OUTER HEBRIDES AND SKYE GRID SUPPLY POINTS: STRATEGIC DEVELOPMENT PLAN

Our network serving communities in the Outer Hebrides, Skye and Lochalsh

DRAFT FOR CONSULTATION

September 2025

Scottish & Southern Electricity Networks

Contents

1. EXECUTIVE SUMMARY

SSEN is taking a strategic approach in the development of its distribution networks. This will help to enable the net zero transition at a local level to the homes, businesses, and communities we serve.

Our Strategic Development Plans (SDPs) take the feedback we have received from stakeholders on their future energy needs to 2050 and translate these requirements into strategic spatial plans of the future distribution network needs. This helps us transparently present our future conceptual plans and facilitate 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 the areas supplied by Grid Supply Points (GSPs) in the Outer Hebrides and Skye (Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs). The specific geographic area is shown in Figure 1 below. This area covers the local authorities of Comhairle nan Eilean Siar (CnES) and Highland Council.

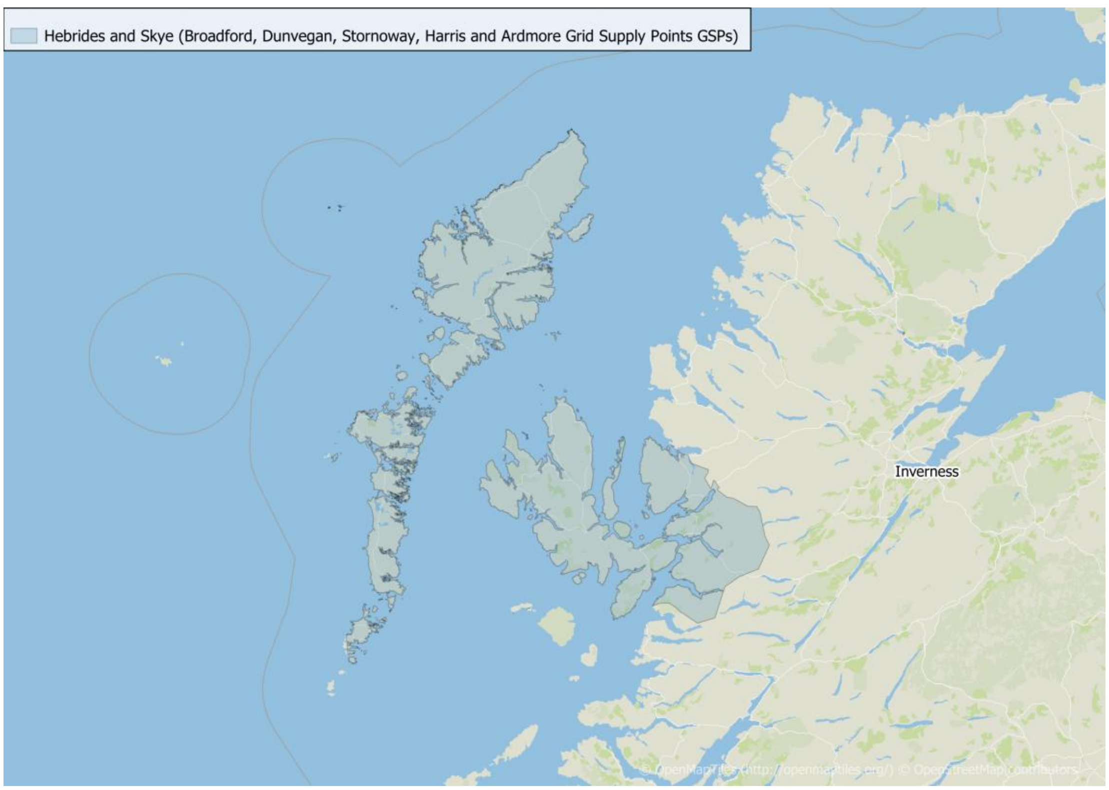

Figure 1 Area of focus for this SDP.

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 demand forecast. In the case of Ardmore, Harris and Stornoway GSPs, significant work has already been triggered through the Distribution Network Option Assessment (DNOA) process. Much of this work has strategically been sized to support 2050 projected demands under the Holistic Transition (formerly Leading The Way) scenario from the Distribution Future Energy Scenarios (DFES).

As part of this work, we aim to identify further needs for the relevant network study area. In the case of Ardmore, Harris and Stornoway GSPs, several additional network reinforcements were needed to provide capacity out to 2050. This will be reassessed on an annual basis to understand the network impact of updated forecasts.

As a result of the work undertaken for this report, we make recommendations for further study of projects that could enter the DNOA process. For the five GSP areas, a number of reinforcements have been recommended to the DNOA process for more detailed assessment.

This SDP is published as a draft report, and we welcome your feedback to shape both the form and content. We will use your feedback to inform both our final published Strategic Development Plan and future publications. Please submit any feedback to us through our inbox at: Whole.System.Distribution@sse.com.

2. INTRODUCTION

The goal of this report is to demonstrate how local, regional, and national targets link with other stakeholder views in the area to provide robust evidence for load growth out to 2050 across the Grid Supply Points (GSPs) in Outer Hebrides and Skye area. A GSP is an interface point with the national transmission system where SSEN 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 commission Regen to produce the annual Distribution Future Energy Scenarios (DFES). The DFES analysis is developed from the National Grid Energy System Operator (NESO) Future Energy Scenarios (FES) while accounting for more granular stakeholder insights and new demand and generation connection applications. The DFES provides a forward-looking view of how demand and generation may evolve under four different pathways (previously scenarios) as we move towards the national 2050 Net Zero target. These pathways are summarised in Figure 2. SSEN use Holistic Transition (previously using Leading The Way) as the central case scenario following stakeholder feedback during the RIIO-ED2 development process. This position is reviewed annually.

Where new customer connection information has not been captured in the DFES, we aim to consider it as part of our studies to ensure that the projected load more accurately reflects what we expect to see in the future.

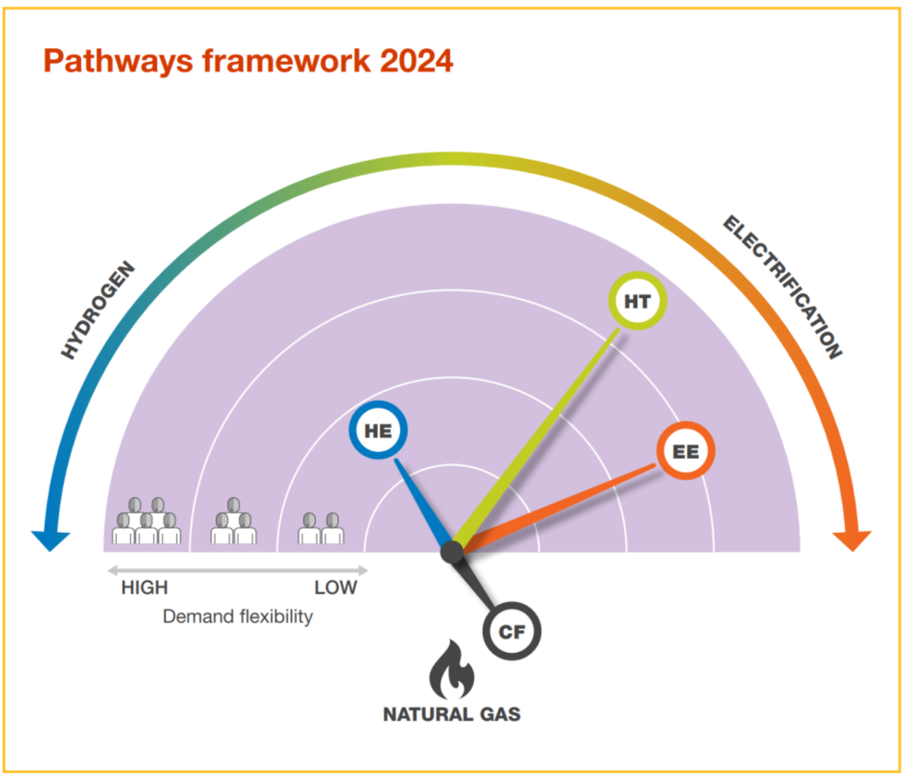

Figure 2 The four FES Pathways adopted for DFES 2024. Source: NESO 2024 FES

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

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

3. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM CONSIDERATIONS

3.1. Local Authorities and Local Area Energy Planning

The local authorities that are supplied by Broadford, Dunvegan, Stornoway, Harris and Ardmore GSPs are Comhairle nan Eilean Siar (CnES) and the Highland Council, as shown in Figure 3. The development plans for these local authorities will have a significant impact on the potential future electricity load growth on SSEN's distribution network. As such, it is vital for SSEN to engage with these plans when carrying out strategic development.

SSEN has strong working relationships with these local authorities and other key stakeholders in the Highlands and the Outer Hebrides. Highland Council has been onboarded to the Local Energy Net Zero Accelerator (LENZA) platform, enabling them to keep SSEN informed of their future energy plans for the region. CnES have attended road show events and webinars regarding strategic energy planning. We also engage with Community Power Outer Hebrides (CPOH), Highlands and Islands Enterprise's Net Zero Transition and Carbon Neutral Islands teams, as well as the Island Centre for Net Zero through which we maintain a two-way flow of information on respective plans for the area.

This engagement, along with collaboration with local businesses and groups, has helped SSEN stay informed about planning and development in the region that will impact local communities' use of the network.

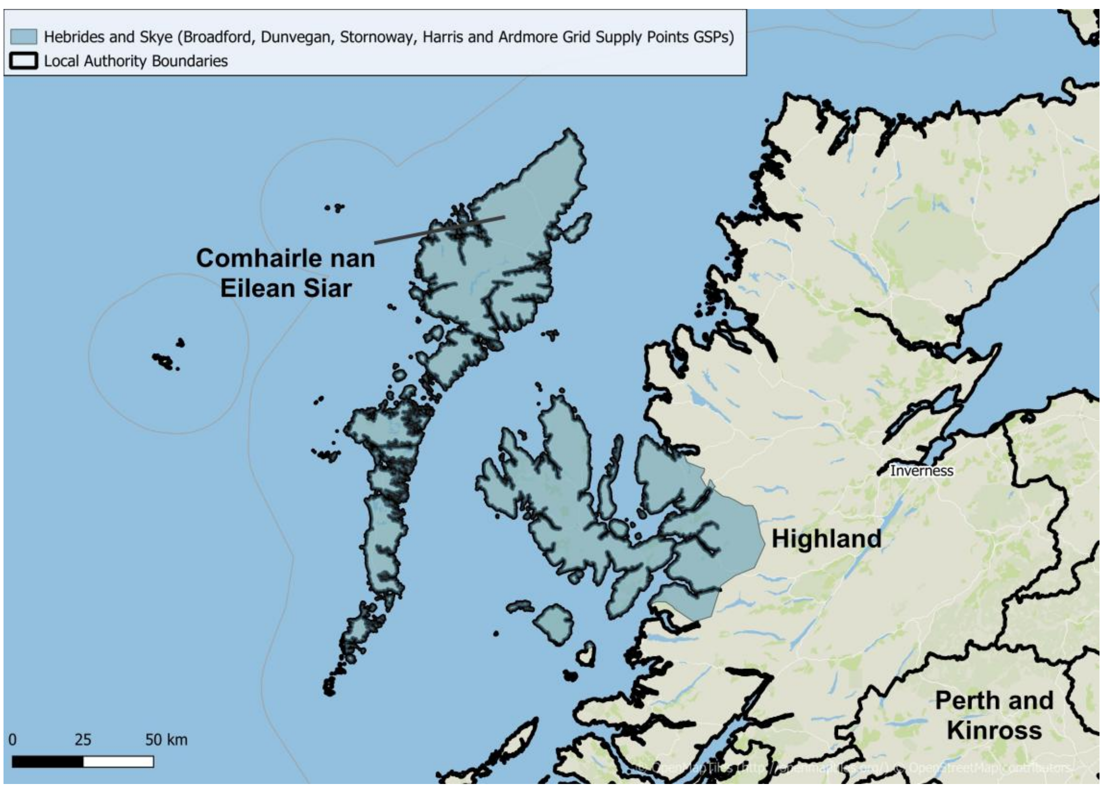

Figure 3 Outer Hebrides and Skye supply area and Local Authority Boundaries.

3.1.1. Comhairle nan Eilean Siar Council (CnES)

The Outer Hebrides, also known as the Western Isles, is a collection of over 70 named islands located off the west coast of Scotland, stretching over 100 miles from north to south. The archipelago currently inhabits c. 26,030 people, which is a slight decrease from the 2011 Census of 27,684. Eleven islands are currently inhabited, with the five major islands being: Lewis and Harris, North Uist, Benbecula, South Uist and Barra. Stornoway, on the Isle of Lewis, is the main settlement with a population of approximately 6,273 people[1].

Comhairle nan Eilean Siar (CnES) is the local authority responsible for the Outer Hebrides. CnES have published multiple action plans and strategies highlighting their net zero ambitions. As part of their Corporate Strategy 2024-2027[2], CnES included 'The delivery of efficient and sustainable services' and 'To protect our natural environment & Reduce our carbon footprint' as part of their core values, demonstrating their commitment to sustainability.

Building on this strategy, CnES also published a separate Climate Change Strategy 2022-2027[3]. This outlines several commitments to reduce carbon emissions for the councils' own estate/operations, as well as developing policies and targets to enable a net zero transition for the Outer Hebrides.

The strategic priorities outlined in this strategy document include:

- Carbon Neutral Comhairle – eliminate direct emissions by 2038, while reducing indirect emissions as much as possible.
- Net Zero Islands – supporting the Outer Hebrides Islands towards net zero by 2045.
- Climate Resilient Islands – supporting improved climate resilience for the Outer Hebrides.

These priorities demonstrate a range of sectoral commitments around buildings, transport, heat, electricity, waste, energy efficiency, green hydrogen production and wind power. Comhairle nan Eilean Siar have also developed a LHEES strategy and delivery, which sets out the long-term plan for decarbonising heat and improving the energy efficiency of buildings across the Council[4]. Community-led Local Energy Plans have been created for Barra and Vatersay[5] (in 2018) and Uist[6] (in 2021), setting out local priorities for energy efficiency, renewable generation, and decarbonisation to support a just transition to net zero.

3.1.2. Highland Council

The Highland Council serves a third of the land area of Scotland, including the most remote and sparsely populated parts of the United Kingdom. The total land area including all islands at low water is 26,484 square kilometres. The length of coastline including islands at low water is 4,905 kilometres, 21% of the Scottish total, and excluding islands is 1,900 kilometres (49% of Scotland).

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1 Comhairle Nan Eilean Siar - Building Standards Annual Performance Report

2 CORPORATE STRATEGY 2024-2027

3 Comhairle nan Eilean Siar Climate Change Strategy 2022-27

4 Local_Heat_and_Energy_Efficiency_Strategy_-_FINAL_-_Acessibility_checked.pdf

5 Barra and Vatersay Local Energy Plan - Local Energy Scotland

6 Uist Local Energy Plan

The population of Highland Council Area in Mid 2021 – 238,060 - 7th largest of 32 Council areas in Scotland. Between 2001 and 2021, the population had increased by 13.9% (Scotland-wide increase of 8.2%)[7].

Highland Council has published their Net Zero Strategy which includes a route map to net zero by 2045, with key interim targets to reduce emissions by at least 75% by 2030 and at least 90% by 2040[8].

Areas of focus from this strategy that are of particular interest to SSEN include:

- Improving energy efficiency across their estate.
- Identifying and developing opportunities arising from renewable energy generation.
- Rationalising the fleet and replacing vehicles with low-emission alternatives.

Highland Council have also published their LHEES (Local Heat and Energy Efficiency Strategy) and Delivery Plan[9] which sets out their ambition for a place-based approach to planning and delivery of heat decarbonisation in the region.

7 Geography | Highland profile - key facts and figures | The Highland Council

8 https://www.highland.gov.uk/info/1210/environment/321/climate_change/2

9 Local Heat and Energy Efficiency Strategy and Delivery Plan | The Local Heat and Energy Efficiency Strategy | The Highland Council

3.2. Whole System Considerations

3.2.1. Specific whole system considerations

We have worked closely with local stakeholders, customers, market participants government bodies and transmission organisations to build on our engagement prior to RIIO-ED2 and develop an enduring whole system solution to meet the future energy needs of the areas supplied from Broadford, Dunvegan, Stornoway, Harris and Ardmore GSPs and to enable the region to support the transition to Net Zero through its extensive natural resource potential.

We are supported in this process by the Hebrides and Orkney Whole System Uncertainty Mechanism (HOWSUM). This regulatory mechanism facilitates exploration of the long-term strategies for decarbonisation and future resilience requirements for relevant island groups and the strategic development plans form a key stage in HOWSUM. We will be using high level options generated from this report and stakeholder feedback to produce detailed proposals that will be submitted to the Regulator in the future.

Through our whole system considerations, several options have been identified for future use in the local area, some based on specific feedback from island stakeholders. It should be noted that some of these elements are not sufficiently mature today, however, potentially form part of our longer-term strategic plans:

1. **Traditional Distribution elements:** We have considered how future network needs could be met with additional Distribution investment. It is recognised that all islands will need to remain connected to the mainland GB system so there is a definite need for continued Transmission and / or Distribution circuitry and capacity.
2. **Traditional Transmission elements:** We have worked closely with SSEN Transmission to understand their future requirements and considered the potential for a second connection to the islands in the future.
3. **Use of new technologies:** We have discussed and will assess the use of new technologies such as hydrogen and other forms of storage to help resolve some of the drivers for change.
4. **Use of flexibility:** We see flexibility as potentially being required as part of all the developed options. For load related drivers, it can help optimise the timing of future investment needs.
5. **Repowering of diesel generators:** The potential to repower our diesel generators with green alternatives is being considered as an option to help decarbonise the Scottish islands.

3.2.2. Network resilience for island groups connected by subsea cables

SSEN own and operate 446.5km of Distribution (33kV & 11kV) submarine cables, across 60 Islands with Scottish Hydro Electric Power Distribution (SHEPD) licence area covering the north of Scotland. As part of SHEPD's distribution Standard Licence Condition (SLC) 24 and the Distribution Code there is an obligation on SSEN to ensure that certain levels of security are in place as per Engineering Recommendation P2 (EREC P2)[10]. SLC 24 also requires SHEPD to demonstrate that the requirements of EREC P2 are being met to provide demand centres with resilience in the event of network faults.

Subsea cable faults are rare events but can have a big impact on our island communities. Due to the nature of the environment in which they operate, fault location and repair on a subsea cable can take significant periods of time.

10 ENA Document Catalogue P2 Issue 8 Security of Supply

Therefore, there is an understanding within the SSEN business that island communities served by our subsea cable assets require additional levels of resilience due to these prolonged outage times.

Given the uniqueness of the SSEN subsea network to the UK, EREC P2 does not account for the operational realities of faults on the subsea cable networks and as such, a different resilience standard is required. This enhanced resilience standard takes the form of SSEN's newly developed Resilience policy for island groups connected by subsea cables which is explained further below.

Achieving these future resilience levels is the long-term ambition for our island groups and will be considered in any strategic planning of the island networks. Please note, this is an enhancement to the existing EREC P2 planning requirements and does not have retrospective application to our existing network.

We have assessed the level of resilience we currently provided to each of our island groups fed from sub-sea cables and developed this policy based on the demand group sizes stated within EREC P2. Table 1 below summarises the enhanced resilience standard developed for our Resiliency policy for Island Groups connected by subsea cables:

Table 1 – SSEN Group Demand sizes for Island Groups fed via subsea cables.

<table>
<tr><th>Forecasted 2050 group demand</th><th>Relevant 2050 P2-8 Category</th><th>Net Zero Resilience Policy for group demand reliant on subsea cables</th></tr>
<tr><td>Over 60MW and up to 300MW</td><td>D</td><td rowspan="2">Group demand secured for sustained long duration
N-1 condition through network assets.
N-2 condition through a combination of network assets and/or local/mobile generation (including third party).</td></tr>
<tr><td>Over 4MW And up to 60MW</td><td>B/C</td></tr>
<tr><td>Over 1MW And up to 4MW</td><td>B</td><td rowspan="2">Group demand secured for sustained long duration
N-1 condition through a combination of network assets and/or local/mobile generation (including third party).
N-2 condition managed through use of mobile generation or use of existing generation on island if available.</td></tr>
<tr><td><1MW</td><td>A</td></tr>
</table>

3.2.3. Diesel Embedded Generation (DEG) Decarbonisation

SSEN Distribution operates four Diesel Embedded Generation (DEG) stations on the Outer Hebrides under specific licence provisions acting as a backup supply for the islands in the event of subsea cable outage due to fault or offline maintenance. These are located at Arnish, and Battery Point (Isle of Lewis), Loch Carnan (South Uist) and Barra Power Station (Barra). These currently run on white diesel fuel.

SSEN has developed a 2050 strategy for the decarbonisation of its Diesel Embedded Generation (DEG) fleet. This will contribute to SSEN achieving its Science Based Targets (SBTs) by 2033 and our Net Zero ambition by latest 2045 as outlined in the RIIO-ED2 business Plan. Further details can be found in our Sustainability Strategy[11].

This strategy is designed to move SSEN towards the Scottish Government's forthcoming final position on NOx emissions from embedded plant. Specifically, this will mean achieving 190mg/Nm3 NOx emissions by 2033 (for planned system outages) and 2039 (for unplanned system outages). Through engagement with the Scottish government, we have agreed a derogation on the NOx emissions for embedded plant, with targets to be reviewed by the end of 2030 for planned running, and the end of 2035 for unplanned running of our embedded generation assets.

The application of this strategy will be tailored to each island group, recognising both the needs of the island communities and the status of the existing DEG infrastructure. We will consider how DEG decarbonisation can be most efficiently enacted for that island group which could be through:

- Bringing forwards additional network resilience from our 2045 vision to reduce probability of operation (e.g., advancement of investment/reinforcement project delivery to provide additional network resilience).
- Use of flexibility solutions as an alternative to running DEG.
- Investigating the potential repowering of DEG with alternative fuel sources such as Hydrotreated Vegetable Oil (HVO).
- Full review of the impact and management of our NOx emissions

3.2.4. Existing long-term strategy for the Outer Hebrides

As part of the Hebrides and Orkney Whole System Uncertainty Mechanism (HOWSUM) we have developed a long-term strategy for the development of the network to the Archipelagos of Lewis & Harris and the Uist Islands. Our existing strategy (which was submitted as part of the HOWSUM reopener window in January 2024) includes a new 33kV circuit from Skye to Uist, augmentation of the existing 33kV subsea circuit between Skye and Harris and a new 33kV subsea link between Harris and North Uist.

11 SSEN Sustainability Strategy

Figure 4 Outer Hebrides 2050 Whole System Proposals.

Expanding on this strategy, we submitted a funding request to OFGEM in July 2024 for the first network intervention required in ED2. In March 2025, we received a final determination from OFGEM, allocating funding for the first phase of our 2050 whole system solution for the Western Isles, a new 33kV subsea circuit from Ardmore GSP on Skye, to Loch Carnan 33kV SW/STN on South Uist.

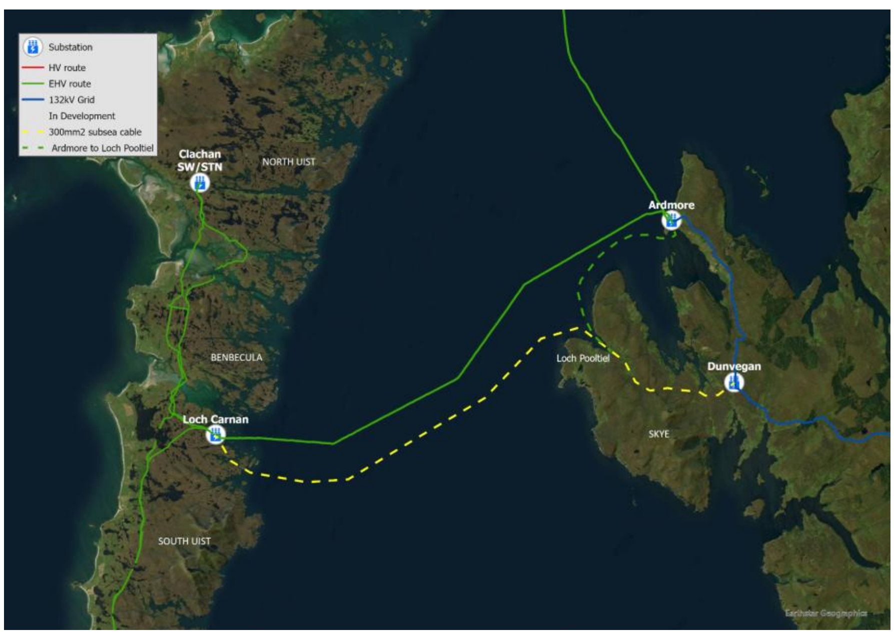

Figure 5 Outer Hebrides ED2 Whole System Proposals.

The next steps in our 2050 vision for the Outer Hebrides remain under review, through the strategic development planning process, and our core system planning activities for ED3 baseline projects.

3.2.5. Transmission interactions

We have seen a significant increase in generator connection applications in the Outer Hebrides and Skye, predominantly in renewable generation supporting the country's drive towards Net Zero. The SSEN Transmission's network Strategy to connect such projects consists of four developments:

- Stornoway – Beauly HVDC Link
- Balallan switching station & 132kV overhead line (Isle of Lewis)
- Fort Augustus – Skye 132kv OHL reinforcement (Isle of Skye)
- Quoich Power Station to Switching Station overhead line Replacement (Isle of Skye)

SSEN Transmission works are underway to design and install a 1.8GW High Voltage Direct Current (HVDC) link between Arnish Point on Stornoway and Beauly. This connection will comprise of approximately 4km of underground HVDC cable from the newly constructed HVDC converter station and AC substation to the landfall at Arnish Point, Stornoway. From the Landfall at Arnish point there will be an 81km HVDC subsea cable section to the landfall area near Dundonnell on the Scottish mainland, followed by approximately 80km of onshore underground HVDC cable to a mainland HVDC converter station near Beauly.

The new HVDC link to the Scottish mainland will enable generation customers on the Outer Hebrides to export the electricity they produce to the wider GB network. This scheme should also increase network resilience with an additional transmission link/presence on the Outer Hebridean archipelago. The HVDC link is expected to be commissioned and energised in 2030.

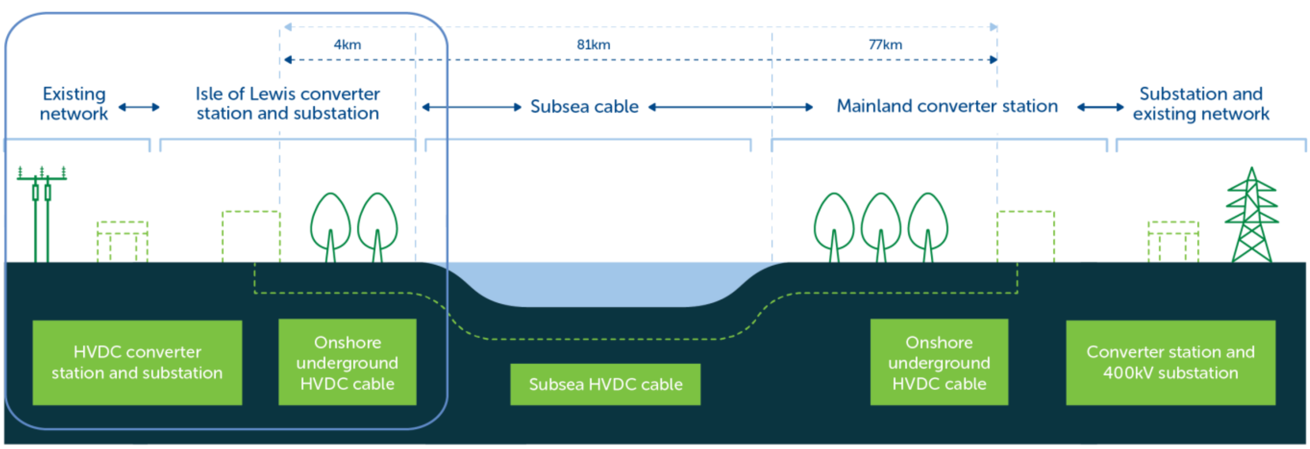

Figure 4 Western Isles Connection Project[12]

The SSEN Transmission project for works at Balallan switching station & 132kV overhead line circuit to Stornoway involves construction of approximately 25km of new 132kV overhead line to replace the existing line linking Lewis and Harris. The construction of a new Gas Insulated Switching Station near Balallan, to facilitate the connection of the Uisenis wind farm onto the electricity transmission network, the removal of the existing 132kV overhead line

12 Western Isles - SSEN Transmission

between Balallan and Stornoway Grid Supply Point and the connections of the overhead line at Balallan, Stornoway Grid Supply Point and the new Creed North substation.

Another SSEN Transmission initiative which is underway is to upgrade the Fort Augustus to Skye 132kV network. This project scope comprises of the construction of a new steel tower double circuit 132kV Overhead Line from Fort Augustas GSP to Broadford GSP. From Broadford GSP to Edinbane GSP the existing wood pole trident single circuit 132kV overhead line will be replaced with a new steel tower double circuit 132kV overhead line, and finally from Edinbane GSP to Ardmore GSP the existing wood pole trident single circuit 132kV overhead line will be replaced with a new higher capacity 132kV wood pole trident overhead line.

3.3. Flexibility Considerations

Through its innovative Constraint Managed Zone (CMZ) initiative in 2016, SSEN was the first UK DNO to introduce flexibility services in their current commercial format. We are continuing to lead the way in this development resulting in over 700MW of flexibility services being procured in the 23/24 Financial Year.

SSEN uses flexibility services to manage areas on our network that would otherwise have power flow that exceeded the network capacity. Flexibility services are a key tool in the design and operation of the network and is used to support our network investment programme by enabling outages to go ahead, optimising the build programme, and delaying reinforcement where economical to do so. In Lewis and Harris, we are actively procuring flexibility services beyond the ENA standard offerings to provide network stability during outages affecting the subsea cable connection to the mainland.

SSEN procures flexibility services from the owners, operators, or aggregators of Distributed Energy Resources (DER), which can be generators, storage, or demand assets. Services are typically needed at specific locations and times of day where high power flows are expected to occur.

In September 2024, we launched a Request for Information (RFI) to identify new flexibility service providers in a selection of island communities and establish routes to market in this geographical location. The consultation closed on the 20th of September. In this region, we procured a commercial service from one provider, which we are actively dispatching. We continue to use the findings from this RFI to explore new ways of deploying flexibility services, particularly to reduce our reliance on diesel generation.

In addition to standard services that address thermal constraints, we launched a procurement initiative to establish a stability service in Lewis and Harris. This tender opened in March 2025 and closed in June, during which we identified two potential providers. We expect it will take up to six months after awarding the contract to ensure the Provider can deliver the service within the required timeframe. This service will enhance network stability during both planned and unplanned outages when the network operates in an “islanded” state. It will also reduce diesel dependency and enable greater integration of intermittent generation.

We aim to establish this service by 2027 and operate it until 2030, when the planned transmission link to the mainland becomes operational, eliminating the need for the service.

4. EXISTING NETWORK INFRASTRUCTURE

4.1. Hebrides and Skye Supply Point Context

Ardmore, Broadford, Dunvegan, Harris and Stornoway GSPs largely supply rural networks located in the Outer Hebrides, Skye, and Lochalsh, where the land use is a mix of residential, commercial, industrial, and agricultural. In total the GSPs supplies approximately 30,000 customers with the breakdown for each substation shown in Table 2.

Substation Name	Site Type	Number of Customers Served	Transformer number /MVA rating	2024 Substation Maximum MVA (Winter)
Fort Augustus 132kV Network				
Ardmore GSP	Grid Supply Point	4,601	1x 60MVA (132/33kV)	9.08
Broadford GSP	Grid Supply Point	6,433	1x 30MVA (132/33kV)	13.18
Dunvegan GSP	Grid Supply Point	5,438	1x 60MVA (132/33kV)	10.64
Harris GSP	Grid Supply Point	1,627	1x 60MVA (132/33kV)	1.30
Stornoway GSP	Grid Supply Point	12,495	1x 60MVA (132/33kV)	24.14

Table 2 Customer number breakdown and substation peak demand readings (2024)

4.2. Current EHV Network Topology.

The Outer Hebrides and Skye are supplied from a 132kV circuit from Fort Augustus, with several Grid Supply Points then feeding into SSEN Distribution's network. The GSPs within this strategic development plan are Ardmore, Broadford, Dunvegan, Harris and Stornoway.

The Isle of Skye and a small area on the mainland including Kyle of Lochalsh are fed from Broadford and Dunvegan GSPs. Ardmore GSP is located on the West side of Skye, this has two 33kV subsea cables which connect Harris, Lewis, and Uist to the GB network. One which connects to Harris GSP and the other to the Loch Carnan network on Uist.

To transmit electricity north from Harris to Lewis there is a 132kV line which supplies into Stornoway GSP. There are four DEG stations on the Outer Hebrides under specific licence provisions acting as a backup supply for the islands in the event of subsea cable outage due to fault or offline maintenance. These are located at Arnish, and Battery Point (Isle of Lewis), Loch Carnan (South Uist) and Barra Power Station (Barra).

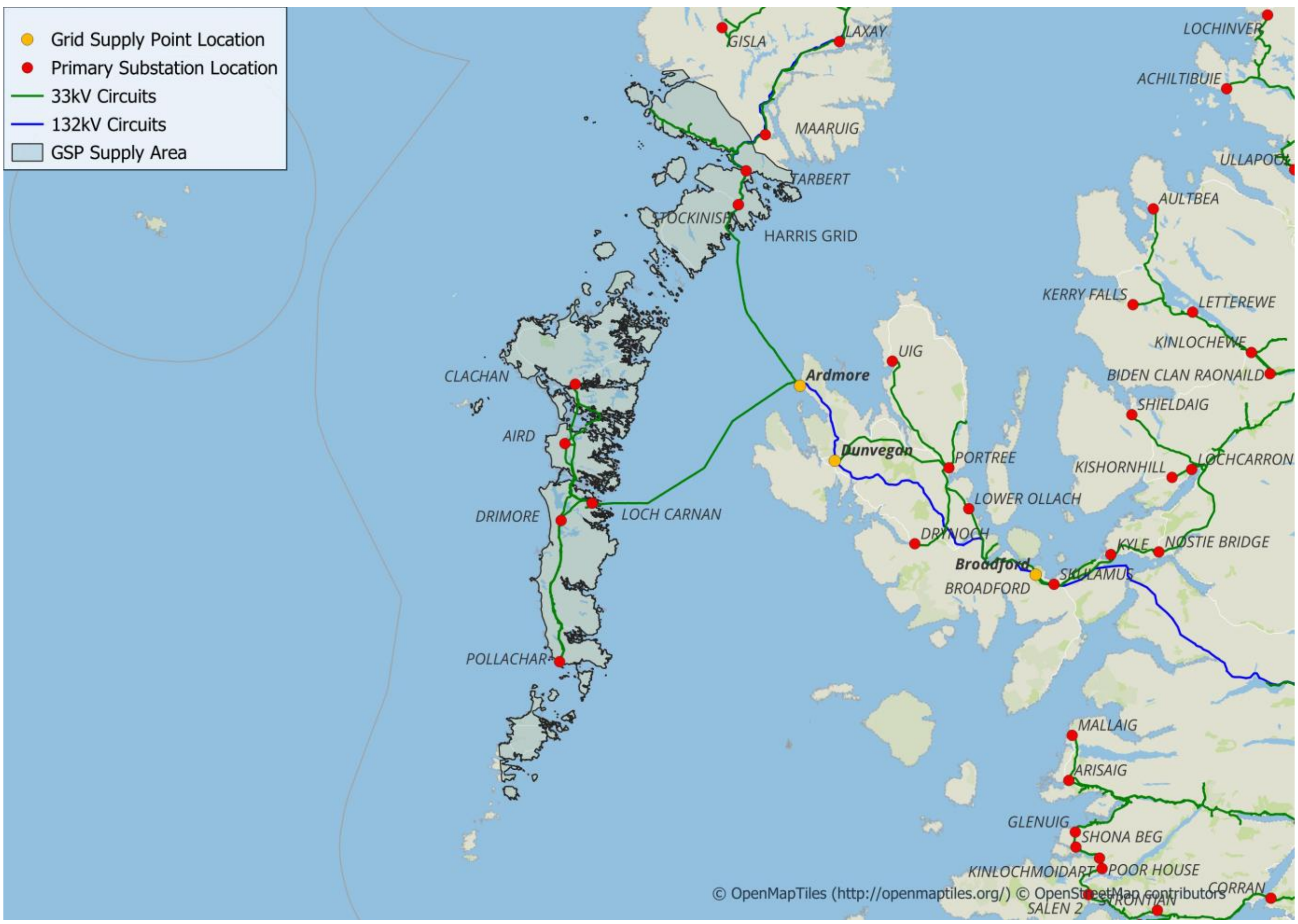

Figure 5 Ardmore, Broadford, and Dunvegan GSP supply areas and wider network.

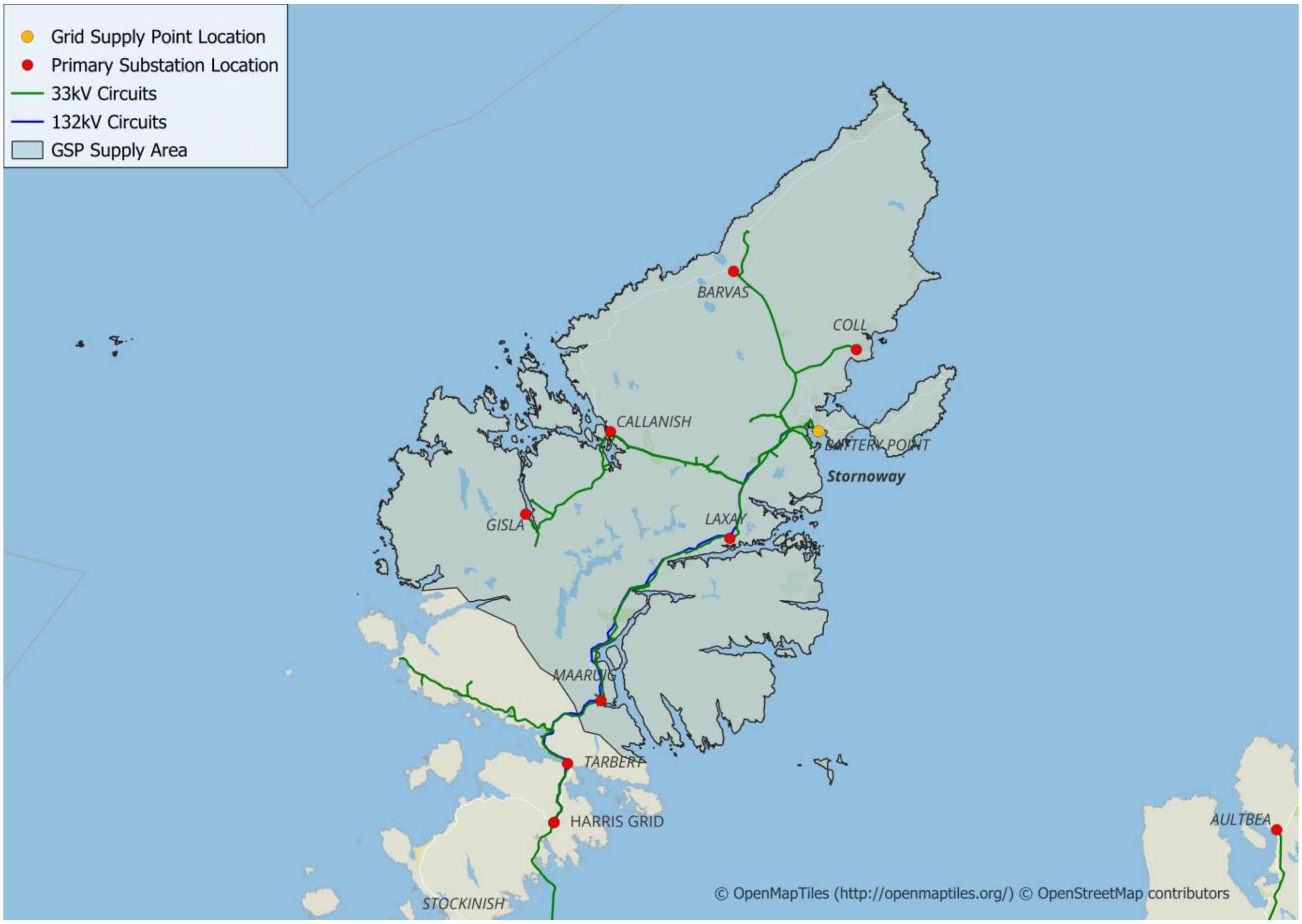

Figure 6 Stornoway GSP supply area and wider network.

4.3. Current Network Schematic

The networks shown in Figure 7, Figure 8, Figure 9 and Figure 10 depict the current configuration of the 33kV networks for the GSPs within the scope of this SDP.

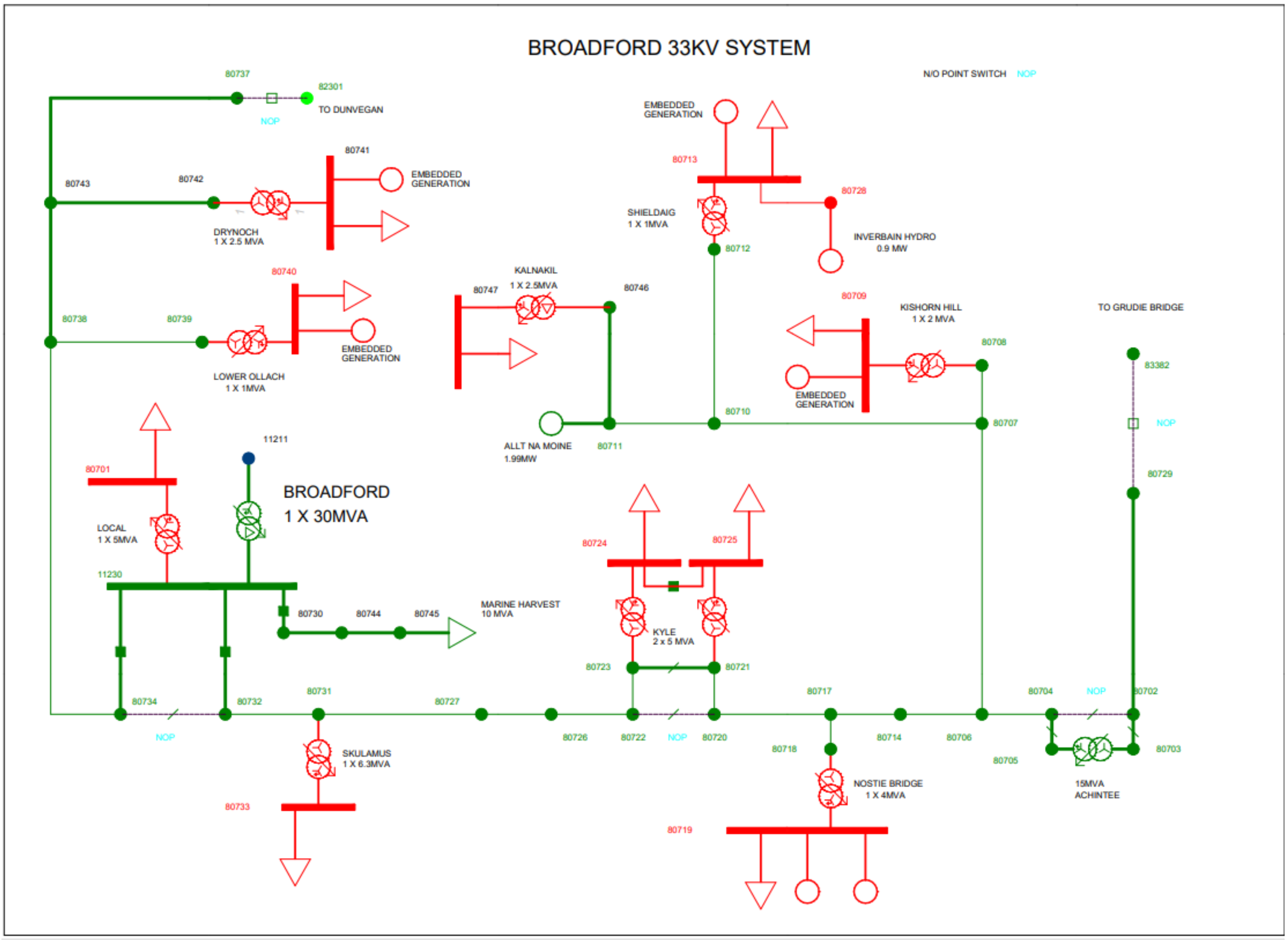

Figure 7 Broadford 33kV Schematic.

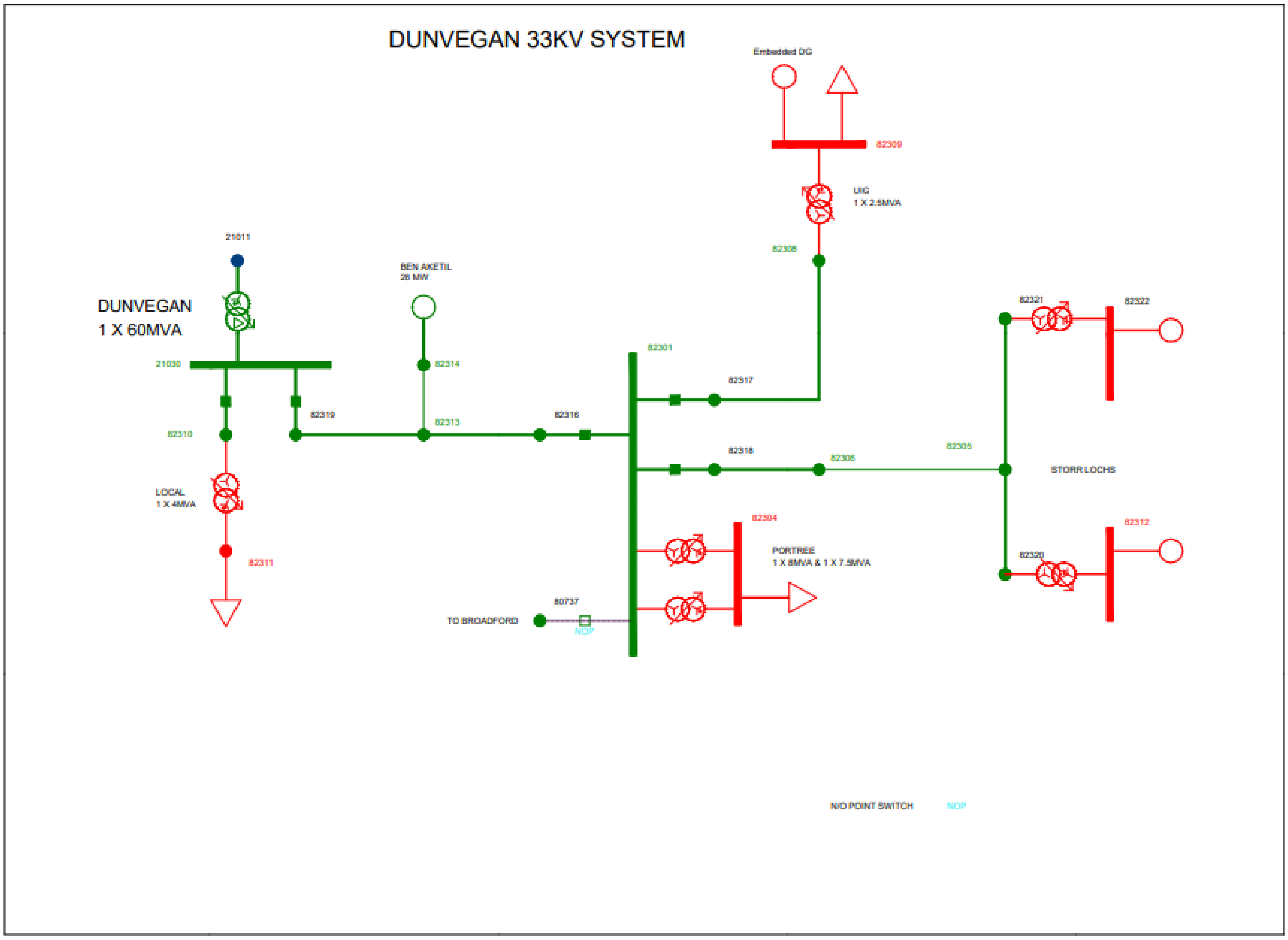

Figure 8 Dunvegan 33kV Schematic.

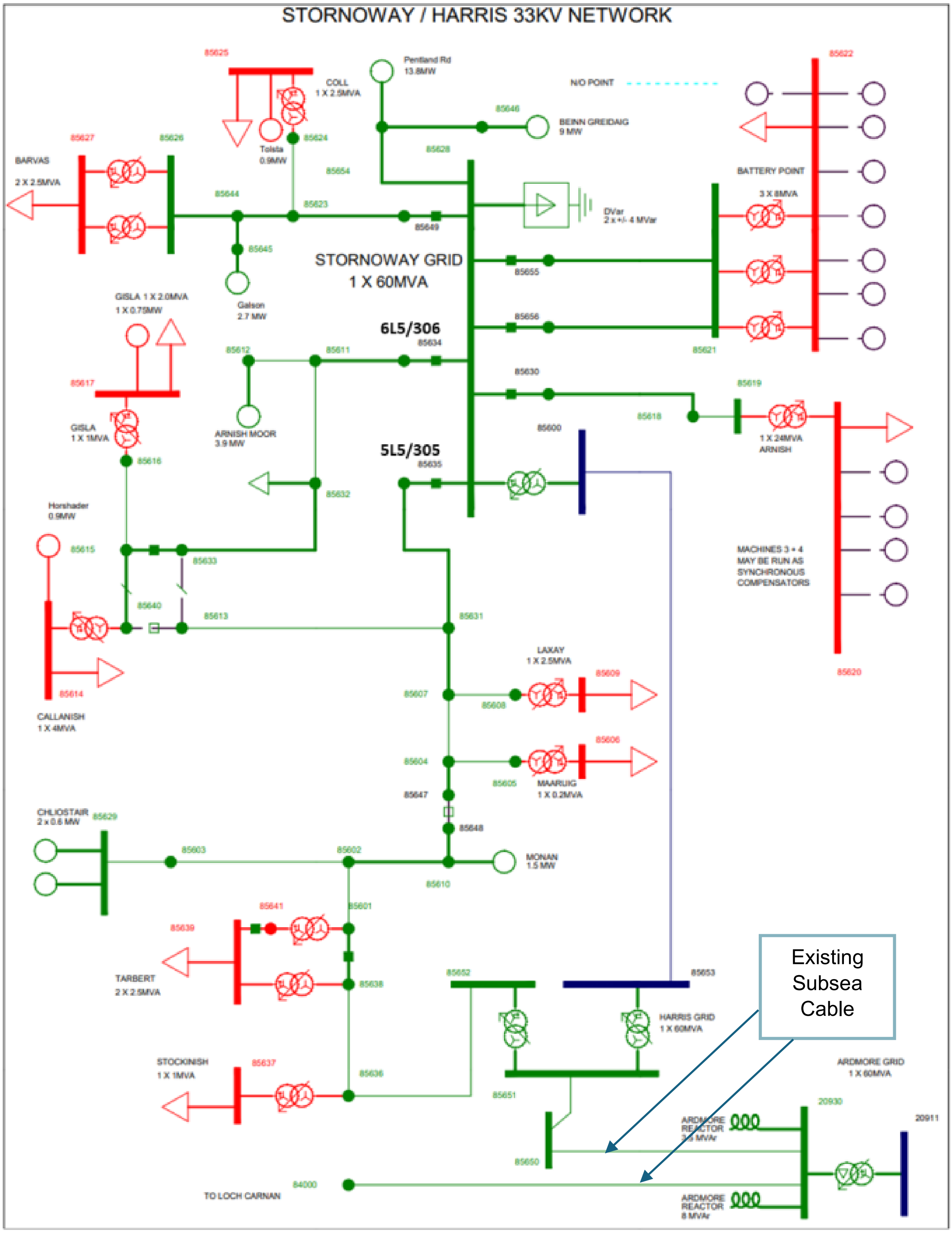

Figure 9 Stornoway/Harris 33kV Schematic.

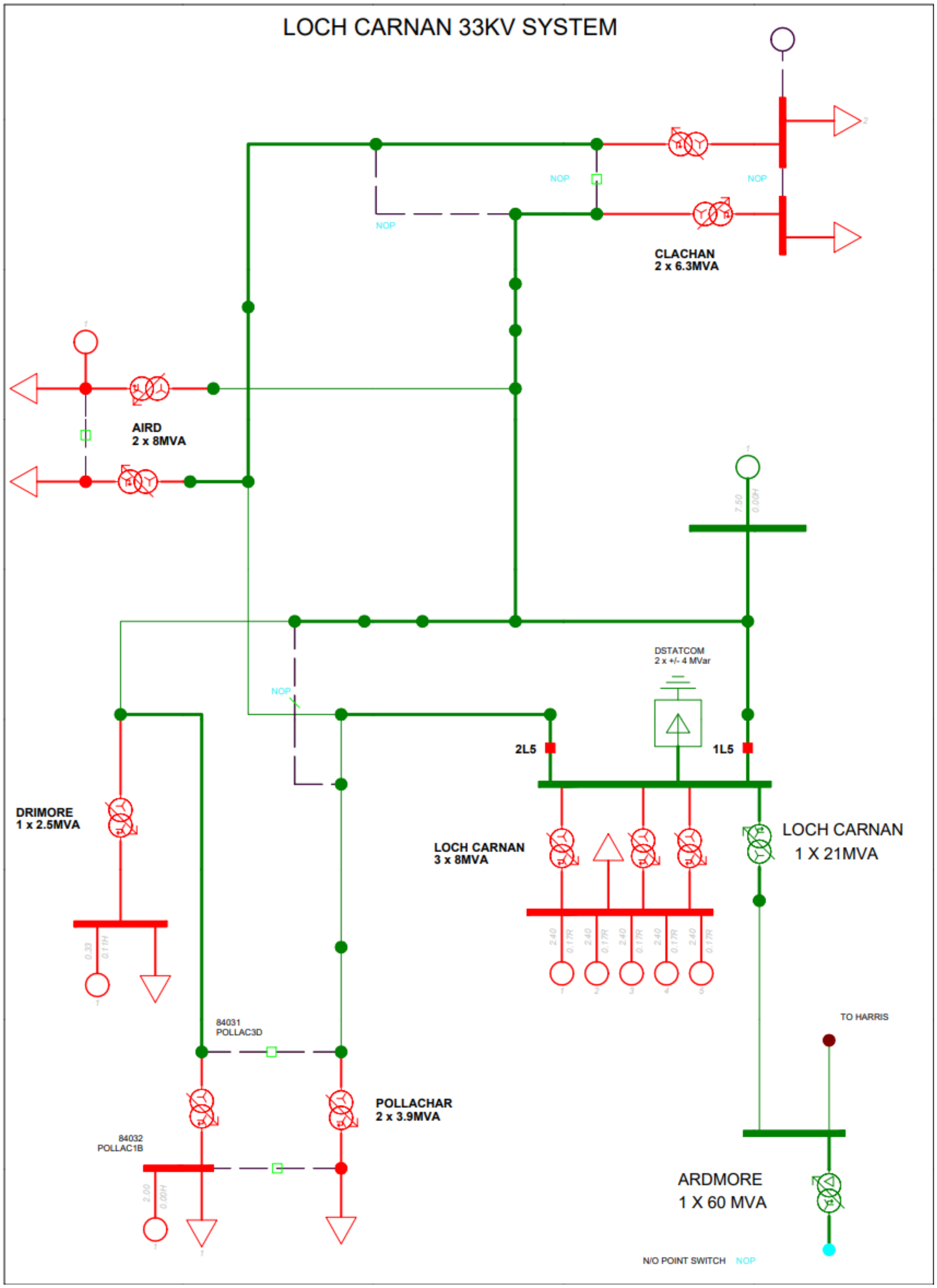

Figure 10 Loch Carnan 33kV Schematic.

5. FUTURE ELECTRICITY LOAD FOR THE OUTER HEBRIDES AND SKYE

5.1. Distributed Energy Resource

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

- These projections relate to the GSPs supply area highlighted in Figure 1 and are not directly aligned to a particular local authority.
- This SDP and the analysis conducted has been completed ahead of any changes arising from Clean Power 2030.
- Where megawatt (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. The projections presented here are the outputs from the most recent DFES 2024 analysis.

Individual DFES technology forecasts, along with connections data and insights from specific stakeholders are then assessed to develop profiled forecasts of demand and generation. This forecast excludes any transmission connections proposed for Skye and Harris.

In the section below, as all the power which flows through Ardmore GSP also goes to Stornoway GSP and Harris GSP's, Ardmore GSP's power analysis will also cover Stornoway and Harris GSPs. This is the initial point where we transform from the transmission network down to the distribution network and covers the land areas of Uist, Harris and Lewis with all the power today flowing through the subsea cables from Ardmore.

Dunvegan GSP covers the north side of the isle of Skye and Broadford GSP covers the south side and mainland area defined within this SDP.

5.1.1. Outer Hebrides region (includes Ardmore, Stornoway, and Harris GSPs)

5.1.1.1. GENERATION

Based on the 2024 DFES projections, under the Holistic Transition (HT) pathway, distributed renewable generation (that connects to the local distribution network) across the Outer Hebrides could increase significantly from 82MW in the currently connected baseline to 218MW in 2050 (as shown in Figure 11).

Onshore wind is the primary contributor to this potential increase in renewable capacity growing to 136MW by 2050 under the HT scenario. This reflects significantly strong wind resources and policy support for onshore wind in the region with onshore wind accounting for most of the distributed generation from 2025 onwards.

We also see a growth in Solar PV up to 42MW could be developed on the islands by 2050.

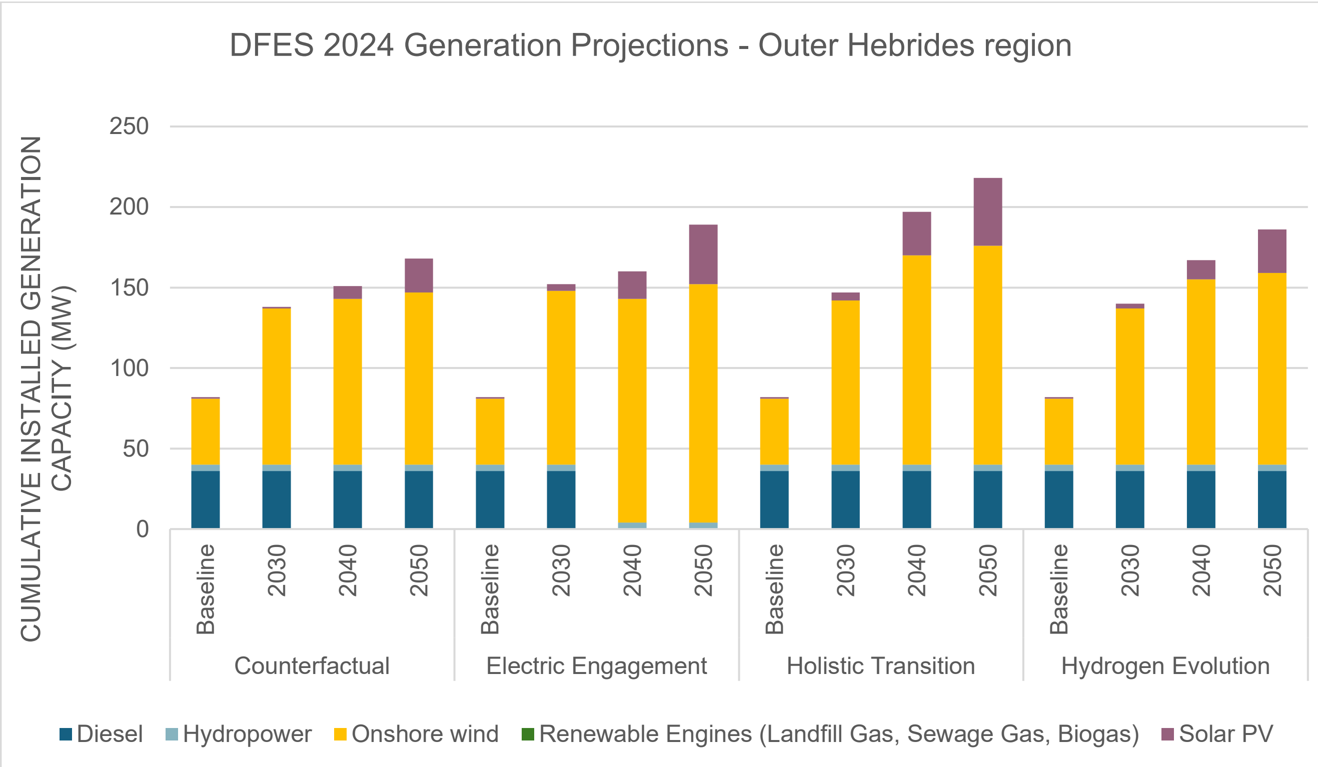

Figure 11 2024 DFES Cumulative Distribution Generation Capacity – Outer Hebrides region.

5.1.1.2. STORAGE

A cumulative storage capacity of approximately 18MW is projected by 2050 under the Holistic Transition (HT) pathway. The co-location generation refers to a system where battery storage is located with renewable generation, and this has a cumulative storage capacity of approximately 4MW projected by 2050 under the HT scenario with domestic storage and high energy user storage at 12MW and 2MW respectively under HT scenario by 2050.

However, to date no large-scale battery storage projects have come online in the Outer Hebrides, and only a single 25MW battery storage proposal located at Battery Point Power Station holds an accepted connection agreement.

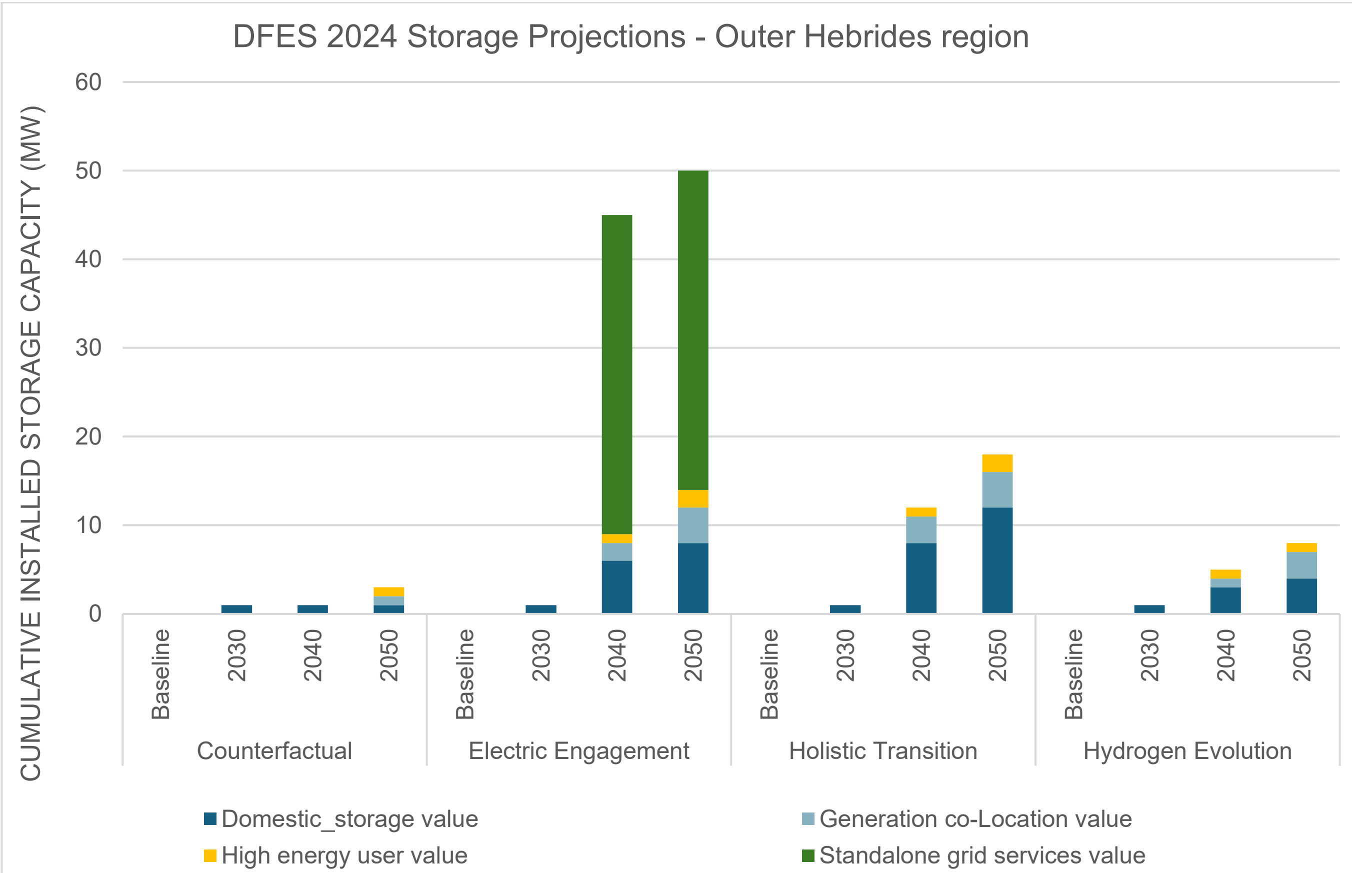

Figure 12 2024 DFES Cumulative Distribution Storage Capacity – Outer Hebrides region.

5.1.2. Skye region (includes Broadford and Dunvegan GSPs)

5.1.2.1. GENERATION

Based on the 2024 DFES projections, under the Holistic Transition (HT) pathway, distributed renewable generation (that connects to the local distribution network) across the Skye region could increase from 37MW in the currently connected baseline to 265MW by 2050 (as shown in Figure 13). The baseline value for hydropower is 8MW, onshore wind is 29MW. We see the largest increase in onshore wind projected to reach 194MW by 2050, followed by solar PV reaching 59MW cumulative installed capacity by 2050.

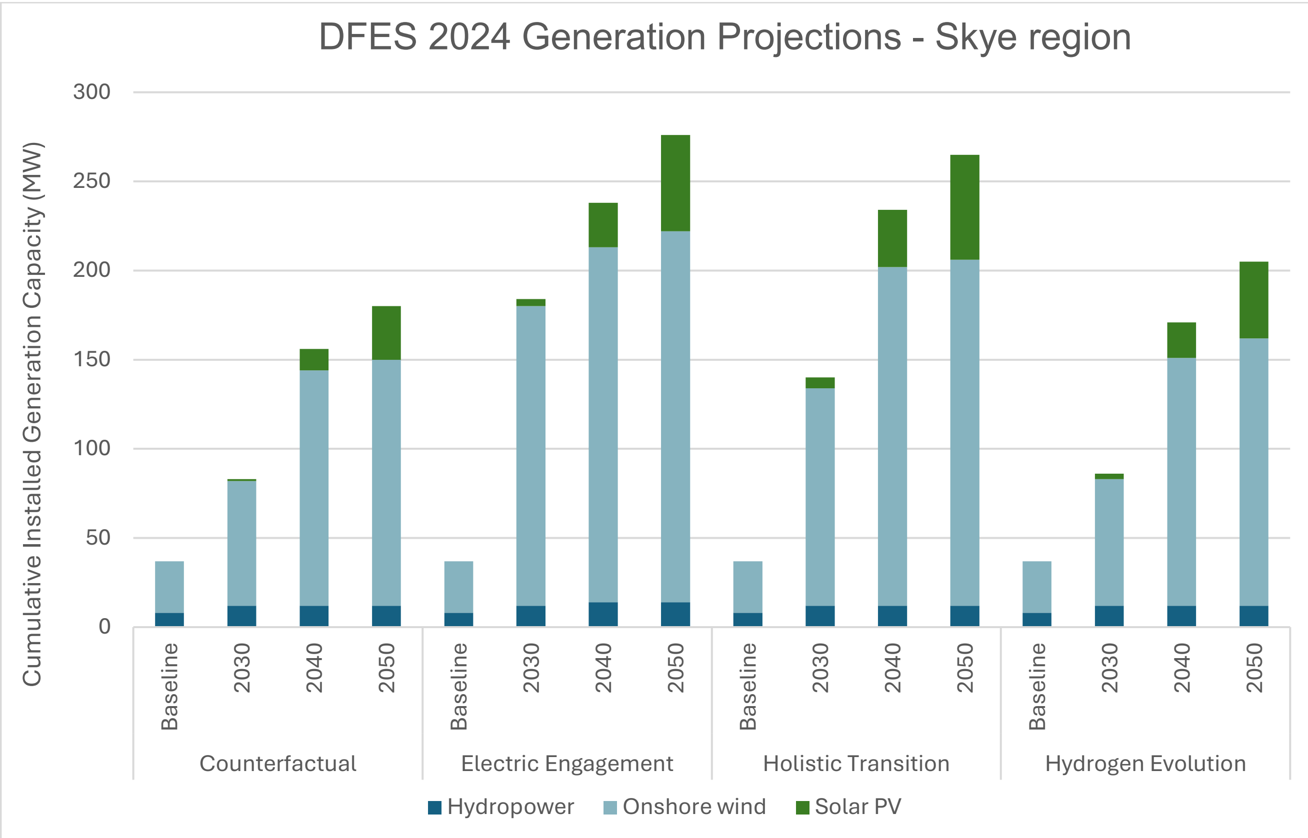

Figure 13 2024 DFES Cumulative Distribution Generation Capacity – Skye region.

5.1.2.2. STORAGE

A cumulative storage capacity of approximately 21MW is projected by 2050 under the Holistic Transition pathway. The co-location generation refers to a system where battery storage is located with renewable generation, and this has a cumulative storage capacity of approximately 9MW projected by 2050 under the HT pathway with domestic storage and standalone grid services at 8MW and 3MW respectively under HT pathway by 2050.

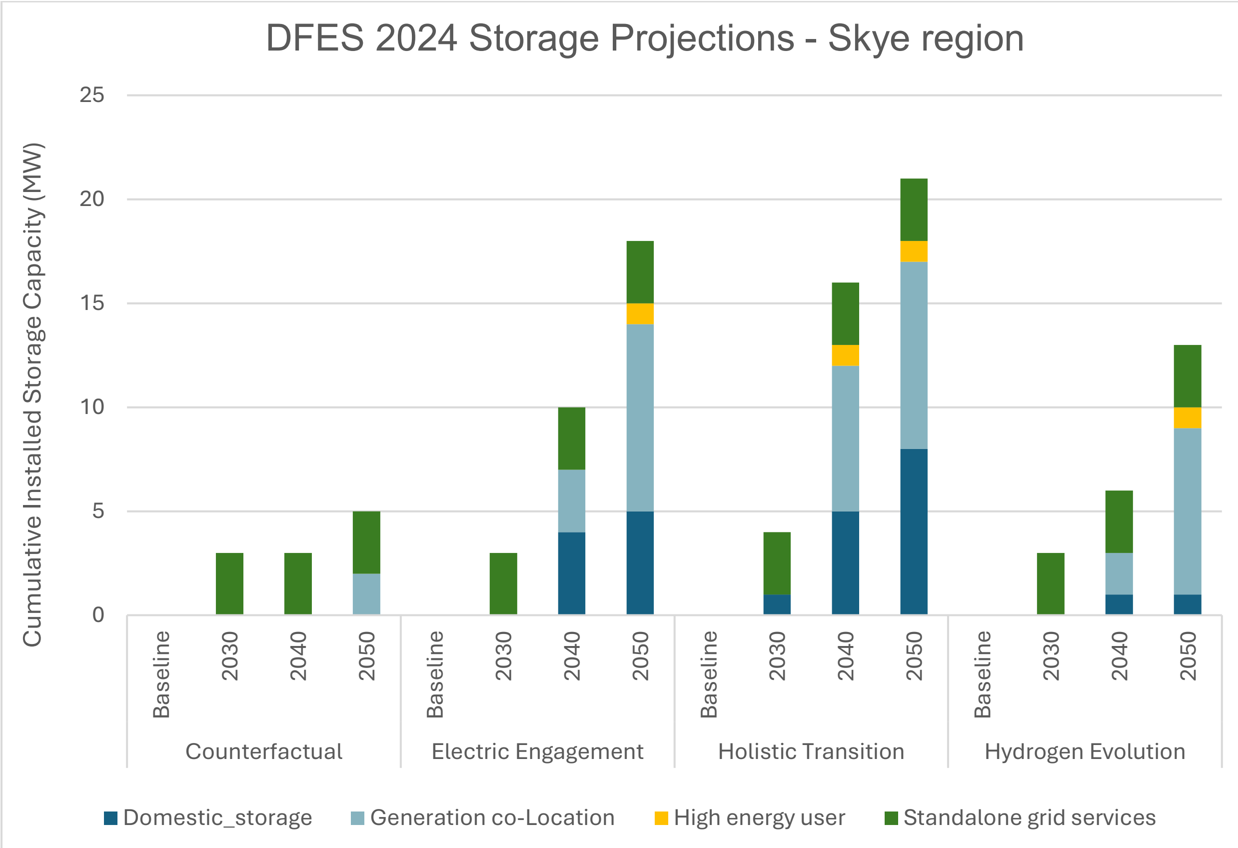

Figure 14 2024 DFES Storage Capacity – Skye region.

5.2. Transport Electrification

The shift to electrified transport is likely to be one of the largest sources of electricity load growth across the Outer Hebrides and Skye. This will be a key consideration for strategic planning. At present the predominant fuel type for both private and public transportation across the Outer Hebrides is fossil fuels. But as policies start to shape the technological and industrial shift away from fossil fuels, the network must be ready to take on the significant increase in electricity demand.

5.2.1. Outer Hebrides region (includes Ardmore, Stornoway, and Harris GSPs)

SSEN's DFES analysis projects that there could be over 3,857 Electric Vehicles (EVs) and Light Goods Vehicles (LGVs) across the Outer Hebrides by 2030, potentially reaching 16,751 by 2050(HT). As the network operator, it is important for SSEN to understand the impact on network driven by the electricity demand of EVs. To do this we can use the projected EV charger capacity (MW) from SSEN's DFES analysis. The SSEN DFES forecasts indicate that the total connected EV charge point capacity on the Outer Hebrides, excluding off-street domestic chargers, could total 13MW (EE) by 2050 (as shown in Figure 15). The forecast data for HT indicates 2MW by 2035 increasing to 12MW by 2050.

The uptake of domestic off-street chargers follows a similar trend. By 2030, there could be as many as 5,483 (EE) domestic off-street chargers installed on the Outer Hebrides with this increasing to approximately 13,136 (EE) by

2050. The forecast also indicates 13,032 (2024 HT) by 2050. It is important to note that this value represents the total installed capacity and does not consider diversity. In our studies, for future system needs diversity (i.e. not all EV chargers will consume peak power at the same time across the network) is taken into consideration so the studied capacity across Ardmore GSP is not equivalent to 12MW.

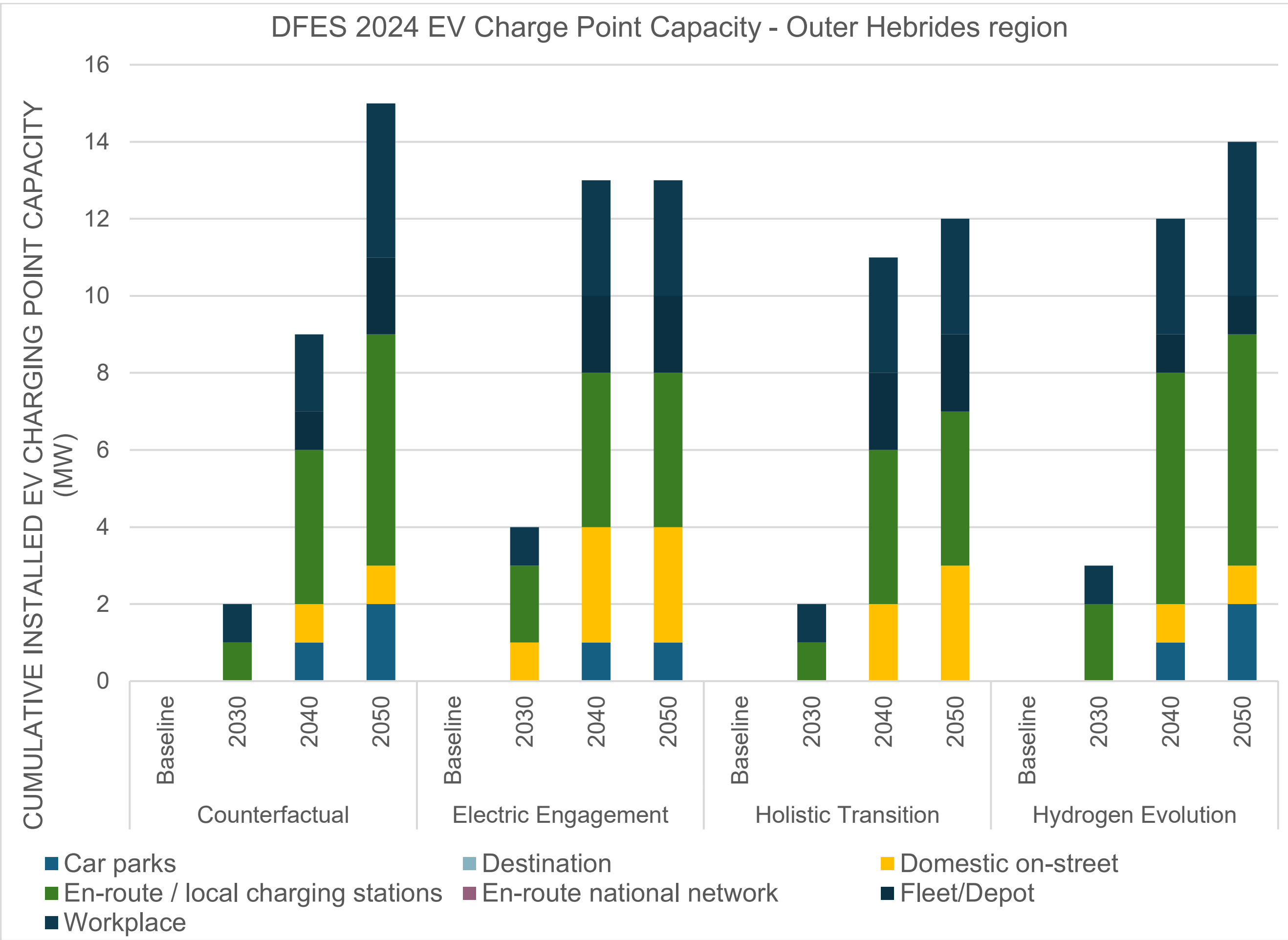

Figure 15 2024 DFES EV Charge Point Capacity – Outer Hebrides region.

5.2.1. Skye region (includes Broadford and Dunvegan GSPs)

According to SSEN's DFES analysis, there could be just over 11,419 (HT) EV cars and light goods vehicles (LGVs) registered in the Skye region by 2050. As the network operator, it is important for SSEN to understand the impact on network driven by the electricity demand of EVs. To do this we can use the projected EV charger capacity (MW) from SSEN's DFES analysis. The SSEN DFES forecasts indicate that the cumulative connected EV charge point capacity in the Skye region, excluding off-street domestic chargers, could total 3MW (HT) by 2050 (as shown in Figure 16).

The uptake of domestic off-street chargers follows a similar trend. By 2030, there could be as many as 1,444 (HT) domestic off-street chargers installed in the Skye region with this increasing to approximately 5,930 (HT) by 2050.

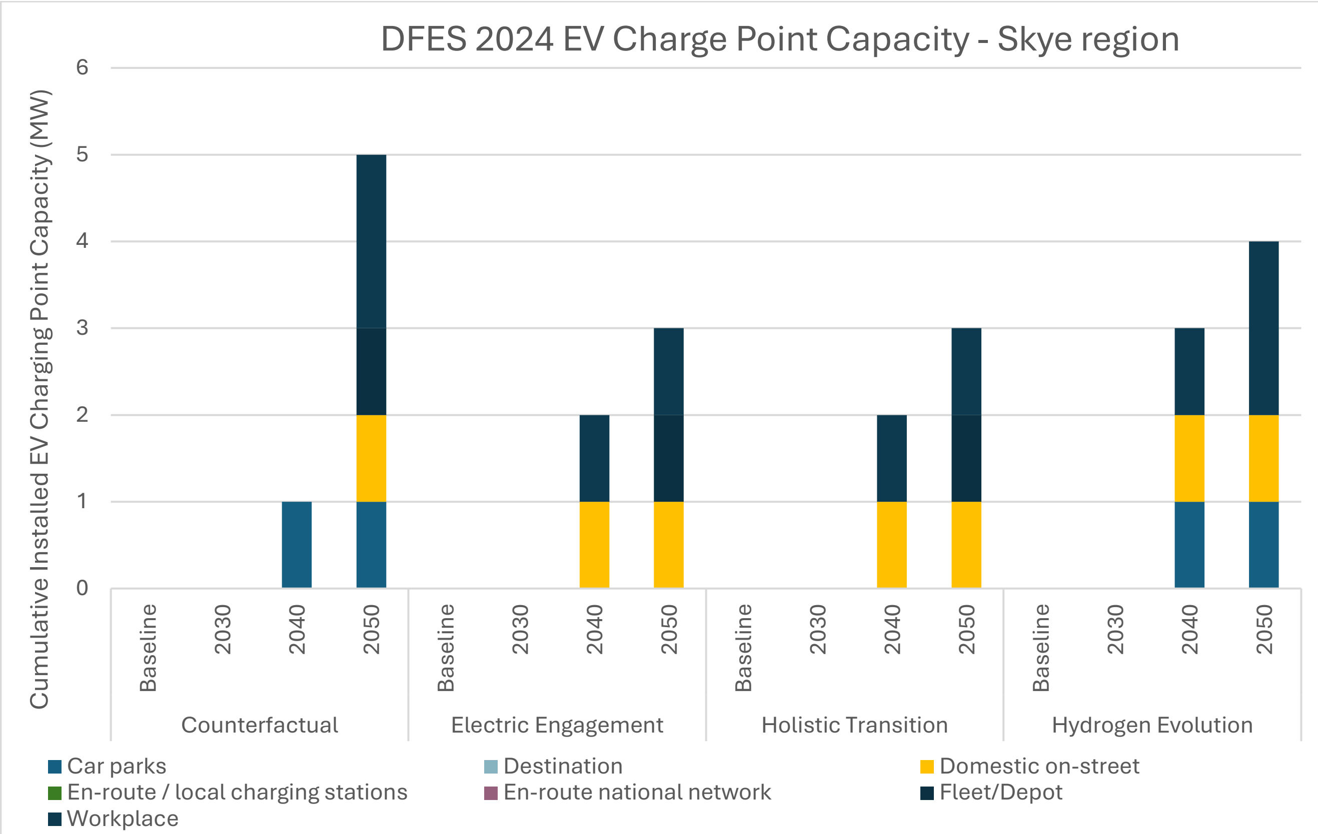

Figure 16 2024 DFES EV Charge Point Capacity – Skye region.

5.3. Electrification of heat

The decarbonisation of space heating technologies in homes and businesses will have a significant impact on the future energy system. Historically in Scotland, central heating is mainly attributable to mains gas & oil (80%) and to electric heating (11% including storage heaters).[13] Government legislation, including the publication of local authorities' Local Heat and Energy Efficiency Strategies (LHEES)[14], and consumer behaviour are just two of many factors that will impact the future electricity demand arising from space heating.

5.3.1. Outer Hebrides region (includes Ardmore, Stornoway, and Harris GSPs)

The electrification of heat could create significant new electricity load in the Outer Hebrides, with the adoption of heat pumps and next generation night storage. Under the HT scenario, domestic air source heat pumps and direct electric heater units could increase by up to 11,971 in 2030 steadily rising to 17,802 by 2050. This excludes air

13 Scottish House Condition Survey: 2021.

14 Local heat and energy efficiency strategies and delivery plans: guidance - gov.scot (www.gov.scot)

conditioning load which accounts for a total of 82 units by 2050. This is highlighted in Figure 17 below. The non-domestic heat pumps will be used for a cumulative footprint of 162,539 m^2.

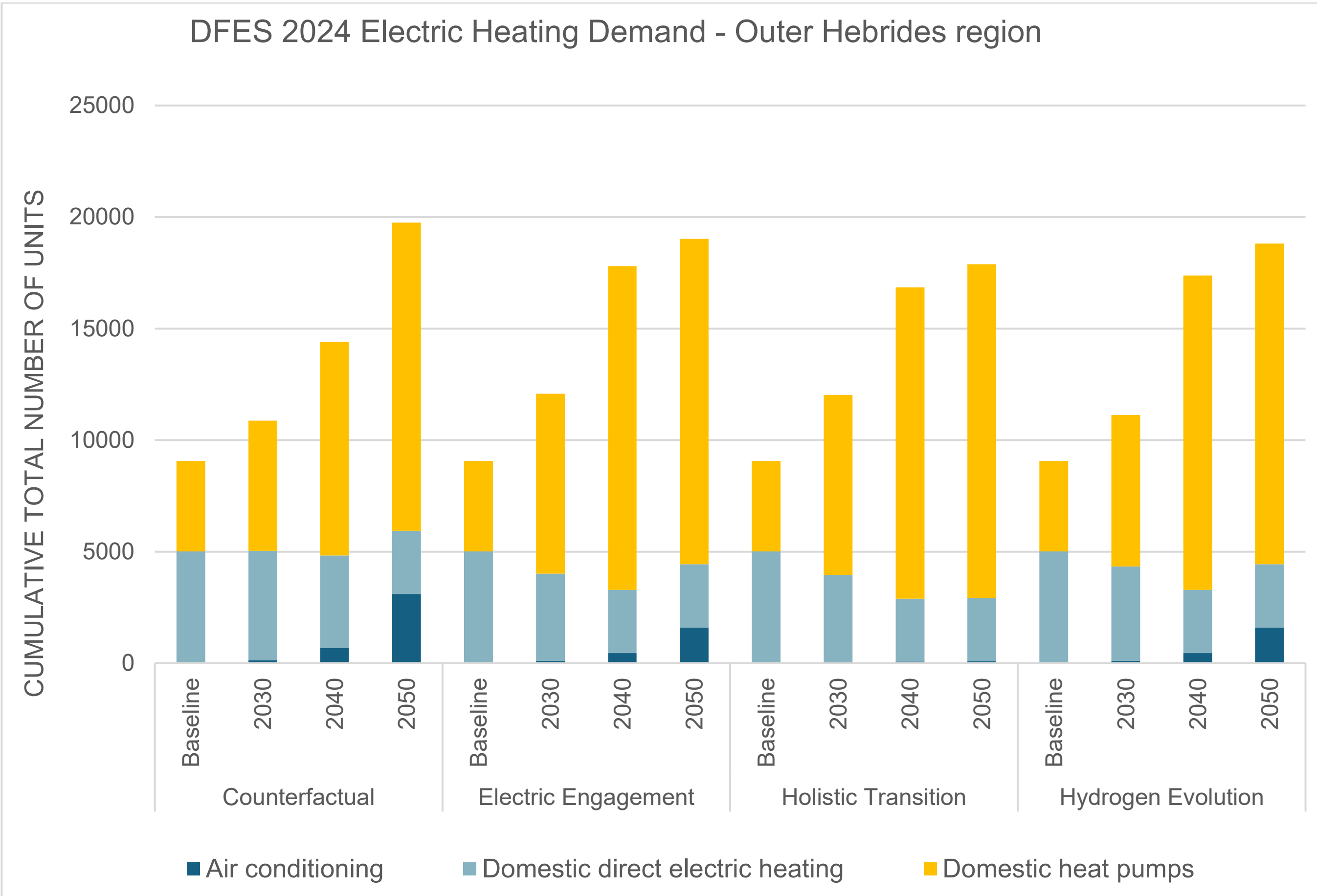

Figure 17 2024 DFES Electric Heating Demand – Outer Hebrides region.

5.3.1. Skye region (includes Broadford and Dunvegan GSPs)

The electrification of heat could create significant new electricity load in the Skye region, with the adoption of heat pumps and next generation night storage. Under the HT scenario, domestic air source heat pumps and direct electric heater units could increase by up to 7,597 in 2030 steadily rising to 10,681 by 2050. This excludes air conditioning load which accounts for a total of 48 units by 2050(HT) and 982 units by 2050(EE). This is highlighted in Figure 18 below. The non-domestic heat pumps will be used for a cumulative footprint of 3,894 m^2.

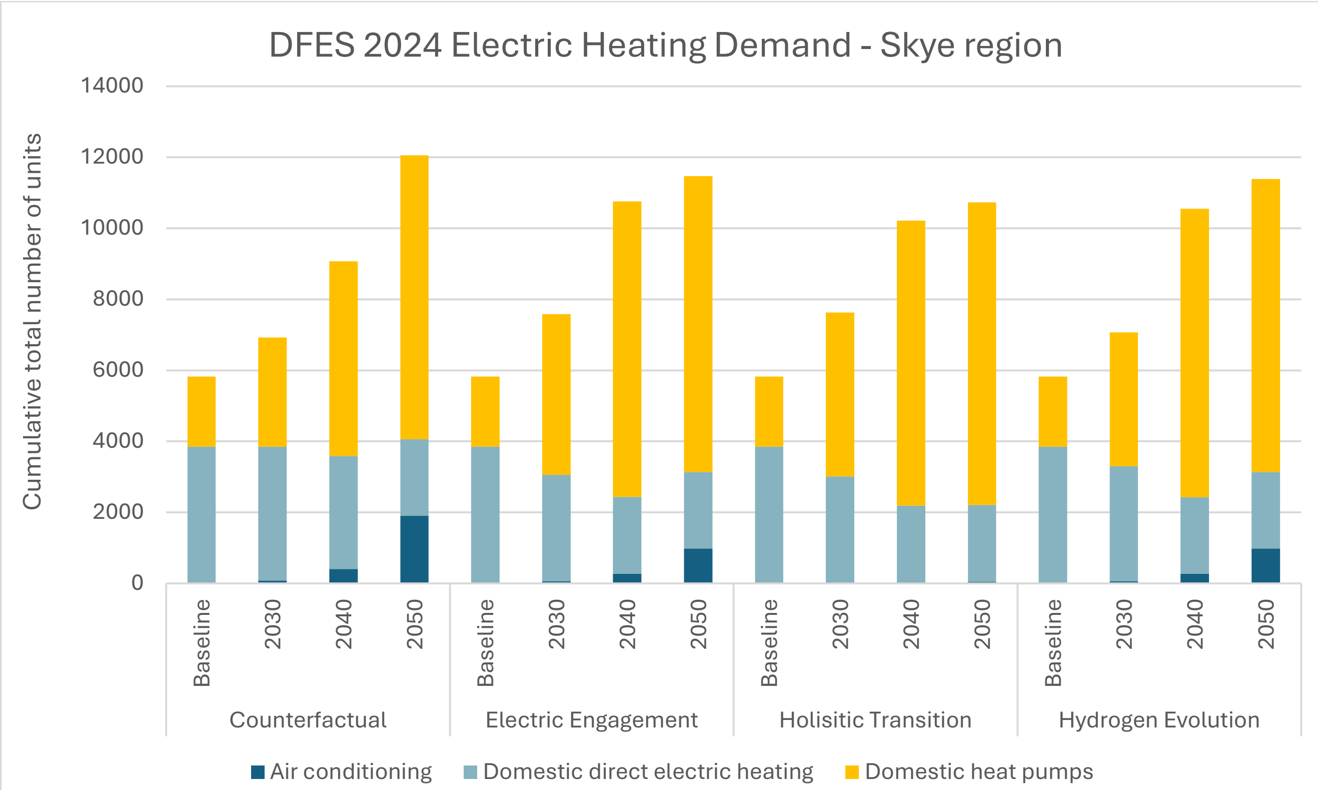

Figure 18 2024 DFES Electric Heating Demand – Skye region.

5.4. New building developments

To produce the SSEN DFES, Regen undertook engagement with local authorities to understand local authority development plans across our licence areas.

5.4.1. Outer Hebrides region (includes Ardmore, Stornoway, and Harris GSPs)

For the Outer Hebrides, the DFES forecasts the cumulative floorspace of non-domestic new developments. Figure 19 shows that the two building classifications contributing to the largest floorspace growth are factory and warehouse developments (96,637m^2 by 2050 in all scenarios), and new office space (31,763m^2 by 2050 in all scenarios). The domestic cumulative number of homes is expected to rise from 150 in 2030 (HT) to 435 in 2050 (HT). The data is similar for the EE scenario with increase from 149 in 2030 to 435 in 2040, with no further change to 2050.

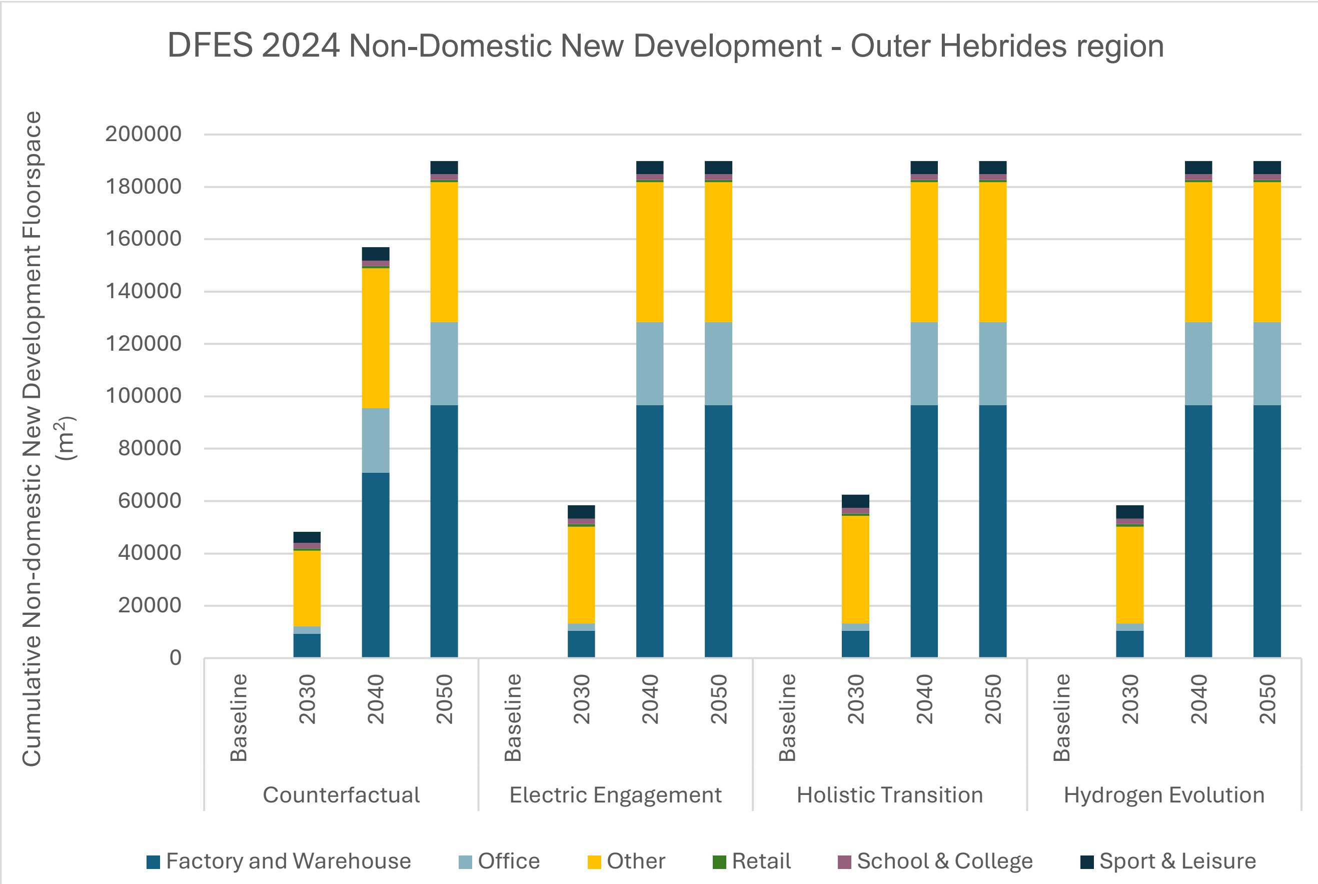

Figure 19 2024 DFES Non-Domestic New Development – Outer Hebrides region.

5.4.1. Skye region (includes Broadford and Dunvegan GSPs)

For the Skye region, the DFES forecasts the cumulative floorspace of non-domestic new developments. Figure 20 shows that the only building classification contributing to the floorspace growth is factory and warehouse developments (22,250m^2 by 2050 in all scenarios). The domestic cumulative number of homes is expected to rise from 376 in 2030 (HT) to 872 in 2050 (HT). The data is similar for the EE scenario with an increase from 269 in 2030 to 825 by 2050.

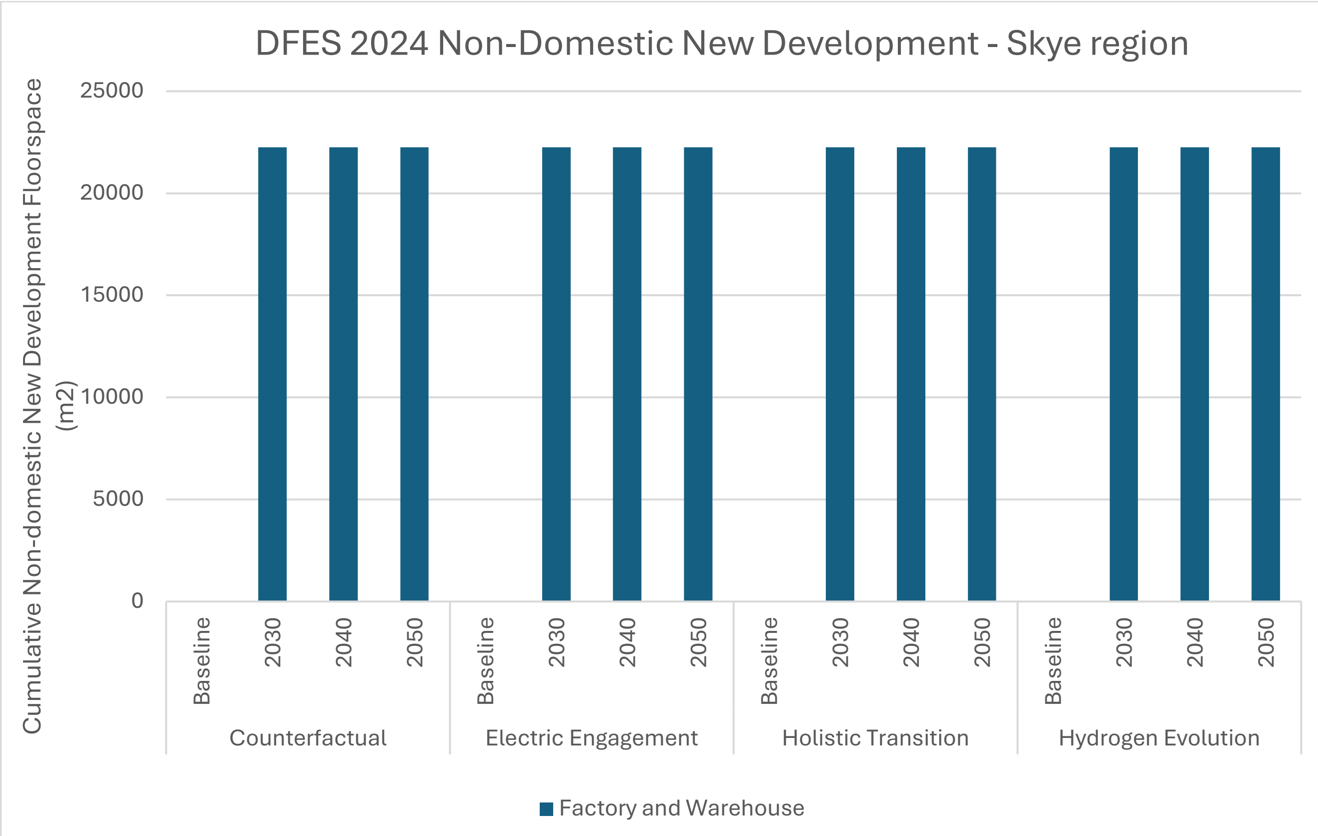

Figure 20 2024 DFES Non-Domestic New Development – Skye region.

5.5. Commercial and industrial electrification

The detailed analysis conducted by Regen regarding the decarbonisation of industries specific to Northern Scotland (i.e., whisky distilleries, fish, and seaweed farming) and broader industries (e.g., agriculture and other commercial businesses) indicate there could be a range of potential electrification outcomes affecting the Outer Hebrides. Further information can be obtained from the Regen Outer Hebrides - Net Zero Load Growth Evidence Summary report[15]. We have also commissioned a further piece of work in collaboration with the Islands Centre for Net Zero (ICNZ), looking to obtain additional insights into the future demand and generation forecasts for the Western Isles and Skye. We have identified distilleries and the port industry as areas of significant future demand growth for the Outer Hebrides. Below we summarise these findings and the impacts on our analysis work.

15 Net zero load growth on Scottish Islands: the Outer Hebrides - Regen

5.5.1. Distilleries

Whisky distilleries are a key part of the Scottish economy, accounting for 74% of all Scottish food and drink exports and 22% of all UK food and drink exports in 2023. More than 41,000 people are employed in the Scotch Whisky industry in Scotland and over 25,000 more jobs across the UK are supported by the industry[16].

Based on the Regen analysis, the current and future energy demand of the distilling industry on the Outer Hebrides and Skye combined with the expansion and decarbonisation pathway is currently hindered by existing grid constraints. If distilleries seek to electrify, the demand capacity on the distribution network could become a more significant source of electricity demand in the region. The Outer Hebrides currently hosts four whisky/gin distilleries supplied from Ardmore GSP. With regards to the Isle of Skye, it plays host to seven whisky/gin distilleries with five supplied by Broadford GSP and two supplied by Dunvegan GSP.

The distilling process has significant and constant high-temperature heat demand which is largely met by fossil fuel combustion at present. The wider whisky industry has made progress towards decarbonisation, with non-fossil fuels making up 20% of its energy use in 2018, up from only 3% in 2008[17]. Regen engagement with the Scotch Whisky Association (SWA) highlighted that their 2023-25 strategy includes commitments to achieving net zero emissions in their own operations by 2040[18]. A Ricardo report commissioned by the SWA in 2019 investigated how carbon reduction in the distillery industry could be achieved[19]. The Regen analysis provided qualitative information on the distilleries. We have initiated discussions with the SWA to gain further quantified information which has now been piloted on Islay and Jura.

5.5.2. Maritime Transportation

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

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

Inter-island ferries and crossings between the Outer Hebrides and other Scottish isles are operated by Caledonian MacBrayne (CalMac Ferries), who run 33 vessels spanning 30 routes across the north and south of the island group. CalMac's Environmental Strategy 2020 estimated their carbon emissions to be approximately 2% of the UK's Domestic shipping total.

Many of the island's ferries including lifeline services, are reaching the end of their operational lifespan – if not already exceeding their estimated lifespan. As such, ferries are currently in the process of being replaced.

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16 Scottish whisky association, 2023. Facts and figures

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

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

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

Caledonian Maritime (who own infrastructure and vessels for CalMac) have committed to decarbonising their ferry fleet. This includes electrifying the current propulsion systems on small ferries by 2027 and increasing the number of hybrid ferries from three to eight. These changes could result in demand requirements at each port, potentially in the realm of 1-5MVA.

The associated use of shore power – to charge these vessels – could equate to a significant load growth at each of the relevant ferry terminals. This could be in the range of 8MW of additional future demand capacity across the islands group through 'Cold ironing' – shore power to berthed ferries.

Figure 21 Ports within the Outer Hebrides

Shore power requirements for other vessels and the roles they provide to residents and businesses should also be considered:

- Recreational sailing – may require shore power to be installed at marinas and harbours.
- Fishing – within the fishing industry, Stornoway Port is the primary port for Shellfish landings and crew changeovers due to its proximity to the airport.
- Aquaculture - the Outer Hebrides accounts for over one-fifth of the Scottish fish farming production, which is distributed by ferry to the mainland once processed.
- Cargo – Stornoway Port handles a variety of general cargo inclusive of road salt, coal, cement, and crucial fuel deliveries which is critical to the islands.
- Cruises – as a popular location, the Outer Hebrides receives almost 15,000 cruise ship passengers each year. A new deep-water terminal in Stornoway is set to be to be operational in 2024, which will give the islands capacity to cater for the majority of the world's cruising fleet.

6. WORKS IN PROGRESS

6.1. Ongoing works

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 Outer Hebrides and Skye these drivers have already triggered network interventions that have now progressed to detailed design and delivery. For this report, the following works are assumed to be complete, with any resulting increase in capacity considered to be released. The network considered for long-term modelling is shown in section 6.2.

A summary of existing works shown below:

Table 3 Works already triggered through customer connections and the DNOA process.

Substation	Description	Driver	Forecast completion	Fully resolves future strategic needs to 2050?	Schematic Reference
Skye and Mainland Network (Broadford and Dunvegan GSP)					
Dunvegan	33kV circuit reinforcement between Ben Aketil tee and Portree busbar on Dunvegan - Portree circuit. Install dynamic compensation equipment. Establish new 33kV connection from Storr Lochs hydro circuit (out of Portree) to a new Primary substation Brogaig Primary.	CV1 – Primary Reinforcement	2028		1
Broadford	Replace existing Skulamus primary with new indoor 33kV and 11kV gas insulated switchgear and two 6.3MVA transformers. One of the new transformers will connect to the 33kV circuit which at present goes towards Marine Harvest. Establish new 33kV gas insulated switchroom at Broadford GSP	CV1 – Primary Reinforcement	2026		2
Broadford	Extend 33kV circuit by 10.7km (including short subsea section). Establish new 1 x 4MVA transformer primary at Ruarach, to include 1 x 33kV CB and 3-panel 11kV board. Additional 11kV works highlighted also.	CV1 – Primary Reinforcement	2026		3

Broadford	Reinforce the 33kV OHL between Broadford and Skulamus and replace the Achintee regulator with a 4MVAr STATCOM	CV1 – Primary Reinforcement	2032		4
Broadford	Extend 33kV circuit between Broadford and Dunvegan by 0.7km to connect into new indoor primary substation. Install new indoor primary substation. The new Sconser Primary will consist of one 4MVA Transformer, two 33kV gas insulated circuit breakers and 3 11kV panel board. Significant 11kV upgrades also required to support voltages for N-1	CV1 – Primary Reinforcement			5
Loch Carnan (Uist) Network					
Ardmore	Reinforce Clachan Primary with two new 6.3MVA 33/11kV transformers with new 33KV Gas insulated switchgear and new 11kV switchgear	CV1 – Primary Reinforcement	Jan-25		6
Ardmore	New Lochmaddy primary substation. Install new single 6.3MVA Transformer primary S/S. Existing 11kV line was built to 33kV spec and will be uprated to connect new S/S	CV1 – Primary Reinforcement	Mar-28		7
Harris and Stornoway Network					
Harris	Reinforce the 33kV Overhead Line which connects into the Ardmore – Harris circuit. This Overhead Line is the weak link since the subsea cable was upgraded following the last fault event. The proposal is to uprate the line to operate at 75deg operation. Overhead Line is 5.6km. Between subsea cable landing point and Harris.	CV1 – Primary Reinforcement	2027		8
Stornoway	Proposal is to move 33kV Normally Open point and install a 4MVAr STATCOM (around Monan) to alleviate voltage constraint on Stornoway 33kV circuit.	CV1 – Primary Reinforcement	2027		9

Stornoway	Build a second 33kV circuit from Stornoway Grid to Barvas primary, including new 33kV teed circuit to Coll primary	CV19- Worst Served Customers	Jan-28		10
Gisla Primary	Replace existing single 1MVA transformer with two 2.5MVA transformers. New two panel 33kV Board, new 6 panel 11kV board and new 33kV line from Stornoway to Gisla (16km)	CV1 – Primary Reinforcement	Sep-27		11
Laxay Primary	New 33kV feeder from Stornoway GSP total 6.2km of new 33kV OHL to a new 33kV board. Replace existing single 2.5MVA transformer with two 6.3MVA transformer. Upgrade 11kV board and establish new 11kV feeder.	CV1 – Primary Reinforcement	Sep-27		12
Barvas Primary	Replace existing single 2.5MVA transformer with two 6.3MVA. Install two new gas insulated 33kV breakers and a new 5 panel indoor 11kV switchboard also some 11kV circuit upgrades. Note that this project is dependent on a second circuit to Coll from Stornoway mentioned earlier.	CV1 – Primary Reinforcement	Jan-28		13
Coll Primary	Replace at Coll Primary existing single 1MVA transformer with two 6.3MVA transformers.	CV1 – Primary Reinforcement	Jan-28		14
Battery Point Primary	Replace three 8MVA Transformers with two 30MVA emergency rated transformers. New 33kV gas insulated switchboard to replace air insulated switchboard.	CV7- Asset Replacement			15
Battery Point DEG	Relocate DEG at Battery Point to Arnish primary substation	CV15 – Quality of Supply			16
Stornoway Grid	Replace 33kV switchboard with new gas insulated switchgear	CV7- Asset Replacement			17

Hebrides and Orkney Whole System Uncertainty Mechanism works					
Ardmore	Reinforce by replacing the existing Ardmore to Loch Carnan 33kV subsea cable with a new larger 33kV subsea cable from Loch Carnan to the landing point at Loch Pooltiel. New 33kV subsea cable from Ardmore to Loch Pooltiel. Establish new 33kV switching station at Loch Pooltiel near Meanish Pier	HOWSUM	2028		18
Dunvegan	New overhead line from Meanish Pier switching station to Dunvegan GSP	HOWSUM	TBC		19

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.

6.2. Network Schematic (following completion of above works)

The network considered for long-term modelling is shown in Figure 22 - Figure 26 below.

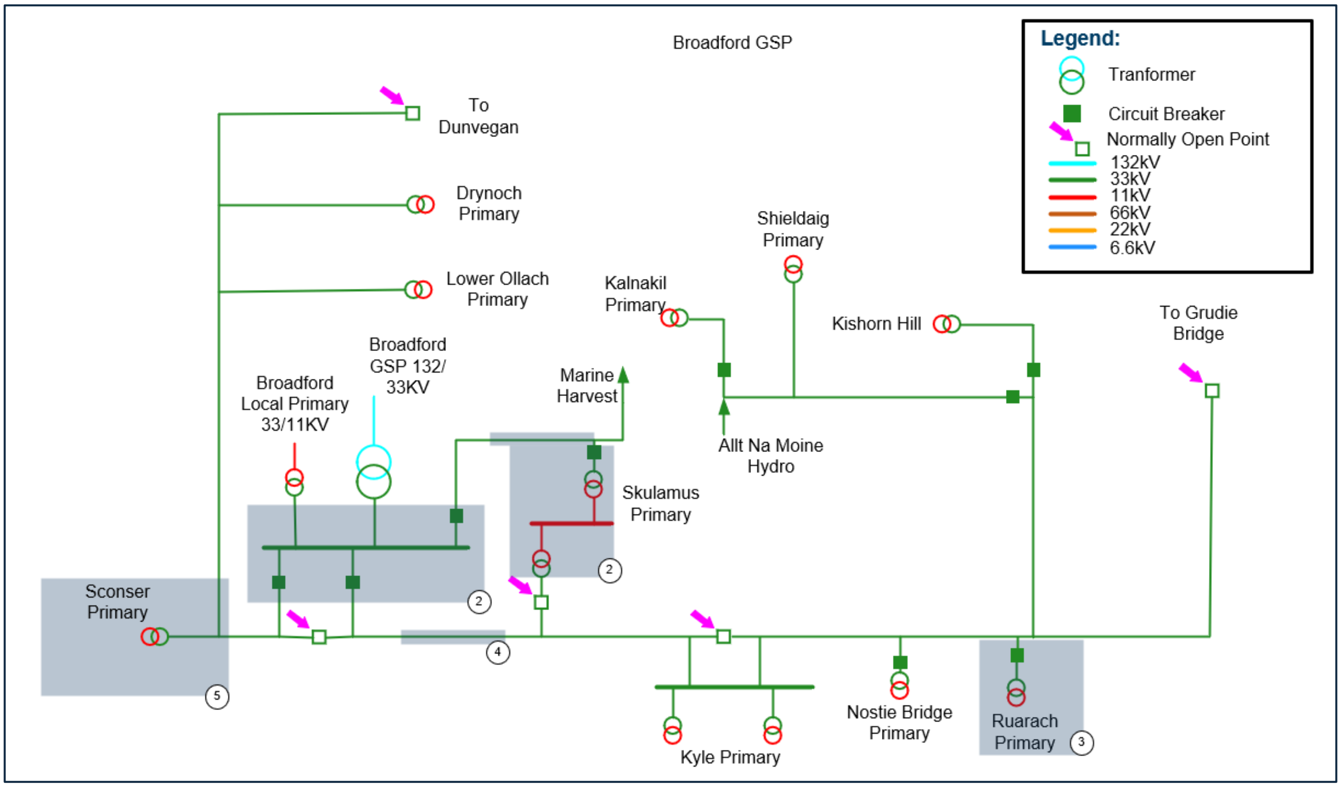


Figure 22 Broadford 33kV Schematic post triggered reinforcement works.

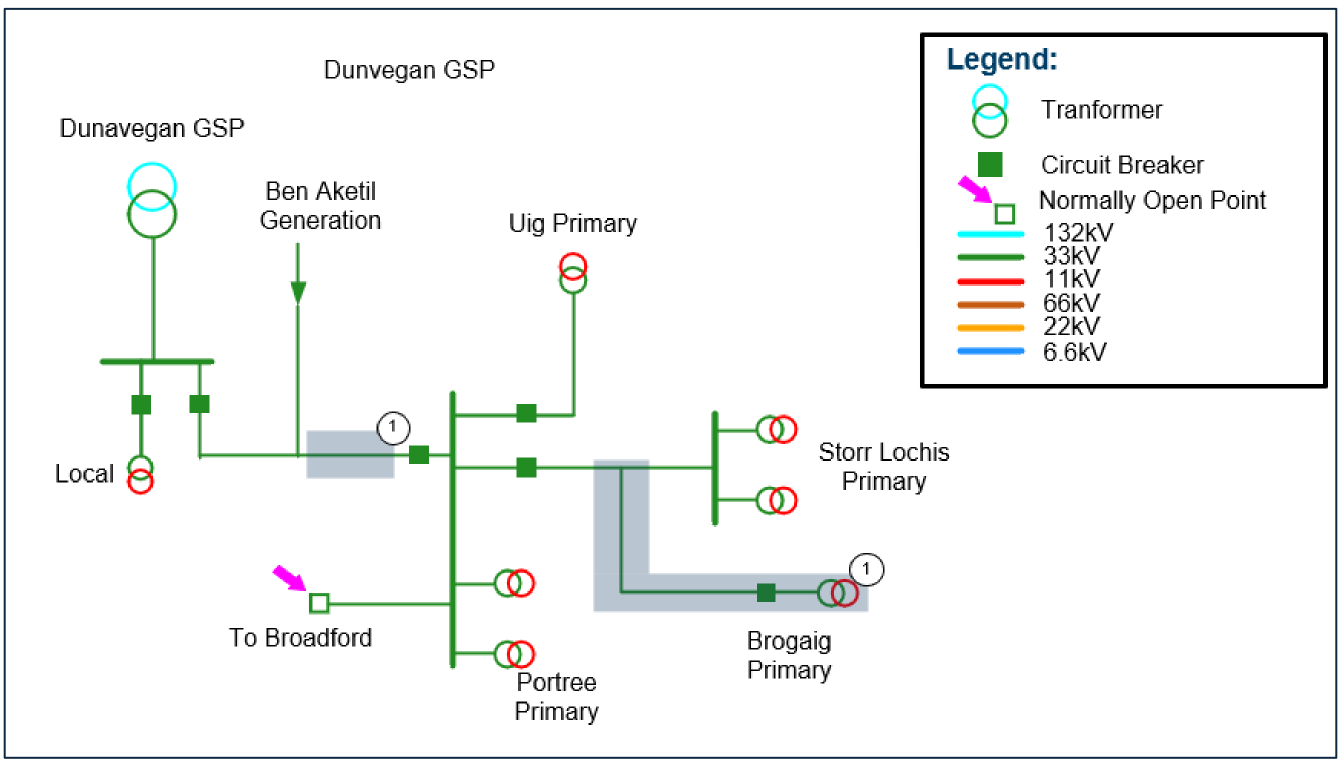


Figure 23 Dunvegan 33kV Schematic post triggered reinforcement.

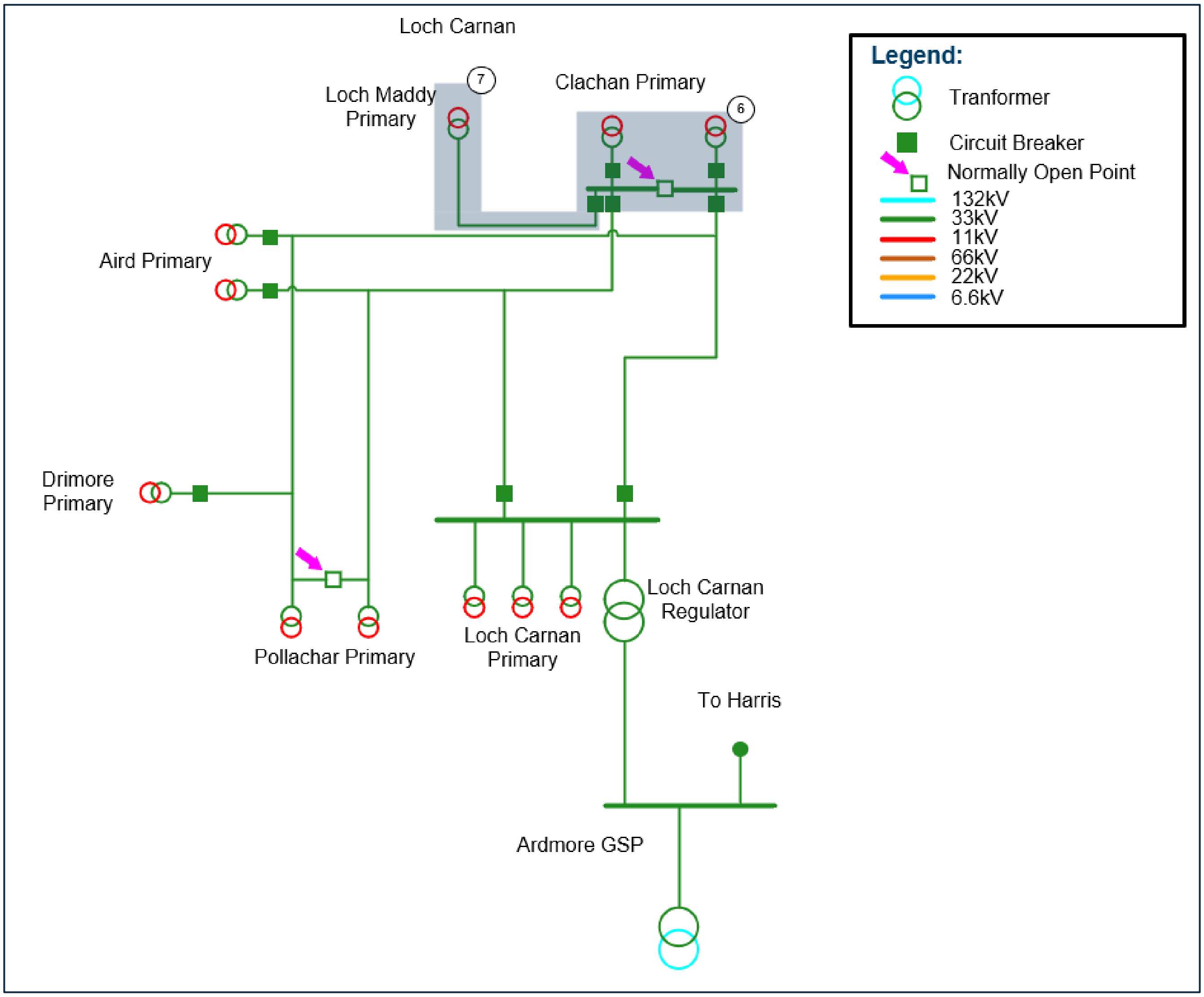


Figure 24 Loch Carnan 33kV Schematic post triggered reinforcement.

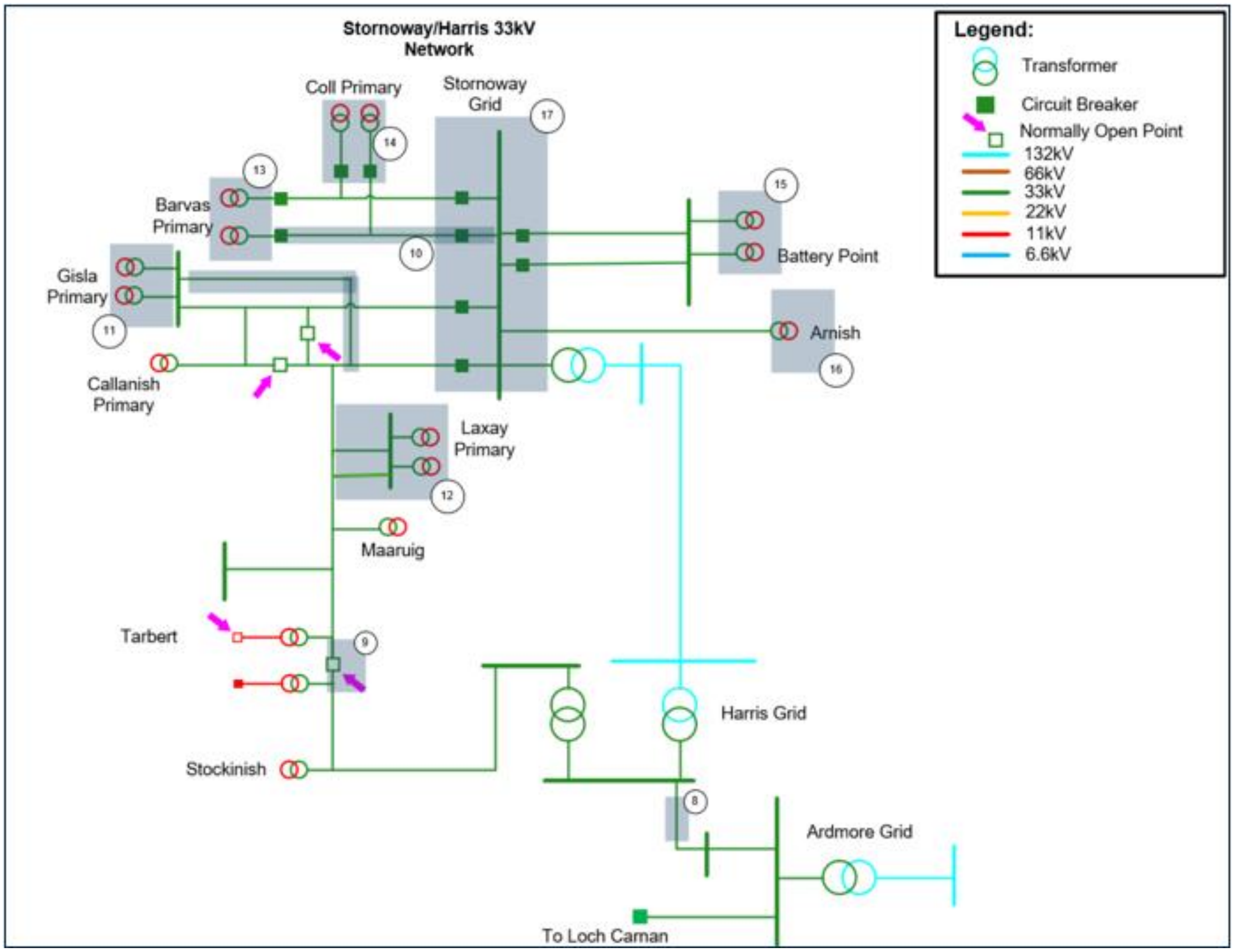


Figure 25 Stornoway and Harris 33kV Schematic post triggered reinforcement.

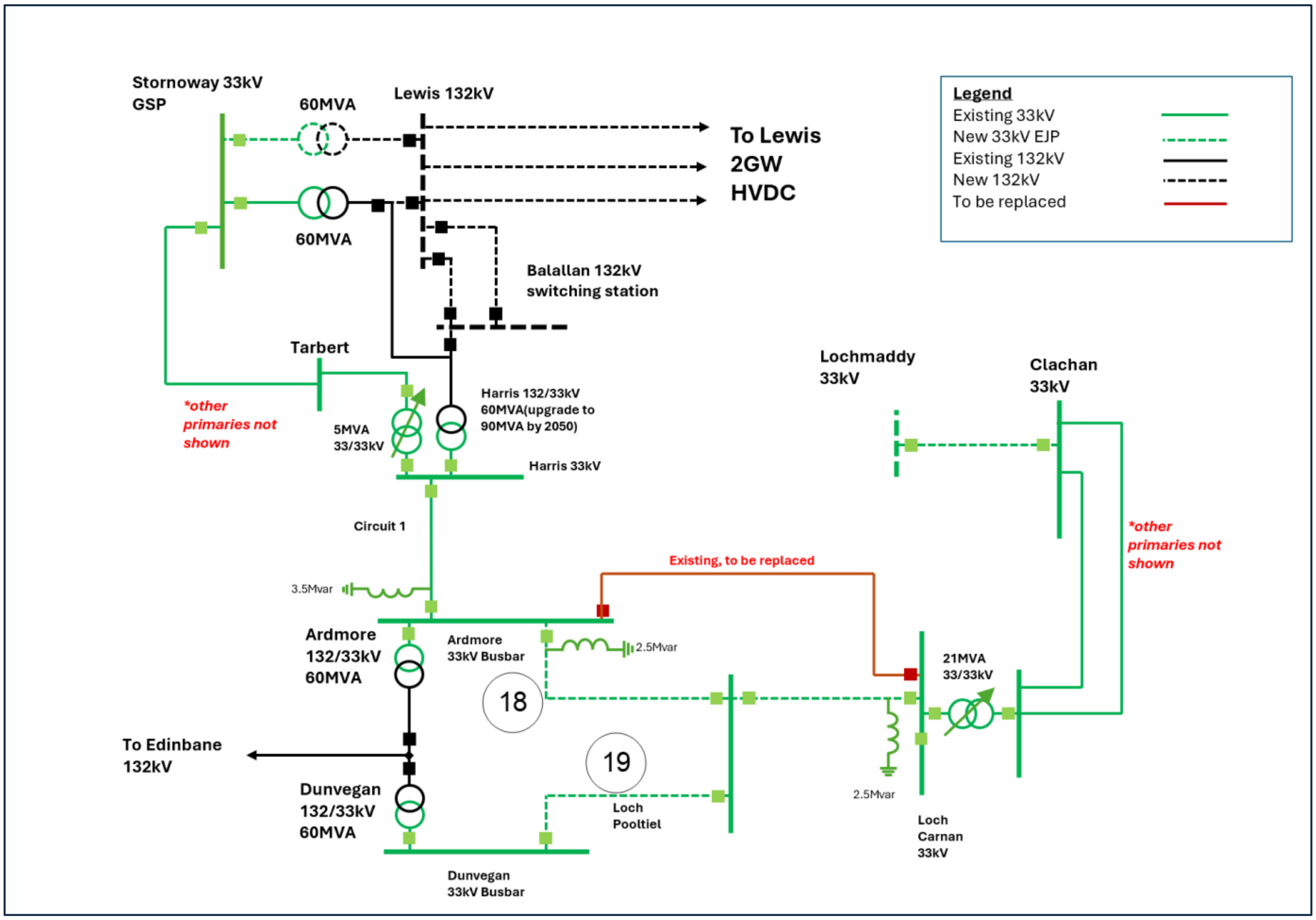


Figure 26 Ardmore, Uist, Harris 33kV Schematic HOWSUM post triggered reinforcement

7. FUTURE SYSTEM NEEDS

In the previous sections we discussed the Regen DFES Demand and Generation forecasts for the Outer Hebrides and Skye. We have used this information to understand what this means for the local networks. Initially this is developed through the creation of a spatial plan of future system demand needs looking at periods of maximum demand with minimum generation. These will be augmented in the future to include spatial plans of low demands with high generation output.

We have created spatial plans at a primary substation level (33/11kV) and secondary substation level (11kV/LV). Snapshots are provided for 2028, 2033, 2040, and 2050 enabling clear visualisation of future distribution system needs beyond the current network capacity. They are currently based on 2024 DFES.

These spatial plans consider the distribution network requirements to capacity requirements. They do not account for the enhanced network resilience policy for island groups fed by sub-sea cables, nor do they account for any needs arising from the transmission system.

7.1. EHV Spatial Plans for Demand Future Needs

The EHV spatial plan for the Outer Hebrides and Skye network is shown in Figure 27 for DFES 2024 HT scenario, with the other scenarios shown in the **Error! Reference source not found.** Figure 32, Figure 33 and Figure 34 for with HE, EE and CF respectively.

Figure 27 Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs EHV spatial plans for HT 2028, 2033, 2040, and 2050.

7.2. HV/LV spatial plans

To understand where load is growing at a lower granularity, we have used information from the SSEN load model.

The data in this section currently represents the DFES 2023 data and we aim to provide updated HV/LV data based on DFES 2024 in due course as we are in the validation process. The secondary transformer projected percentage loadings for each of the four DFES 2023 scenarios are highlighted in Figure 28 for CT, with ST, LW and FS all shown in the Figure 35, Figure 36 & Figure 37 respectively. As shown in the legend, the points are coloured based on their percentage loading with green being low percentage loading and darker reds being higher percentage loading (see legend for detail on loading bands and colouring).

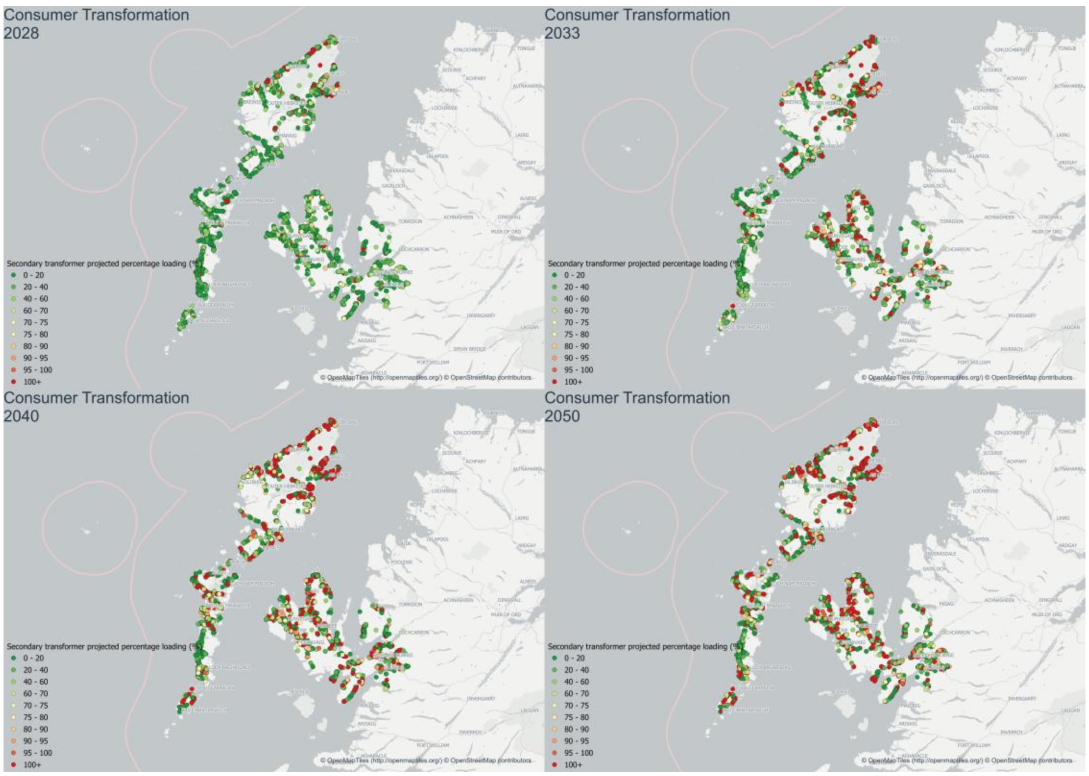


Figure 28 HV/LV demand spatial plans for 2028, 2033, 2040, and 2050 for HT.

8. OPTIONS TO RESOLVE

The relevant spatial plans provide us with a strategic view of future system needs. We have reviewed this through thermal power system analysis to understand the specific requirements of our EHV networks through 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 were all accounted for. Contingency N-2 considerations for islands supplied by subsea cables were also assessed.

In this section we propose initial options to resolve these needs. If required during the next seven years, these will be further developed through the HOWSUM and DNOA processes, where they will be considered alongside the potential for flexibility.

The section is split into three parts:

- Future EHV system needs to 2040 – these needs are more certain and therefore we have more clearly defined options to meet the requirements. For needs within the next ten years, we recommended that these are progressed through the HOWSUM and DNOA process. In all cases we are proposing solutions that meet the projected requirements for 2050. We also provide a summary of more strategic elements that also need to be considered in these timeframes.
- Future EHV system needs to 2050 – there is a greater degree of uncertainty of outcomes in this timeframe. 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 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: Works proposed here are dependent on the supply chain required to deliver the project. This has been tested through delivery of RIIO-ED1 projects. This has shown that the supply chain is able to provide the capacity and skills required to deliver these projects. As we move into RIIO-ED2 with the increased amount of capital delivery required it is important for us to ensure that the supply chain can continue to deliver.

Risks: Works delay potential interventions downstream and/or cannot deliver the subsea cable on time.

Mitigation: In response to this we have commenced early market engagement with subsea cable installation contractors to ensure that the capacity and skills to deliver this project are available.

Dependency: Procurement of flexible services to defer reinforcement where possible and economically viable.

Risks: Insufficient flexibility in the relevant area to resolve system needs.

Mitigation: Flexible service procurement carried out ahead of time with signposting of future needs. Latest commissioning date identified to allow time for traditional reinforcement if flexibility is not viable.

Dependency: Lack of network capacity stifles the connection of new generation projects to local distribution networks..

Risks: Community generation projects are unable to connect.

Mitigation: Work with SSEN Transmission to understand how CP2030 and Connections Reform can help facilitate local projects.

Dependency: Lack of appropriate network resilience unduly impacts remote communities on the Outer Hebrides.

Risks: Prolonged periods of supply interruptions for affected communities.

Mitigation: Flexible service procurement carried out ahead of time with signposting of future needs. Latest commissioning date identified to allow time for traditional reinforcement if flexibility is not viable.

Dependency: Need to reflect local generation and demand needs accurately.

Risks: DFES methodology does not appropriately reflect island needs.

Mitigation: Greater engagement with local stakeholders to understand needs building on works and insights already developed through HOWSUM.

8.2. Future EHV System Needs to 2040

Table 4 below summarises the system options we have identified through the HOWSUM process. These are needs relating to future requirements for the infrastructure from Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs ahead of 2040. These options form alternative potential solutions that will be tested further through detailed system analysis as part of the HOWSUM and DNOA process. Section 8.2 – Section 8.3 break these options down further into the potential time periods for their need.

Table 4 Future EHV system needs projected to arise ahead of 2040.

Option	HT Year of need	HE Year of need	EE Year of need	CF Year of need	Network State	Comments
Establish enhanced supply route for Callanish primary	2028	2028	2028	2028	Secures N-1 resilience for Callanish primary	Establish second 4MVA transformer and 33kV switching station at Callanish to improve N-1 resilience
Improve Lower Ollach resilience	2033	2033	2033	2033	Secures N-1 resilience for Lower Ollach primary	Establish 1x4MVA transformer at Lower Ollach and ensure there is sufficient 11kV backfeed resilience between Lower Ollach, Drynoch and New Sconser.

Improve Pollachar resilience	2031	2031	2031	2031	Secures N-1 resilience for Pollachar primary	Replace existing transformers with 2x6.3MVA units (plus 33kV switchgear works)
Improve Stockinish resilience	2038	2038	2038	2038	Secures N-1 resilience for Stockinish primary	Establish second 2.5MVA transformer plus 33kV switchgear and short circuit span to sectionalisation of the network
Augment Harris and Ardmore with new supplies	2033-2040	2033-2040	2033-2040	2033-2040	Secures N-2 resilience for Stornoway-Harris demand Group.	Establish two new Ardmore - Harris interconnectors. The voltage level to be specified following detailed analysis.
Augment Loch Pooltiel switching substation and Clachan with new 33kV supply	2033	2033	2033	2033	Secures N-1 resilience for South Uist Group.	Establish new 35MVA rated interconnector from Loch Pooltiel switching substation to Clachan.
Augment Loch Pooltiel switching substation and Loch Carnan with new 33kV supply	2033-2040	2033-2040	2033-2040	2033-2040	Secures N-2 resilience for South Uist Group.	Establish a second 35MVA rated interconnector from Loch Pooltiel switching substation to Loch Carnan. This requires replacement of the existing 33kV regulator with 2x30MVA units plus 33kV switchgear works at Loch Carnan.

8.3. Future EHV System Needs to 2050

Table 5 Future EHV system needs projected to arise between 2040 - 2050.

Option	HT Year of need	HE Year of need	EE Year of need	CF Year of need	Network State	Comments
Remove Stornoway local voltage constraint	2050	2050	2050	2050	Low cost to mitigate voltage issue and release capacity. May be required in conjunction with other options.	Install STATCOMs at Gisla or Callanish and refurbish OHL sections

Enhance resilience at Battery Point	2045	2045	2045	2045	Secures N-1 resilience for Battery Point primary	Establish third 30MVA transformer at Battery Point with auto-close scheme at 11kV
Enhance resilience at Portree	2050	2050	2050	2050	Secures N-1 resilience for Portree primary	Replace 8MVA transformer with 7.5/15MVA transformer
Enhance resilience at Drynoch	2050	2050	2050	2050	Secures N-1 resilience for Drynoch primary	Upgrade existing transformer to 1x4MVA unit

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, and this section provides further context on this work for both the Outer Hebrides and Skye high voltage and low voltage network needs to 2050.

8.4.1. 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.[20]

The load model is a machine learning product which estimates a half-hourly annual demand profile for each household based on a series of demographic, geographic and heating type factors. This enables us to estimate capacity on the electricity network while protecting individual customers data privacy by using modelled data. These views are then aggregated up the network hierarchy based on the combinations of customers associated with each asset. This view is supplemented with the DFES to highlight the projected impact of LCTs on the network.

For the 27 primary substations supplied from Broadford, Dunvegan, Stornoway, Harris and Ardmore GSPs, 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 29 demonstrates how this percentage changes under each DFES scenario from now to 2050. This graph utilises DFES2023 data while we develop and validate the HV/LV load models for DFES2024.

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

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.

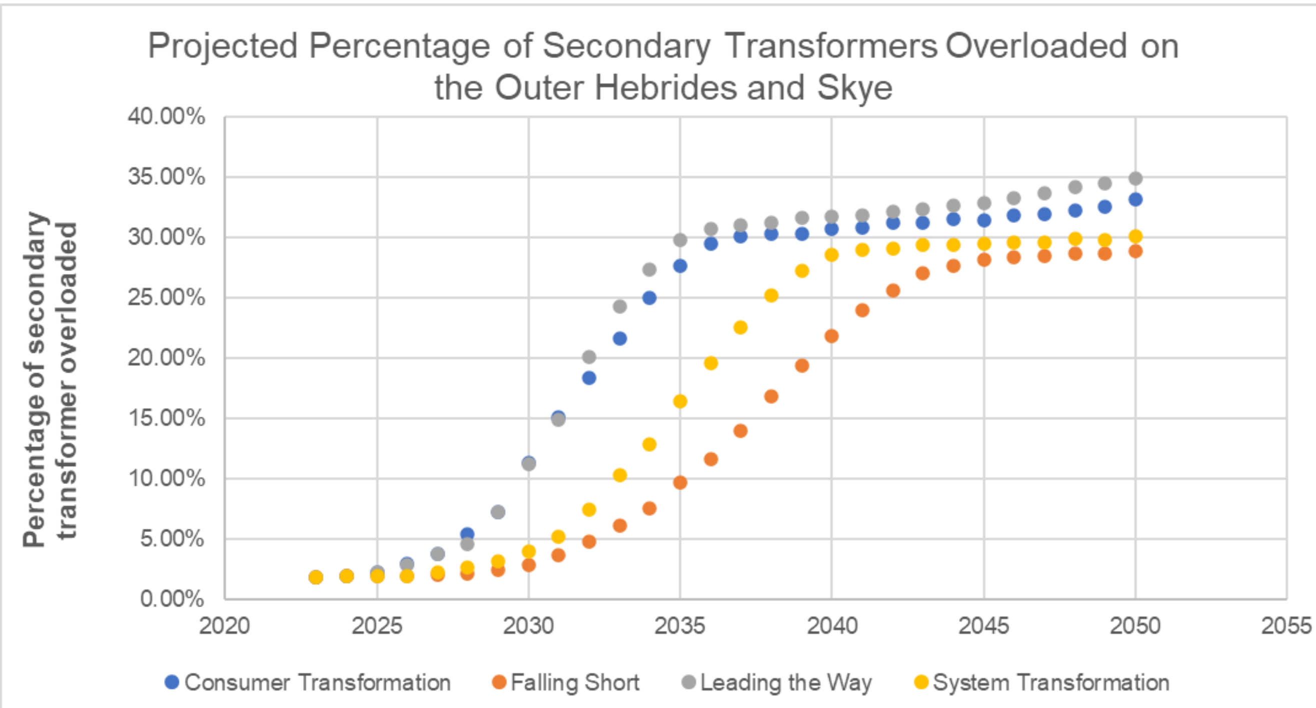


Figure 29 Projected Percentage of Secondary Transformers Overloaded on the Outer Hebrides and Skye

Considering the Just Transition in HV development

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

One of the outputs from this innovation project was the report produced by the Smith Institute. [21] This work groups LSOAs[22] 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 6**.

Table 6 VFES Groupings

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.

To understand the vulnerability groupings across Ardmore, Broadford, Dunvegan, Harris and Stornoway supply areas we have visualised the LSOA categorisation for the study area. By overlaying secondary transformers that are projected to be overloaded by 2028 (under the Consumer Transformation scenario), we begin to understand

21 VFES Machine Learning Discovery of Vulnerability Signatures Report, Smith Institute, 08/11/2022, (NIA SSEN 0063; VFES)

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

the crossover between network capacity needs and areas categorised as high vulnerability through the VFES work.

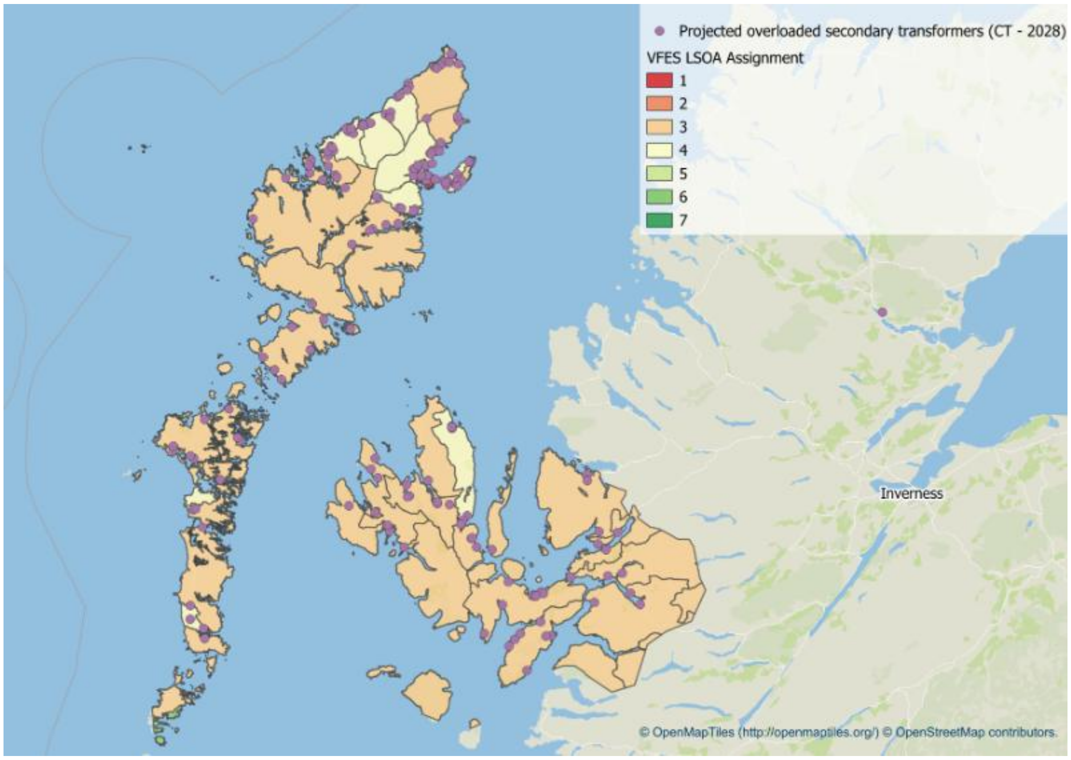


Figure 30 Outer Hebrides & Skye region VFES Output with secondary transformer overlay.

We can see that much of the area falls within group 3 – high levels of vulnerability. This high level of vulnerability is driven up by larger elderly population levels, reduced by lower levels of disability and mental health benefit claimants.

By overlaying the point locations of secondary transformers projected to be overloaded (in 2028 under the Consumer Transformation scenario) we identify areas that are categorised as more vulnerable and 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 LCT's 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 disadvantaged by outages.

8.4.2. Low Voltage Networks

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

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

Capacity driven needs – Thermal constraints tend to materialise in the sections of cable leading to the substation (transformer) where multiple customer loads aggregate. 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 LV system need changes for remote rural communities including those on Scottish Islands 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.

Our LV analysis utilises DFES2023 data while we develop and validate the HV/LV load models for DFES2024. Initial analysis indicates that 3.2% of low voltage feeders may need intervention by 2035 and around 4% by 2050 under the CT scenario as shown in Figure 31. The need is unlikely to be triggered until 2028 onwards. However, due to the timeline to grow workforce, with jointing skills typically taking 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.

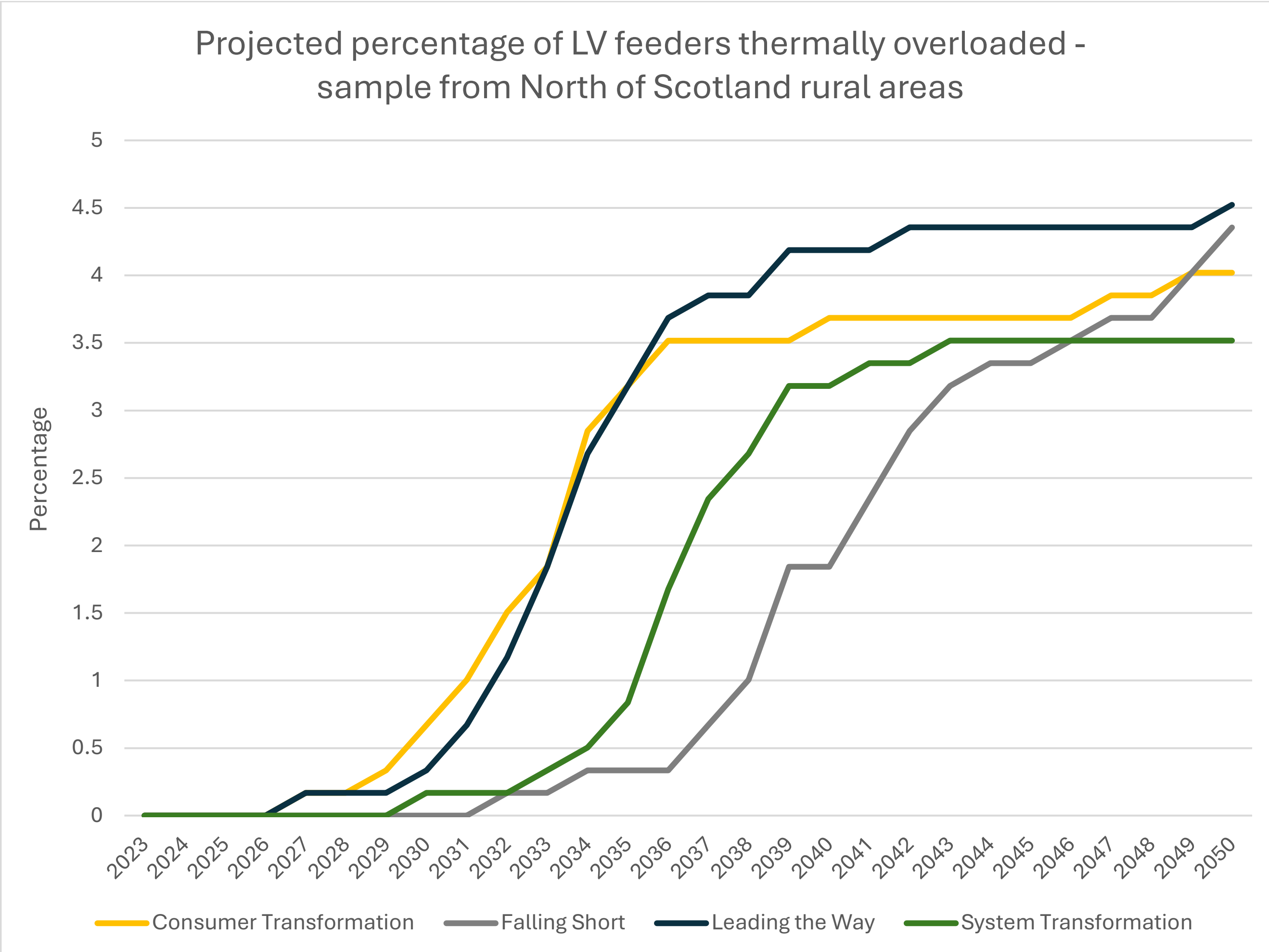


Figure 31 Percentage of LV feeders projected to be overloaded in Northern Scotland remote rural areas.

9. RECOMMENDATIONS

The review of stakeholder engagement and the SSEN 2023 DFES analysis provides a robust evidence base for load growth across the Outer Hebrides and Skye in both the near and longer term. Drivers for load growth across the Outer Hebrides and Skye arise from multiple sectors and technologies. These drivers impact not only our EHV network but will drive system needs across all voltage levels. They are driven by both demand and generation needs and detailed optioneering will need to consider both scenarios.

Across the Outer Hebrides and Skye, 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 four key recommendations:

- Proposed works to resolve the system needs projected in the short and medium term should be assessed through the DNOA methodology and HOWSUM.[23] Through detailed study we will understand the network requirements in more detail and progress these where appropriate. This includes the following system needs to 2040:
    - Callanish primary
    - Lower Ollach primary
    - Pollachar primary
    - Stockinish primary
    - Loch Carnan GSP
    - Stornoway – Harris GSP group.

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

- 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 Outer Hebrides and Skye, therefore we are assessing the demand increases throughout the Outer Hebrides, aggregating projects that can address these demand needs and moving these projects through to delivery. This needs to be based on strategic modelling of LV networks to understand the volume of work needed.

- SSEN should proactively engage with key stakeholders to scope longer term works that have been signposted in this document including plans to decarbonise operations. This could take the form of input from Local Area Energy Plans (LAEPs), Local Heat and Energy Efficiency Strategy (LHEES), or more specific engagement on the details of individual projects. This needs to include discussions on related

23 https://www.ssen.co.uk/globalassets/about-us/dso/consultation-library/distribution-network-options-assessment-dnoa---making-decisions-on-the-future-use-of-flexibility.pdf

activities such as land availability and usage. Consideration should be given to supplementing DFES insights with more granular insights from local communities.

- The further development of a long-term whole system 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. This will also ensure future resilience of whole system networks to customers on Skye and the Outer Hebrides.

- SSEN should also actively engage with specific large customers in Ardmore, Broadford, Dunvegan, Harris and Stornoway GSPs with the aim of refining its demand forecast methodology for industries such as distillery and ports which will play a major role in both local decarbonisation and driving future network needs.

Actioning these recommendations will allow SSEN to develop a network that supports local net zero ambitions. By doing so, contributing to net zero targets at a national level.

10. APPENDICES

APPENDIX A: PRIMARY SUBSTATION EXISTING NETWORK

Substation Name	Site Type	Number of Customers Served	Transformer number /MVA rating	2024 Substation Maximum MVA (Winter)
Skye and Mainland Network				
Broadford 11kV	Primary Substation	958	1x 5MVA	1.51
Drynoch	Primary Substation	984	1x 2.5MVA	1.47
Kalnakil	Primary Substation	233	1x 2.5MVA	0.36
Kishornhill	Primary Substation	147	1x 2MVA	0.93
Kyle	Primary Substation	932	2x 5MVA	2.15
Lower Ollach	Primary Substation	426	1x 1MVA	0.87
Nostie Bridge	Primary Substation	1,250	1x 4MVA	2.26
Shieldaig	Primary Substation	159	1x 1MVA	0.85
Skulamus	Primary Substation	1,339	1x 6.3MVA	2.78

Dunvegan	Primary Substation	1,207	1x 4MVA	4.43
Portree	Primary Substation	2,375	1x 15MVA and 1x 8MVA	4.76
Uig	Primary Substation	872	1x 2.5MVA	1.45
Loch Carnan Network				
Loch Carnan	Primary Substation	188	3x x 6.5MVA	0.28
Aird	Primary Substation	1,015	2x 8MVA	2.58
Clachan 33/11kV	Primary Substation	1,158	2x 6.3MVA	2.10
Drimore	Primary Substation	469	1x 2.5MVA	1.30
Pollachar	Primary Substation	1,771	2x 3.9MVA	2.83
Harris Network				
Stockinish	Primary Substation	466	1x 2.5MVA	0.40
Tarbert	Primary Substation	1,008	2x 2.5MVA	0.90
Stornoway Network				
Stornoway	Primary Substation	221	1x 60MVA	0.02

Battery point	Primary Substation	6,480	3x 8MVA	13.24
Coll	Primary Substation	1,409	1x 2.5MVA	2.89
Barvas	Primary Substation	1,791	2x 2.5MVA	2.48
Maaruig	Primary Substation	41	1x 0.2MVA	0.07
Laxay	Primary Substation	1,113	1x 2.5MVA	1.66
Callanish	Primary Substation	1,046	1x 4MVA	1.98
Gisla	Primary Substation	394	1x 2MVA	1.81

APPENDIX B: SPATIAL PLANS EHV/HV FOR OTHER DFES PATHWAYS

Figure 32 Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs EHV spatial plans for HE 2028, 2033, 2040, and 2050.

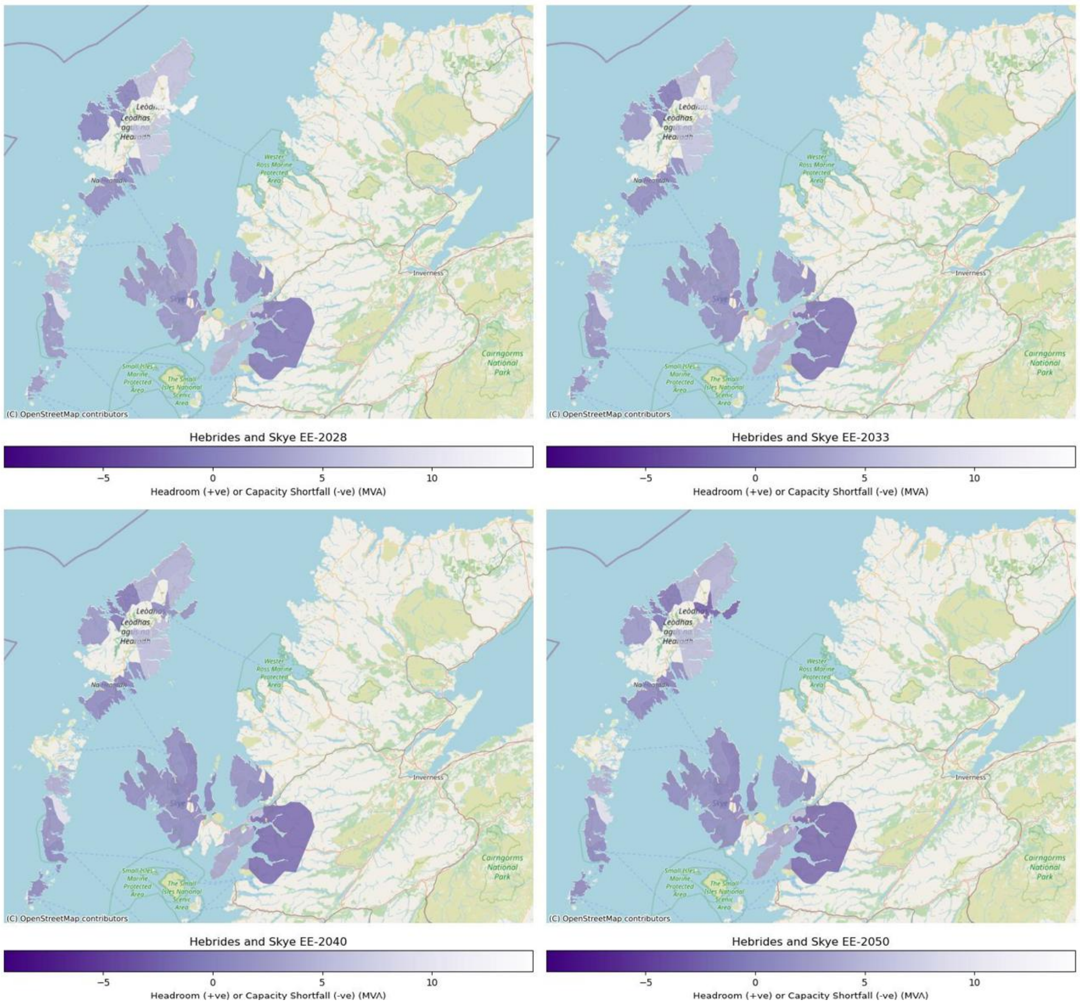


Figure 33 Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs EHV spatial plans for EE 2028, 2033, 2040, and 2050.

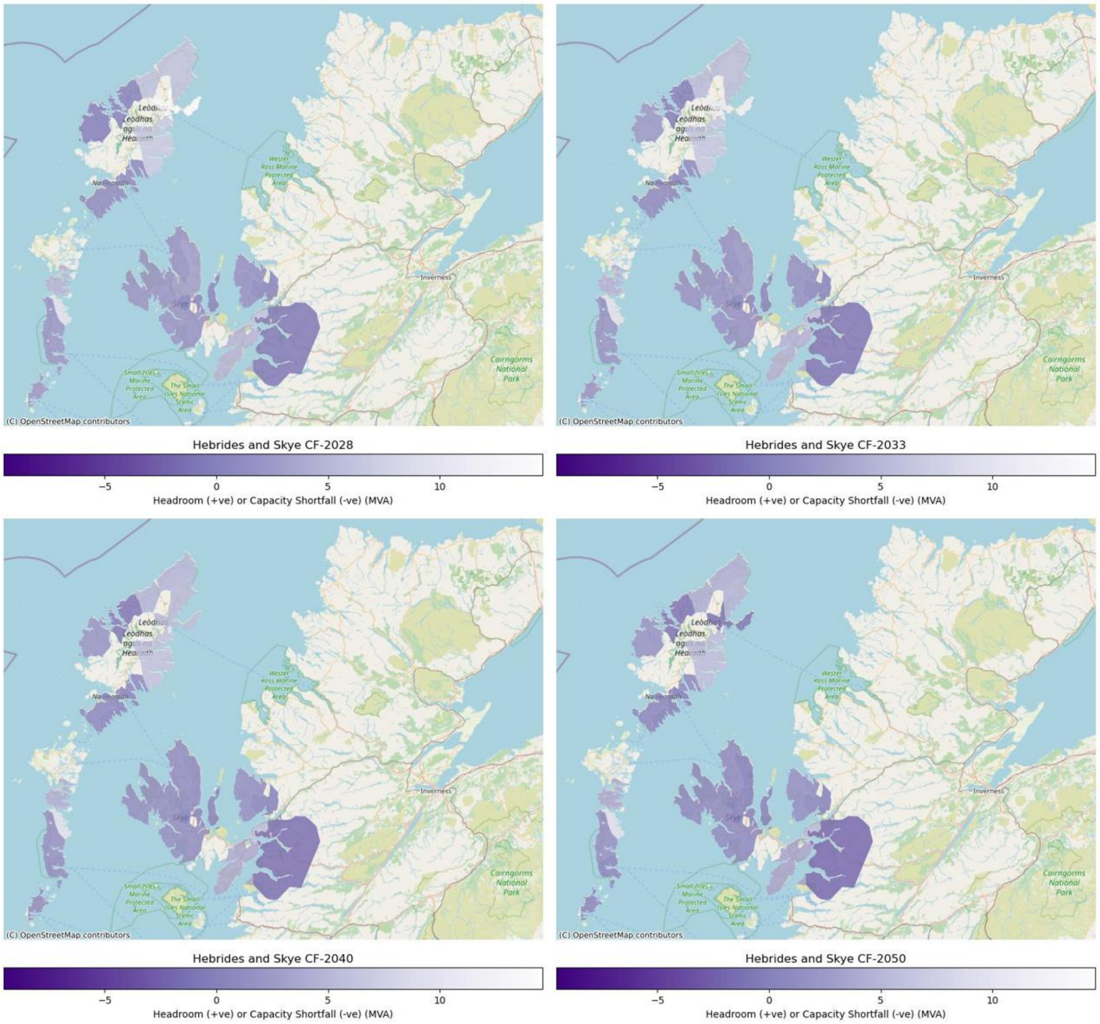


Figure 34 Broadford, Dunvegan, Stornoway, Harris, and Ardmore GSPs EHV spatial plans for CF 2028, 2033, 2040,2050

APPENDIX C: SPATIAL PLANS HV/LV FOR OTHER DFES PATHWAYS

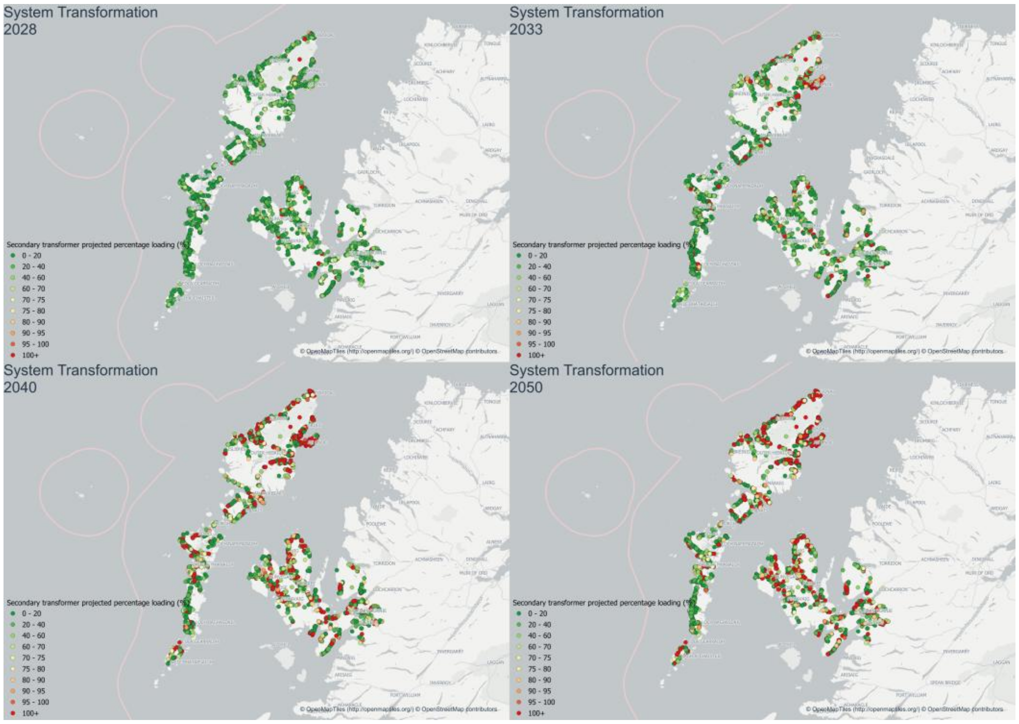


Figure 35 HV/LV demand spatial plans for 2028, 2033, 2040, and 2050, for ST.

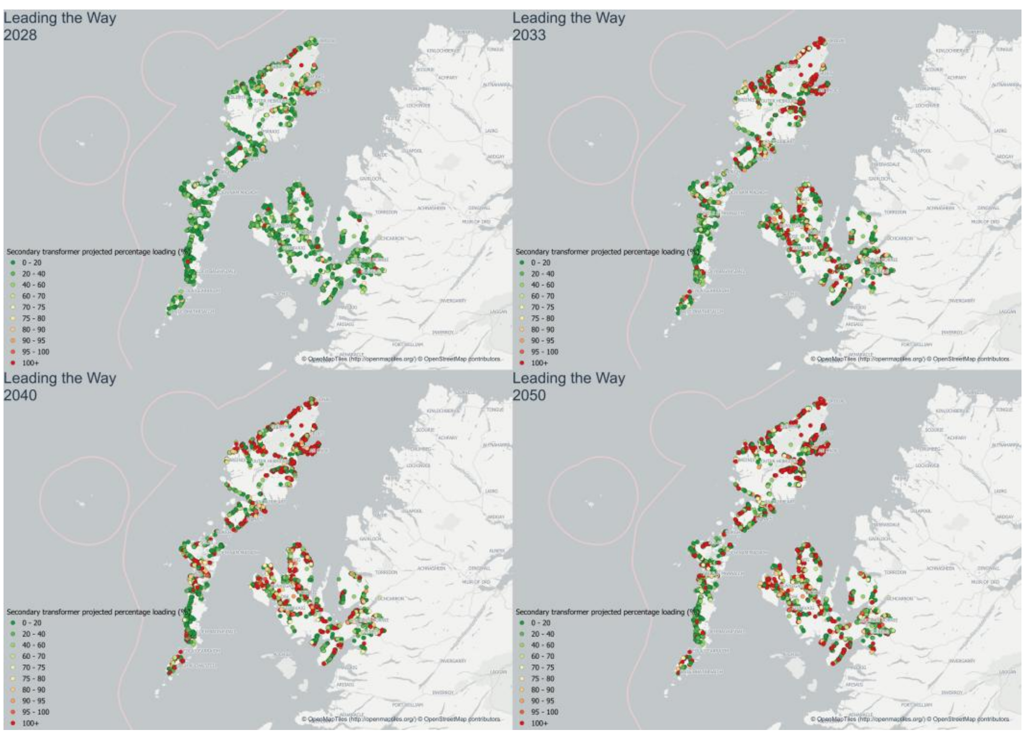


Figure 36 HV/LV demand spatial plans for 2028, 2033, 2040, and 2050, for LW.

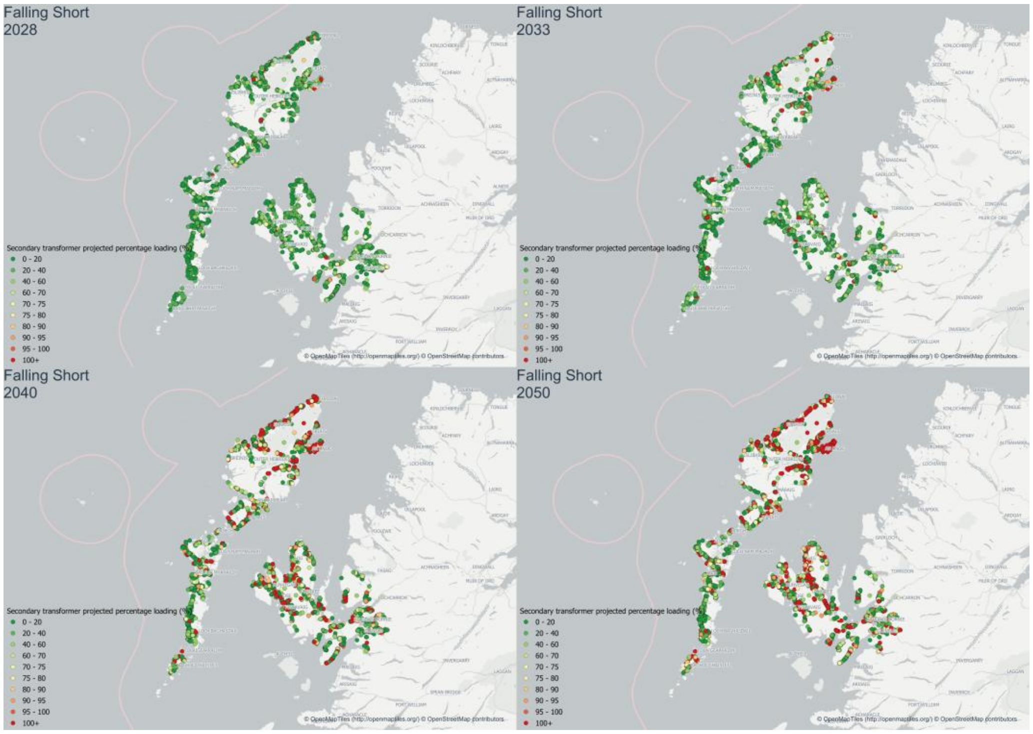


Figure 37 HV/LV demand spatial plans for 2028, 2033, 2040, and 2050, for FS.

APPENDIX D: RELEVANT DNOA OUTCOME REPORTS

DNOA Outcome Report

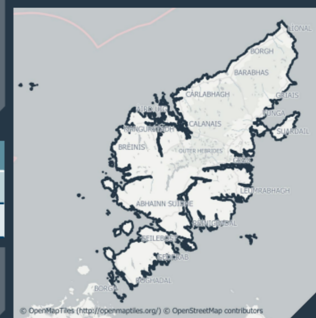
Harris & Lewis (Harris 33kV circuits) Ref. 0724-09

Scheme description

- Harris Grid Supply Point is in the Western Isles of Scotland and is the supply point for the Isles of Lewis & Harris. Postcode(s): HS1, HS2, HS3, HS4 & HS5.
- Load related – 33kV Overhead line between subsea cable termination and Harris GSP projected to be thermally overloaded.

Proposed option

- Asset Solution: Increase the current carrying capacity of the existing overhead line through reinforcement works. Refurbish the overhead line appropriately to increase its operating temperature to 75˚C.
- This will increase the Winter rating of overhead line section from 29.3MVA to 35.4MVA. The use of flexibility was deemed to be uneconomical by the CEM tool.
- Capacity released: 6.1MVA



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: N/A
- Utilisation: N/A

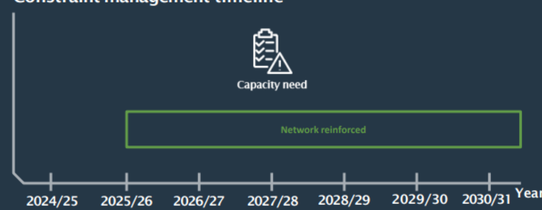
Reinforcement timeline

- Reinforcement delivery in 2025/26.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	- (0.94)	- (3.11)	- (5.22)	- (7.59)
ST	-	-	-	-	- (0.58)	- (1.50)	- (2.50)
LTW	-	-	-	- (1.13)	- (3.15)	- (5.11)	- (7.51)
FS	-	-	-	-	-	- (0.20)	- (0.97)

Constraint management timeline



DNOA Outcome Report

Isle of Lewis (Gisla PSS)

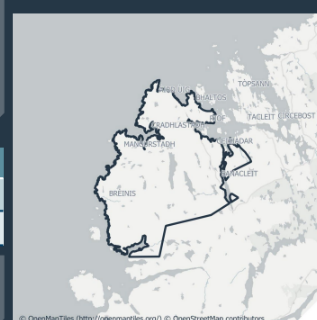
Ref. 0724-12

Scheme description

- Gisla primary substation is located on the Isle of Lewis, Scotland. Postcode(s): HS2.
- Load Related-Thermal overloading of primary transformer and voltage compliance issues under network intact scenarios due to forecasted demand growth.

Proposed option

- Reinforcement of Gisla primary substation and corresponding circuits. New 33kV feeder, reinforcement of existing transformer to 2.5MVA and addition of second 2.5MVA primary transformer, new 11kV circuit (Gisla-Timsgarry Junction), including 11kV voltage regulating equipment at Carishader.
- Constraint to be operationally managed until reinforcement delivery.
- Capacity Released: 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: N/A
- Utilisation: N/A

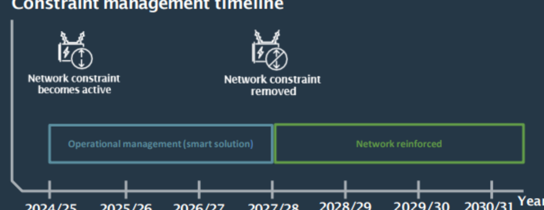
Reinforcement timeline

- Reinforcement delivery by 2027/28.

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

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	0.64	0.64	0.74	- (0.74)	- (0.74)	- (0.84)	- (0.84)
ST	0.64	0.64	0.64	- (0.64)	- (0.74)	- (0.74)	- (0.74)
LTW	0.64	0.64	0.74	- (0.74)	- (0.74)	- (0.74)	- (0.84)
FS	0.64	0.64	0.64	- (0.64)	- (0.64)	- (0.74)	- (0.74)

Constraint management timeline



DNOA Outcome Report

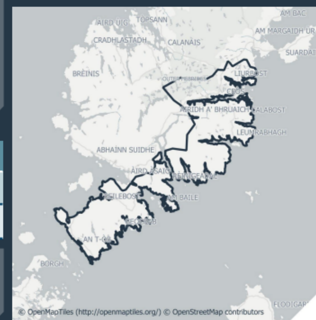
Lewis and Harris (Stornoway and Harris GSP's) Ref. 0724-13

Scheme description

- Stornoway and Harris GSP's are located on the islands of Lewis and Harris in the Outer Hebrides and supply customers within the Comhairle nan Eilean Siar council area. Postcode(s): HS2, HS3, HS4, HS5
- Load Related – Voltage compliance issues during winter peak demand under FCO conditions.

Proposed option

- Asset Solution: Install voltage regulating equipment on the Stornoway 305 circuit & reconfigure 33kV network arrangements. Flexibility is not viable due to the interaction of voltage and thermal constraints.
- This option ensures compliance in FCO conditions until 2032 and sets up future works.
- Capacity Released: 0.23MVA



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: N/A
- Utilisation: N/A

Reinforcement timeline

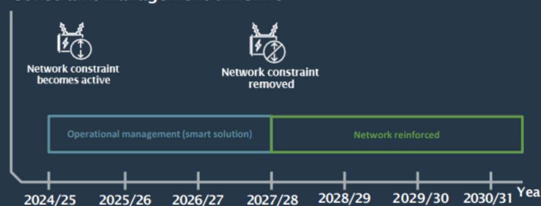
- Network constraint will be operationally managed to ensure voltage compliance, until reinforcement delivery.
- Reinforcement delivery complete by 2027/28.

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	-	-	-	-	-	-	-
ST	-	-	-	-	-	-	-
LTW	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-

Constraint management timeline



DNOA Outcome Report

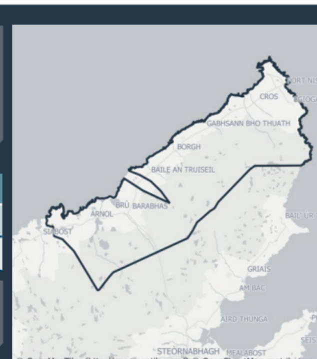
Stornoway (Barvas PSS)

Scheme description

- The reinforcement of the Barvas PSS will increase capacity in the Stornoway area. Postcode(s): HS2.
- Local authority: Comhairle nan Eilean Siar (CnES).
- Load related – substation thermal overload during network intact conditions due to forecasted demand growth.

Proposed option

- Flexibility/Asset Solution: Utilise flexibility for 4 years to manage thermal overload until reinforcement delivery is complete. Followed by reinforcement of Barvas PSS transformers.
- This option addresses the forecasted thermal overload at Barvas PSS out to 2050.
- Capacity released: 3.8MVA.



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 £108/MW/h
- Utilisation price £133/MWh

Reinforcement timeline

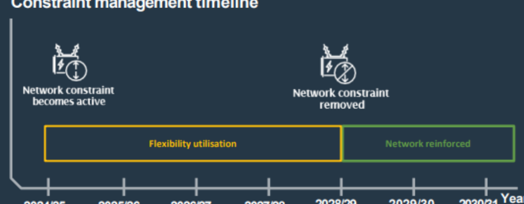
- Flexibility solution utilised from 2024/25.
- Reinforcement delivery by end of 2027/28.

Estimated peak MW outside firm network capacity under each scenario

Grey text relates to estimated peak MW without reinforcement delivery

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
CT	0.19	0.29	0.39	0.59	- (0.79)	- (0.99)	- (1.19)
ST	0.19	0.39	0.59	0.69	- (0.89)	- (1.09)	- (1.19)
LTW	0.09	0.19	0.29	0.39	- (0.39)	- (0.49)	- (0.59)
FS	0.09	0.19	0.19	0.29	- (0.29)	- (0.39)	- (0.49)

Constraint management timeline



DNOA Outcome Report

Stornoway (Coll PSS)

Scheme description

- The reinforcement of the Coll PSS will increase capacity in the Stornoway area. Postcode(s): HS2
- Local authority: Comhairle nan Eilean Siar (CnES)
- Load related – substation thermal overload/voltage issues during network intact conditions due to forecasted demand growth.

Proposed option

- Smart Solution/Asset Solution: Reinforcement of the existing Coll PSS transformer and installation of a new transformer and associated circuitry.
- Flexibility was unable to be utilised due to not being suitable for voltage constraint type and insufficient flexible assets.
- This option addresses the forecasted thermal/voltage issues at Coll PSS out to 2050.
- Capacity released: 2.77MVA.

System need requirement

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

DNOA History

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

Indicative flexibility price (if available):

- Availability price N/A
- Utilisation price N/A

Reinforcement timeline

- Reinforcement delivery by end of 2026/27

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	0.50	0.56	0.63	- (0.82)	- (1.01)	- (1.17)	- (1.34)
ST	0.50	0.56	0.37	- (0.36)	- (0.15)	- (0.17)	- (0.35)
LTW	0.50	0.83	0.88	- (1.05)	- (1.01)	- (0.97)	- (1.34)
FS	0.23	0.56	0.37	- (0.13)	- (0.15)	- (0.03)	- (0.15)

Constraint management timeline

Broadford (Drynoch PSS and Lower Ollach PSS – New Site)

DNOA Outcome Report
Related SDP: Outer Hebrides and Skye

DNOA outcome: Operational management followed by asset solution.

Scheme description

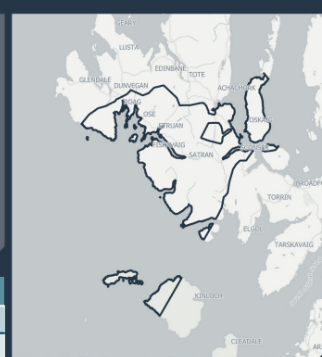
- The reinforcement of the Lower Ollach and Drynoch PSSs will increase capacity in the Highlands and Islands area. Postcode(s): IV42, IV49, IV54.
- Local authority: Highland
- Load related – substation thermal overload and voltage issues during intact conditions due to forecasted demand growth.

Indicative flexibility price (if available)

Availability price: £ N/A /MW/h Utilisation price : £ N/A /MWh

Proposed option

- Smart Solution/Asset Solution: Build a new 4MVA primary substation at Sconser. Reinforce and reconfigure the 11kV network to fix the voltage and thermal issues.
- Flexibility was unable to be utilised due to insufficient flexible assets.
- This option addresses the forecasted thermal overload and voltage issues beyond 2033 (end of ED3). Additional reinforcement of the 11kV network is required within and beyond ED3 for a constraint-free network up to at least 2050.
- Capacity released: 0.05MVA



System need requirement

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

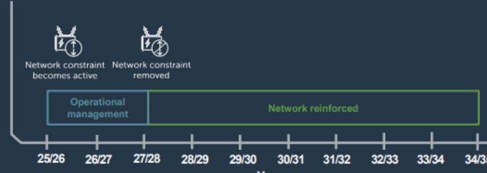
DNOA History

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

Estimated peak MW outside firm network capacity under each scenario

	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35
CT	-	-	-	-	-	-	-	-	-	-
ST	-	-	-	-	-	-	-	-	-	-
LTW	-	-	-	-	-	-	-	-	-	-
FS	-	-	-	-	-	-	-	-	-	-

Constraint management timeline



Laxay
(Laxay PSS)

DNOA Outcome Report
Related SDP: Outer Hebrides and Skye

DNOA outcome: Operational management followed by asset solution.

Scheme description

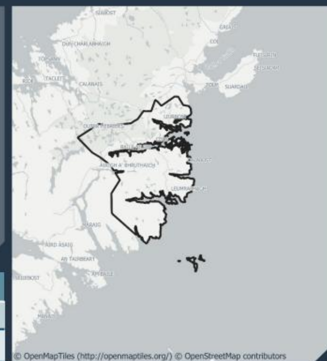
- The reinforcement of Laxay PSS will increase capacity in the Laxay area. Postcode(s): HS1.
- Local authority: Na h-Eileanan Siar
- Load related – substation thermal overload during FCO conditions due to forecasted demand growth.

Indicative flexibility price (if available)

Availability price: £ N/A /MW/h Utilisation price : £ N/A /MWh

Proposed option

- Asset Solution: Upgrade the existing transformer and install an additional transformer at Laxay PSS. Install a 33kV board at Laxay PSS and extend a 33kV circuit from Stornoway to establish a second 33kV supply to Laxay PSS. Install a new 11kV board and reinforce the 11kV network at Laxay PSS.
- Flexibility could not be used as it does not address specific security of supply issues.
- This option addresses the forecasted thermal issues at Laxay PSS out to 2050.
- Capacity released: 3.8 MVA



System need requirement

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

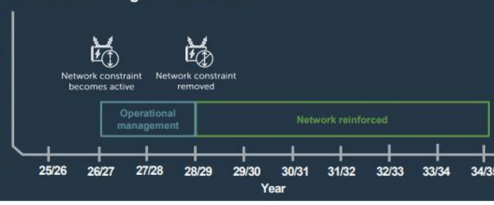
DNOA History

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

Estimated peak MW outside firm network capacity under each scenario

	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35
CT	-	-	2.23	(4.56)	(6.93)	(8.98)	(10.51)	(12.26)	(14.24)	(16.11)
ST	-	-	-	(0.35)	(1.88)	(3.13)	(4.79)	(6.36)	(8.26)	(10.32)
LTW	-	0.56	2.59	(4.63)	(7.01)	(9.26)	(11.00)	(12.80)	(14.89)	(16.89)
FS	-	-	-	-	-	(0.95)	(2.18)	(3.46)	(4.89)	(6.39)

Constraint management timeline



GLOSSARY

Acronym	Definition
ANM	Active Network Management
BAU	Business as Usual
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
EREC P2	Engineering Recommendation P2
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
SW/STN	Switching Station
SWA	Scottish Whisky Association

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Scottish & Southern Electricity Networks