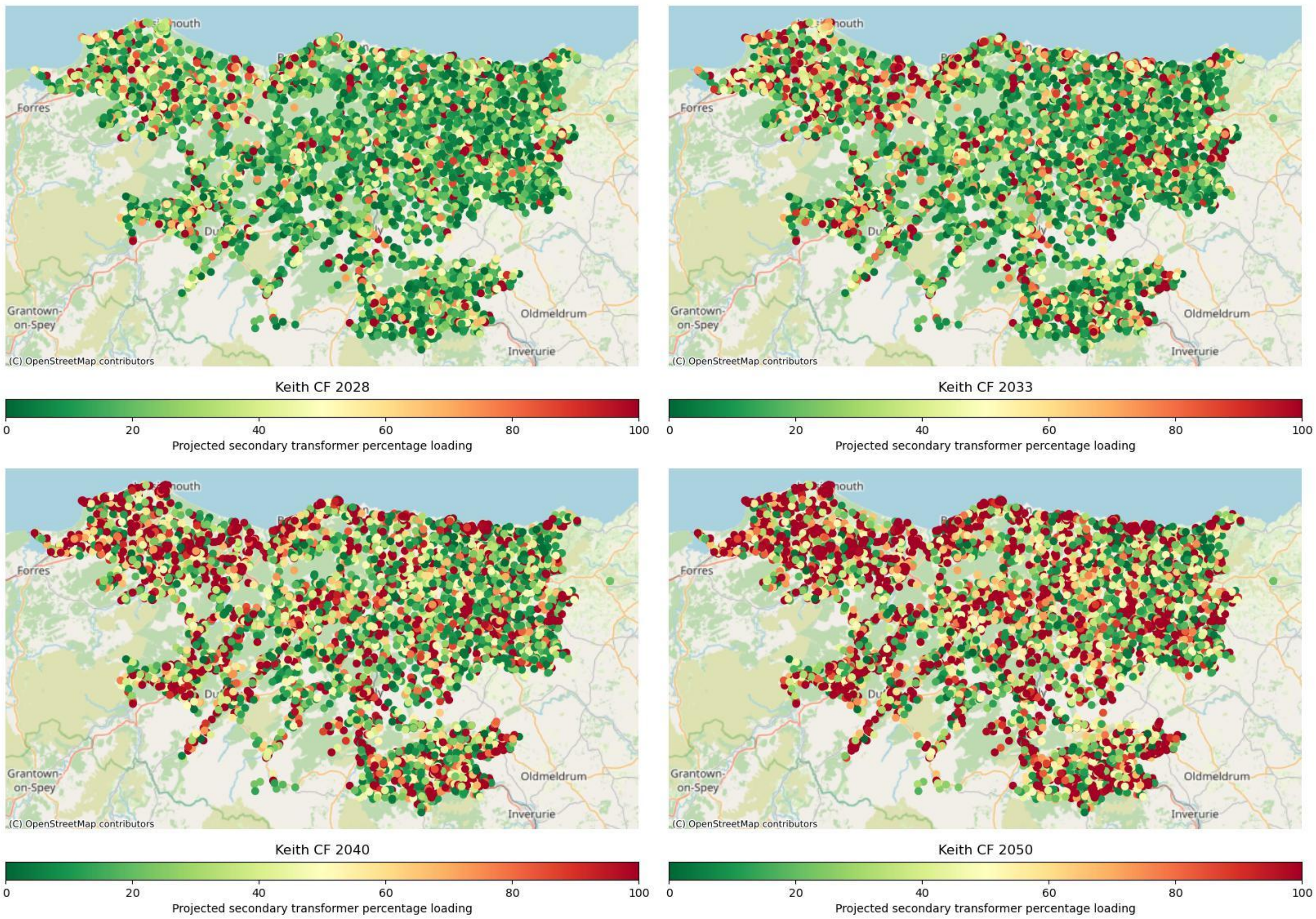


Figure 31 Keith 132kV supply area HV/LV CF spatial plans for 2028, 2033, 2040, and 2050

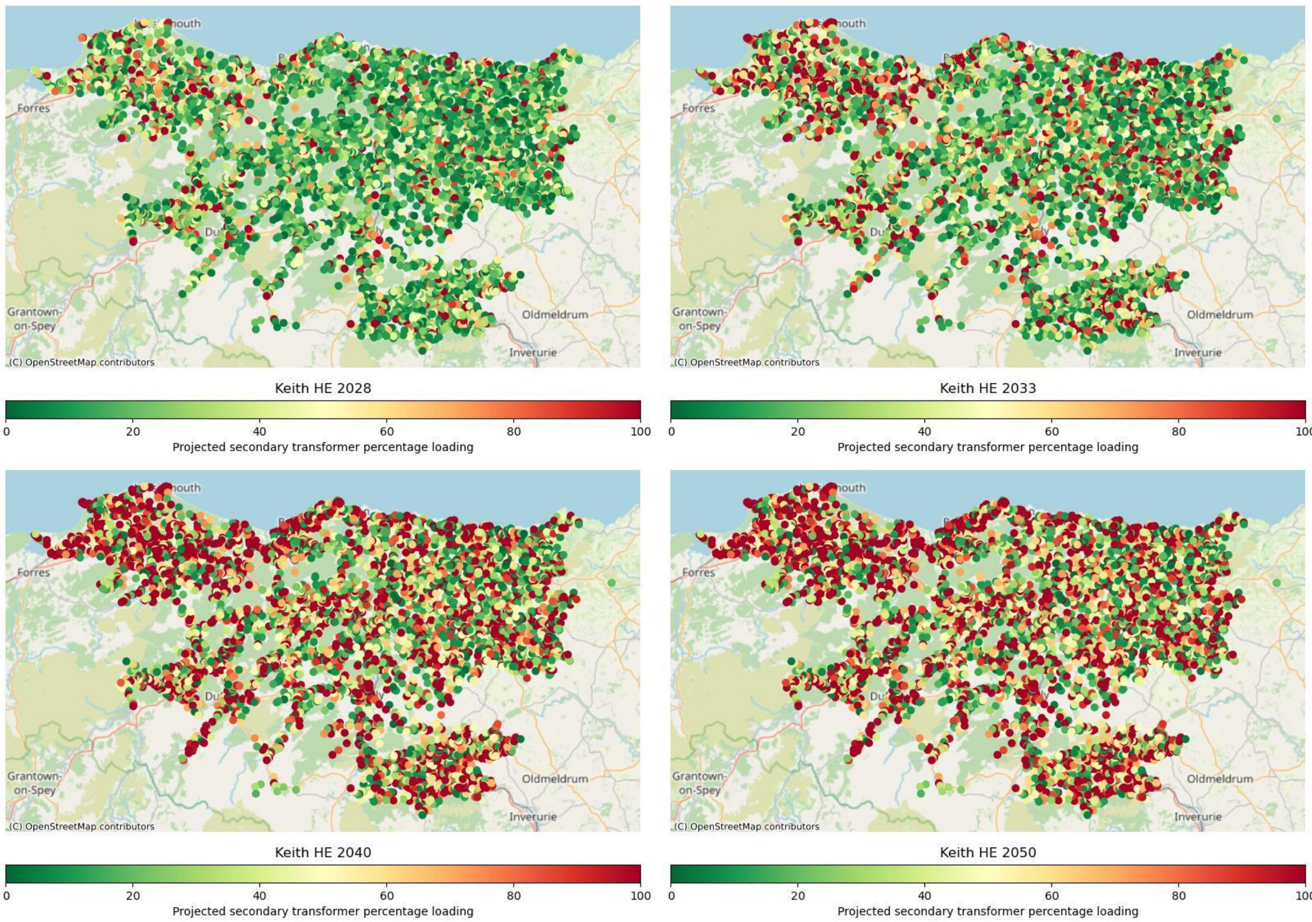


Figure 32 Keith 132kV supply area HV/LV HE spatial plans for 2028, 2033, 2040, and 2050

Appendix D APPENDIX D – GLOSSARY

ACRONYM	DEFINITION
ANM	Active Network Management
BAU	Business as Usual
BSP	Bulk Supply Point
CER	Consumer Energy Resources
CMZ	Constraint Managed Zone
CT	Consumer Transformation
DEG	Diesel Embedded Generation
DER	Distributed Energy Resources
DFES	Distribution Future Energy Scenarios
DGAD	Distributed Generation Automatic Disconnection
DNO	Distribution Network Operator
DNOA	Distribution Network Options Assessment
DSR	Demand Side Response
EHV	Extra High Voltage
EJP	Engineering Justification Paper
ER P2	Engineering Recommendation P2
ESO	National Grid Energy System Operator
EV	Electric Vehicle
FES	Future Energy Scenarios
FS	Falling Short
GSPs	Grid Supply Points
HV/LV	High Voltage/Low Voltage
HOWSUM	Hebrides and Orkney Whole System Uncertainty Mechanism
HVO	Hydrotreated Vegetable Oil
LAEP	Local Area Energy Planning
LENZA	Local Energy Net Zero Accelerator
LW	Leading the Way
OHL	Overhead Line
PV	Photovoltaic

MW	Megawatt
MVA	Mega Volt Ampere
NESO	National Energy System Operator
NRS	National Records of Scotland
RIIO-ED1/2	RIIO Electricity Distribution Price Control periods 1 and 2
SBTs	Science Based Targets
SDP	Strategic Development Plan
SHEPD	Scottish Hydro Electric Power Distribution
SLC	Standard Licence Condition
SSEN	Scottish and Southern Electricity Network
ST	System Transformation
SWA	Scottish Whisky Association
WSC	Worst Served Customers

Appendix E DNOA OUTCOME REPORTS

This annex shows the published DNOA Outcome Reports which are relevant to the Keith 132kV supply area.

DNOA Outcome Report

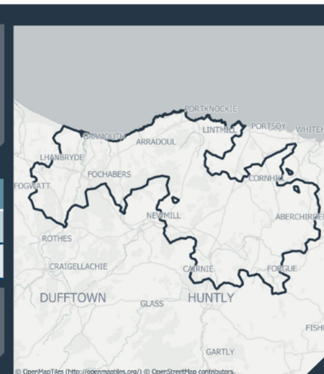
Aberdeenshire (North Coast) 33kV Network

Scheme description

- The affected 33kV circuits support the network in the Moray area of Scotland, covering postcodes AB38, AB55, AB37 & AB54.
- Load related - The circuits face challenges with voltage levels dropping below regulatory-accepted thresholds under normal operating conditions.

Proposed option

- Increase the size of the voltage compensation equipment at the new Glenrothes Distillery 33kV switchboard and loop the new switchboard into to the 33kV ring.
- Low additional cost to achieve compliant volts whilst meeting the requirements for predicted 2050 demands.



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 delivered 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	-	-	-	-	-	-	-
ST	-	-	-	-	-	-	-
LTW	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-

Constraint management timeline

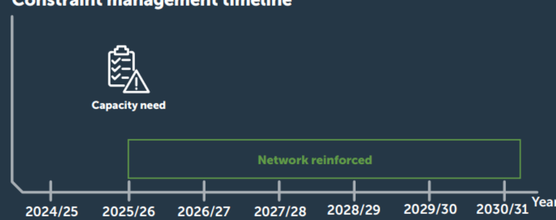


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Figure 33 DNOA Outcome Report for Aberdeenshire North Coast 33kV network (Keith GSP)

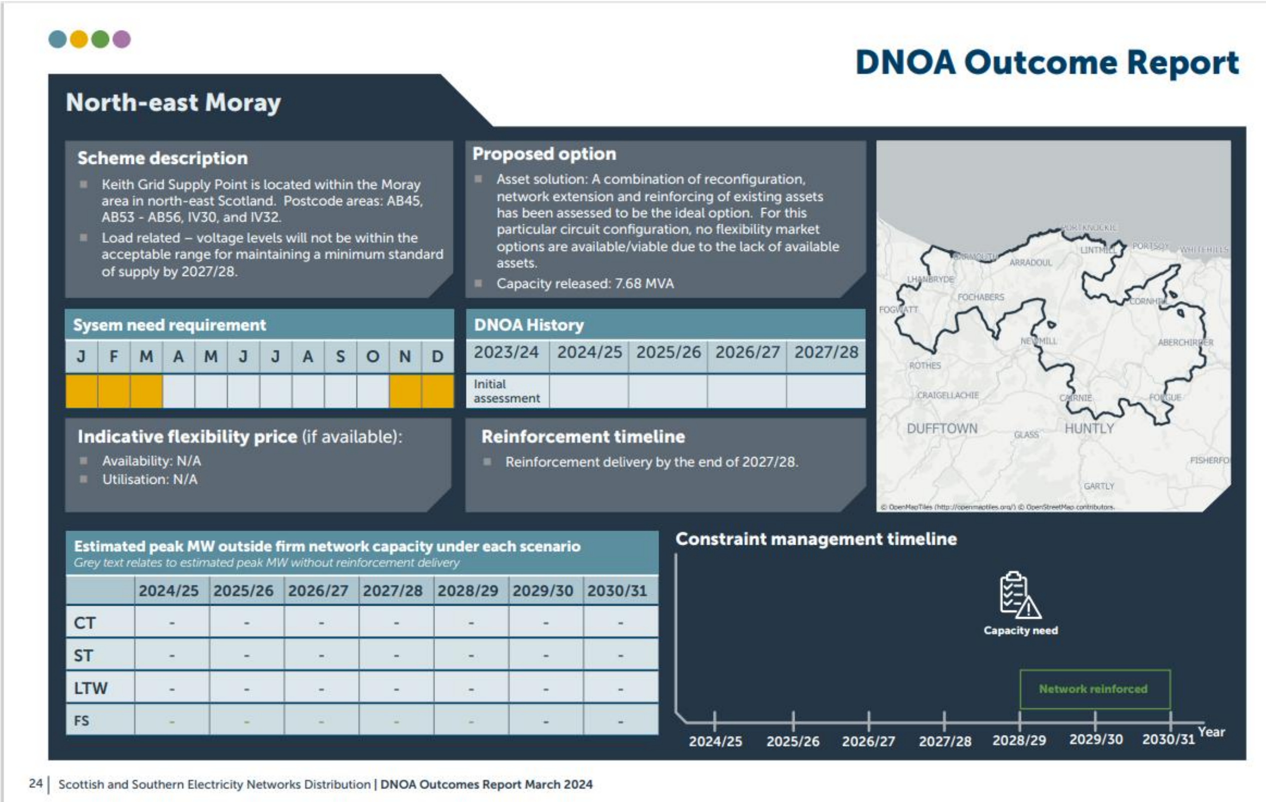


Figure 34 DNOA Outcome Report for North East Moray (Keith GSP)

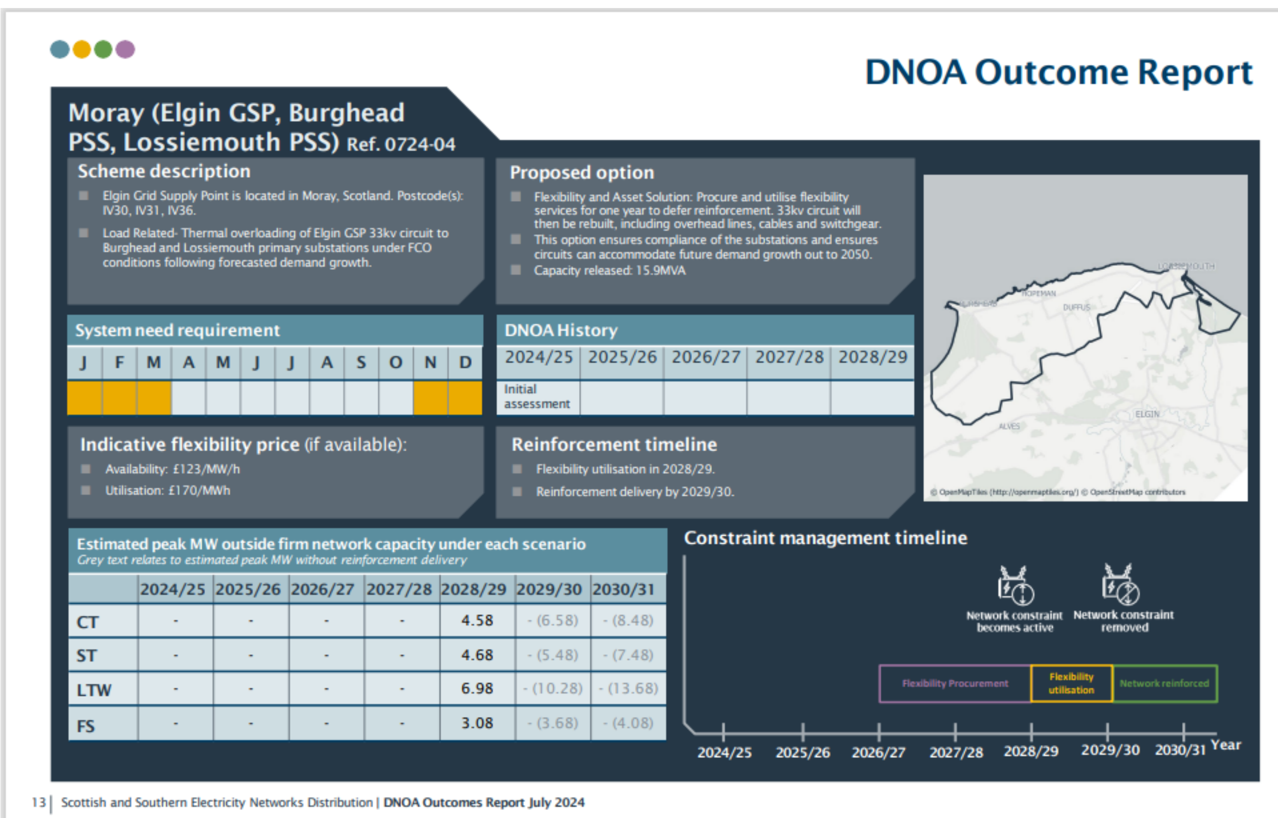
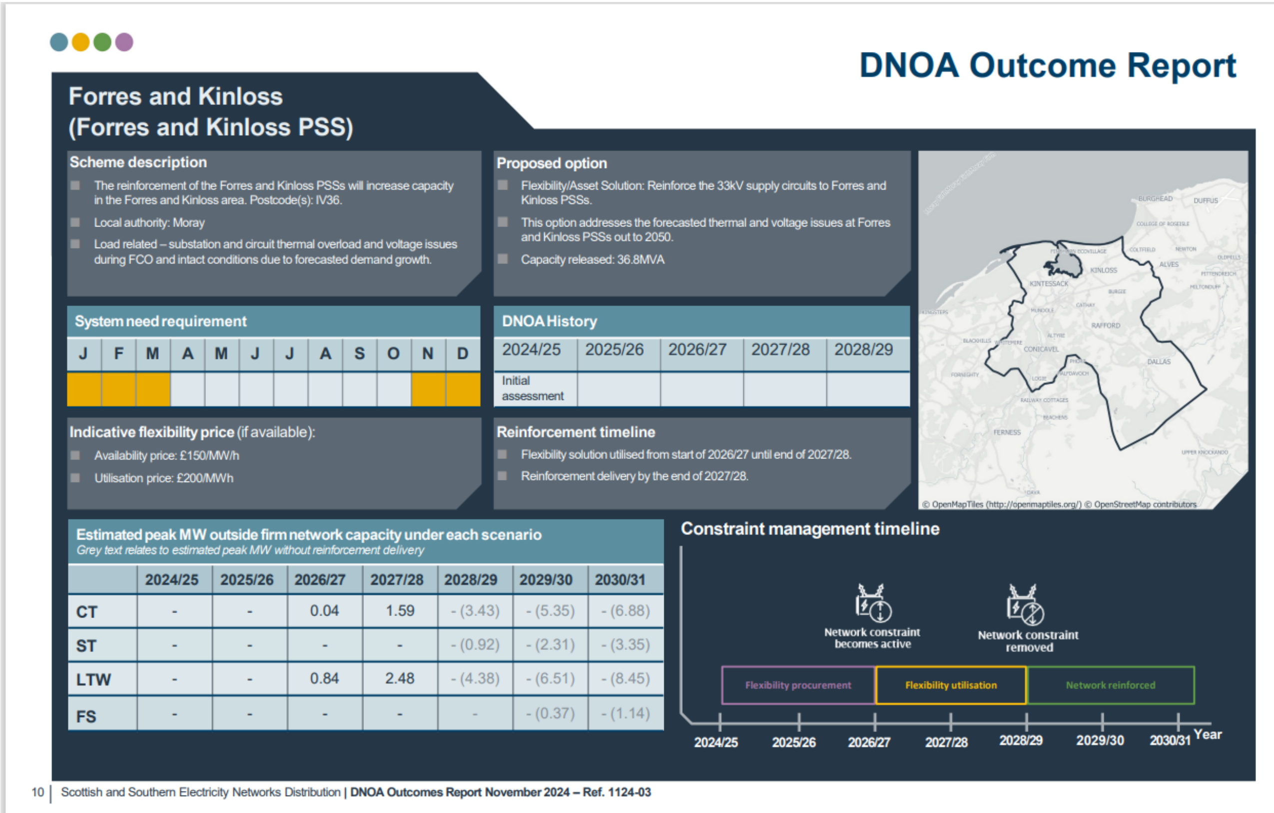


Figure 35 DNOA Outcome Report for Moray (Elgin GSP)



DNOA Outcome Report

Forres and Kinloss (Forres and Kinloss PSS)

Scheme description

- The reinforcement of the Forres and Kinloss PSSs will increase capacity in the Forres and Kinloss area. Postcode(s): IV36.
- Local authority: Moray
- Load related – substation and circuit thermal overload and voltage issues during FCO and intact conditions due to forecasted demand growth.

Proposed option

- Flexibility/Asset Solution: Reinforce the 33kV supply circuits to Forres and Kinloss PSSs.
- This option addresses the forecasted thermal and voltage issues at Forres and Kinloss PSSs out to 2050.
- Capacity released: 36.8MVA

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: £150/MW/h
- Utilisation price: £200/MWh

Reinforcement timeline

- Flexibility solution utilised from start of 2026/27 until end of 2027/28.
- Reinforcement delivery by the end of 2027/28.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	0.04	1.59	- (3.43)	- (5.35)	- (6.88)
ST	-	-	-	-	- (0.92)	- (2.31)	- (3.35)
LTW	-	-	0.84	2.48	- (4.38)	- (6.51)	- (8.45)
FS	-	-	-	-	-	- (0.37)	- (1.14)

Constraint management timeline

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Figure 36 DNOA Outcome Report for Forres and Kinloss (Elgin GSP)

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Scottish & Southern Electricity Networks