TEALING 132KV SUPPLY AREA - STRATEGIC DEVELOPMENT PLAN

Our network serving communities across Tayside and Central 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) take the feedback we have received from stakeholders on their future energy needs from today out to 2050 and translate these requirements into strategic spatial plans of distribution network needs. This helps us transparently present our future conceptual plans and facilitate discussion with local authorities and other stakeholders. The overall methodology and how it fits into our wider strategic planning process is presented in the [Strategic Development Plan Methodology](). The focus area of this SDP is the area that is supplied by Arbroath, Bridge of Dun, Charleston, Dudhope, Fiddes, Lunanhead, Lyndhurst and Milton of Craigie Grid Supply Points (GSP), shown below in **Figure 1**.

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 Dundee City, Angus, Perth and Kinross, and Aberdeenshire councils have been considered in preparation for this plan. Some reinforcement work has been triggered in this area through the Distribution Network Options Assessment (DNOA) process.

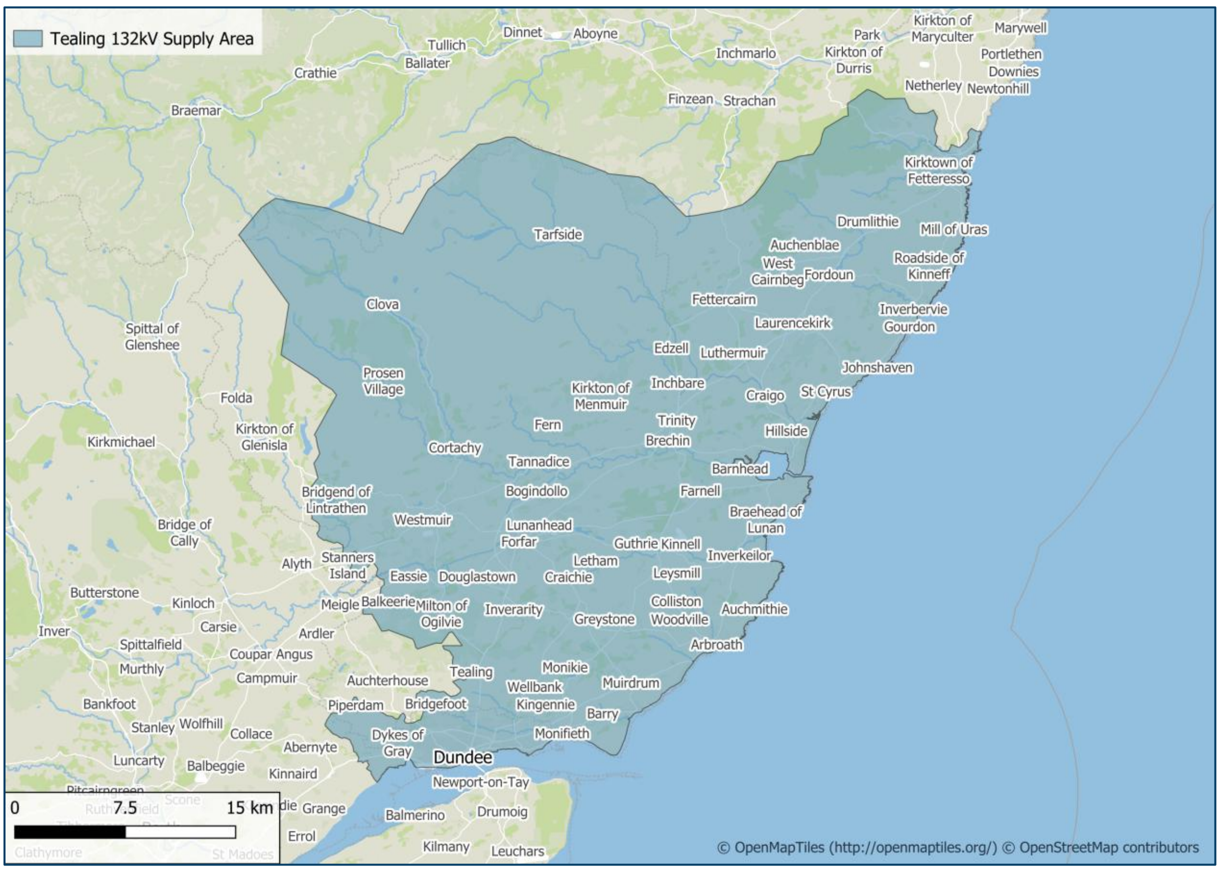

Figure 1 - Area of focus for this SDP.

This SDP utilises the Distribution Future Energy Scenarios (DFES) to understand the pathways to a 2050 network that can support net zero and growth in the local economy. Recommendations from this report outline the initial steps that we believe should be taken on that pathway to develop the network in an efficient and stakeholder-led way.

2. INTRODUCTION

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

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

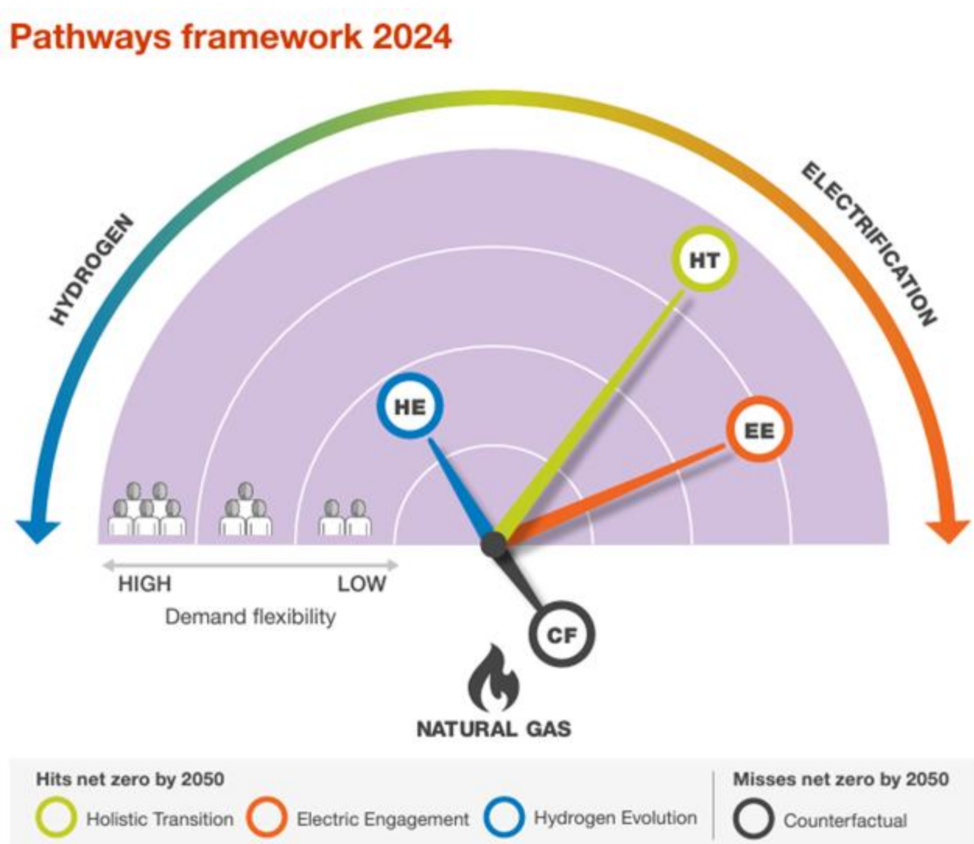

Figure 2 - The FES Scenario framework (source: NESO)

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. We also model across the other scenarios to understand when these needs arise and what network capacity should be planned for in the event each scenario is realised.

The DNOA process provides more detailed optioneering for each of these system needs, 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.

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

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

. The 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 closely with these plans when carrying out strategic network investment.

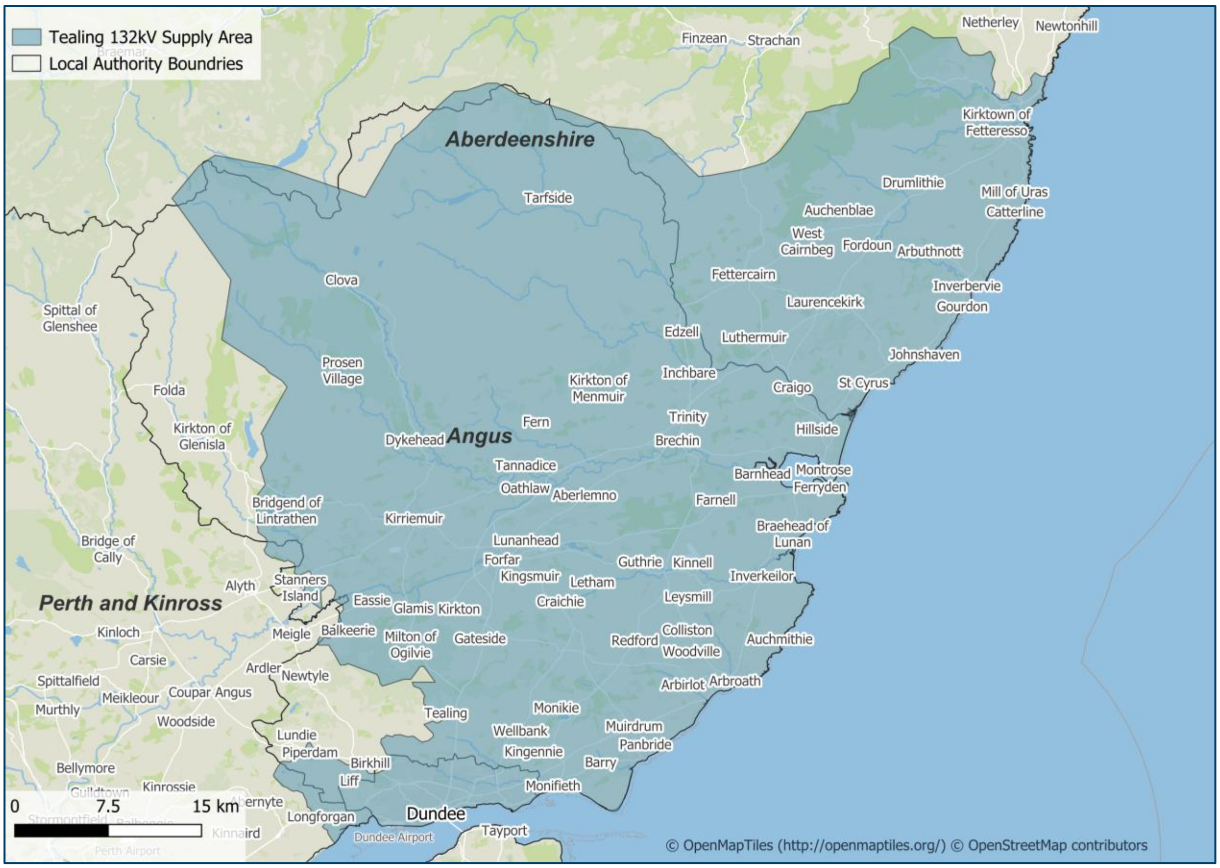

Figure 3 - Tealing SDP supply area and local authority boundaries.

3.1.1. Dundee City Council

Dundee City Council serves approximately 150,390 residents and is the smallest local authority in Scotland by land area, covering 60 square kilometres[1]. It has one of the highest population densities in the country. The Council is recognised as a leading authority in climate action and aims to achieve city-wide net zero emissions by 2045, in line with Scottish Government targets. Under its Net Zero Transition Plan (2024–2030)[2], the Council has committed to becoming a net zero organisation by 2038. Emission reduction efforts focus on buildings, street lighting, fleet operations, business and service travel, and Council-generated waste.

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1 Dundee City - National Records of Scotland (NRS)

2 Net Zero Transition Plan 2024-2030

The Council has also launched Dundee Climate Leadership Group which provides active leadership on Dundee's net zero challenge, SSE-Networks (incl. Distribution and Transmission) are members of this group[3].

To underpin these ambitions, Dundee has developed a comprehensive Local Area Energy Plan (LAEP)[4], published in 2024, which maps out the city's energy transition through interventions like large-scale retrofitting, heat networks, solar PV, battery storage, and EV infrastructure. It also addresses system-wide transformation and grid resilience, with strong emphasis on stakeholder collaboration. Complementing this is the statutory Local Heat and Energy Efficiency Strategy (LHEES)[5], which identifies strategic and priority zones for heat decarbonisation and energy upgrades, while tackling fuel poverty and housing inequality. The LHEES includes a five-year delivery plan with 39 actionable steps and is rooted in a just transition approach. Dundee City Council have also been enrolled onto SSEN's Local Energy Net Zero Accelerator (LENZA) tool.

3.1.2. Angus Council

Angus Council serves a population of approximately 114,820 residents across a predominately rural area of 2,200 square kilometres, making it one of the largest council areas in Scotland by land mass[6]. The main towns are Arbroath, Brechin, Carnoustie, Forfar, Kirriemuir, Monifieth and Montrose. The Council has committed to achieving net zero emissions by 2045, in line with national targets, and adopted its Transition to Net Zero Action Plan (2022–2030) to meet the interim goal of a 75% reduction in emissions by 2030[7]. This plan focuses on key sectors including buildings, energy infrastructure, fleet, business travel, waste, and land use adaptation.

Angus Council is implementing its Local Heat and Energy Efficiency Strategy (LHEES)[8], which aims to improve building energy performance and ensure a just transition to decarbonised heat sources. In addition, the Council has commissioned a Renewable Energy Masterplan and Infrastructure Delivery Plan, designed to identify and unlock opportunities for renewable, low-carbon, and zero-emission energy development across the region. They have also been enrolled onto SSEN's Local Energy Net Zero Accelerator (LENZA) tool.

3.1.3. Aberdeenshire

Aberdeenshire Council serves a population of approximately 262,690 residents across a largely rural area spanning over 6,300 square kilometres, making it the fourth largest local authority in Scotland by land mass[9]. After a period of sustained growth up to 2014/15, the population declined for four consecutive years before rising slightly in 2021. The region's largest towns include Peterhead, Inverurie, Fraserburgh, Westhill, Stonehaven, and Ellon. Aberdeenshire Council has committed to a 75% reduction in emissions by 2030, based on its 2010/2011 baseline, and aims to achieve net zero by 2045, in line with the Scottish Government's national target[10].

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3 Who We Are | Sustainable Dundee

4 Dundee Local Area Energy Plan | Dundee City Council

5 Local Heat and Energy Efficiency Strategy and Delivery Plan | Sustainable Dundee

6 Local indicators for Angus (S12000041) - ONS

7 Angus Council 8 September - Report No 309 - Angus Council Transition To Net Zero Action Plan 2022-2030 - App 1

8 Angus Local Heat & Energy Efficiency Strategy and Delivery Plan | Engage Angus

9 Population statistics - Aberdeenshire Council

10 Climate change and sustainability - Aberdeenshire Council

The Council published its Local Heat and Energy Efficiency Strategy (LHEES) in July 2024 and is currently preparing the associated delivery plan[11]. The strategy outlines long-term plans to decarbonise heat in buildings and improve energy efficiency across the region. They have also produced a 'Route Map to 2030 and Beyond' which sets out the investment and infrastructure required to meet the net zero ambition[12].

As part of a wider regional initiative, Aberdeenshire, alongside Aberdeen City, Moray, and Highland Councils, has been awarded £7.24 million from the Scottish Government's Electric Vehicle Infrastructure Fund, effective from spring 2025[13]. The Council continues to expand its EV charging network and is assessing the feasibility of installing heat pumps, solar PV, and battery storage on council-owned buildings. Aberdeenshire Council has also joined the SSEN LENZA platform to support local energy planning and coordination.

3.1.4. Perth and Kinross

Perth and Kinross is a predominantly rural region in Scotland, characterised by a high proportion of properties located off the gas grid. As the fifth-largest unitary authority in the country, it spans an area of 5,285 km² and had an estimated population of 150,953 according to the 2022 Census. The city of Perth serves as the area's largest urban centre.

In 2021, Perth and Kinross Council (PKC) introduced its Climate Change Action Plan, outlining their commitment to achieving net zero carbon emissions by 2045 or sooner[14]. Building on this, the Council developed both a Local Area Energy Plan (LAEP) and a Local Heat and Energy Efficiency Strategy (LHEES), which together form a comprehensive roadmap for decarbonisation in the region[15]. Notably, PKC is one of only two Scottish local authorities to have produced a LAEP (alongside Dundee City Council), which adopts a whole-systems approach to meet their net zero ambition. Perth and Kinross Council are enrolled on SSEN's LENZA platform and have actively used the tool for strategic planning.

3.2. Whole System Considerations

SSEN works closely with the main local authorities supplied by the Tealing grid supply area, including Angus, Dundee City, Perth and Kinross, and Aberdeenshire, to understand evolving local demand and generation data. This includes housing projections, renewable generation projects, energy storage, and the uptake of electric vehicles and heat pumps. This engagement has helped SSEN to stay informed about planning and development that will impact local communities' use of the network.

We have also begun engaging with regional stakeholders to build a comprehensive whole-system view of future energy needs, such as Scottish Enterprise. SSEN is also 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.

3.2.1. Industrial and Commercial users

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11 Local Heat and Energy Efficiency Strategy - Aberdeenshire Council

12 Climate change and sustainability - Aberdeenshire Council

13 Electric Vehicle Infrastructure Fund | Transport Scotland

14 Climate Change Strategy and Action Plan

15 Local Heat and Energy Efficiency Strategy (LHEES) - Perth & Kinross Council

The Port of Dundee supports offshore wind operations, cargo handling, and decommissioning activities. Dundee Airport offers direct flights to London and the Shetland Islands. The city is undergoing a £1.6 billion Waterfront regeneration and hosts the University of Dundee and Abertay University. The Michelin Scotland Innovation Parc is a major redevelopment site focused on advancing low-carbon technologies and sustainable mobility through industry, research, and skills training.

Angus is a leading agricultural region, with key products including beef, berries and potatoes. It includes Montrose Port, which supports offshore energy, and major employers such as GlaxoSmithKline and GE Oil & Gas. There is also a growing tourism sector, with key with attractions like Carnoustie Golf Links and Glamis Castle.

Further information on industrial and commercial decarbonisation can be found in section 5.5.

3.2.2. 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 Tealing 132kV supply area. Currently, there are several notable SSENT projects under way in the city, which are primarily driven by contracted connection jobs. Key relevant projects are summarised below.

New Stannergate 132kV Substation
SSENT is proposing to relocate and replace the existing Dudhope GSP by constructing a new substation at Stannergate, near Dundee Harbour. The project is primarily driven by a 132kV connection request from Network Rail, alongside SSENT's obligation to renew transmission assets that are nearing the end of their operational life. The new 132 kV substation along with the new GSP will strengthen local network resilience, provide capacity to support Scotland's rail electrification, support a generation connection pipeline of 43.5 MW and deliver wider benefits to the Dundee community.

Arbroath GSP Upgrade
To accommodate a transmission connection offer accepted by SHEPD, reinforcement is required at the existing Arbroath GSP. The upgrade involves replacing the existing 2 × 45 MVA GTs with 2 × 120 MVA units.

Lunanhead GSP Upgrade
SSENT is in the early stages of replacing the existing 90 MVA transformer (GT1) at Lunanhead with a 120 MVA unit, to match the capacity of GT2, which will also undergo reconfiguration. This reinforcement has been triggered to support a connection pipeline of 64.2 MW, due for connection by October 2029.

3.3. Flexibility Considerations

SSEN procures Flexibility Services from owners, operators, or aggregators of Distributed Energy Resources (DERs) or Consumer Energy Resources (CERs), which can be generators, storage, or demand assets. These services are needed in areas of the network which have capacity constraints at particular times or under certain circumstances. SSEN purchases Flexibility Services from all types of providers (e.g. domestic or commercial). Information on the process for procurement and how to participate are published on the Flexibility Services website and information on real time decision making on which providers are dispatched can be found in the Operational Decision-Making document.[16,17]

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

Areas across the Tealing 132kV supply area where flexibility has been procured is shown below in **Figure 4**. This map shows all Flexibility Services procured, which covers requirements beyond those identified for managing the deferral of reinforcement.

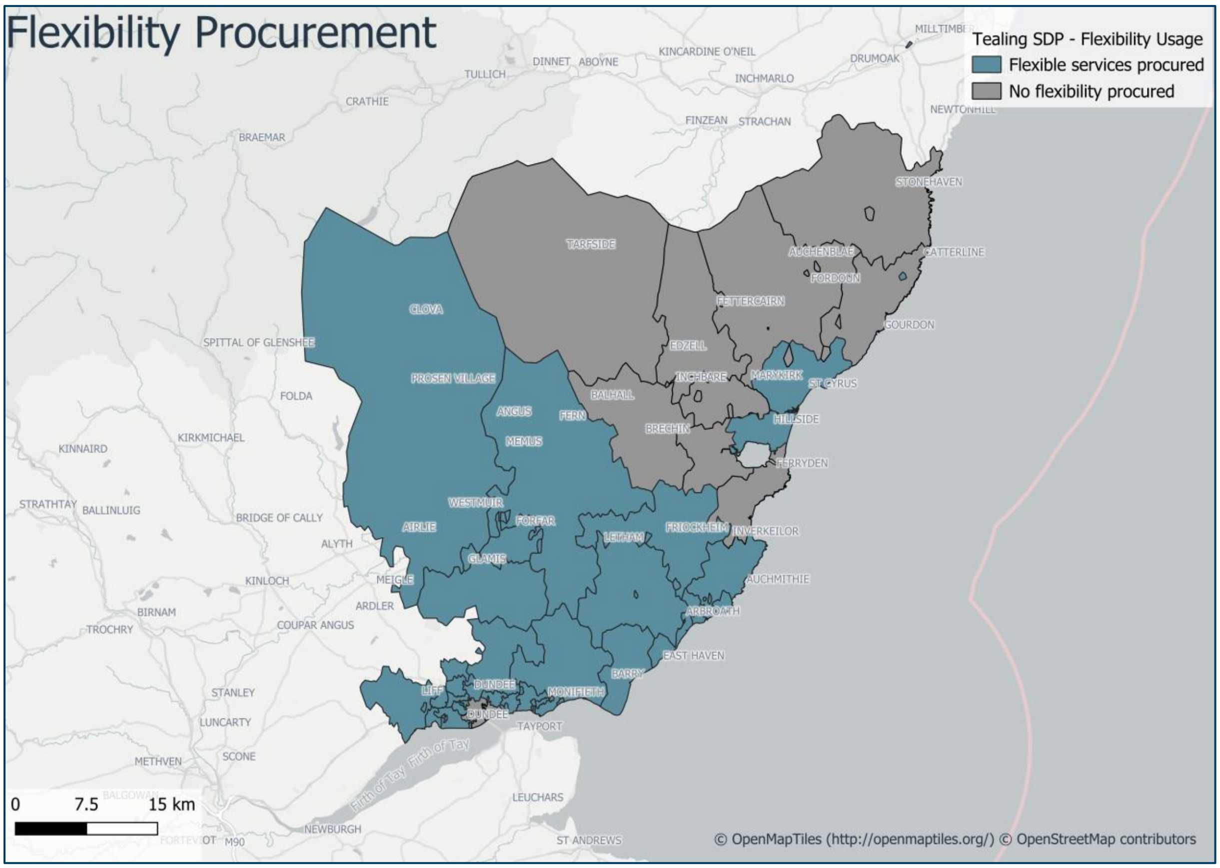


Figure 4 - Flexibility procurement across the Tealing 132kV supply area.

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

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

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Tealing SDP Context

The Tealing 132kV supply area is made up of 33kV, 11kV and LV circuits. The network is a mix of rural and urban circuits spanning across multiple council regions. In total, the supply area serves 155,000 customers. **Table 1** shows number of customers and peak demands for the GSPs for the SDP 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).

GSP Name	Number of Customers Served (approximate)	2024 Substation Maximum demand in MVA (Season)
Arbroath	20,400	58.41
Bridge of Dun	15,600	25.96
Charleston	11,600	66.56
Dudhope	27,000	39.92
Fiddes	13,200	20.07
Lunanhead	16,700	45.45
Lyndhurst	18,200	70.30
Milton of Craigie	31,900	39.49

Table 1 - Customer number breakdown and substation peak demand readings (2023-2024) for Tealing 132kV supply area.

4.2. Current Network Topology

Figure 5 below highlights the existing 33kV network topology in the Tealing 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.

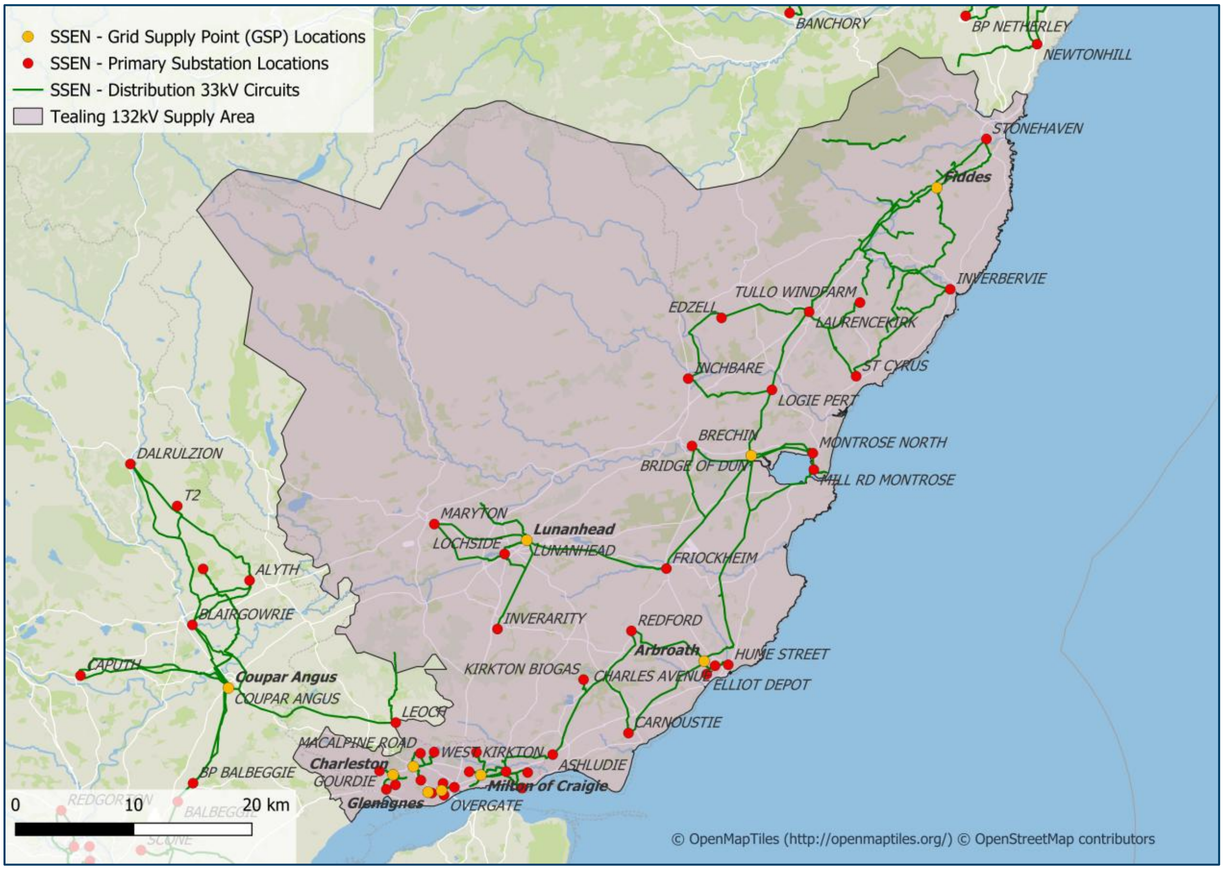


Figure 5 - Current network topology of Tealing SDP supply area.

4.3. Current Network Schematic

The existing 33kV network at Arbroath, Bridge of Dun, Charleston, Dudhope, Fiddes, Lunanhead, Lyndhurst and Milton of Craigie GSPs are shown below in **Figures 6-13**.

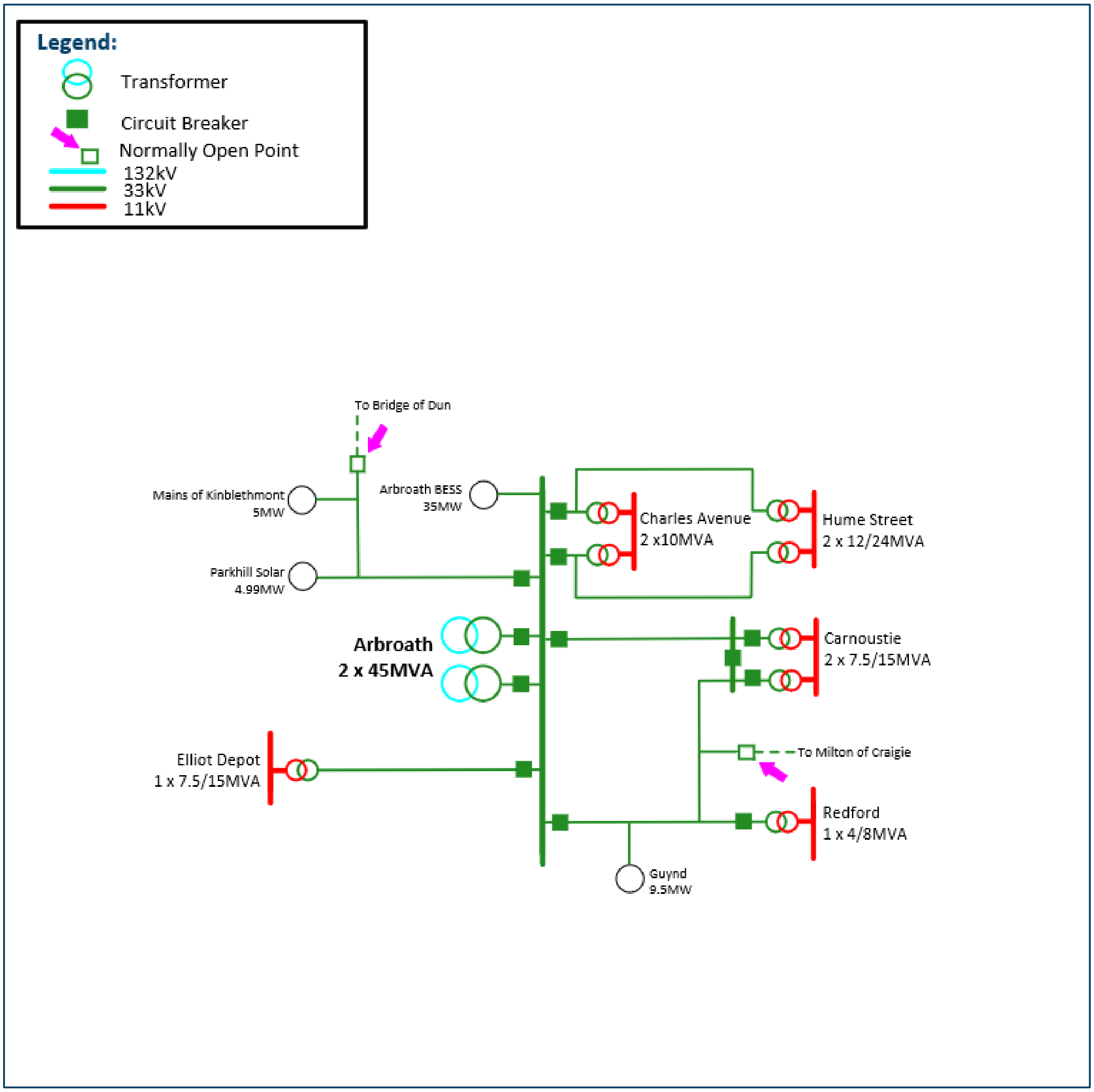


Figure 6 – Arbroath GSP Existing 33kV Network.

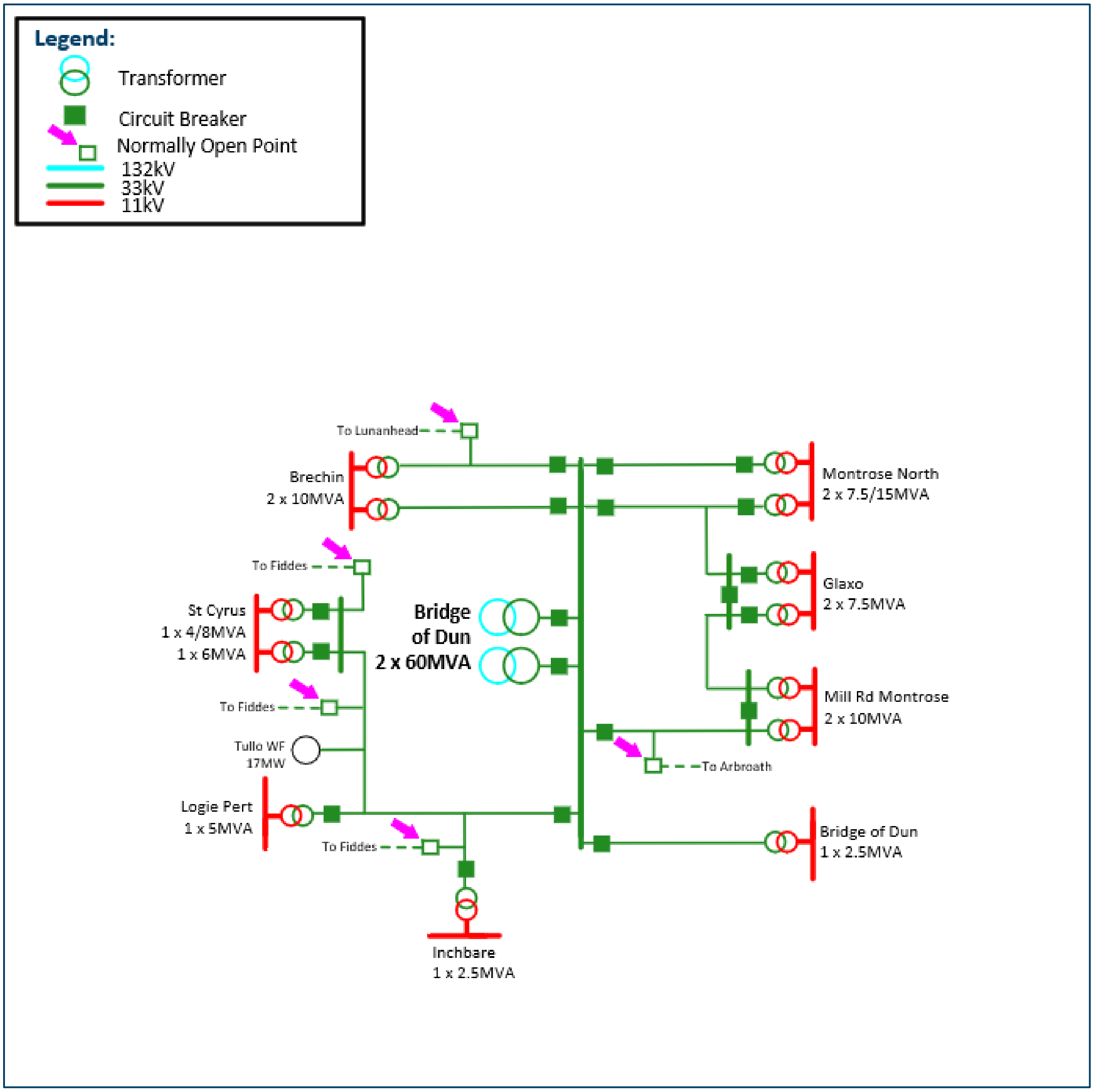


Figure 7 – Bridge of Dun GSP Existing 33kV Network.

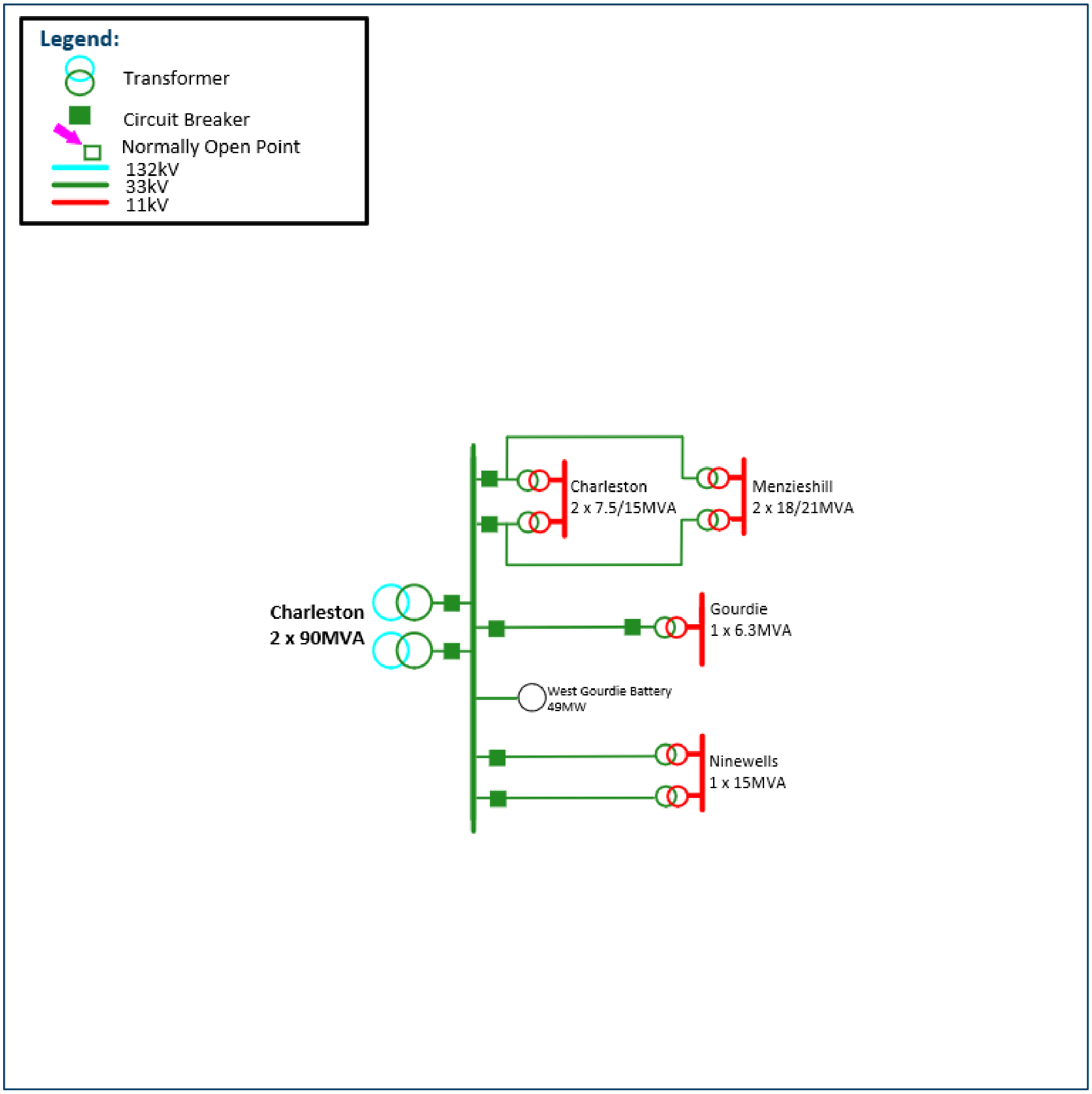


Figure 8 – Charleston GSP Existing 33kV Network.

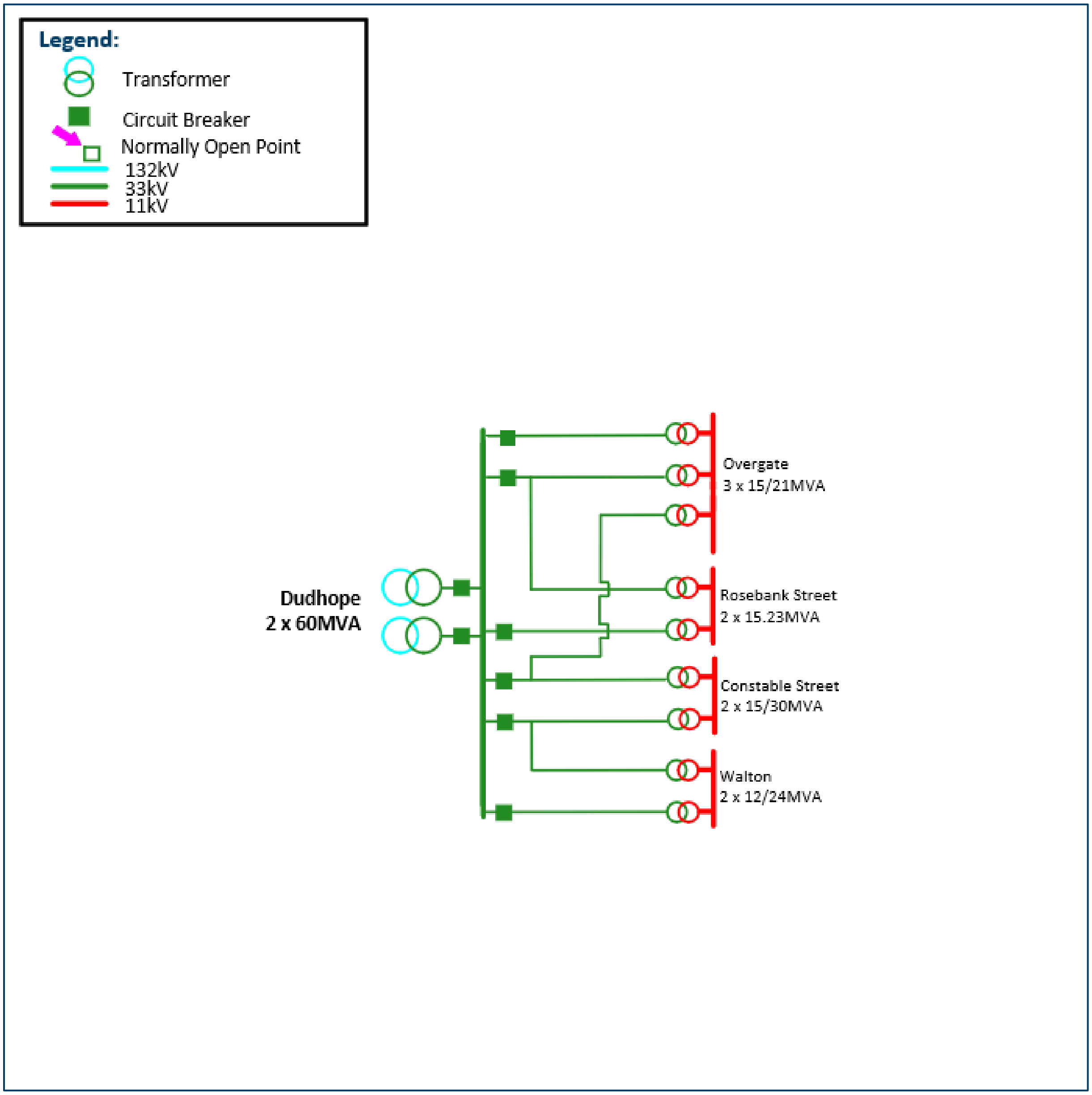


Figure 9 – Dudhope GSP Existing 33kV Network.

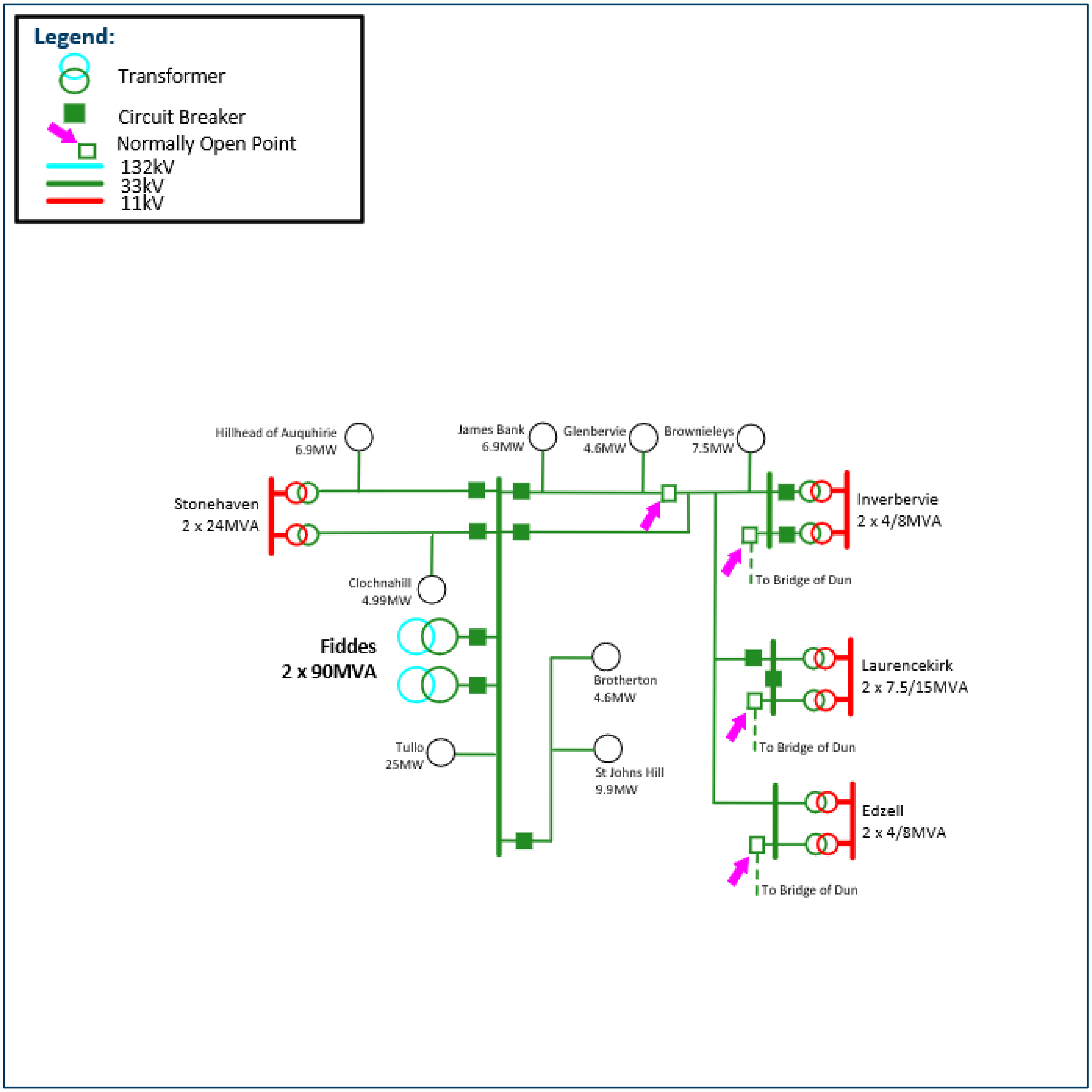


Figure 10 – Fiddes GSP Existing 33kV Network.

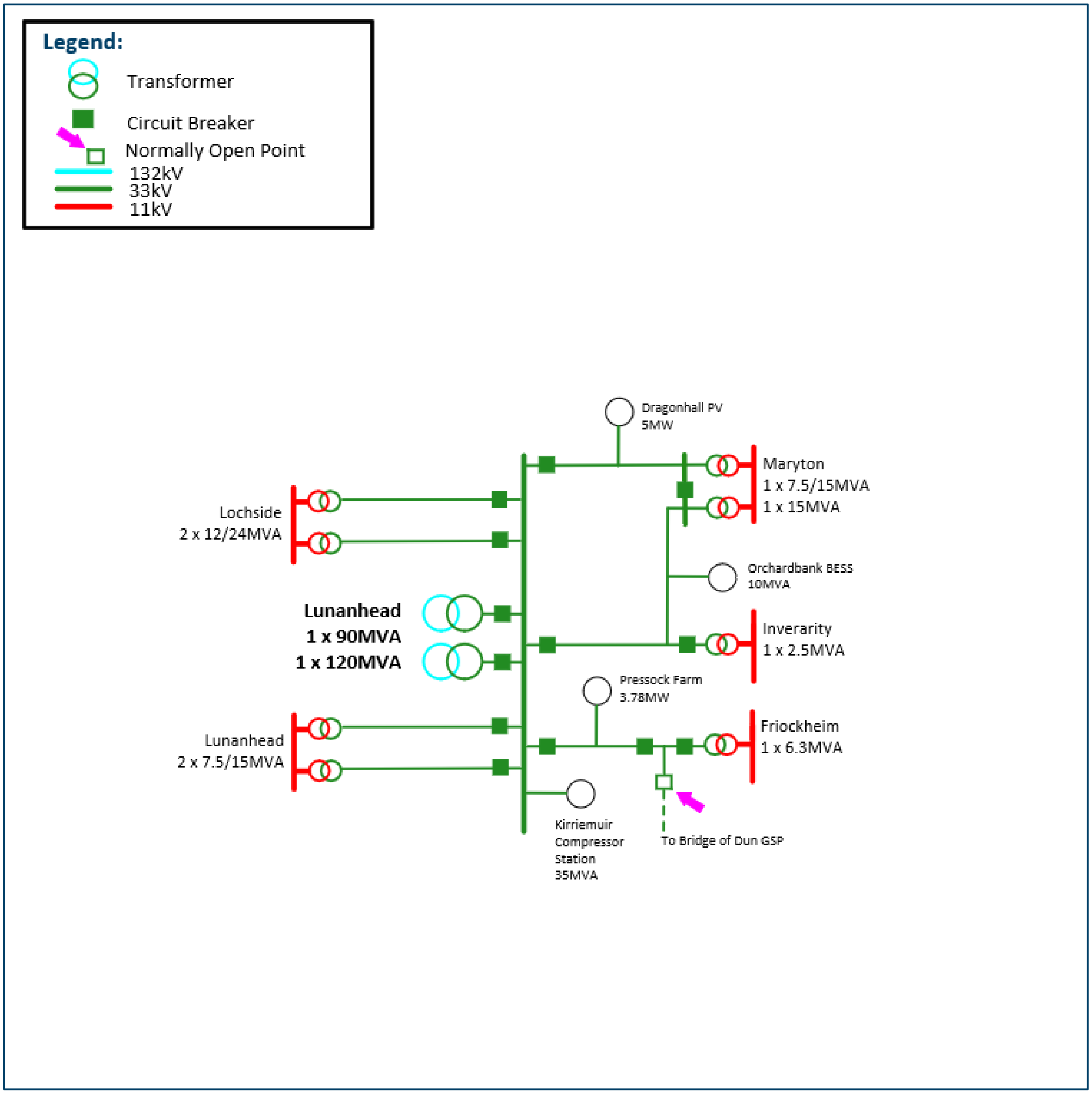


Figure 11 – Lunanhead GSP Existing 33kV Network.

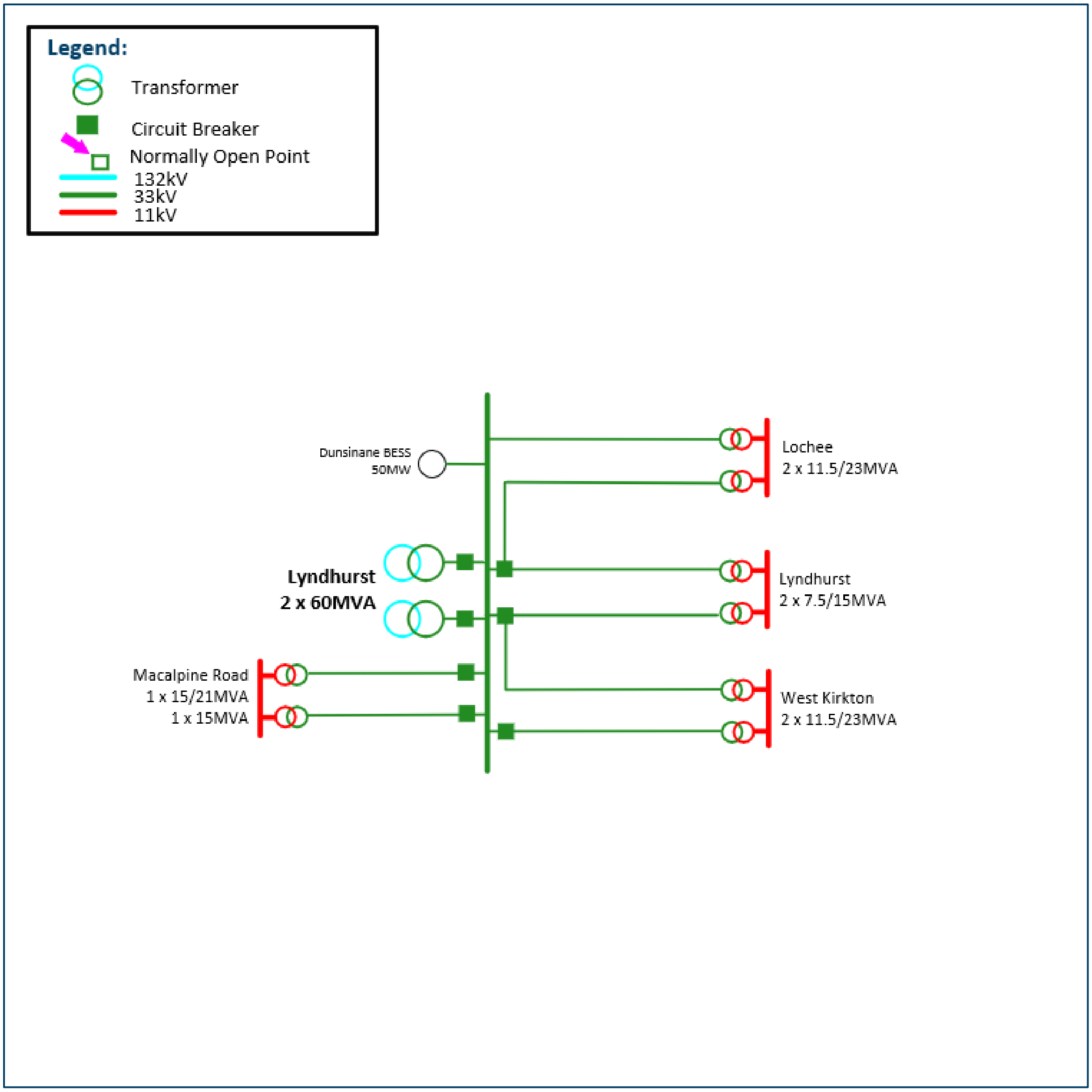


Figure 12 – Lyndhurst GSP Existing 33kV Network.

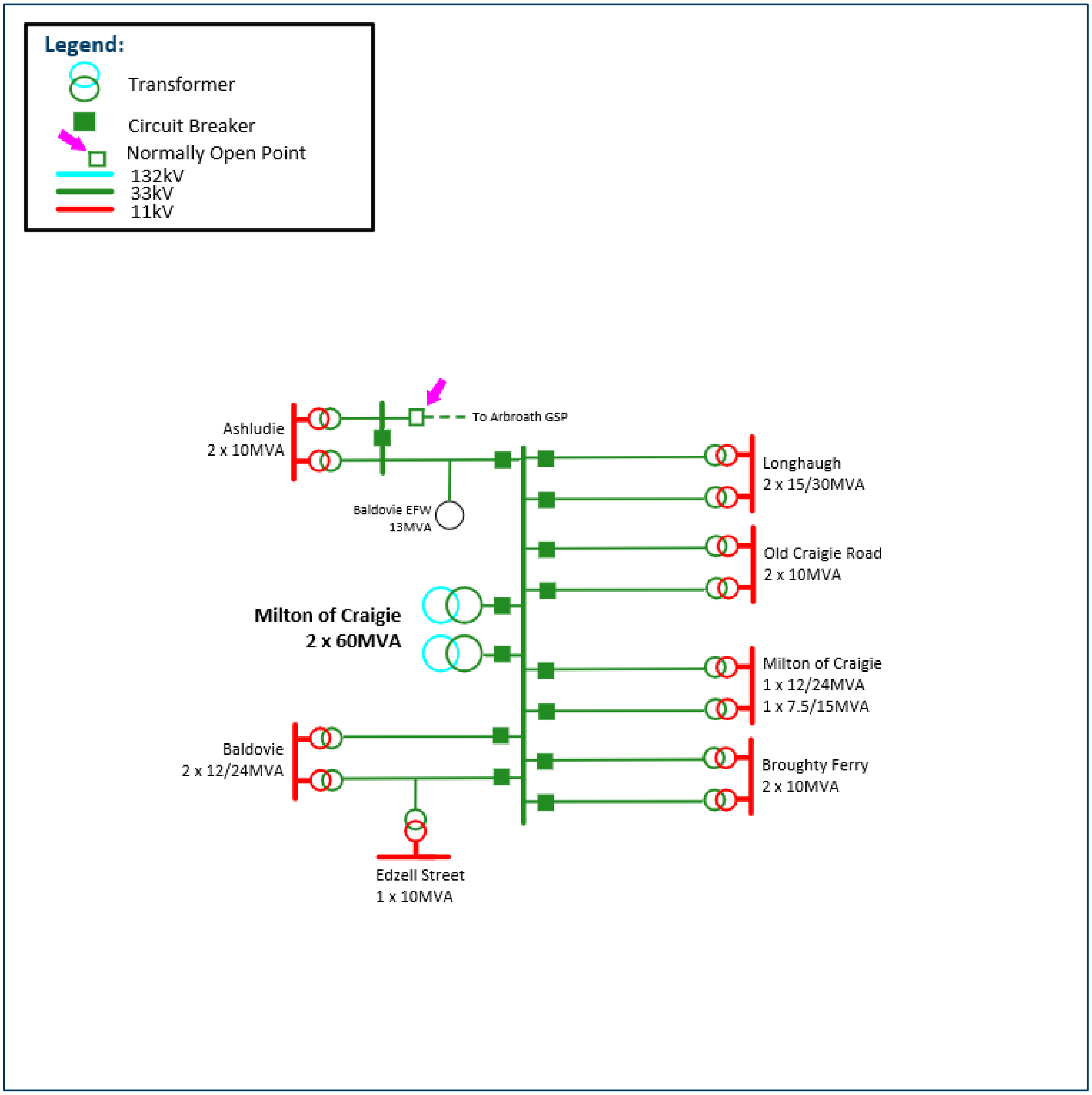


Figure 13 – Milton of Craigie GSP Existing 33kV Network.

5. FUTURE ELECTRICITY LOAD IN TEALINGS 132KV SUPPLY AREA

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

- This SDP and the analysis conducted has been completed ahead of any changes arising from Clean Power 2030.
- These projections relate to the SDP supply area highlighted in **Figure 1** and are not directly aligned to a particular local authority.
- Where MW values are presented in this section, they represent total installed capacity. When conducting network studies these values are appropriately diversified to represent the coincident maximum demand of the entire system rather than the total sum of all demands.
- For projections specific to individual primary substations or local authorities, please refer to our online dashboard.[18]

5.1. Generation and Storage

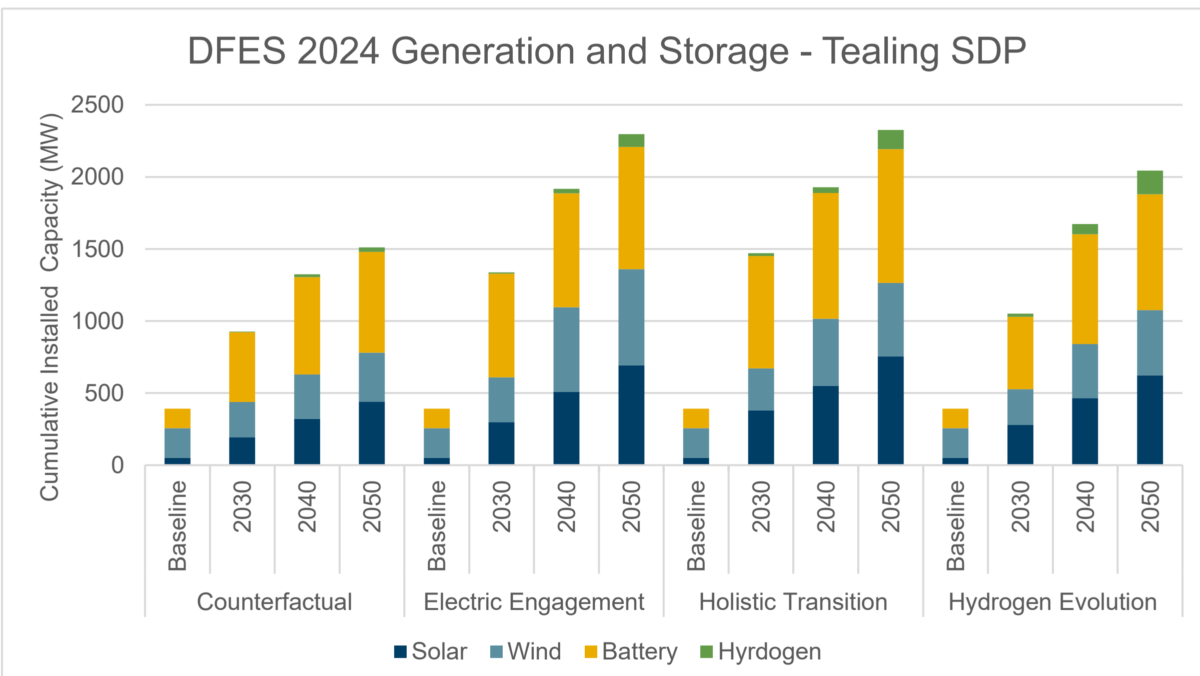


Figure 14 - Projected cumulative distributed generation capacity Tealing 132kV (MW). *Source: SSEN DFES 2024*

18 SSEN DFES Technology Projections - Microsoft Power BI

5.2. Transport Electrification

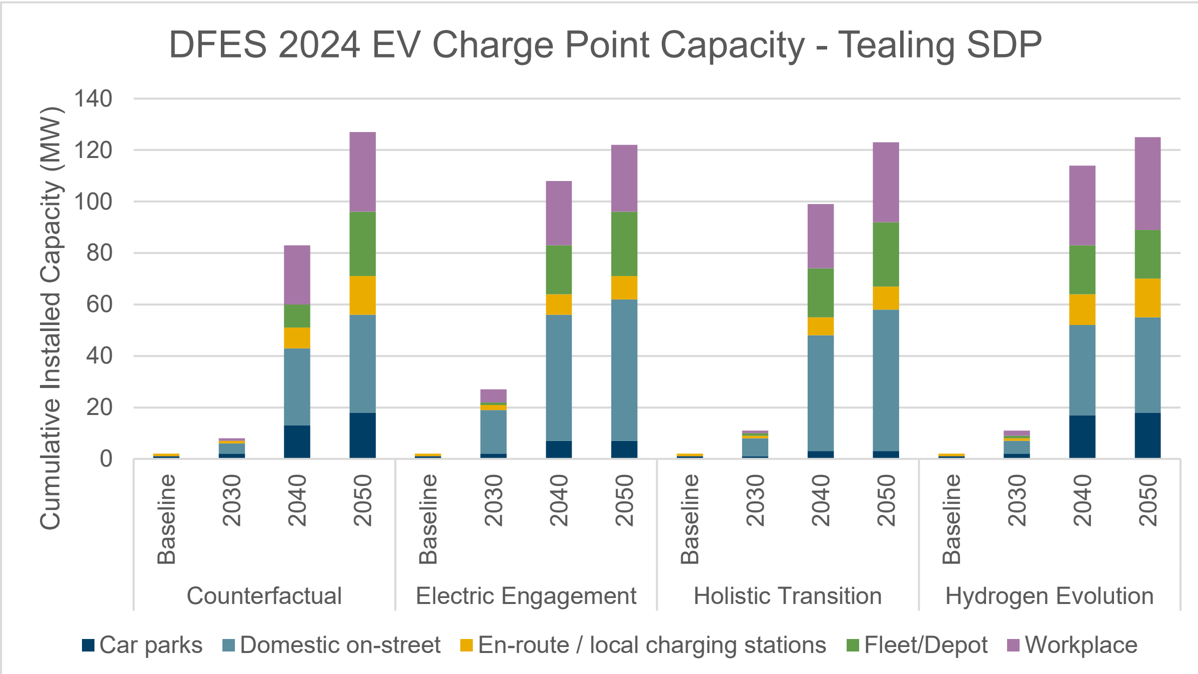


Figure 15 - Projected EV charge point capacity across Tealing 132kV (MW). *Source: SSEN DFES 2024*

5.3. Electrification of Heat

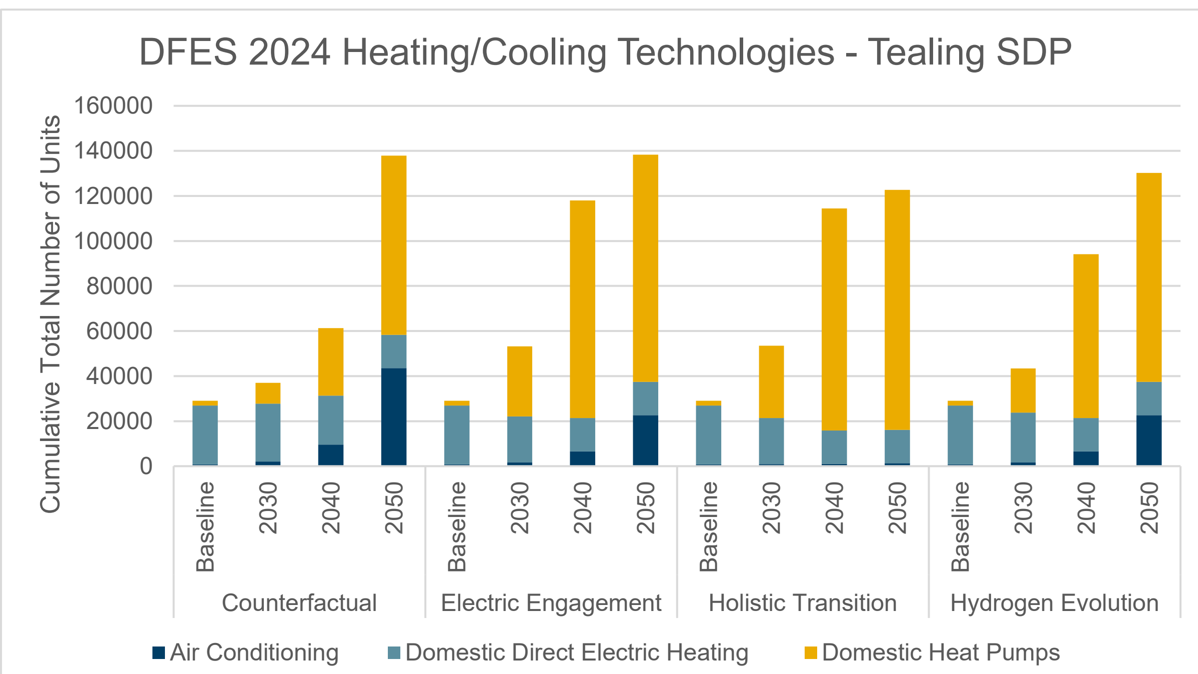


Figure 16 - Projected number of heating/cooling technologies across Tealing 132kV (MW). *Source: SSEN DFES 2024*

5.4. New Building Developments

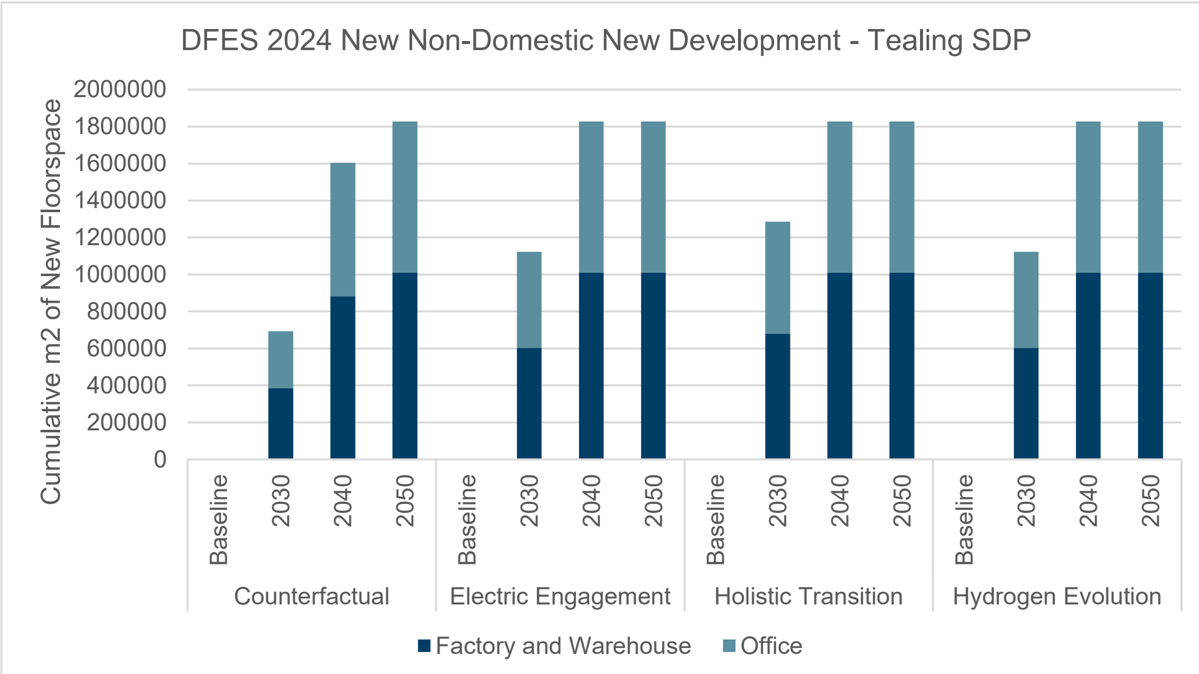


Figure 17 - Non-domestic new development across Tealing 132kV (MW). *Source: SSEN DFES 2024*

5.5. Commercial and Industrial Electrification

The decarbonisation of industries specific to Northern Scotland and broader industries indicate there could be a range of potential electrification outcomes for the Tealing 132kV supply area. We have identified agriculture and ports as areas of potential significant future industrial demand growth for the region.

Decarbonisation of the agricultural sector is an important consideration in this geographic area. SSEN leads the innovation project 'Future Agricultural Resilience Mapping' (FARM)[19] 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.

As well as this, SSEN leads an innovation project aimed at better understanding the potential electricity demands arising from the maritime industry, so assets and network in the area can be sized appropriately. SSEN's SeaChange innovation project has been funded through the Strategic Innovation Fund.[20] This project involves building a 'Navigating Energy Transitions' (NET) tool, which will help ports to plot their most viable pathways for decarbonisation.

19 Future Agricultural Resilience Mapping FARM | SSEN Innovation

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

6. WORK IN PROGRESS

6.1. Ongoing works in the Tealing 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 Tealing 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 published DNOA outcomes relevant to the SDP are included in **Appendix B.** The work included here is all work that has passed through the ID2 gate of our Distribution Governance and Investment Framework (DGIF), further information on this process is available in the DSO service statement 2025.[21] The networks considered for long-term modelling are shown in **Section 6.2.** Summary of existing works shown below in Error! Reference source not found.**.**

ID	Substation	Description	Driver	Forecast completion	Resolves future strategic needs to 2050?
Arbroath GSP					
1	Arbroath GSP	6.5km of UG cable upgraded on 1L5 and 2L5, which supply both Charles and St Hume PSSs, required to replace oil filled cables.	Asset Replacement	2029/30	
2	Elliot Depot PSS	PSS transformer upgraded from 7.5/15 to 12/14MVA under a contracted demand project.	Load Reinforcement	2026/27	
3	Arbroath 2 GSP	New GSP to be triggered for multiple contracted generation projects as current GSP no longer has distribution options available.	Load Reinforcement	NA	NA
Bridge of Dun GSP					
4	Bridge of Dun GSP and Montrose North PSS	Works include: • 2 x PSS transformers upgraded from 7.5/15 to 20/40MVA. • Whole 33kV and 11kV PSS switchboard replaced. • GSP 33kV switchboard replaced. • Both 33kV circuits from Bridge of Dun GSP to	DNOA process	2030/31	

21 DSO Service Statement 2025

		Montrose North PSS replaced with cable, as well as associated pilot wire.			
5	Bridge of Dun GSP 2	New GSP to be triggered for multiple contracted generation projects as current GSP no longer has distribution options available.	Load Reinforcement	NA	NA
Charleston GSP					
6	Charleston GSP	GSP switchboard replaced in a new switchroom building for a contracted generation project.	Load Reinforcement	2027/28	
Dudhope GSP					
7	Dudhope GSP	GSP switchboard replaced in a new switchroom building for a contracted generation project.	Load Reinforcement	2030/31	
8	Overgate PSS	PSS transformers upgraded from 3 x 15/21 to 2 x 15/30MVA.	Asset Replacement	2026/27	
Fetteresso GSP					
9	Fetteresso GSP	GSP switchboard replaced for a contracted generation project.	Load Reinforcement	2028/29	
Fiddes GSP					
10	Fiddes GSP	5.6km of OHL upgrade on the 5L5 Edzell PSS spur, triggered by a contracted demand project.	Load Reinforcement	2027/28	
11	Fiddes GSP 2	New GSP to be triggered for contracted generation projects as current GSP no longer has distribution options available.	Load Reinforcement	NA	NA
Lunanhead GSP					
12	Lunanhead GSP 2	New GSP to be triggered for contracted generation projects as current GSP no longer has distribution options available.	Load Reinforcement	NA	NA
Lyndhurst GSP					

13	Lyndhurst GSP	GSP switchboard replaced in a new switchroom building for a contracted generation project.	Load Reinforcement	2031/32	
Milton of Craigie GSP					
14	Ashludie PSS	Works include: • 2 x PSS transformers upgraded from 10 to 15/30MVA. • All 33kV and 11kV PSS switchboard replaced. • Addition of 2 x PSS batteries required for SCADA and protection.	DNOA process	2028/29	
15	Milton of Craigie PSS	Upgrade existing PSS transformer T2 from 7.5/15 to 12/24MVA to match T1, triggered by contracted demand project.	Load Reinforcement	2025/26	

Table 2 – SHEPD Works already triggered for the Tealing 132kV supply area.

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.

6.2. Network Schematic (following completion of above works)

The network schematic below in **Figure 18 - 24** shows the 33kV network with changes highlighted and referenced to the data in **Table 2.**

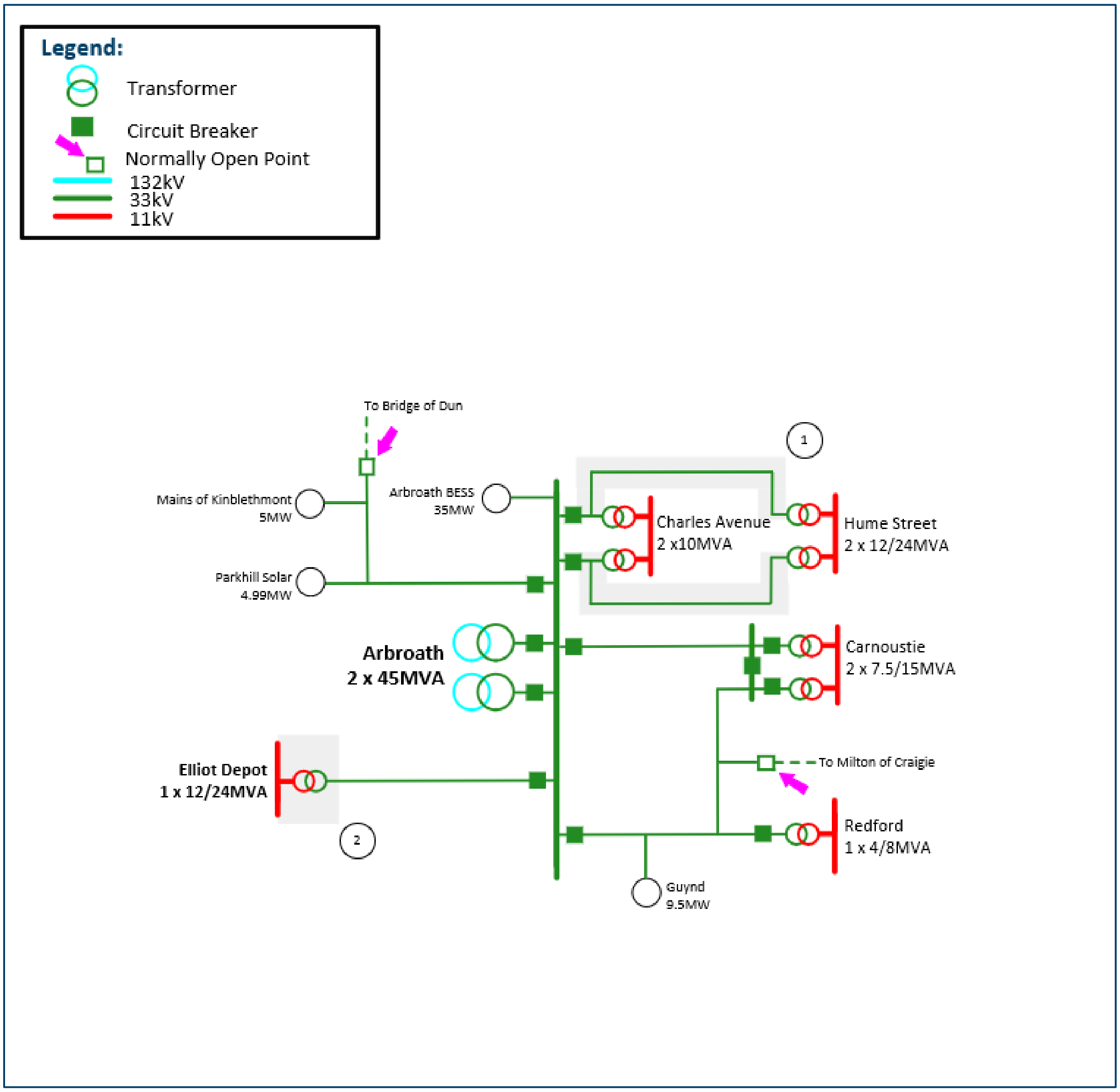


Figure 18 - Arbroath GSP Future 33kV Network.

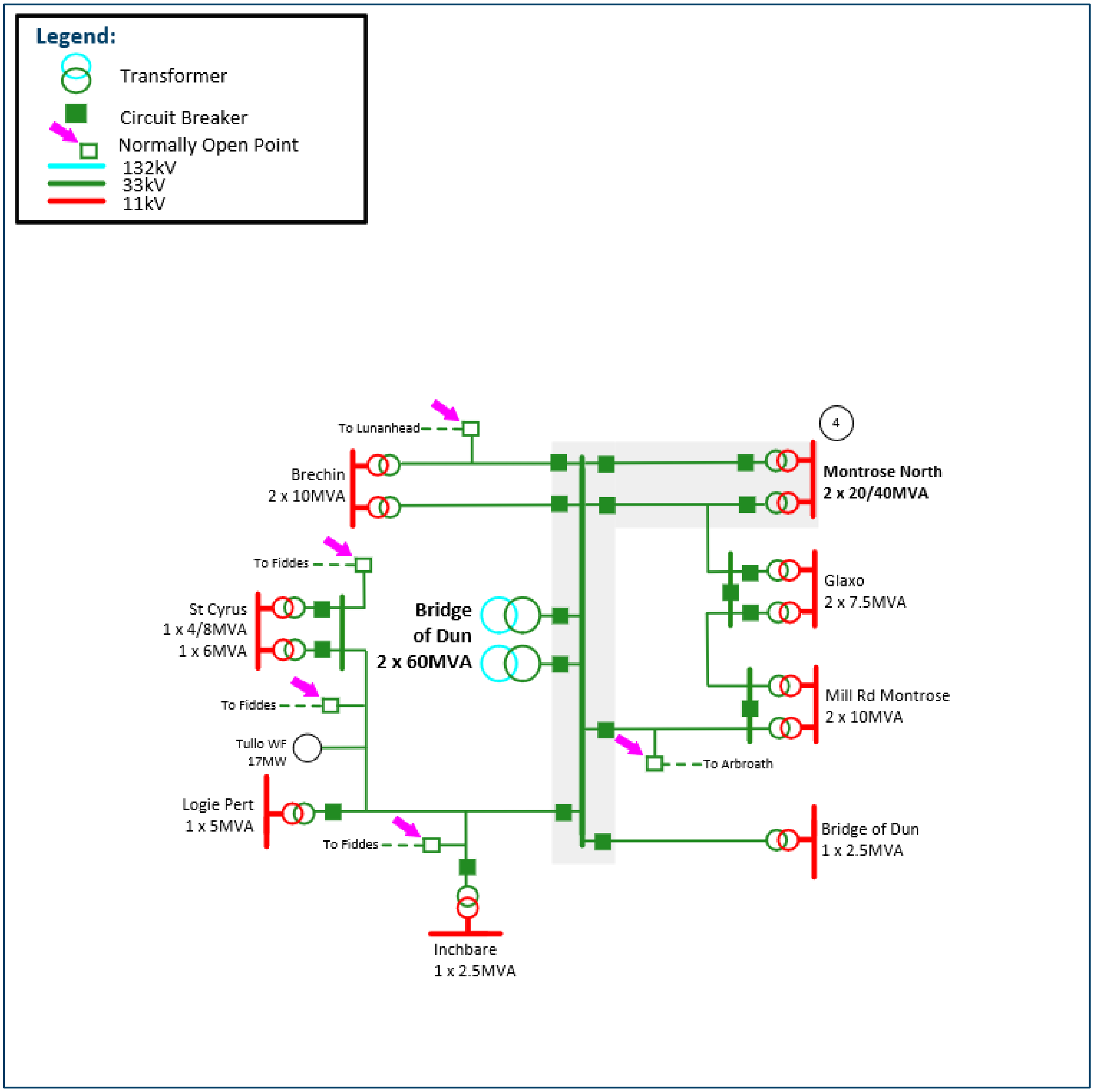


Figure 19 – Bridge of Dun GSP Future 33kV Network.

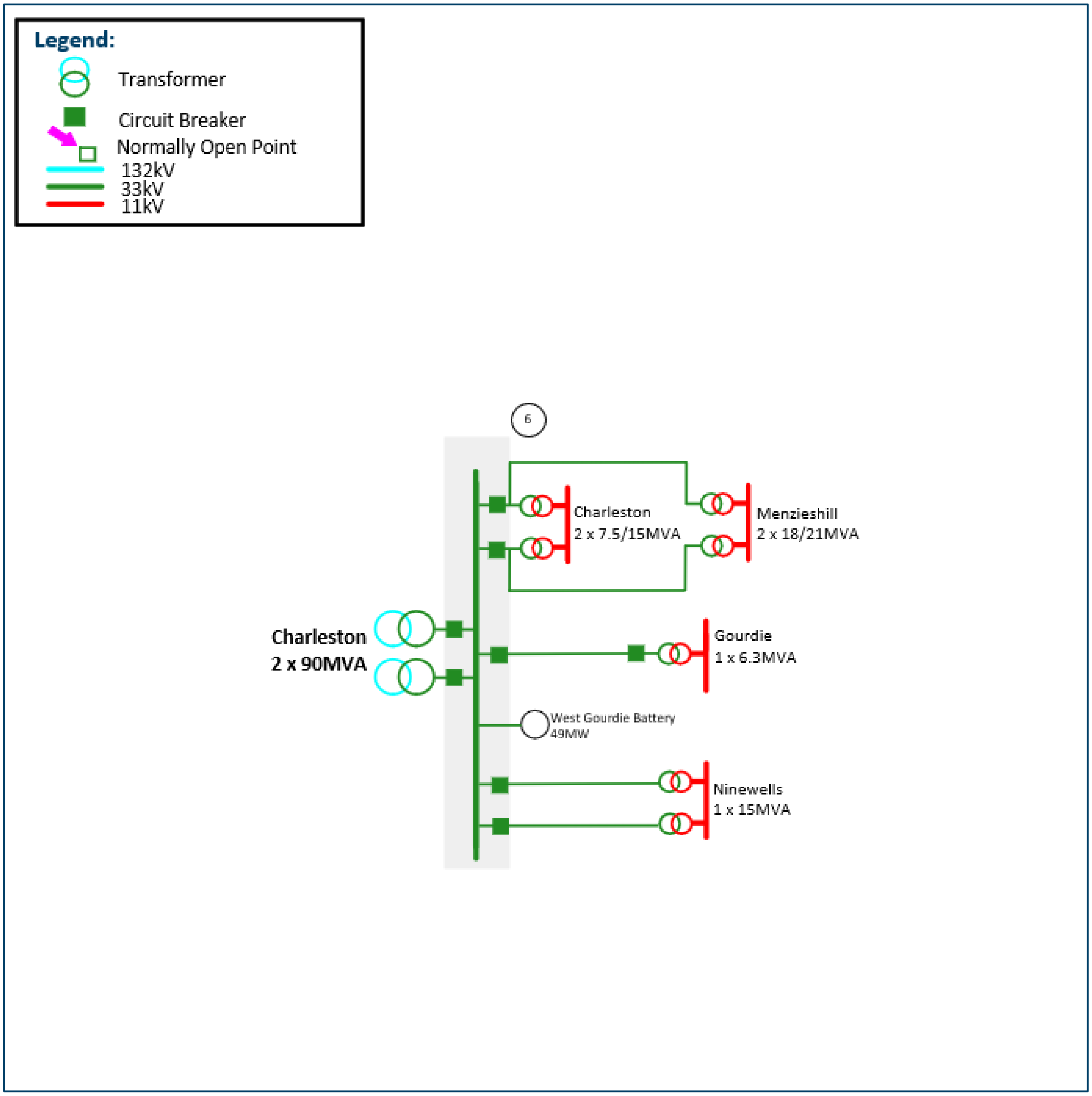


Figure 20 – Charleston GSP Future 33kV Network.

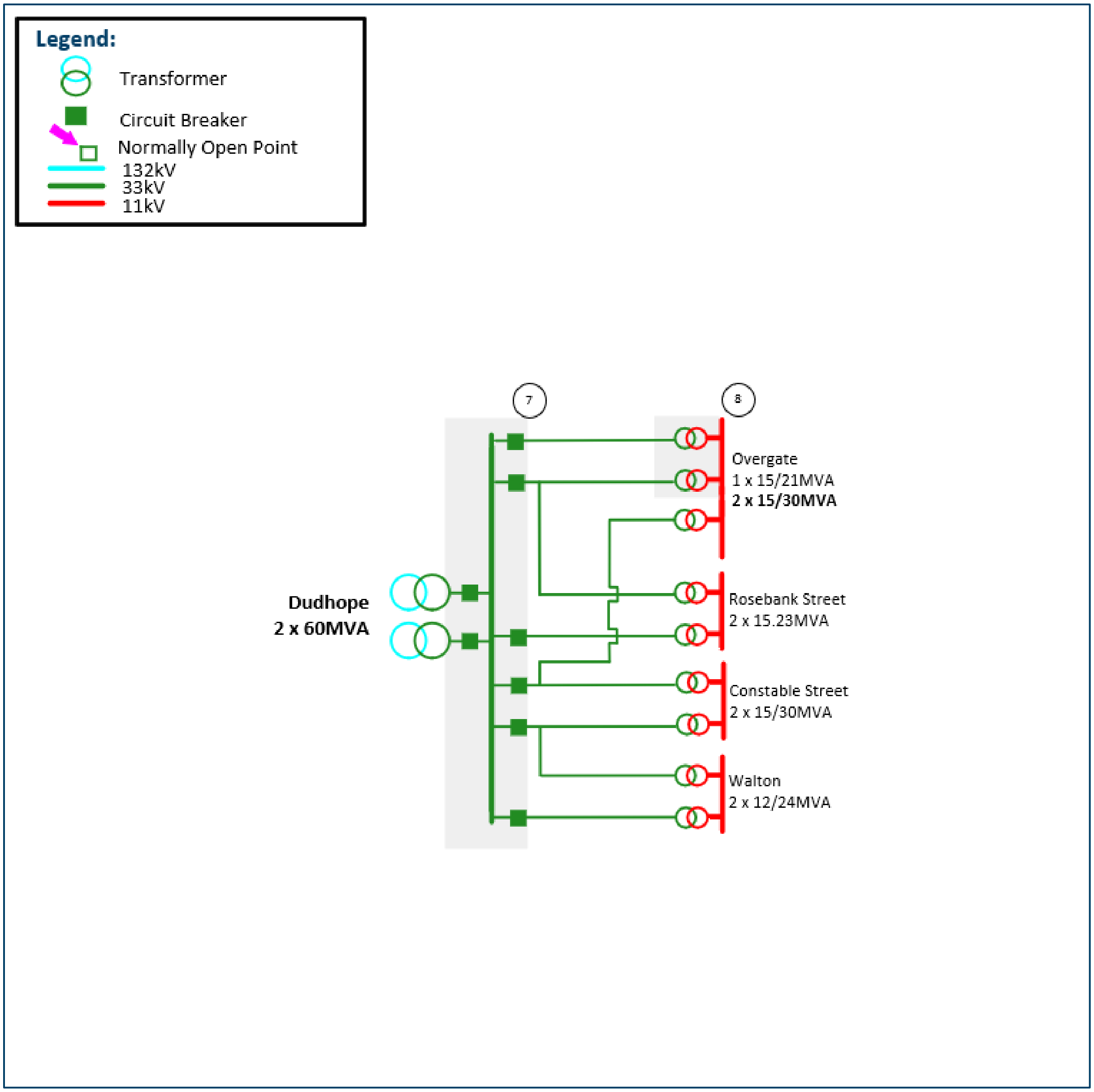


Figure 21 – Dudhope GSP Future 33kV Network.

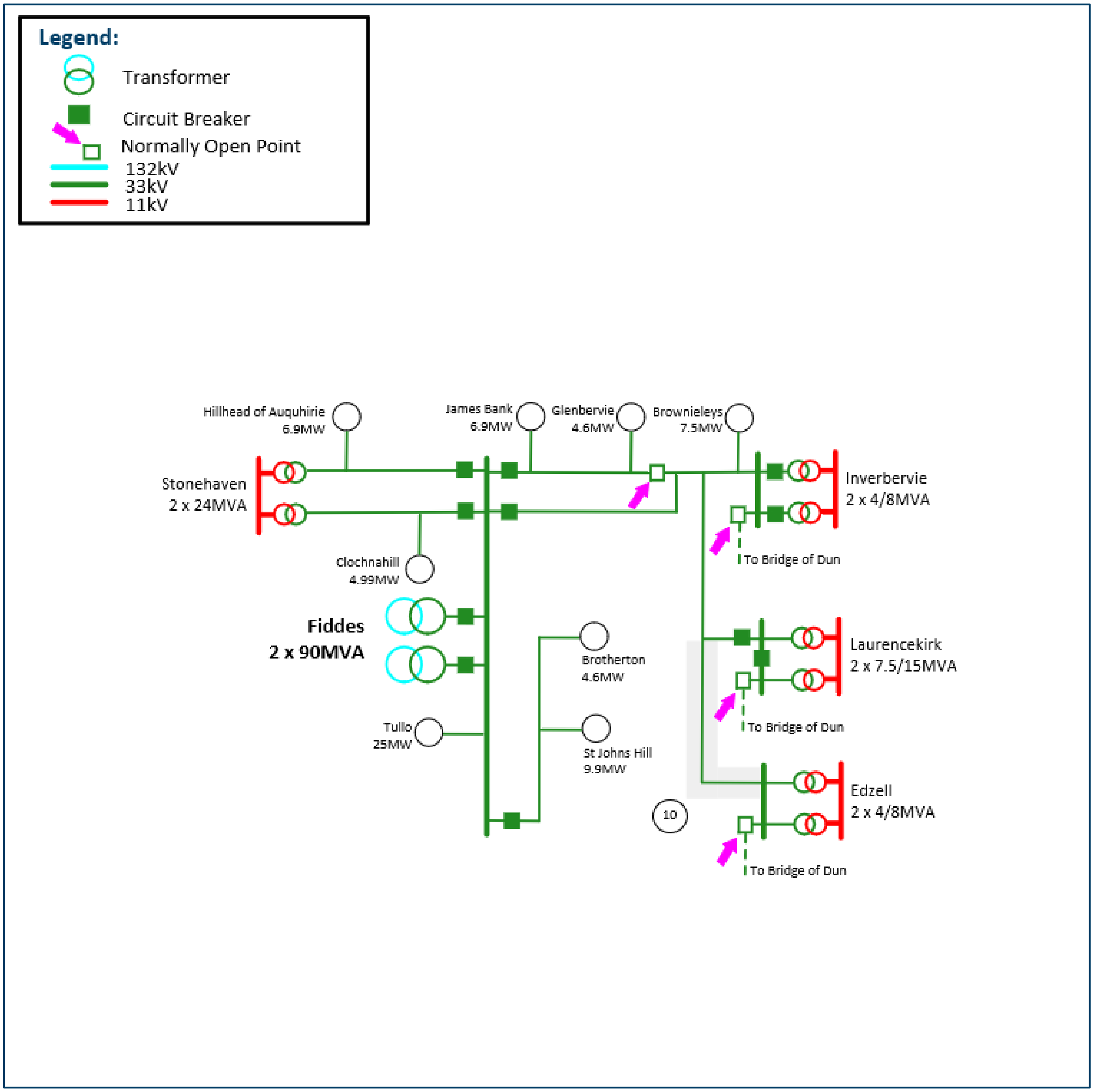


Figure 22 - Fiddes GSP Future 33kV Network.

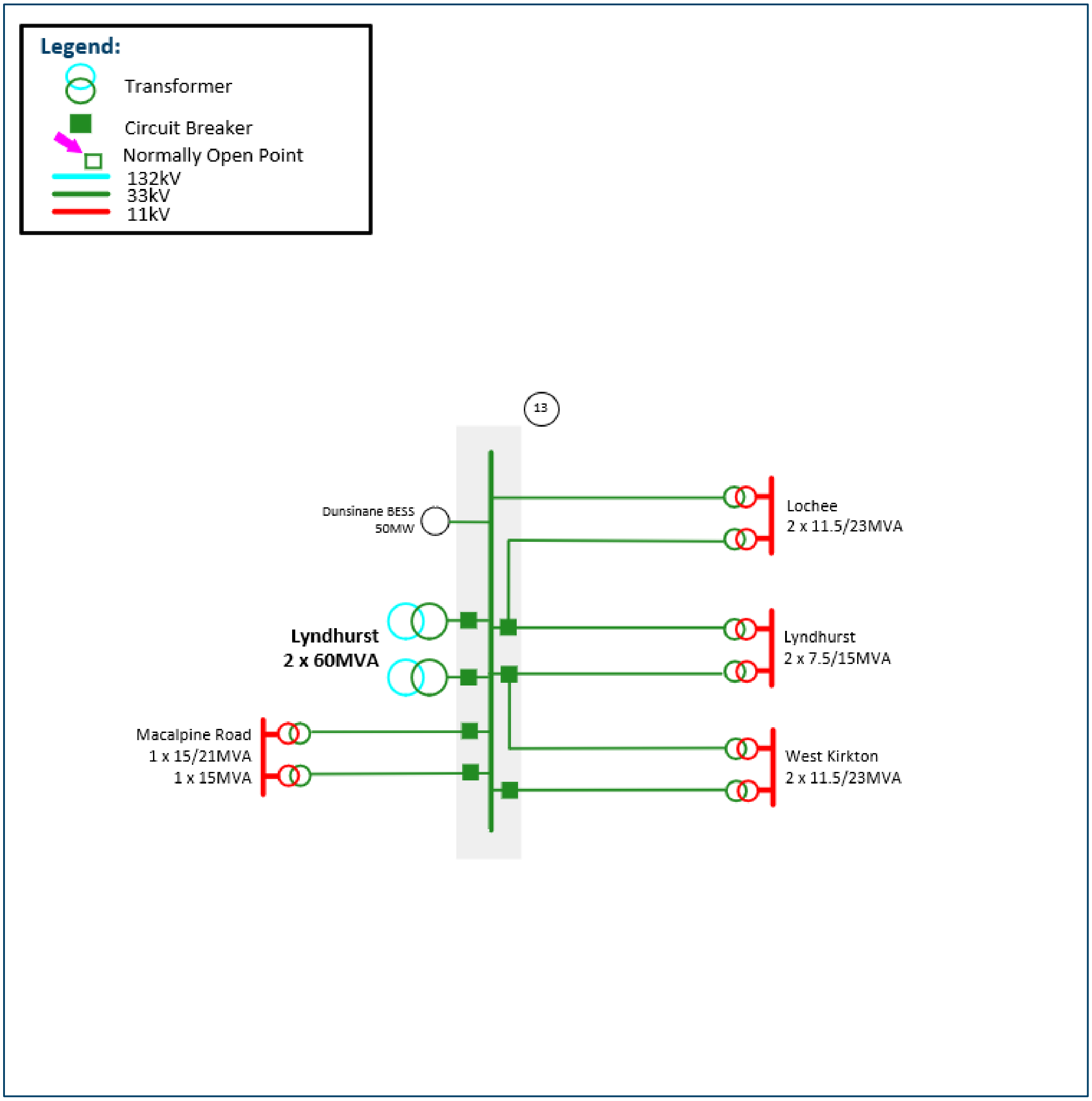


Figure 23 - Lyndhurst GSP Future 33kV Network.

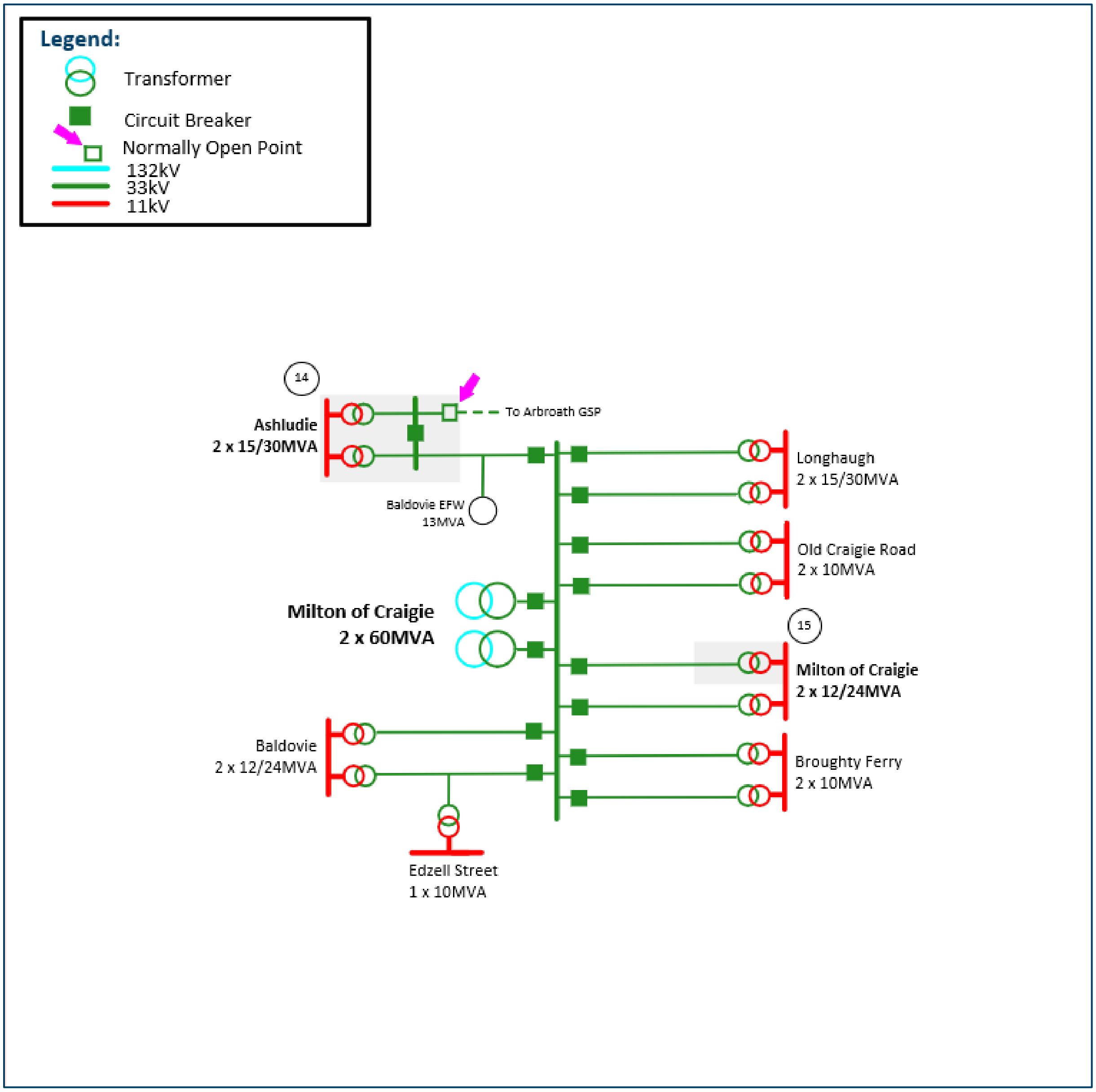


Figure 24 - Arbroath GSP Future 33kV Network.

7. SPATIAL PLANS OF FUTURE NEEDS

7.1. Extra High Voltage / High Voltage Spatial Plans

The EHV/HV spatial plans shown below in **Figure 25** show the projected headroom or capacity shortfall due to demand increases at primary substations across the Tealing 132kV supply area. Darker shades indicate that there is a projected capacity shortfall whereas lighter blue shades indicate that there is headroom capacity based on current projections. EHV/HV spatial plans for the other DFES scenarios are presented in **Appendix B.**

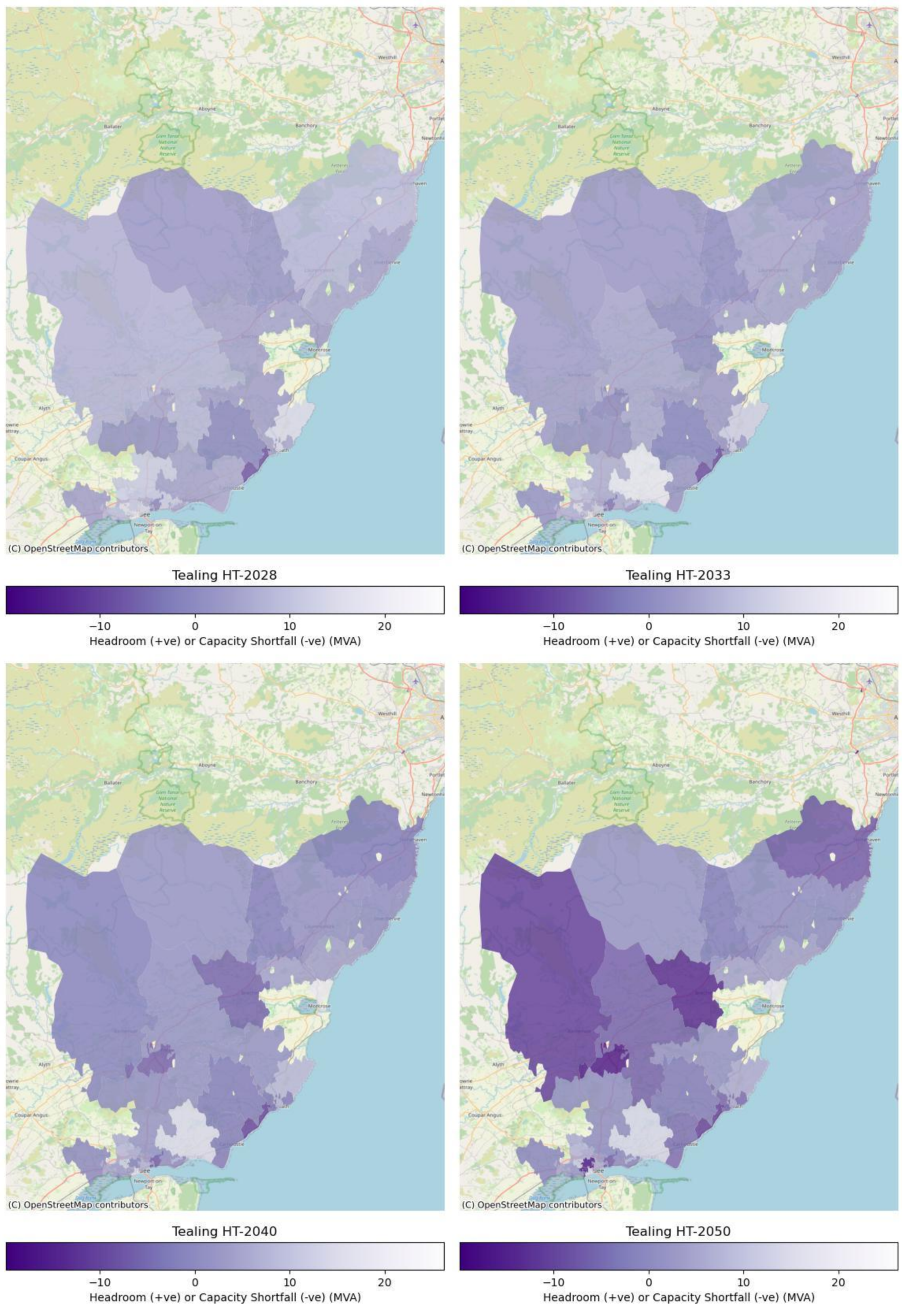


Figure 25 - Tealing 132kV Supply Area - EHV/HV Spatial Plans – Holistic Transition

7.2. HV/LV Spatial Plans

The HV/LV spatial plans shown below in **Figure 26** show the point locations of secondary transformers supplied by Tealing GSP. The points are colourised based on the projected percentage loading with red meaning higher percentage loading and green being lower percentage loading. The HV/LV spatial plans for the other DFES 2024 scenarios are available in **Appendix C.**

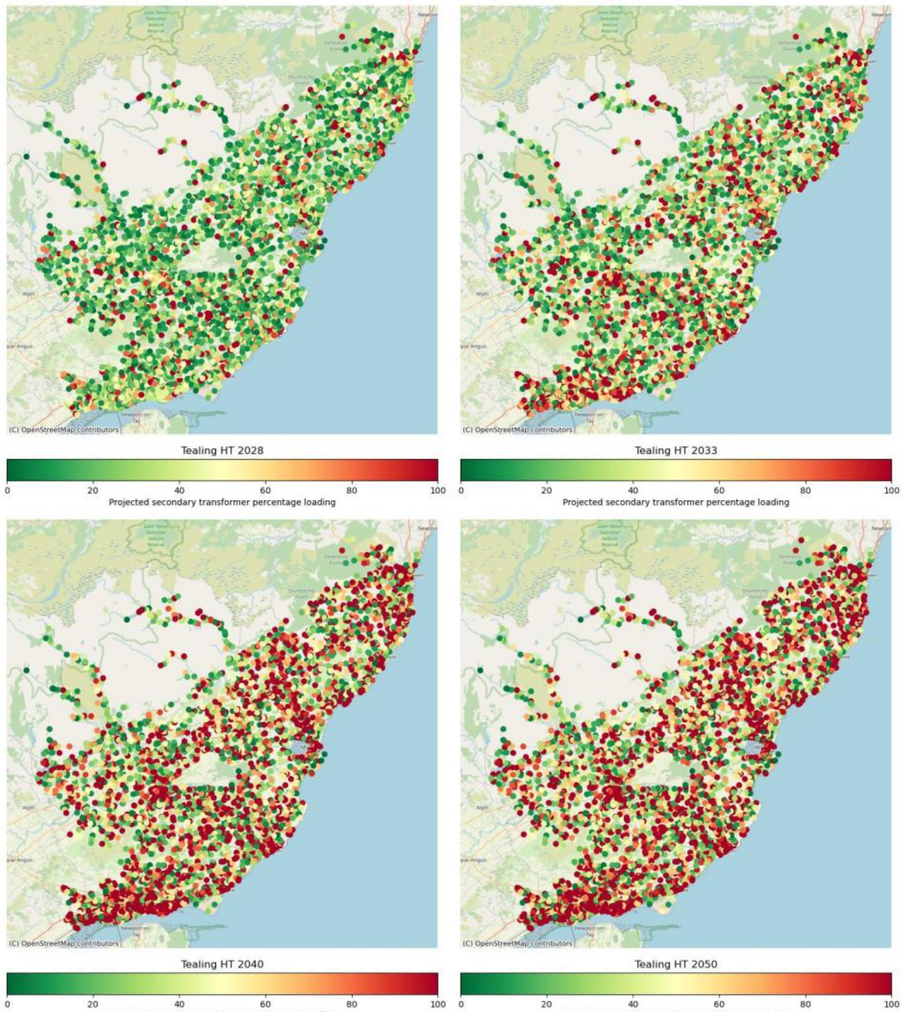


Figure 26 - Tealing 132kV Supply Area - HV/LV Spatial Plans – Holistic Transition

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.

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

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

8.1. Overall Dependencies, Risks, and Mitigations

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

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 Tealing 132kV supply area.

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. 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 the 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.

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: 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

The following tables details the 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 3** we recommend that these are progressed through the DNOA process so that there is sufficient time for solutions to be designed and delivered.

8.2.1. System needs to 2035

ID	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
Lunanhead GSP							
1	1L5 circuit to Inverarity and Maryton PSS	2027	2027	2027	2028	Loss of 4L5 circuit.	Thermal constraints imminent due to 1km of weak rated UG cable, remaining circuits don't overload till 2031. Options to resolve include: - Upgrade existing cables. - Procurement of flexibility services - Load shedding on the 11kV network (both PSSs have interconnections with Lunanhead PSS)
2	3L5 and 6L5 circuits to Lochside PSS and Transformers	2031	2032	2032	2038	Loss of either PSS transformer and loss of either 3L5 or 6L5 circuits.	Options to resolve thermal constraints: - Upgrade existing transformers and cables (additional transformer unlikely due to space constraints). - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with Lunanhead and Maryton PSS)
Fiddes GSP							

3	5L5 Circuit to Inverbervie, Laurencekirk and Edzell PSS.	2029	2029	2030	2032	Base Case and loss of Bridge of Dun 1L5.	Voltage and thermal constraints occur simultaneously; voltage under intact and thermal under an N-1 outage. Options to resolve include: - Upgrade existing OHL to a larger conductor (higher thermal rating and lower impedance, hence lower voltage drop) - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
4	1L5 Circuit to Stonehaven PSS.	2032	2033	2033	2040	Loss of 2L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing OHL to a larger conductor or by respecifying existing conductor to run at a higher temp (dependent on OHL survey). - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
5	2L5 Circuit to Stonehaven PSS.	2035	2035	2037	2044	Loss of 1L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing UG cable to a larger conductor. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
Arbroath GSP							
6	Charles Avenue PSS Transformers	2030	2030	2032	2034	Loss of either PSS transformer.	130% overload permissible on ONAN transformers, which means reinforcements won't be required till 2033, under the HT scenario. However, options to resolve include: - Upgrade existing transformers (additional transformer unlikely due to space constraints) - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Elliot Depot PSS)
Bridge of Dun GSP							
7	1L5 circuit to Inchbare, Logie Pert and St Cyrus PSS.	2030	2030	2031	2035	Loss of Fiddes 5L5 circuit.	Voltage and thermal constraints occur simultaneously and options to resolve include: - Upgrade existing OHL and UG cable to a larger conductor (higher thermal rating and lower impedance, hence lower voltage drop) - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs) The inverse N-1 outage, shown in Table 3, Row 3, also presents constraints. A broader intervention approach may be required, such as isolating one of the larger PSSs with dedicated 33 kV feeds. At present, six PSSs are supplied through a single feeder under an N-1 outage. Isolating PSSs would help to address these constraints and improve overall network resilience.

8	Mill Rd Montrose PSS Transformers	2030	2031	2030	2035	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformers (additional transformer unlikely due to space constraints) - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Montrose North and Hume Street PSS) Montrose North and Mill Rd Montrose PSS have multiple 11kV interconnections. Load balancing onto Montrose North PSS (due to have upgraded capacity) could potentially defer additional reinforcements.
9	Brechin PSS Transformers	2031	2031	2031	2034	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformers (additional transformer unlikely due to space constraints) - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Lunanhead and Inchbare PSS)
10	2L5 circuit to Mill Rd Montrose PSS	2034	2033	2036	2042	Loss of 3L5 or 6L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing OHL to a larger conductor or by respecifying existing conductor to run at a higher temp (dependent on OHL survey). - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Montrose North and Hume Street PSS)
Charleston GSP							
11	Gourdie PSS Transformer	2032	2032	2033	2038	Intact.	Options to resolve thermal constraints include: - Upgrade of existing transformer or addition of a second transformer (farmland adjacent to existing site) - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Charleston and Ninewells PSS)
Milton of Craigie GSP							
12	6L5 and 5L5 Circuits to Baldovie and Edzell Street PSS	2033	2033	2038	2040	Loss of either 6L5 or 5L5 circuit	6L5 circuit overloads 3 years later under the HT scenario; however, cables run partially parallel and should therefore be resolved together. Options to resolve include: - Upgrade existing UG cable to a larger conductor. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections notable with Milton of Craigie and Broughty Ferry PSS)
13	Broughty Ferry PSS Transformers	2034	2034	2036	2042	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformers (additional transformer unlikely due to space constraints). - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections

							with Baldovie and Edzell Street PSS) Resolving the circuit thermal overloads identified in Table 3, Row 11, together with appropriate 11kV load balancing, could potentially avoid the need for PSS transformer upgrades.

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

8.2.2. System needs to 2050

ID	Location of proposed intervention	HT Year	EE Year	HE Year	CF Year	Network State	Comments and potential options to resolve the system need
Fiddes GSP							
1	Stonehaven PSS Transformers.	2038	2040	2040	2050	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformers (additional transformer unlikely due to space constraints) - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Baldovie and Edzell Street PSS)
Arbroath GSP							
2	Carnoustie PSS Transformers	2036	2036	2039	2046	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformer or addition of a second transformer (farmland adjacent to existing site). - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
3	5L5 Circuit to Carnoustie and Redford PSS	2037	2039	2041	2049	Loss of 6L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing OHL to a larger conductor or by respecifying existing conductor to run at a higher temp (dependent on OHL survey). - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
Bridge of Dun GSP							
4	6L5 circuit to Montrose North and Mill RD Montrose PSS	2037	2038	2035	2047	Loss of 2L5 circuit.	The incoming 33kV circuit for Montrose North PSS is due to be upgraded as shown in Table 2, Row 4. However, the upstream section to Mill Rd Montrose PSS is due to overload. Options to resolve include: - Upgrade existing UG cable to a larger conductor. - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs). Montrose North and Mill Rd Montrose PSS have multiple 11kV interconnections. Load balancing onto Montrose North PSS (due to have

							upgraded capacity) could potentially defer additional reinforcements.
5	4L5 and 5L5 Circuits to Brechin PSS	2037	2038	2038	2049	Loss of either 4L5 or 5L5 circuit.	Thermal overload initially; however, voltage constraints present by 2039 under the HT scenario. Options to resolve include: - Upgrade existing OHL to a larger conductor (higher thermal rating and lower impedance, hence lower voltage drop) - Procurement of flexibility services. - Load shedding on the 11kV network (several interconnections with multiple PSSs)
Dudhope GSP							
6	Rosebank PSS Transformers	2037	2038	2038	2050	Loss of either PSS transformer.	Options to resolve thermal constraints include: - Upgrade of existing transformer or addition of a second transformer (current site previously had a third transformer). - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Constable Street and Lochee PSS)
7	5L5 and 6L5 Circuits to Constable Street PSS	2038	2037	2044	2049	Loss of either 5L5 or 6L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing UG cable to a larger conductor. - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections Rosebank Street PSS)
8	2L5 and 4L5 Circuits to Rosebank PSS	2040	2041	2040	-	Loss of either 2L5 or 4L5 circuit.	Options to resolve thermal constraints include: - Upgrade existing UG cable to a larger conductor. - Procurement of flexibility services. - Load shedding on the 11kV network (several notable interconnections with Constable Street and Lochee PSS) Rosebank and Constable Street PSS have multiple 11kV interconnections. Load balancing onto Constable Street PSS (with recently upgraded transformers), together with upgrading the incoming circuits highlighted in Table 5, Row 7, could potentially defer additional reinforcements highlighted here and in Table 5, Row 6.

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

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

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

8.3.1. High Voltage Networks

As well as the EHV system needs identified in the previous section, increased penetration of low carbon technologies (LCTs) connecting to the distribution network will result in system needs on the High Voltage (HV) and Low Voltage (LV) networks. To provide a view on the impact of these technologies on the distribution network here we have used the load model that is produced by SSEN's Data and Analytics team.[22]

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 the Tealing 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 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.

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

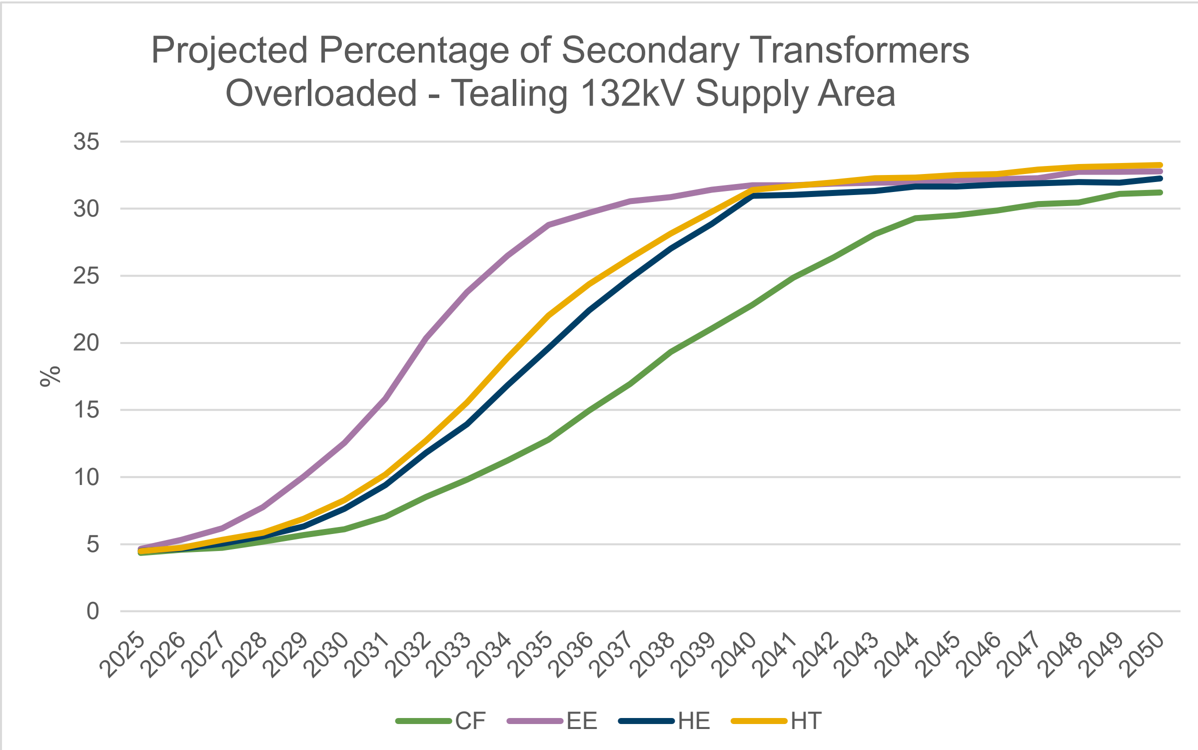


Figure 27 - Tealing 132kV supply area projected secondary transformer loading. *Source: SSEN Load Model*

Considering the Just Transition in HV development

SSEN are building on the findings from the Vulnerability Future Energy Scenarios (VFES). This innovation project investigated how the use of new foresighting techniques, along with data analytics and expert validation could be used to identify and forecast consumers in vulnerable situations as we move toward net zero. Use of the outputs from the VFES enable SSEN to develop the network in a way that truly accounts for the levels of vulnerability their customers in different locations face. Inclusion of the use of the VFES also acts as an example of how this data can be used more broadly by SSEN as well as other organisations for spatial planning. For example, it can help us identify areas where energy efficiency mechanisms could help reduce the need for network investment.

One of the outputs from this innovation project was the report produced by the Smith Institute.[23] This work groups LSOAs[24] 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.**

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

24 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 5 - VFES Groupings

To understand the vulnerability groupings across the Tealing 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 HT 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 28.**

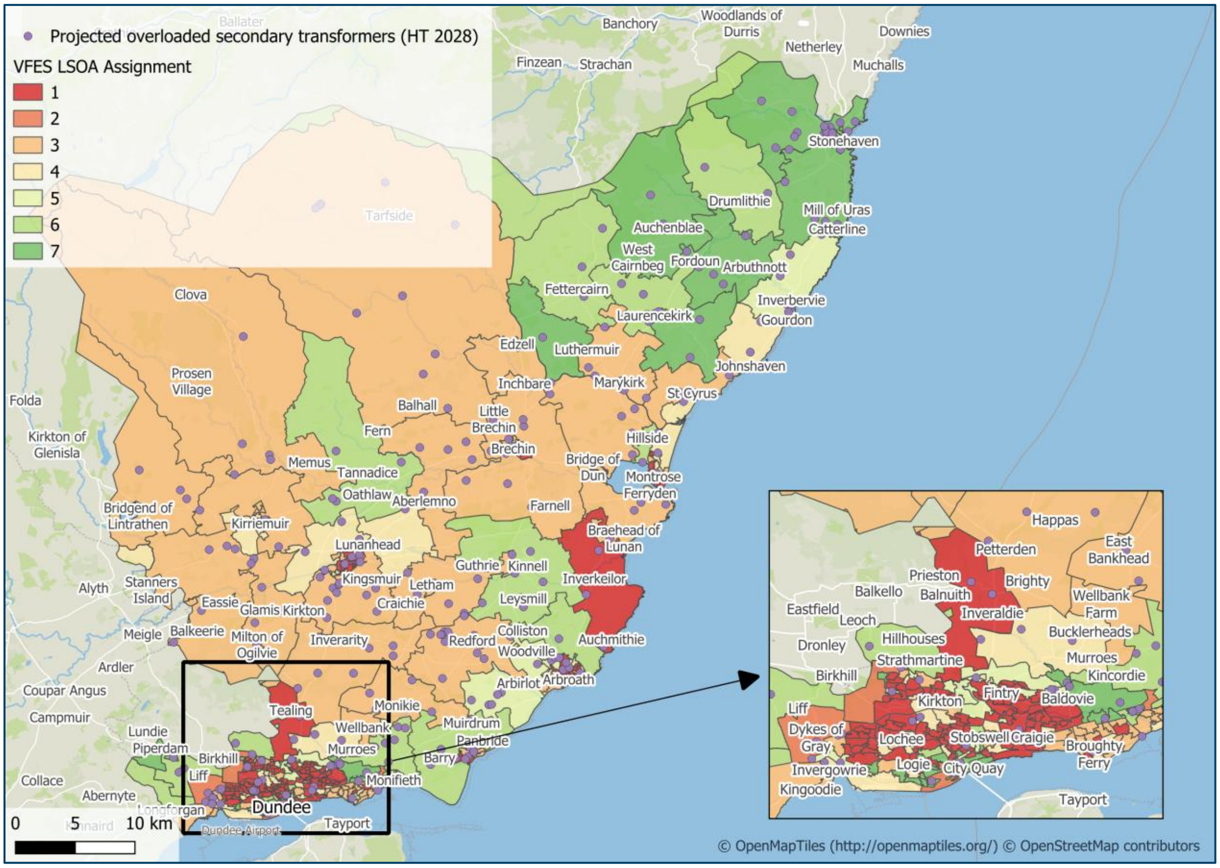


Figure 28 – Tealing 132kV supply area VFES heat map with overloaded secondary transformers.

The majority of the SDP area falls within group 3, indicating higher levels of vulnerability. This is driven up by a larger elderly population, reduced by lower levels of disability and mental health benefit claimants. There are several LSOAs that fall into the higher categories of vulnerability – particularly around Dundee City.

By overlaying the point locations of secondary transformers projected to be overloaded (in 2028 under the HT scenario), we identify areas that are categorised as more vulnerable and 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.

8.3.2. Low Voltage Networks

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

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

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 the Tealing 132kV supply area 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 27% of low voltage feeders may need intervention by 2035 and 43% by 2050 under the HT scenario as shown in **Figure 29.** 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.

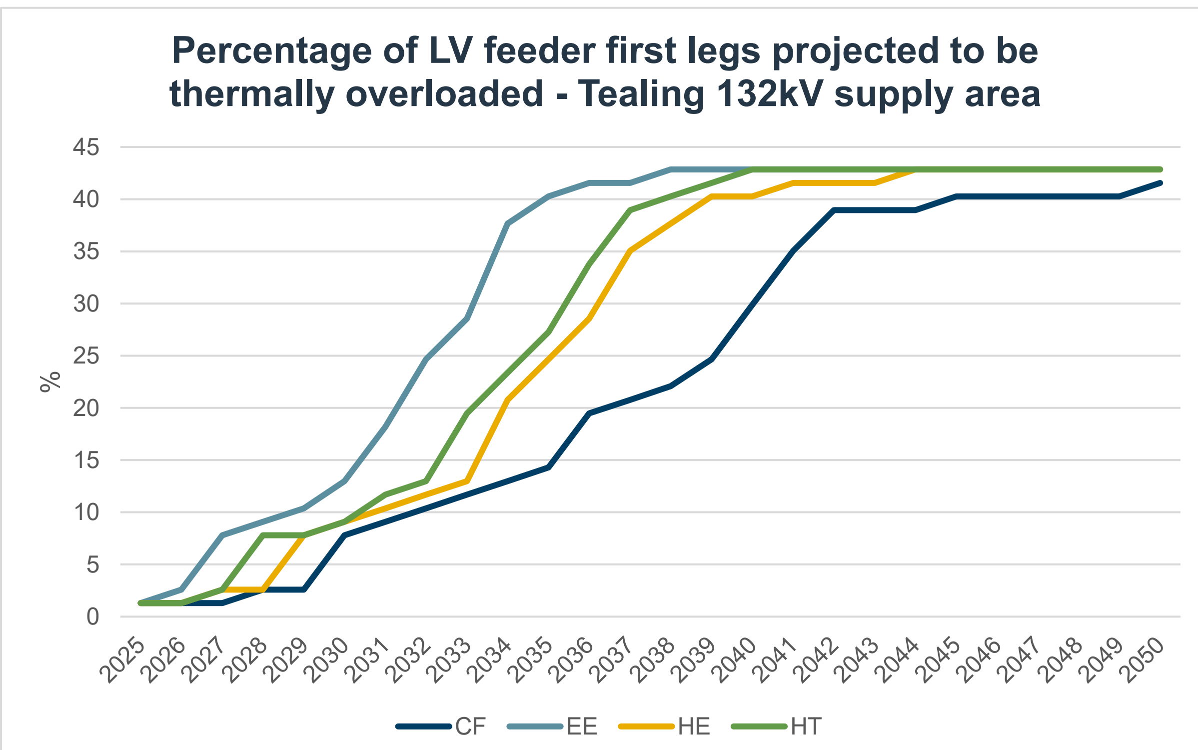


Figure 29 - Percentage of LV feeders projected to be overloaded in Tealing 132kV supply area.

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2024 DFES analysis provides a robust evidence base for load growth across Tealing 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.

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

1. System needs that have been identified to arise in the near-term should be progressed through the DNOA process to develop a more in-depth solution. For this SDP, this includes:
    a) Transformer thermal constraints at:
        i) Lochside PSS.
        ii) Charles Avenue PSS.
        iii) Brechin PSS.
        iv) Mill RD Montrose PSS.
        v) Gourdie PSS.
        vi) Broughty Ferry PSS.

    b) Thermal and/or voltage constraints on the:
        i) Circuit to Inverarity and Maryton PSS.
        ii) Circuits to Lochside PSS.
        iii) Circuit to Inverbervie, Laurencekirk and Edzell PSS.
        iv) Circuit to Stonehaven PSS.
        v) Circuit to Inchbare, Logie Pert and St Cyrus PSS.
        vi) Circuit to Mill Rd Montrose PSS.
        vii) Circuits to Baldovie and Edzell Street PSS.

2. Considering the significant generation growth expected across Tealing 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 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 Tealing 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 a network that supports local net zero ambitions and enables growth in the local economy. By doing so, this will ultimately contribute to net zero targets at a national level.

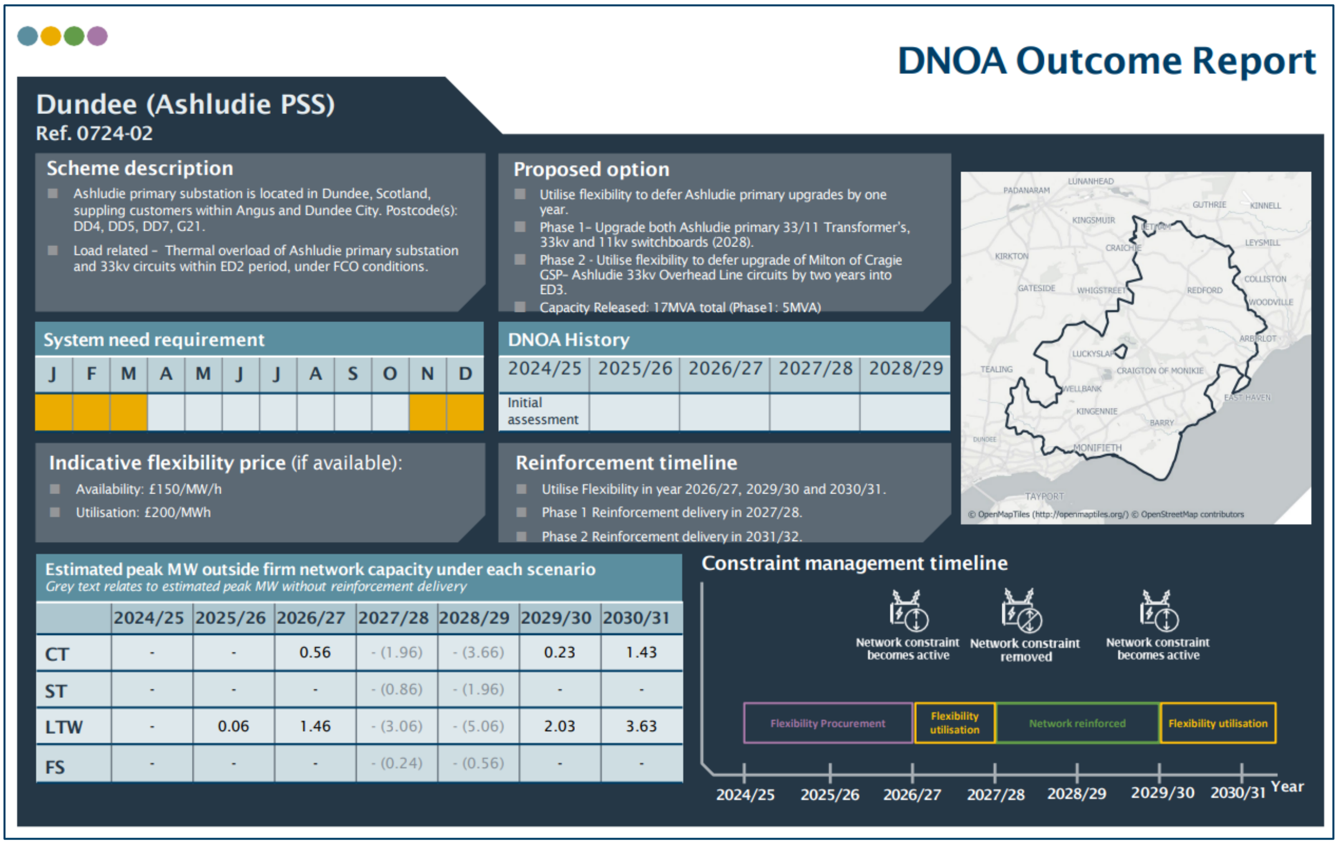
Appendix A: Primary Substation Customer Numbers

Grid Supply Point	Primary Substation	Number of Customers Served (approximate)	2024 Substation Maximum demand in MVA (Winter)
Arbroath	ARBROATH GRID	6	NA
Arbroath	CARNOUSTIE	5907	6.91
Arbroath	CHARLES AVENUE	5636	8.51
Arbroath	ELLIOT DEPOT	1356	5.69
Arbroath	HUME STREET	6192	7.66
Arbroath	REDFORD	1290	2.59
Craigiebuckler	BRECHIN	4861	6.67
Bridge of Dun	BRIDGE OF DUN 11kV	465	0.96
Bridge of Dun	BRIDGE OF DUN GRID	4	NA
Bridge of Dun	INCHBARE	386	1.15
Bridge of Dun	LOGIE PERT	323	1.31
Bridge of Dun	MILL RD MONTROSE	4314	6.14
Bridge of Dun	MONTROSE NORTH	4170	6.63
Bridge of Dun	ST CYRUS	1116	2.43
Bridge of Dun	BRIDGE OF DON	7177	NA
Charleston	CHARLESTON	1886	5.67
Charleston	GOURDIE	1584	2.66
Charleston	MENZIESHILL	5965	8.32
Charleston	NINEWELLS	2177	4.62
Dudhope	CONSTABLE STREET	8152	12.42
Dudhope	OVERGATE	2957	13.30
Dudhope	ROSEBANK STREET	10574	10.40
Dudhope	WALTON	5272	4.80

Fiddes	EDZELL	1381	2.39
Fiddes	FIDDES	15	NA
Fiddes	INVERBERVIE	2322	3.42
Fiddes	LAURENCEKIRK	2945	4.79
Fiddes	STONEHAVEN	6583	9.11
Lunanhead	FRIOCKHEIM	1687	3.19
Lunanhead	INVERARITY	325	0.68
Lunanhead	LOCHSIDE	5940	13.75
Lunanhead	LUNANHEAD	3994	6.70
Lunanhead	LUNANHEAD GRID	4	NA
Lunanhead	MARYTON	4712	6.50
Lyndhurst	LOCHEE	4355	5.58
Lyndhurst	LYNDHURST	2222	5.70
Lyndhurst	MACALPINE ROAD	5245	5.75
Lyndhurst	WEST KIRKTON	6376	7.24
Milton of Craigie	ASHLUDIE	5272	8.70
Milton of Craigie	BALDOVIE	1381	8.64
Milton of Craigie	BROUGHTY FERRY	15	6.47
Milton of Craigie	EDZELL STREET	2322	2.64
Milton of Craigie	LONGHAUGH	2945	8.16
Milton of Craigie	MILTON OF CRAIGIE	6583	9.33
Milton of Craigie	OLD CRAIGIE ROAD	1687	5.27

Table 6 - PSS Customer Numbers.

Appendix B: Relevant DNOA Outcome Reports



DNOA Outcome Report

Dundee (Ashludie PSS)
Ref. 0724-02

Scheme description

- Ashludie primary substation is located in Dundee, Scotland, suppling customers within Angus and Dundee City. Postcode(s): DD4, DD5, DD7, G21.
- Load related – Thermal overload of Ashludie primary substation and 33kv circuits within ED2 period, under FCO conditions.

Proposed option

- Utilise flexibility to defer Ashludie primary upgrades by one year.
- Phase 1– Upgrade both Ashludie primary 33/11 Transformer's, 33kv and 11kv switchboards (2028).
- Phase 2 - Utilise flexibility to defer upgrade of Milton of Cragie GSP- Ashludie 33kv Overhead Line circuits by two years into ED3.
- Capacity Released: 17MVA total (Phase1: 5MVA)

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

- Utilise Flexibility in year 2026/27, 2029/30 and 2030/31.
- Phase 1 Reinforcement delivery in 2027/28.
- Phase 2 Reinforcement delivery in 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	-	-	0.56	- (1.96)	- (3.66)	0.23	1.43
ST	-	-	-	- (0.86)	- (1.96)	-	-
LTW	-	0.06	1.46	- (3.06)	- (5.06)	2.03	3.63
FS	-	-	-	- (0.24)	- (0.56)	-	-

Constraint management timeline

Figure 30 - Ashludie PSS DNOA Outcome

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

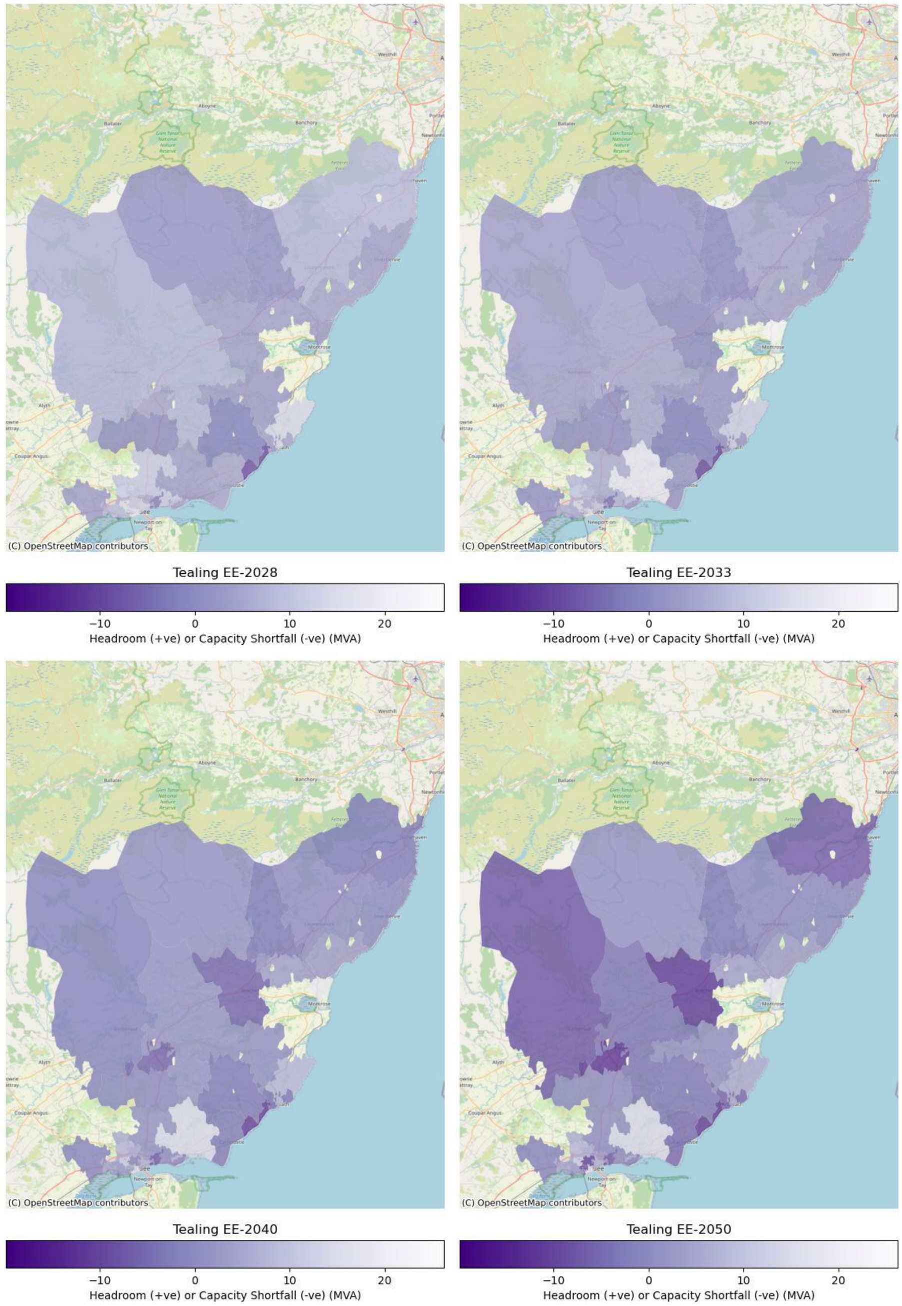


Figure 30 - Tealing 132kV supply area - EHV/HV Spatial Plan – Electric Engagement

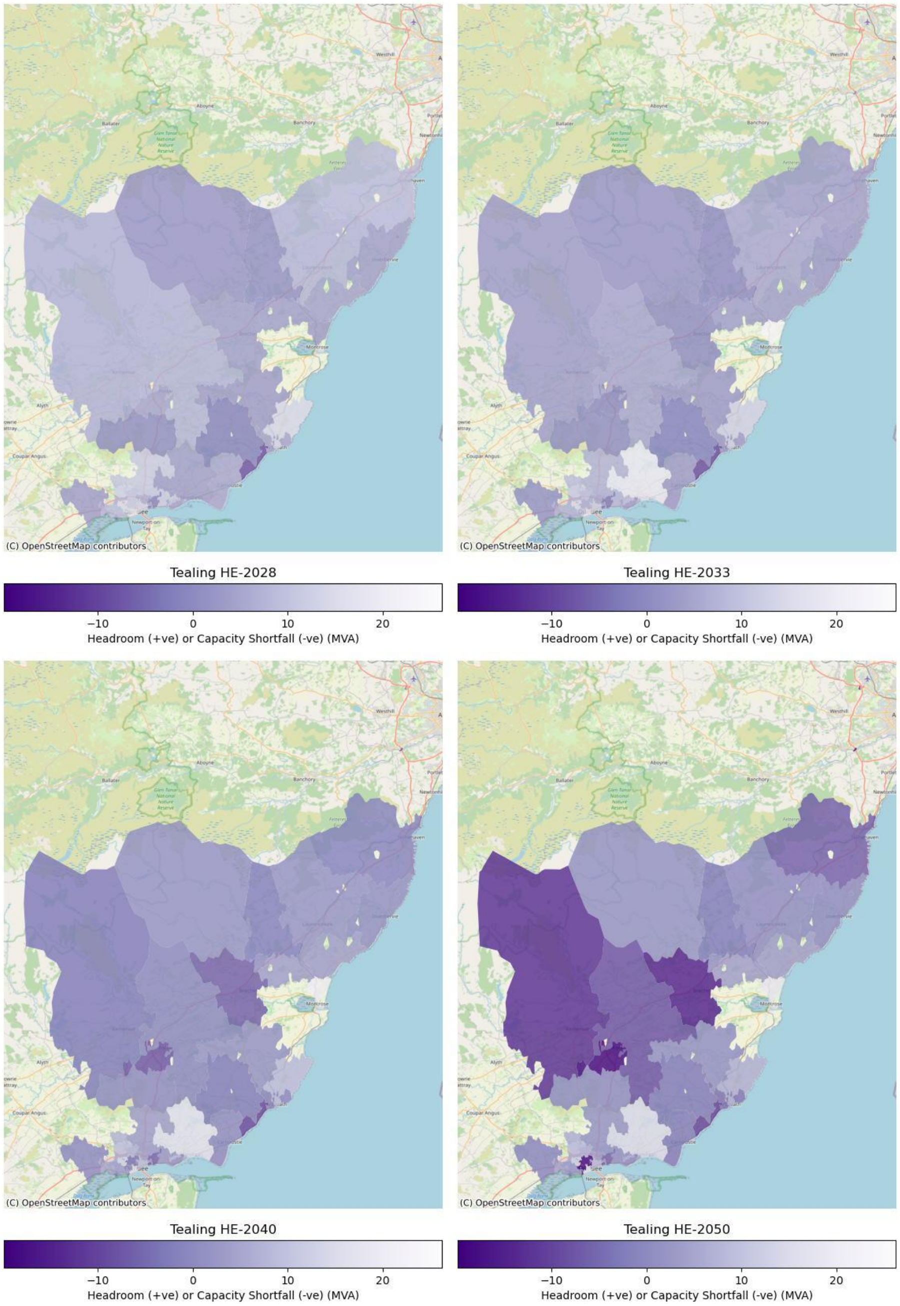


Figure 31 - Tealing 132kV supply area - EHV/HV Spatial Plan – Hydrogen Evolution

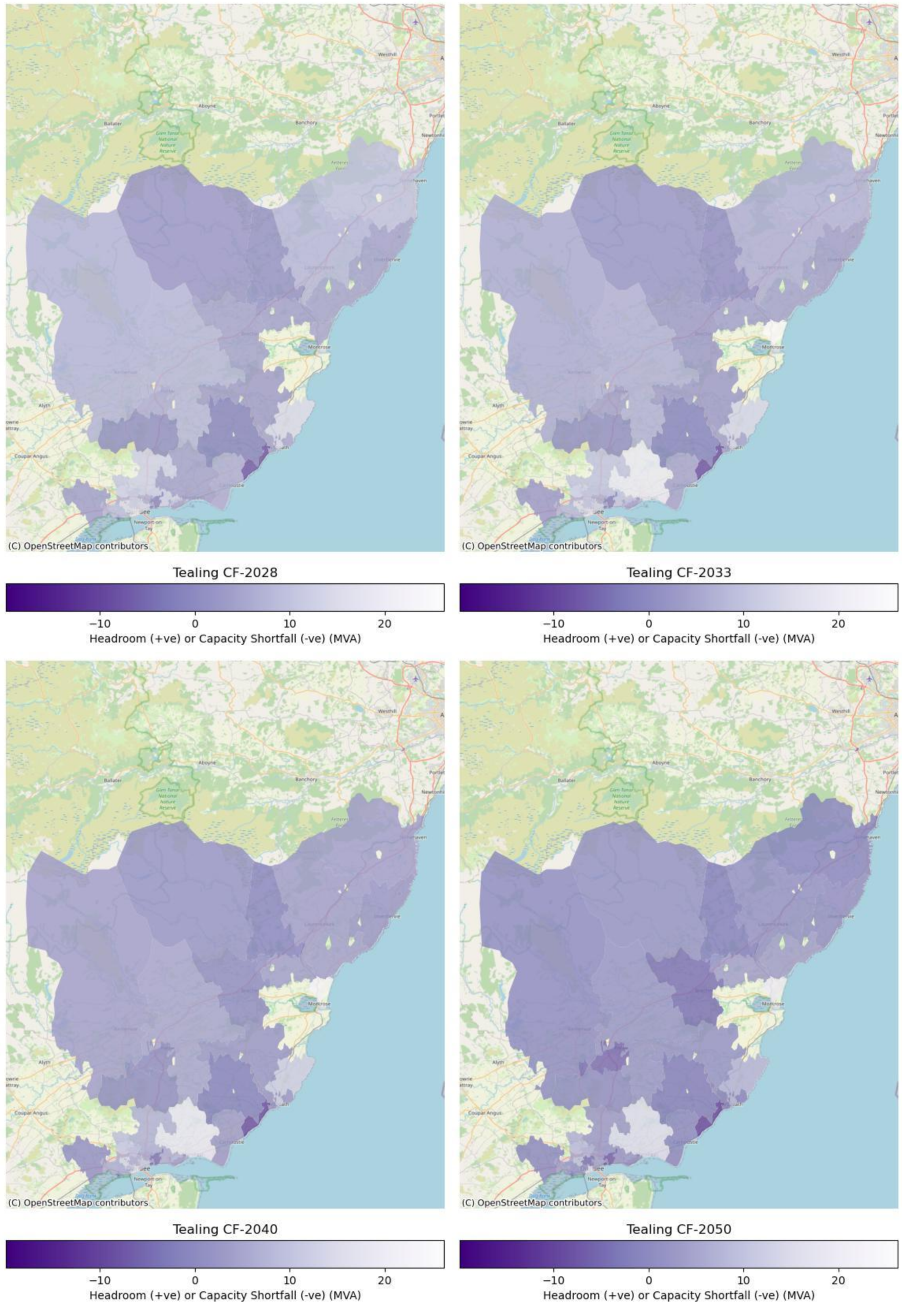


Figure 32 - Tealing 132kV supply area - EHV/HV Spatial Plan – Counter Factual

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

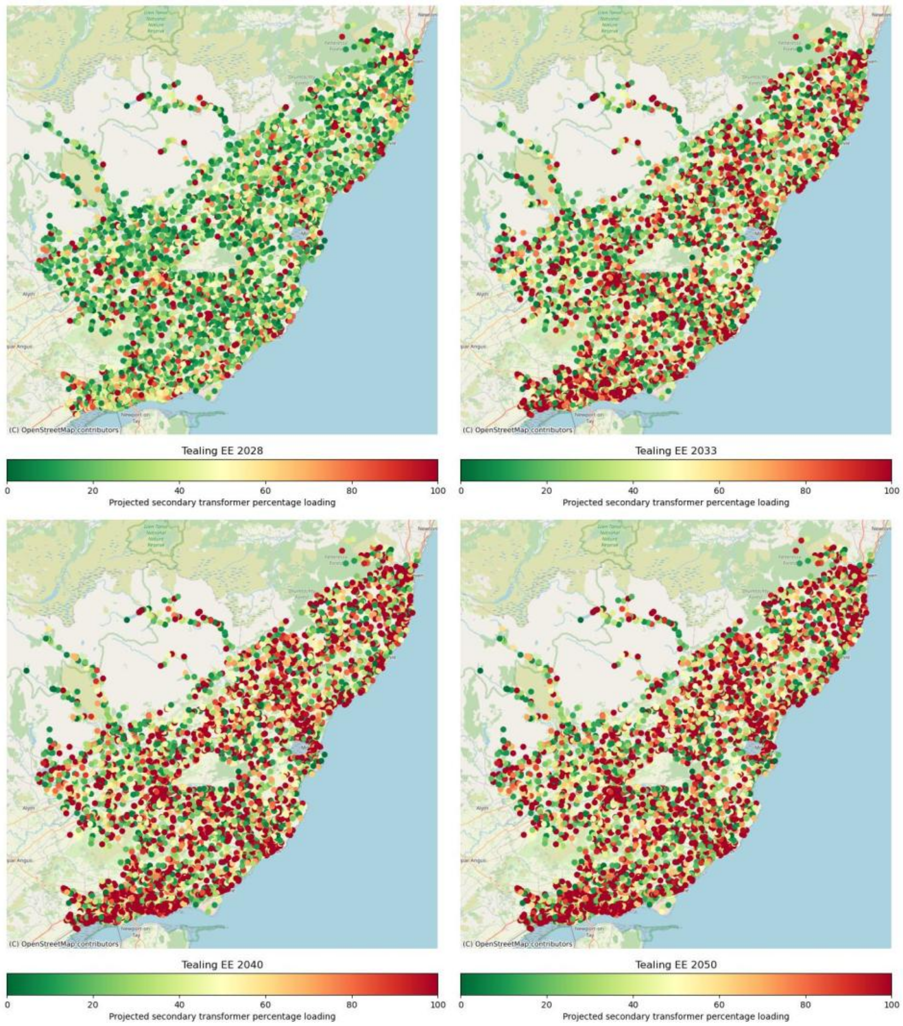


Figure 33 - Tealing 132kV supply area - HV/LV Spatial Plan – Electric Engagement

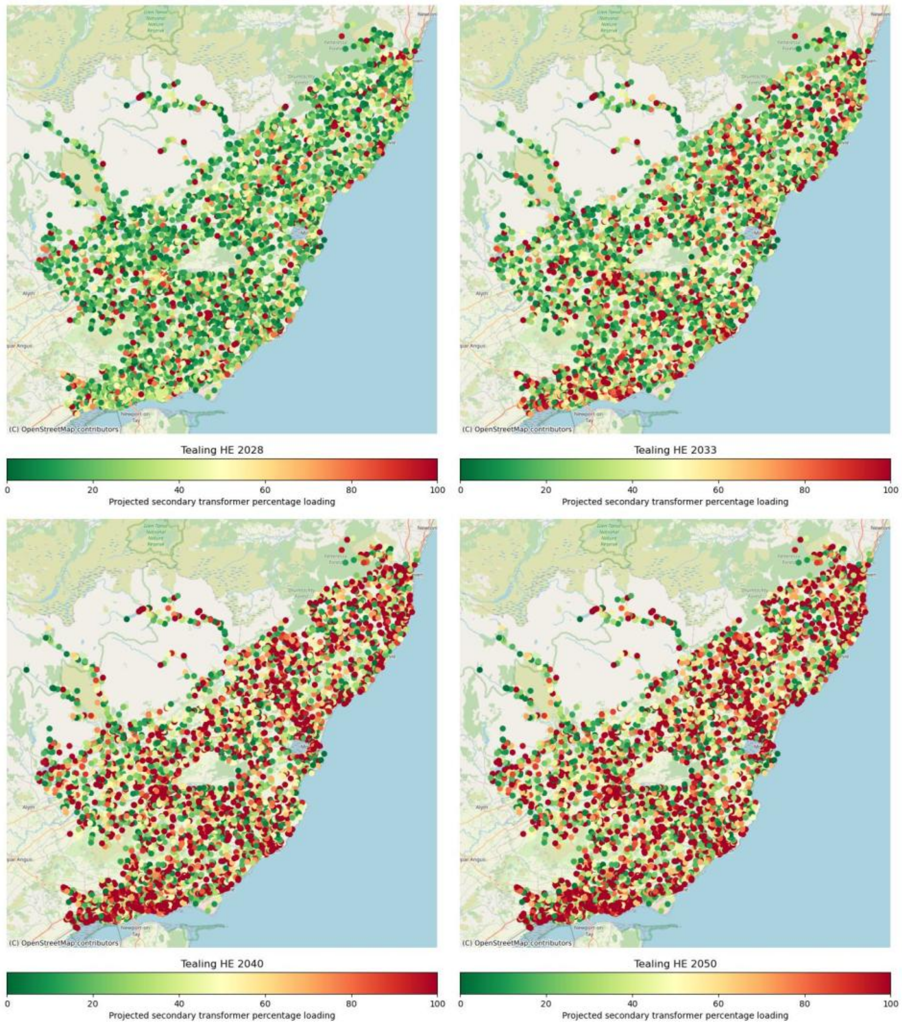


Figure 34 - Tealing 132kV supply area - HV/LV Spatial Plan – Hydrogen Evolution

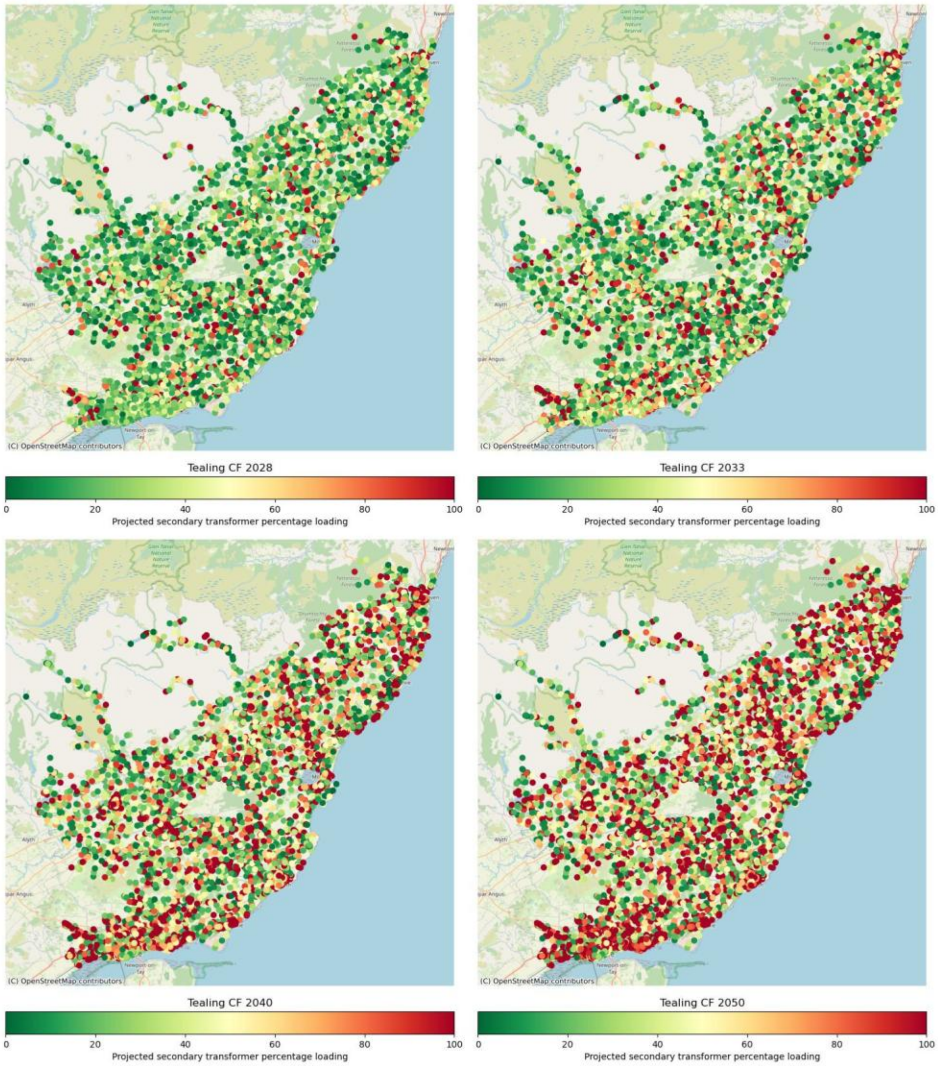


Figure 34 - Tealing 132kV supply area - HV/LV Spatial Plan – Counter Factual

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
CF	Counterfactual
CMZ	Constraint Managed Zone
CT	Consumer Transformation
DER	Distributed Energy Resources
DESNZ	Department for Energy Security and Net Zero
DFES	Distribution Future Energy Scenarios
DNO	Distribution Network Operator
DNOA	Distribution Network Options Assessment
DSO	Distribution System Operation
DSR	Demand Side Response
EE	Electric Engagement
EHV	Extra High Voltage
EJP	Engineering Justification Paper
ER P2	Engineering Recommendation P2
NESO	National Energy System Operator
NGET	National Grid Electricity Transmission
ENA	Electricity Networks Association
EV	Electric Vehicle
FES	Future Energy Scenarios
FS	Falling Short
GIS	Gas Insulated Switchgear
GSPs	Grid Supply Point
HE	Hydrogen Evolution

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

Table 7 - Glossary

CONTACT

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Scottish & Southern Electricity Networks