505_SHEPD_HSM_25_INNER HEBRIDES: ISLAY AND JURA 2050

INNER HEBRIDES: ISLAY AND JURA 2050 WHOLE SYSTEMS

ENGINEERING JUSTIFICATION PAPER

Scottish & Southern Electricity Networks

Author	[redacted]
Technical recommendation	
Regulatory review	
Recommended by	
Approved by	

CONTENTS

1 Executive Summary

1.1 Summary

The purpose of this EJP as part of the HOWSUM is to detail the long-term solution for the networks feeding the island group of Islay, Jura and Colonsay, to ensure they remain resilient and meet the projected demands of the island communities out to 2050. The EJP will also support SHEPD's request for funding and present the needs case and technical solution to Ofgem for the first phase of work within RIIO-ED2 for this island group. This is to install new submarine electricity cables that connect mainland Scotland to the islands of Islay and Jura.

SHEPD has identified Option 2 as the preferred option for meeting the region's electricity demands whilst ensuring a resilient network, sufficient capacity, and low carbon footprint. This option involves installing a new 33kV circuit from BAT Wind I (Carradale GSP) to Port Ellen 33kV substation and a new circuit from BAT Wind III (Carradale GSP) to Port Ellen 33kV during the RIIO-ED2 period and installing a new Port Ann – Knocklearach 33kV circuit in RIIO-ED3. This option has been chosen because it is:

1) The most cost-effective network option with the lowest Totex over the whole life period (55 years).
2) Ensures future resilience on the Islay and Jura network.
3) Meets future demand and generation requirements.
4) Provides a credible route to facilitate decarbonisation of our embedded diesel generation fleet.
5) Involves conventional circuit reinforcement which is part of our Business as Usual (BAU) approach.

The investment timeline for this option spans 2025-2040, with the first new circuit (from BAT Wind I in Carradale GSP) and second new circuit (from BAT Wind III in Carradale GSP) being completed in 2027/28 and the new Port Ann – Knocklearach circuit with additional Jura – Islay submarine cable circuit by 2033 while Lochgilphead – Knocklearach and Bowmore – Knocklearach reconductoring will be completed by 2040, aligning with the forecasted Distribution Future Energy Scenarios (DFES) demand profile. The total capital cost of this option is [redacted], spread across the current and subsequent price control periods.

Option 2 delivers a solution which would remove reliance on the DEG whilst catering for our long term demand and generation forecasts. It is presented in this paper as our recommended option.

This recommendation is based on a detailed analysis of 13 options (long list) of which 4 options (short list) fulfilled our stringent criteria. The short-listed options underwent further Cost Benefit Analysis (CBA) to provide a commercial comparison. The analysis considered a whole system approach as part of our options development and therefore each option includes the scope of works outlined to support 2050 needs. The detailed options analysis as mentioned above concluded that Option 2 was the most suitable option.

Due to the uncertainty on the future demand growth scenarios in the region, we propose to deliver the two 33kV circuits from Carradale GSP by 2028 [redacted] and installation of the Port Ann – Knocklearach circuit by 2033. This allows us to take a staged approach which will mitigate future demand uncertainty.

[redacted] The supply chain has been tested through previous RIIO-ED1 and RIIO-ED2 projects, [redacted].

Table 1 - Overview of Considered Options

Option	Description	Cost (C0a, £M)	NPV (£M)	CBA Consideration and Result
Option 1 (Do nothing)	Leave the network in its current state.	0	N/A	Does not met [redacted] or [redacted] compliance for 2050 hence not considered in the CBA.
Option 2	Install three new 33kV circuits to Islay (one from BAT Wind I, one from BAT Wind III and one from Port Ann GSP), and second Islay – Jura submarine cable to complete the fourth circuit.	[redacted]	[redacted]	Meets [redacted] requirements providing four circuits to feed Islay and Jura. Extends Port Ellen 33kV substation to facilitate future demand and generator connections. This removes reliance on Bowmore diesel and allows us to meet our net zero ambitions.
Option 3	Install two new 33kV circuits to Islay (one from BAT Wind I and one from Port Ann GSP), one new 132kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable to complete the fourth circuit.	[redacted]	[redacted]	Meets [redacted] requirements providing four circuits to feed Islay and Jura. Provides new Claggain Bay 33kV substation to facilitate future demand and generator connections. This removes reliance on Bowmore diesel and allows us to meet our net zero ambitions.
Option 4	Install two new 33kV circuits (one from BAT Wind I and one from Port Ann GSP), one new 66kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable to complete the fourth circuit.	[redacted]	[redacted]	Meets [redacted] requirements providing four circuits to feed Islay and Jura. Provides new Claggain Bay 33kV substation to facilitate future demand and generator connections. This removes reliance on Bowmore diesel and allows us to meet our net zero ambitions. Also introduces 66kV network to the Carradale/Port Ann GSP group.
Option 13	Install three new 33kV circuits to Islay (one from BAT Wind I, one from Port Ann GSP and one from new Crossaig 132/33kV) and second Islay – Jura submarine cable to complete the fourth circuit.	[redacted]	[redacted]	Meets [redacted] requirements providing four circuits to feed Islay and Jura. Provides new Claggain Bay 33kV substation to facilitate future demand and generator connections. This removes reliance on Bowmore diesel and allows us to meet our net zero ambitions.

2 Investment Summary Table

Table 2 – Investment Summary Table

Name of Scheme/Programme	Inner Hebrides: Islay and Jura 2050 Whole Systems Engineering Justification Paper	
Primary Investment Driver	Future resilience on the Port Ann and Carradale GSP networks feeding Islay and Jura. Future demand and generation requirements. Decarbonisation of our diesel generation fleet.	
Scheme reference/ mechanism or category	EJP/SHEPD/SUBMARINE/Port Ann	
Output reference/type	New 33kV overhead line, cable and submarine cable (BAT Wind I – Port Ellen) – 2028 New 33kV overhead line, cable and submarine cable (BAT Wind III – Port Ellen) – 2028 New 33kV overhead line, cable and submarine cable (Port Ann – Knocklearach) – 2033 Auto-close scheme at Port Ellen substation – 2033 New submarine cable (Islay – Jura) – 2033 Upgraded 33kV overhead line and submarine cable (Lochgilphead – Knocklearach) – 2040 Upgraded 33kV overhead line (Bowmore – Knocklearach) - 2040 Voltage compensation at Knocklearach and Port Ellen substations – 2033 and 2040	
Cost	[redacted]	
Delivery Year	RIIO-ED2, 2025-2028 RIIO-ED3+, 2029 - 2040	
Reporting Table(s)	R3 – Re-openers (subject to specific activities, costs will be included under other reporting tables)	
Outputs in RIIO-ED2 Business Plan	HOWSUM development funding has been provided as part of SHEPD's RIIO-ED2 settlement for HOWSUM project development costs. For Islay/Jura/Colonsay, development costs in RIIO-ED2 are currently estimated at [redacted] (see also Hebrides and Orkney Whole System Core Narrative, Section 2).	
Spend Apportionment	**RIIO-ED2**	**RIIO-ED3+**
	[redacted]	[redacted]
MVA released	**97.5**	**13.1**

3 Appendices Summary

Table 3 - Summary of Appendices

Appendix A - Definitions and Abbreviations	Provides a summary of all the abbreviations used in this EJP

4 Introduction

This EJP outlines reinforcement of the network connecting the archipelagos of Islay/Jura/Colonsay to the Port Ann and Carradale Grid Supply Points (GSPs). The main drivers for reinforcement are the increased load related growth and the need to maintain network resilience in line with SSEN's Islands Resilience Policy. The network on Islay specifically has seen a sharp increase in new connection activity in recent years due to the expansion and decarbonisation of the local whisky distilleries and the development of new housing to support this. The proposed solution involves installation of one 33kV circuit from BAT Wind I (Carradale GSP) to Port Ellen by 2028 and another 33kV circuit from BAT Wind III (Carradale GSP) to Port Ellen by 2028. Further works include the installation of a new Port Ann – Knocklearach circuit, install an additional Jura – Islay submarine circuit with voltage compensation at Knocklearach by 2033, upgrade of Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits and further voltage compensation at Port Ellen and Knocklearach substations by 2040. Additionally, an auto-close scheme at Port Ellen 33kV substation by 2033 is required.

The specific geographic area is shown in Figure 1 below. This area covers the local authorities of Argyll and Bute Council and North Ayrshire Council.

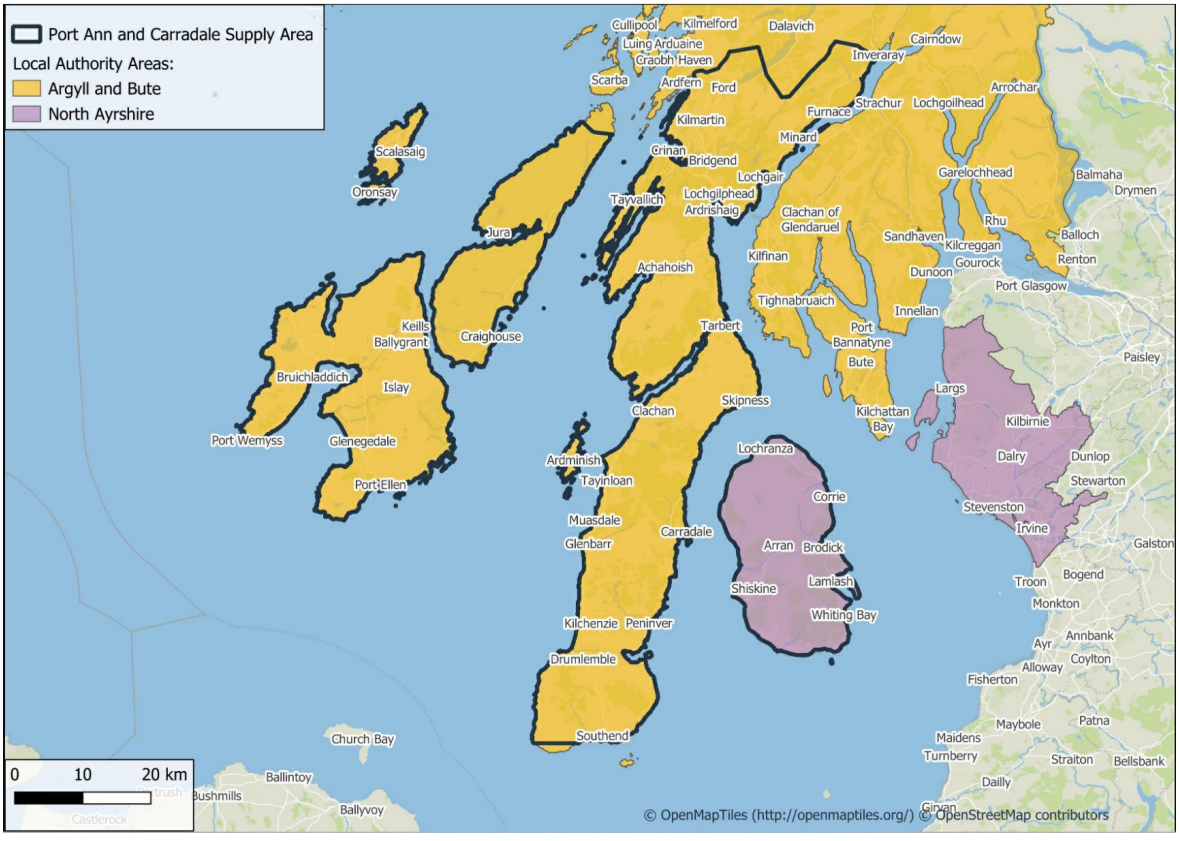


Figure 1 - Geographic area covered by this report

Section 5 outlines the existing network arrangements, the load growth forecast based on the DFES data and network analysis, justifying the requirement to reinforce Islay and associated circuits.

An overview and a comparison of the considered options are given in Section 6, with a detailed option analysis being provided in Section 7, where the reasons for the options that are deemed unviable, and thus not taken forward to the CBA, are presented. Details and the results of the CBA can be found in Section 8.

The preferred option is shown in Section 9 followed by the deliverability and possible risks of the proposed option in Section 10. Section 11 presents the strategic planning of investment to operate a congestion-free grid up to at least 2050. Finally, Section 12 concludes this EJP, providing main conclusions and recommendations contained within this document.

4.1 Uncertainty Mechanism

The Hebrides and Orkney Whole Systems bespoke Uncertainty Mechanism was put in place following the submission of the RIIO-ED2 business plan. A number of drivers are relevant under the scope of this regulatory mechanism, including demand and generation forecasts, continued resilience of island groups, the need to reduce Diesel Embedded Generation emissions and meet net zero, and the replacement of life expired assets.

The content of this EJP focuses on the Islay/Jura/Colonsay Archipelago which is one of the island groups included the January 2025 application.

4.2 Primary Investment Drivers

SHEPD's overarching strategy is to decarbonise the Islay/Jura/Colonsay Archipelago, meet security of supply standards, drive least worst regret investment and to facilitate island net zero ambitions and deliver a coordinated approach that meets stakeholder, customer, and consumer needs. Therefore, our three Primary Investment Drivers for this EJP are:

1. Future resilience on the archipelago. This can be considered through two elements:
    a. Asset Condition: Considering the age and condition of the existing submarine cable assets.
    b. Future impacts of diesel generation: Understanding how we can maintain resilience on the islands whilst removing reliance on our aging diesel generation fleet.
2. Future demand and generation requirements. This can be further broken down into:
    a. Load Growth: Electrification of heat, transport and industrial processes on the islands and their impact on future demand requirements.
    b. Generation Growth: The Inner Hebrides and surrounding waters have a significant potential for wind and tidal.
3. Decarbonisation of our diesel generation fleet.

The addition of two 33kV submarine circuits from Carradale to Port Ellen and one from Port Ann to Knocklearach aligns with all three of our primary drivers as it will [redacted], allow us to meet future demand and generation requirements by increasing the capacity, and decarbonise our network by reducing our reliance on diesel generators. Table 4 below summarises the primary drivers mentioned above.

Table 4 - Summary of the primary drivers

Driver	Primary	Description
Future resilience on the Inner Hebrides	Primary	Additional circuits to Port Ellen will reduce dependency on existing cables and provide greater support [redacted].
Future demand and generation requirements	Primary	Increased capacity rating will accommodate future demand and generation growth.
Decarbonisation of our diesel generation fleet	Primary	Remove reliability on diesel generators.

4.3 Needs Case

The need to change current network arrangements in the Islay archipelago is supported by current load forecasts which are discussed further in 5.3.

4.3.1 Future demand and generation requirements

Investment in new submarine assets is costly and we need to ensure we are developing a network that meet stakeholders' needs through to 2050.

We have considered this through four elements:

1. Load growth - electrification of heat, transport and industrial processes on the islands and their impact on future demand requirements.
2. Generation growth - The Inner Hebrides and surrounding waters have significant potential for wind and tidal.
3. Decarbonisation of our diesel generation fleet. - This is a significant source of carbon emissions for SHEPD when required to run for long periods of time. Emissions reached [redacted] tCO2-e in 2022/23 across the fleet, and we must reduce these to meet our 1.5-degree Science Based Targets in 2033 (35% reduction in Scope 1 and 2 emissions) and 2033 (55% reduction).
4. Continued island resilience: Resilience conditions for Scottish islands are unique given the geographies and potential lengthy system outages in the unlikely event of a submarine cable fault. We have developed a specific Islands Resilience Policy for island groups connected by submarine cables recognising the impacts of decarbonisation on electrification of heat and transport. We are looking to achieve the resilience levels in our policy through staged interventions.

4.3.2 Summary

Intervention is, therefore, imperative to ensure that SHEPD continue to meet the needs of our customers. The following sections provide further evidence for the need of investment within this price control period.

5 Background Information

5.1 Existing Network Arrangements

A large part of the area supplied by Port Ann and Carradale GSPs falls within the Argyll and Bute Council area, while the Isle of Arran, although supplied from Carradale GSP, falls within the North Ayrshire Council area. The Port Ann GSP supplies a rural area with approximately 9,030 customers with the networks on the islands of Islay and Jura supplying 2,932 of those customers. The breakdown of each substation within the isles of Islay, Jura and Colonsay is shown in Table 5**.**

Currently the Isle of Jura is fed by a single 33kV submarine cable approximately 8.5km in length connecting the island to the wider Port Ann network. The Isle of Islay is then connected by another 33kV submarine cable fed from the Isle of Jura approximately 2km in length. Much of the works outlined in this EJP are to support network growth to these two isles to meet the increased future loading on the network.

Table 5 - Customer number breakdown and substation peak demand readings (2024) for Islay and Jura Primaries

Substation Name	Site Type	Number of Customers Served	Transformer number / MVA rating	2024 Substation Maximum MVA (Season)
ISLAY and JURA AREA (ISLAND SUBSTATIONS)				
BOWMORE	Primary Substation	1,580	2x8MVA	3.31 (Winter)
LUSSAGIVEN	Primary Substation	13	1x0.1MVA	0.03 (Winter)
PORT ASKAIG	Primary Substation	463	2x2.5MVA	1.15 (Winter)
PORT ELLEN	Primary Substation	866	1x4MVA	3.17 (Winter)
TARBERT JURA	Primary Substation	10	1x0.2MVA	0.02 (Winter)

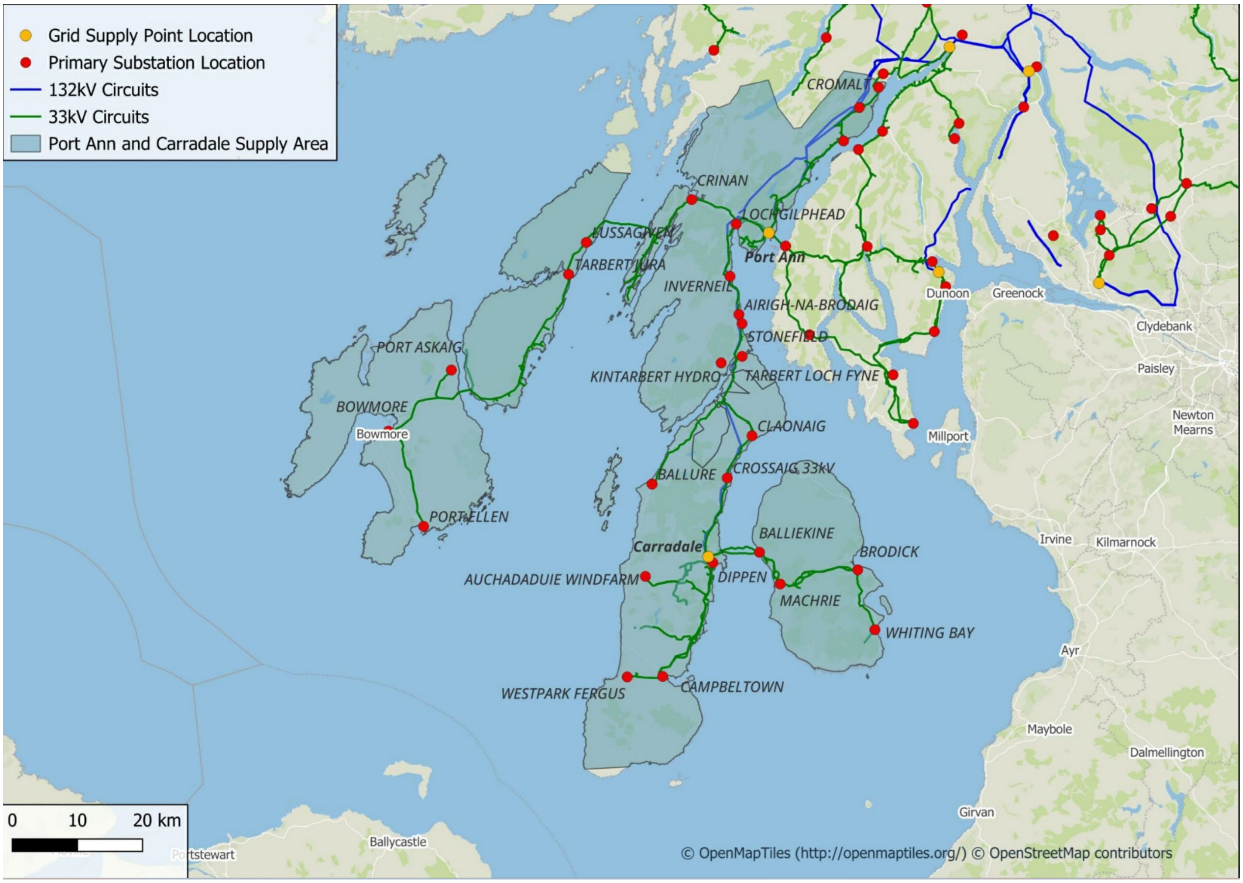


Figure 2 - Port Ann and Carradale GSP Geographic Information System (GIS) View

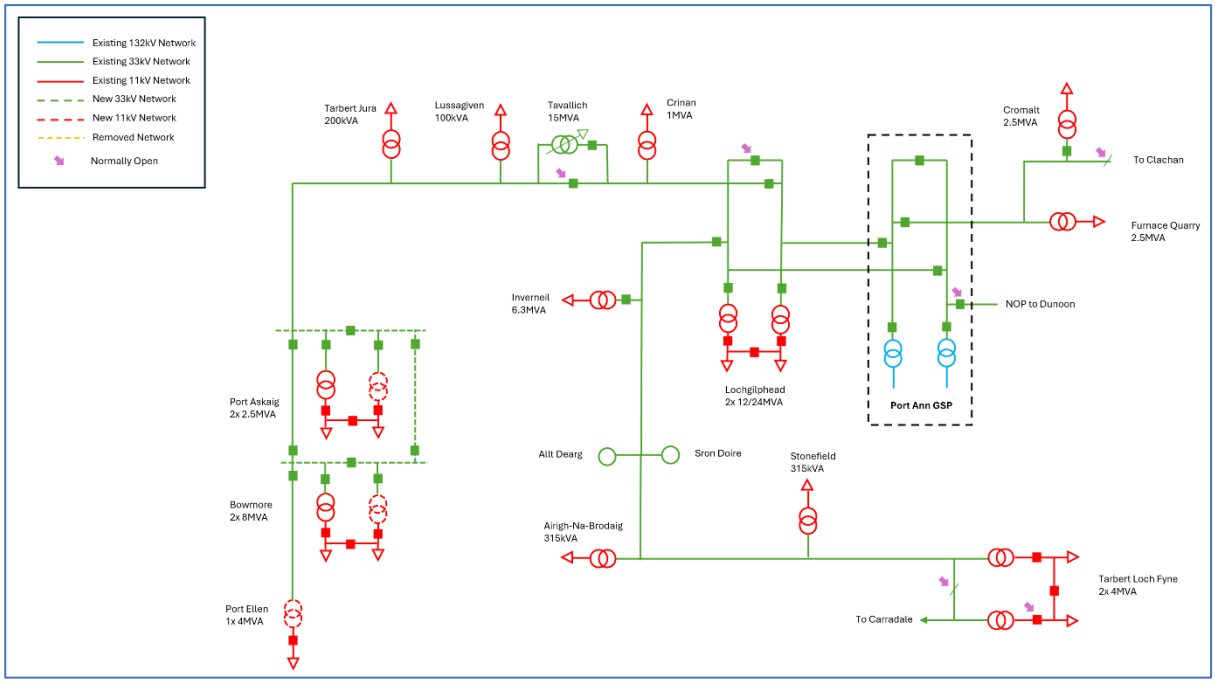


Figure 3 - Port Ann GSP network schematic – current running arrangement – transformer nameplate ratings

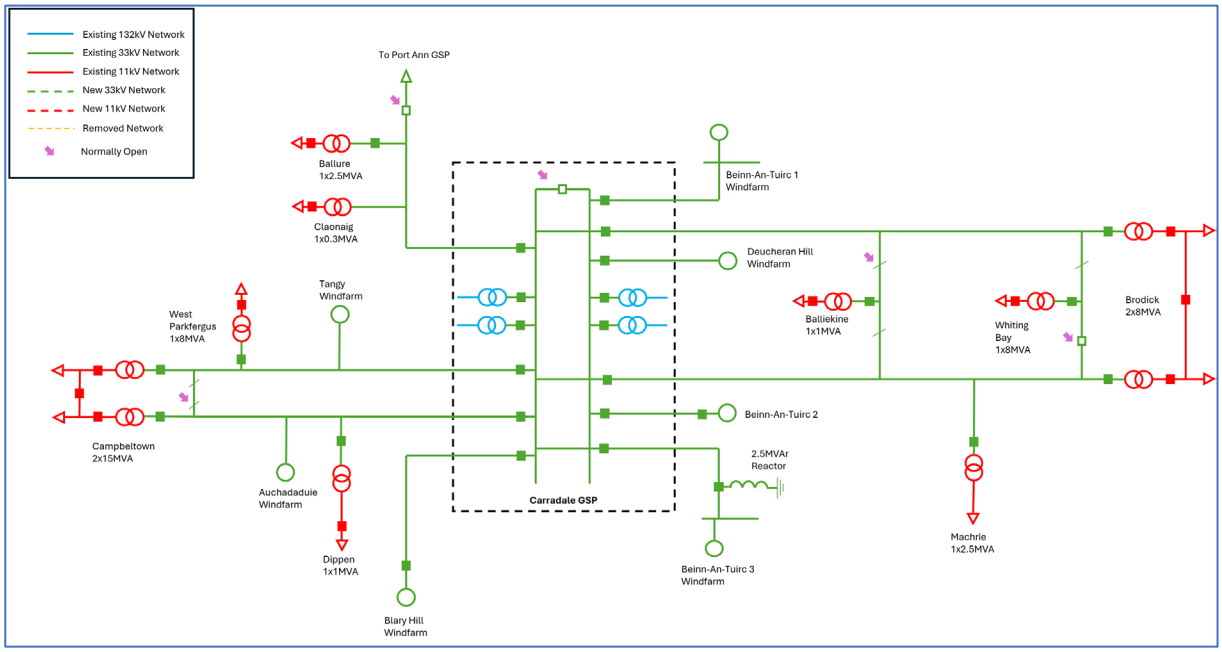


Figure 4 - Carradale GSP network schematic – current running arrangement – transformer nameplate ratings

5.2 Projects in Progress

Within the Port Ann GSP and Carradale GSP networks, several projects are underway to meet demand requirements. The proposed works are summarised in Table 6 below and are modelled in the background for the system studies for the relevant study years (i.e. 2028, 2033, 2040 and 2050).

Table 6 - Works already triggered through customer connections and the DNOA process

Substation	Description	Driver	Forecast completion	Fully resolves future strategic needs to 2050?	Relevant GSP
Knocklearach/Port Askaig/ Bowmore/Port Ellen	*New 33kV overhead lines Port Askaig – Bowmore - Port Ellen and new primary transformers at each substation. Install a new switching station at Knocklearach. This will include 3x4Mvar STATCOMs and facilitate installation of 33kV ring on Islay*	*North of Scotland resilience project* [redacted]	*2025*		**Port Ann**
Cromalt-Inveraray Network Reinforcement	*33/11kV reinforcement works at Cromalt and Inveraray*	*DNOA process*	*2033*		**Port Ann**
Lochgilphead 1L5 and Carradale 5L5 Circuit Reinforcement	*33kV works on Lochgilphead 1L5 and Carradale 5L5 to resolve thermal and voltage issues*	*DNOA process*	*Stage 1 - 2025 Stage 2 –2027-28*		**Port Ann**
Port Ann diversion to Craig Murrail	*Relocate Port Ann GSP to Craig Murrail (including associated substation and cable works)*	*Triggered by SHET*	*2027*		**Port Ann**
Brodick and Machrie reinforcement	*Install 2x4Mvar STATCOMs at a new Brodick 33kV switching station and a second 33/11kV transformer at Machrie substation*	*DNOA process*	*2028*		**Carradale**
Brodick – Balliekine 33/11kV reinforcement (New Lochranza primary)	*Install new primary at Lochranza to split and interconnect the current Brodick - Balliekine 11kV and tee-off the 33kV network*	*DNOA process*	*2027*		**Carradale**

5.2.1 Network Schematic and GIS View (following completion of above works)

The network considered for long-term modelling is shown in Figure 5 and Figure 6.

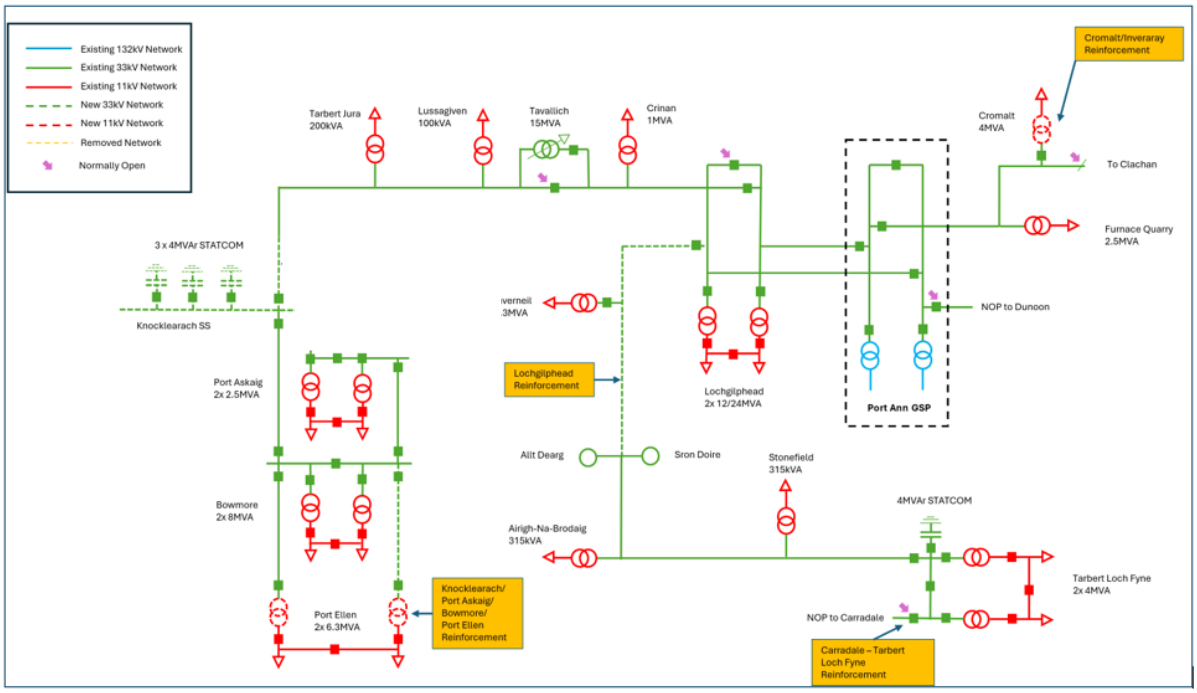


Figure 5 - Future Network Development around Port Ann GSP

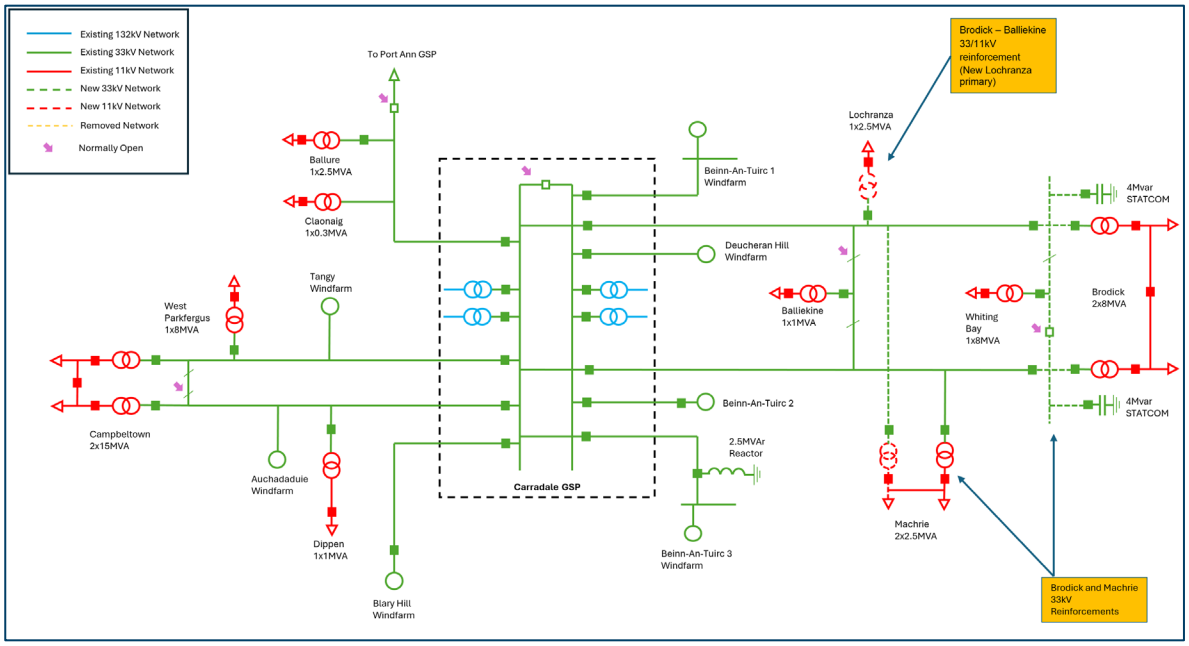


Figure 6 - Future Network Development around Carradale GSP

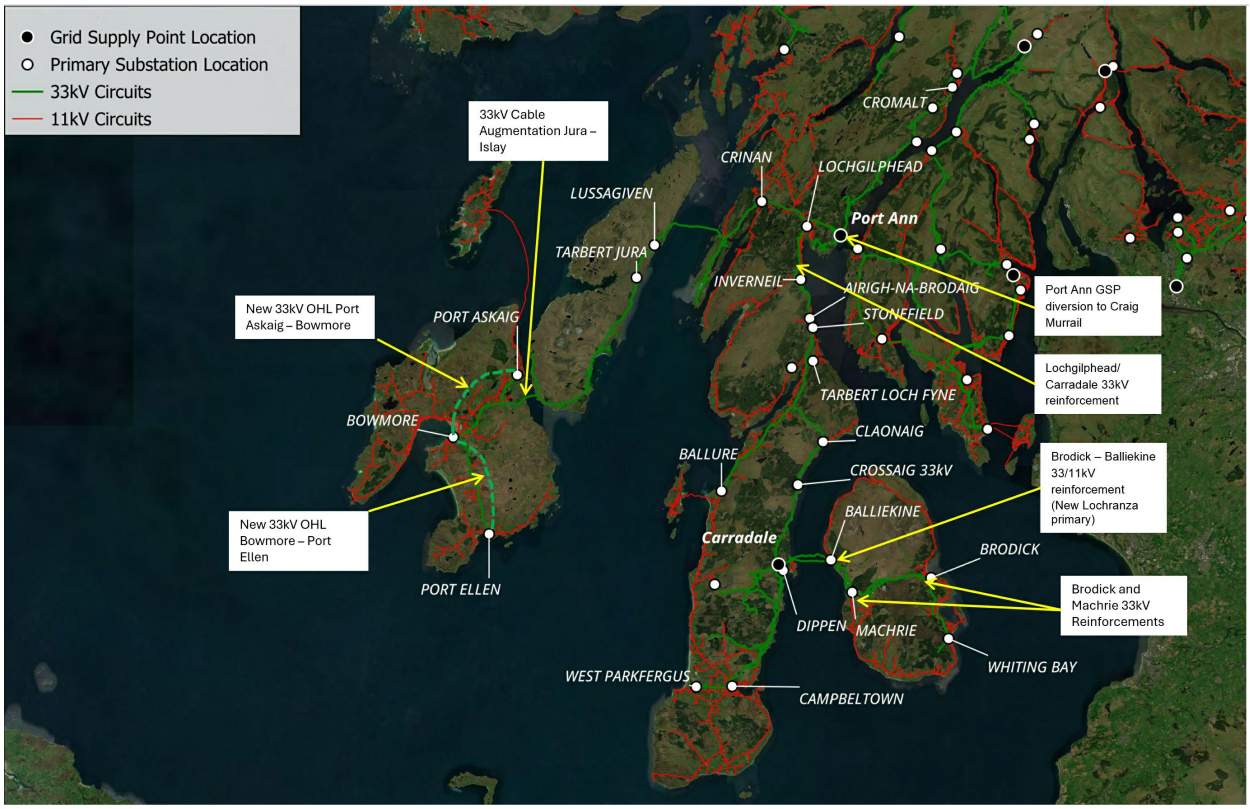


Figure 7 - GIS view of works in progress

5.3 Load Forecast for Islay, Jura and Colonsay Archipelago

The DFES process creates projections for the volumes and regional distribution of the uptake of demand (load) and generation (supply) customers across our regions. This uses stakeholder-informed bottom-up analysis using a scenario framework consistent with the national industry-developed Future Energy Scenarios.

Through our DFES work, a range of political and economic outlooks are considered to create the envelope of credible future network usage. We use this information internally to develop strategic proposals. As part of this work, we assess four different scenarios:

1) Customer Transformation (CT)

2) Leading the Way (LW)

3) System Transformation (ST)

4) Falling Short (FS)

Based on stakeholder feedback Customer Transformation has been selected as the baseline scenario for investment. The winter-peak maximum demand and the summer minimum demand(includes the maximum generation) are presented in this paper(Table 8), as it corresponds to the worst-case demand in winter and the worst-case generation in summer scenarios. This includes information on contracted demand increases including maritime decarbonisation.

Table 8 also provides a forecast view of additional distillery demand due to expansion and decarbonisation. The derivation of these values is explained further in section 5.3.3. This information would not normally be captured through our DFES process which is focused on core building block technologies as per the agreed national process.

Table 7 - Cumulative generation capacity projections from today to 2050 for Islay and Jura - Source: SSEN DFES 2023 (PowerBI)

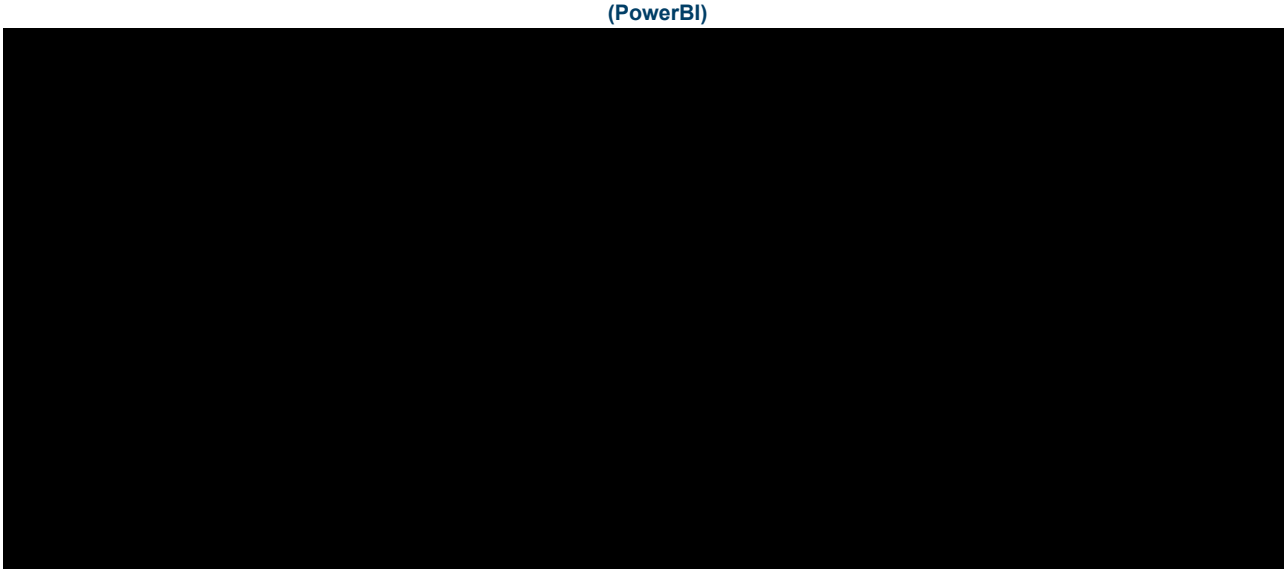
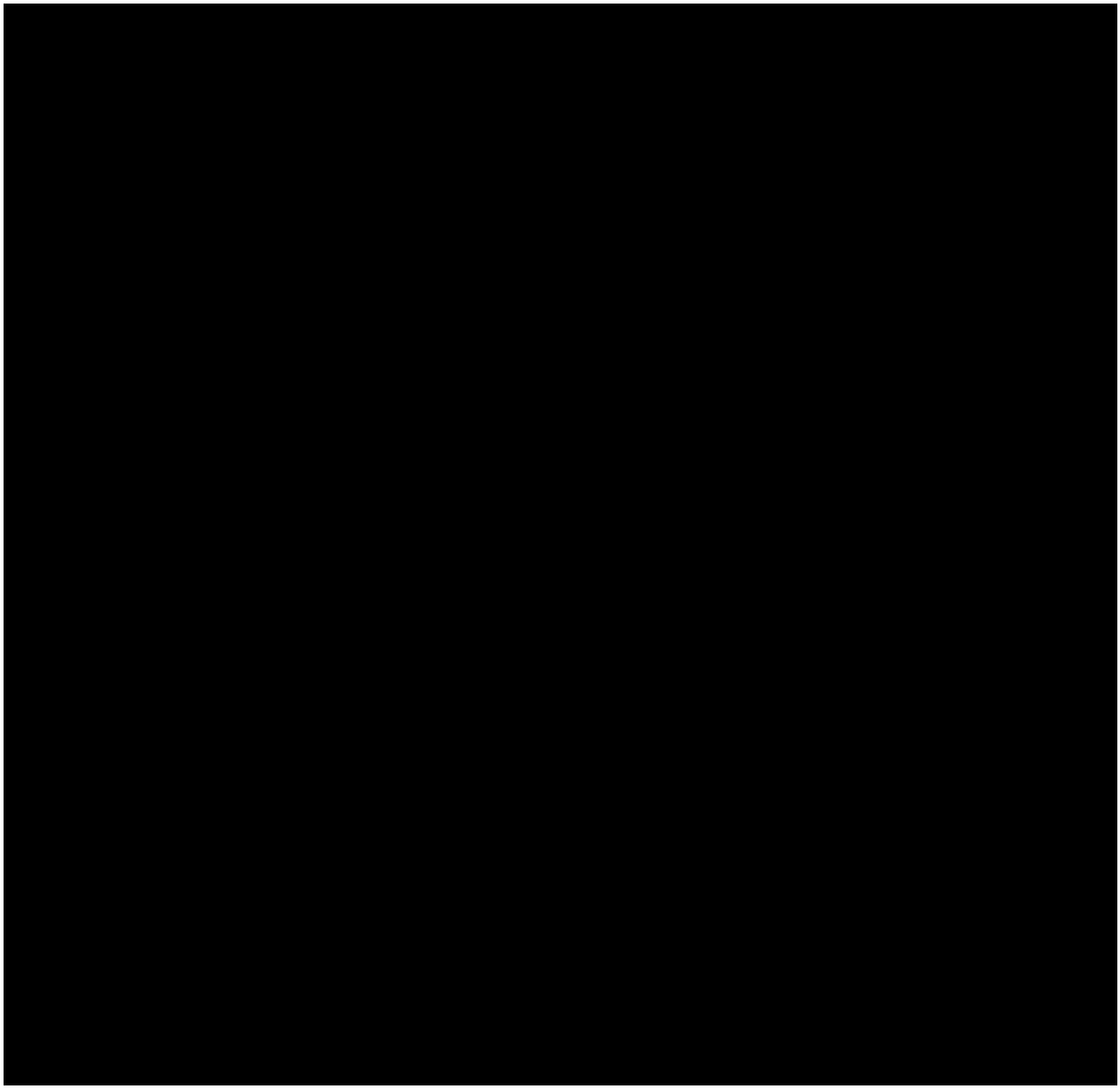


Table 8 - The cumulative forecast demand forecast from today to 2050 for Islay and Jura - Source: SSEN DFES 2023 (PowerBI)



5.3.1 Demand Forecast Summary

Figure 8 - Islay and Jura Demand Forecast (Including new connections and distillery forecast)

5.3.2 Diesel Embedded Generation Decarbonisation

SSEN has developed a 2050 strategy for the removal of reliance on its DEG fleet. This will contribute to SSEN achieving its Science Based Targets 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.[1]

The application of this strategy will be tailored to each island group, recognising both the needs of the island communities and also the status of the existing DEG infrastructure.

5.3.3 Distilleries

If distilleries seek to electrify, the demand capacity on the distribution network could become one of the largest sources of electricity demand in the region.

The Regen analysis provided qualitative information on the distilleries.

To forecast distillery uptake in the region a sensitivity analysis was conducted producing high, medium and low confidence load estimates for dates out to 2050. The different confidence levels were classified as follows for the results below. High confidence is based on existing demands and firm plans for change

[1] Sustainability - SSEN

which are expected to happen in RIIO-ED2 timescales. Medium confidence considers existing demands and outlined plans through survey responses which are assessed as being delivered in RIIO-ED3. [redacted] The outcome of this analysis is shown below in Table 9.

Table 9 - Summary of distillery demand estimates

Demand	Values in kW			
	High Confidence	Medium Confidence	Low Confidence (Sensitivity)	Low Confidence (Central case)
	2028	2033	2040-2050	2040-2050
Total (kW)	[redacted]	[redacted]	[redacted]	[redacted]

5.4 Existing Asset Conditions

The Islay and Jura network is currently supplied via one 33kV circuit from Lochgilphead containing two 33kV submarine cable sections. There is a circa 8.5km submarine cable installed between Tayvallich on the Mainland and Lussagiven on Jura, this cable is named SHEPD_165 Mainland – Jura. This cable was installed in 2020 following the failure of the previous cable. A subsequent second 33kV submarine cable then crosses from the South of Jura to the Northeast of Islay to Knocklearach and supplies [redacted] Islay. This cable is SHEPD_176 and is named Jura – Islay (7). The previous SHEPD_121 Jura – Islay cable was identified as in need of proactive replacement as part of the RIIO-ED2 business plan and the replacement Jura-Islay (7) was installed in 2024. The SHEPD_121 Jura – Islay cable has been retained in service as a strategic back up whilst it still operates but will be abandoned upon failure.

SHEPD perform periodic inspections of our submarine cables which inform their condition assessments and feed into the CNAIM to produce cable health scores and subsequent Health Index Bands.

Utilising the information gathered on our assets and sites from inspections along with other key information collected during installation, commissioning, and configuration we utilise the industry standard approach of CNAIM to calculate asset health scores for each of our submarine cable assets. The assets are then assigned Health index bands from HI1 to HI5 as per Table 10 below.

Table 10 - HI bandings and definition

Bandings	Definition	Range
Health Index 1	New or as New	• The submarine cable outer serving has no visible damage. • There is no exposed armour. • There is no exposed insulation.
Health Index 2	Good or Serviceable condition	• The submarine cable outer serving may have visible damage. • There are small number of sections with damaged armour. • There is no exposed insulation.

Bandings	Definition	Range
Health Index 3	Deterioration requires assessment and monitoring	• The submarine cable outer serving has areas of visible damage. • There are numerous sections of exposed armour. • There is no exposed insulation
Health Index 4	Material deterioration, intervention requires consideration	• The submarine cable outer serving has visible damage and at points it is no longer present. • There are significant sections of exposed armour, with corroded armour visible. • There is no significant exposed insulation.
Health Index 5	End of serviceable life, intervention required	• The submarine cable outer serving has visible damage and has little, or none left. • There are significant sections of exposed armour, with major corrosion to the armour. • Armour is likely to have lost mechanical strength. • There is exposed insulation.

The existing submarine assets supplying the Jura and Islay networks have the following HI Bands as contained in Table 11.

Table 11 - Health and Criticality Index for the submarine cables supplying Jura and Islay

Asset	Criticality Index 2024	Health Index 2024	Health Index 2028	Health Index 2033
SHEPD_165 Mainland – Jura	C2	[redacted]	[redacted]	[redacted]
SHEPD_121 Jura – Islay	C2	[redacted]	[redacted]	[redacted]
SHEPD_176 Jura – Islay (7)	C2	[redacted]	[redacted]	[redacted]

SHEPD currently have no concerns over the existing asset condition of these submarine cables. SHEPD_176 is the replacement for SHEPD_121 [redacted] and will maintain a supply route to Islay [redacted]. Both SHEPD_165 and SHEPD_176 are relatively new assets and therefore asset condition does not drive a need for intervention in this instance.

5.5 Existing Operational Issues

There are no existing operational issues on the islands of Islay and Jura.

5.6 Network Analysis Summary

The network analysis studies have been carried out using the 2023 release of the DFES data for the CT scenarios analysing the network for 2028, 2033, 2040 and 2050. The studies have assumed completion of the previously mentioned works outlined in Section 5.2. We also assessed a sensitivity of having the connection of the low confidence – full decarbonisation of the distilleries, with results summarised below. As the LW forecast demand is similar to the CT demand and the LW generation forecast is lower than CT generation, no LW studies have been carried out.

The studies were based on the assumptions outlined in Table 12.

Table 12 - Study Assumptions

Assumption	Type
Voltage limits: Normal Running Arrangements: [redacted] All unknown cables assumed to be equal to lowest rated cable in RSN.	**Technical threshold for study:** Winter Demand Network modelled as wholly intact with maximum winter loads applied at each Primary Substation. Zero Generation (including embedded 11kV) operating on GSP. Summer Generation Network modelled as wholly intact with minimum summer loads applied at each Primary Substation. Full Generation (including embedded 11kV) operating on GSP.

Table 13 - Study Summary

Options	Summary
Option 2 (Winter Maximum and Summer Minimum scenarios)	**2028** It will be required to install the BAT Wind I(Carradale GSP) – Port Ellen 33kV and BAT Wind III(Carradale GSP) – Port Ellen 33kV circuits by 2028 [redacted]. **2033** It will be required to install auto-close scheme at Port Ellen, Port Ann – Knocklearach, second Jura – Islay circuit, upgrade Tayvallich voltage regulator and voltage compensation at Knocklearach by 2033 [redacted]. **2040** It will be required to upgrade the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits and install voltage compensation at Port Ellen and Knocklearach substations by 2040 [redacted]. **2050**

Options	Summary
	With all the above reinforcement in place, no further reinforcement works are required up to 2050.
Option 3 (Winter Maximum and Summer Minimum scenarios)	**2028** It will be required to install auto-close scheme at Port Ellen, Port Ann – Knocklearach and BAT Wind I (Carradale GSP) – Port Ellen 33kV circuits by 2028 [redacted]. **2033** It will be required to install the Crossaig 132kV – Claggain Bay 132/33kV – Port Ellen 33kV circuit, second Jura – Islay circuit, [redacted]. **2040** It will be required to upgrade the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits [redacted] by 2040 [redacted]. **2050** With all the above reinforcement in place, no further reinforcement works are required up to 2050.
Option 4 (Winter Maximum and Summer Minimum scenarios)	**2028** It will be required to install auto-close scheme at Port Ellen, Port Ann – Knocklearach and BAT Wind I(Carradale GSP) – Port Ellen 33kV circuits by 2028 [redacted]. **2033** It will be required to install the Crossaig 132kV – Crossaig 132/66kV – Claggain Bay 66/33kV – Port Ellen 33kV circuit, second Jura – Islay circuit, [redacted] by 2033 [redacted]. **2040** It will be required to upgrade the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits and install voltage compensation at Port Ellen and Knocklearach substations by 2040 [redacted]. **2050** With all the above reinforcement in place, no further reinforcement works are required up to 2050.
Option 13 (Winter Maximum and Summer Minimum scenarios)	**2028** It will be required to install auto-close scheme at Port Ellen, Port Ann – Knocklearach and BAT Wind I(Carradale GSP) – Port Ellen 33kV circuits by 2028 [redacted]. **2033** It will be required to install the Crossaig 132kV – Crossaig 132/33kV – Claggain Bay 132/33kV – Port Ellen 33kV circuit, second Jura – Islay circuit, [redacted] by 2033 [redacted].

Options	Summary
	2040 It will be required to upgrade the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits and install voltage compensation at Knocklearach substation by 2040 [redacted]. **2050** With all the above reinforcement in place, no further reinforcement works are required up to 2050.
Low Confidence – Full Distillery decarbonisation (Sensitivity)	**2028** It will be required to install an auto-close scheme at Port Ellen, Port Ann – Knocklearach and BAT Wind I(Carradale GSP) – Port Ellen 33kV circuits by 2028 [redacted]. **2033** It will be required to install a second Carradale(BAT Wind III) – Port Ellen circuit, install second Jura – Islay circuit, upgrade Tayvallich voltage regulator, [redacted] by 2033 [redacted]. **2040** It will be required to install a third Carradale – Port Ellen circuit, upgrade the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits [redacted], upgrade the Jura - Islay cable on the Port Ann – Knocklearach route, reconductor both Bowmore – Port Ellen circuits by 2040

5.7 Regional Stakeholder Engagement and Whole Systems Analysis Summary

SSEN has productive working relationships with local authorities and other key stakeholders in the region. We have met with Argyll and Bute Council to discuss local area energy planning and constraints on their local network. SSEN has engaged with Highlands and Islands Enterprise, Scottish Government's LHEES Forum, Community Energy Scotland, Transport Scotland, and the Scottish Futures Trust. This engagement has helped SSEN to stay informed about planning and development that will impact local communities' use of the network. SSEN has engaged extensively with the Islay Energy Trust and the Scotch Whisky Association to understand the needs of Islay and Jura specifically.

Argyll and Bute Council has committed to become a net zero organisation by 2045 in alignment with national targets. In their 2022-2025 Decarbonisation Plan, the Council states that they endeavour to install more solar PV on council buildings, identify further opportunities for renewable energy sourcing, and produce an Electric Vehicle Infrastructure Strategy. The Council is expanding the electric vehicle charge point network via funding secured from Scottish Government. Through March 2026, residents in rural areas can take advantage of ECO Grants to install heat pumps and insulation in their homes.

The network on Islay specifically has seen a sharp increase in new connection activity in recent years due to the expansion and electrification of the local whisky distilleries and the development of new housing to support this. [redacted] load growth is expected in the area as a result, [redacted]. SSEN are working closely with Argyll and Bute Council to gain further insight on their housing strategy on Islay, in terms of demand requirements and timeline for connection, to ensure that our reinforcement proposal for the Island aligns. In addition, SSEN has worked with the Scotch Whisky Association (SWA) to gain a better understanding of the distillery

process, demand profile, and likely future demand requirements on Islay. This will assist in establishing whether there is flexibility, in terms of managing this process during periods of high demand, and if there is potential to release network capacity for contracted demand customers ahead of reinforcement intervention.

5.7.1 Local Authority and Government

Our engagement with Local Authorities (LAs) and government brought to light that when maintaining a reliable network, they would like SHEPD to strike a balance between simply fixing older assets and replacing assets (at a higher cost) to ensure that the network is reliable for future use.

This is aligned with what we are requesting as part of this intervention, which is to increase reliability in the present and develop a network that is fit for future needs.

5.7.2 Community Energy Groups and Interest Groups

There are several active community energy groups and community generators in the Port Ann and Carradale Grid Supply Point areas. SSEN are aware of the appetite for exploration of further community energy initiatives in this area and are continuing to engage with local stakeholders to ensure our network plans are fit for purpose. In particular SSEN has engaged with the Islay Energy Trust to get their views on both the drivers and options for our work.

5.7.3 Whole System Approach

Over the last few years, we have worked closely with local stakeholders, customers, market participants government bodies and our transmission company to develop an enduring Whole System solution to meet the future energy needs of the Outer Hebrides and to enable the region to support the transition to net zero through its extensive natural resource potential.

A number of options have been considered, 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 generally 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 132kV 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. Connection to local offshore wind project: We have discussed the potential for a connection to the MachairWind project with ScottishPower Renewables following feedback from the island communities. Our long term plan has been developed so as not to rely on this connection to meet future demand and generation projections, however we will continue to liaise with SPR on the viability of any proposed connection which may be considered in future price controls.

5.7.4 Network resilience for island groups connected by submarine cables

SSEN own and operate over 445km of Distribution (33kV and 11kV) Submarine Cables, across 60 Islands within the SHEPD licence area covering the north of Scotland. SSEN's Islands Resilience Policy for island groups connected by submarine cables was developed to provide increased resilience in areas connected via submarine cables where faults can take significant periods of time to repair. Based on the level of resilience currently provided for each of the island groups fed from submarine cables the standard, summarised in Table 14, was developed.

Table 14 - SSEN Group Demand sizes for Island Groups fed via submarine cables

Forecasted 2050 group demand (CT)*	Relevant 2050 P2-8 Category	Islands Resilience Policy for Island groups fed via subsea cables
Over 60MW and up to 300MW	D	Group demand secured for sustained long duration N-2 condition through a combination of network assets and local generation (including third party).
Over 4MW And up to 60MW	C	
Over 1MW And up to 4MW	B	Group demand secured for sustained long duration N-1 condition through a combination of network assets and local generation (including third party). N-2 condition managed through use of portable generation or use of existing generation on island if available.
<1MW	A	

5.7.5 Summary

As part of our engagement for RIIO-ED2, it was confirmed that a wide range of stakeholders, including the Transmission Owner (TO), strongly support our proposed approach of prioritising assets with a higher likelihood of failure as part of the asset management strategy. In addition, stakeholders also highlighted that network reliability was a high priority, greater than sustainability but below value for money. Stakeholders communicated that reliability is expected as they depend on electricity for so many things in everyday life. This dependence on a reliable network is increasing, for example, with more households working from home and the electrification of heating and transport. These expectations and views validate Ofgem's Interruptions Incentive Scheme (IIS) targets and Guaranteed Standards, so on this basis we have set our ambition to meet these levels of network performance. Building on this engagement as part of the HOWSUM re-opener, we have seen strong support for adopting a whole system strategy for the island networks, where the use of flexibility markets and emerging technologies is considered along with traditional asset investment to secure a reliable and fit for purpose network.

5.8 Flexible Market Viability

SSEN uses flexibility services to create capacity in areas of constrained network. 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 deferring reinforcement where economical to do so.

SSEN procures Flexibility Services from owners, operators, or aggregators of Distributed Energy Resources (DERs), 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.

There is an existing Flexibility Service contracted on Islay which has supported the network during faults and planned outages on the Island, reduced the use of diesel generation during these circumstances. Additionally other flexibility services have been procured in the Argyll and Bute council area.

In August 2024, we launched a Request for Information (RFI) to identify new Flexibility Service Participants in a selection of island communities and establish routes to market in this geographical location. The consultation closed on the 20th of September. The consultation revealed one potential provider that could provide turn up generation on the Archipelagos of Islay, Jura and Colonsay.

The RFI has not identified a single area where Flexibility Services can be currently used to remove the reliance on diesel generators totally. It may be possible to reduce their use in some areas with Flexibility Services. In other areas long term market stimulation may eventually allow a combined solution.

In summary, the RFI has successfully highlighted that there is interest in Flexibility Services in the Island communities from both commercial assets and community led schemes. However, there are clear complexities and barriers for participation, particularly around grid access. Flexibility solutions will likely require strong financial incentives and support on infrastructure investments to overcome these challenges and expand renewable integration across the islands. We will continue to communicate with providers and monitor progress in the market.

5.9 Confidence Table

Table 15 - Confidence table

Confidence Factor	Certainty (High, Medium, Low)	Comments
Load Forecast	Medium	The 2023 DFES data has been used for the purpose of this study and a predictor of load forecast. However, these are longer term proposals and as such we recognise the potential for variation during the period to 2050. [redacted] We will review this further with stakeholders ahead of our RIIO-ED3 submission.
Existing Asset Condition	High	Offshore ROV inspections show condition is good and cables are relatively new. Existing HI5 cable already has replacement in place.
Existing Operational Issues	High	No known operational issues.
Connections Activity	Medium	Connections are regularly changing, and new applications can be received at any time. However, we have reasonable certainty based on DFES analysis that demand growth has been accurately captured in the DFES. [redacted]
Regional Stakeholder engagement	High	Whole system webinars have been held with the offer of bilateral. Further engagement undertaken through DFES and wider community engagement sessions.
Flexible market Viability	Low	Flexibility as a viable alternative to reinforcement has been explored as part of the optioneering study. However, the amount of flexibility which would need to be procured to

Confidence Factor	Certainty (High, Medium, Low)	Comments
		prevent reinforcement before 2050 is approximately [redacted]MVA on average for the options developed. Procuring between [redacted]MVA worth of flexibility is not sustainable as an enduring solution and thus flexibility has been discounted as a viable alternative. However, it is possible that smaller amounts of flexibility could be procured to defer reinforcement by a few years. This will be continually assessed.
Funding Position	Medium	We have agreement to use the HOWSUM, and the outcome of the submission is subject to Ofgem's assessment. Based on our analysis of island needs we believe we have identified the correct solution for implementation at the correct time.

6 Summary of options considered

SSEN has a defined approach in the strategic development of its distribution networks to enable net zero at a local level. This approach is referred to as the strategic development planning process. The aim of the strategic development planning process is to provide the capacity on the network to deliver net zero by 2050 whilst retaining a clear focus on safety and reliability.

This approach extends to Scottish islands, and we have used this approach in our development of proposals relating to relevant RIIO-ED2 uncertainty mechanisms including the Hebrides and Orkney Whole System Uncertainty Mechanism (HOWSUM). The approach is summarised in the process chart in Figure 9.

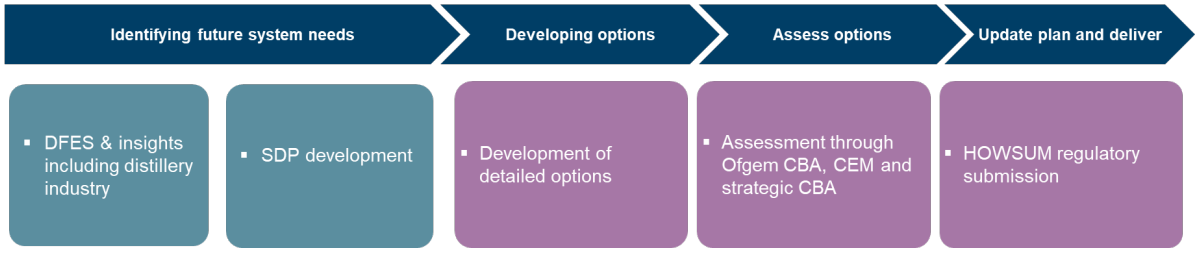


Figure 9 - Summary of Strategic Development Planning Process.

6.1 Long list of Options

Our optioneering approach used to identify and evaluate schemes is built on the knowledge gained from various areas of the business while operating as a DNO. The following section presents a long list and shortlist of options which were considered reasonably suitable to providing a solution to the investment need. For clarity the full scope of works out to 2050 is included for each option to show the whole systems approach that was taken to consider the options.

Table 16 - Longlist of options

Name	Summary
1. Do nothing	• Not compliant with future demand or generation requirements.
2. Install three new 33kV circuits to Islay (one from BAT Wind I and one from BAT Wind III and one from Port Ann GSP), and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one 33kV circuit from BAT Wind Farm III (Carradale GSP) to Port Ellen • Install new Port Ann – Knocklearach circuit and install second Jura - Islay circuit • Upgrade sections of Lochgilphead - Knocklearach and upgrade Bowmore - Knocklearach circuits
3. Install two new 33kV circuits to Islay (one from BAT Wind I and one from Port Ann GSP), one new 132kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install new Port Ann – Knocklearach circuit and install second Jura - Islay circuit • Install one 132kV circuit between Crossaig 132kV to Port Ellen (Land at Claggain Bay) • Upgrade sections of Lochgilphead - Knocklearach and upgrade Bowmore - Knocklearach circuits
4. Install two new 33kV circuits (one from BAT Wind I and one from Port Ann GSP), one new 66kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install new Port Ann – Knocklearach circuit and install second Jura – Islay circuit • Install one 66kV circuit from a new Crossaig 132/66kV to Port Ellen(Land at Claggain Bay) • Upgrade sections of Lochgilphead – Knocklearach and upgrade Bowmore – Knocklearach circuits
5. Install one new 33kV circuit from BAT Wind I to Islay and two new 66kV circuits from Crossaig to Islay	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install two 66kV circuits from a new Crossaig 132/66kV substation to Port Ellen (Land at Claggain Bay)
6. Install three new 33kV circuits to Islay (one from BAT Wind I and one from BAT Wind III and one from Port Ann GSP via a longer submarine cable) and upgrade Lochgilphead –	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one circuit between Port Ann GSP and Islay(using longer submarine route towards Craighouse at South Jura) • Install one 33kV circuit from BAT Wind Farm III(Carradale GSP) to Port Ellen

Name	Summary
Islay North – Knocklearach and Bowmore – Knocklearach circuits	• Upgrade Islay North - Knocklearach circuit and upgrade Tayvallich regulator • Upgrade sections on Lochgilphead – Knocklearach and Bowmore - Knocklearach circuits
7. Install three new 33kV circuits to Islay (one from BAT Wind I, one from new Carradale 33kV GSP and one from Port Ann GSP) and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install Port Ann – Knocklearach circuit and install second Jura - Islay circuit • Install one 33kV circuit from New Carradale GSP to Port Ellen • Upgrade sections on Lochgilphead – Knocklearach and Bowmore - Knocklearach circuits
8. Install two new 33kV circuits to Islay (one from Port Ann, one from BAT Wind I) and one new 132kV circuit to Islay (from Carradale 132kV) and install second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one 132kV circuit from new Carradale 132kV substation to Port Ellen (Land at Kilnaughton Bay) • Install Port Ann - Knocklearach circuit and install second Jura - Islay circuit • Upgrade sections on Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits
9. Install two new 33kV circuits to Islay (one from Port Ann, one from BAT Wind I) and one new 66kV circuit to Islay (from new Carradale 132/66kV) and install second Jura – Islay submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one 66kV circuit from new Carradale 132/66kV substation to Port Ellen (Land at Kilnaughton Bay) • Install Port Ann - Knocklearach circuit and install second Jura - Islay circuit • Upgrade sections on Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits
10. Install two new 33kV circuits (one from Port Ann, one from BAT Wind I) and one new 132kV (from Crossaig 132kV) circuits to Islay and install second Jura - Islay	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one 132kV circuit from Crossaig 132kV substation to Port Ellen (Land at Kilnaughton Bay) • Install Port Ann - Knocklearach circuit and install second Jura - Islay circuit • Upgrade sections on Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits

Name	Summary
11. Install two new 33kV (one from Port Ann, one from BAT Wind I) and one new 66kV (from new Crossaig 132/66kV) circuits to Islay and install second Jura – Islay	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I (Carradale) to Port Ellen • Install one 66kV circuit from new Crossaig 132/66kV substation to Port Ellen (Land at Kilnaughton Bay) • Install Port Ann - Knocklearach circuit and install second Jura - Islay circuit • Upgrade sections on Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits
12. Install two new 33kV circuit to Islay (one from BAT Wind I, one from Carradale 33kV GSP) and one new 66kV circuit to Islay (from Crossaig 132kV)	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install one 33kV circuit from new Carradale 33kV GSP - Port Ellen • Install one 66kV circuit from new Crossaig 132/66kV substation to Port Ellen(Land at Kilnaughton Bay)
13. Install two new 33kV circuits to Islay (one from BAT Wind I and one from new Crossaig 132/33kV) and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation • Install one 33kV circuit from BAT Wind Farm I(Carradale) to Port Ellen • Install new Port Ann – Knocklearach circuit and install second Jura - Islay circuit • Install one 33kV circuit from new Crossaig 132/33kV to Port Ellen • Upgrade sections of Lochgilphead - Knocklearach and upgrade Bowmore - Knocklearach circuits

6.2 Short List of Options

The shortlist of options considers the technically feasible options drawn from the longlist of options which has been put through an initial CBA comparing both the costs and benefits to narrow down the options.

Table 17 - Shortlist of options

Name	Summary
1. Do nothing	• Not compliant with future demand or generation requirements.
2. Install 3 new 33kV circuits to Islay (one from BAT Wind I and one from BAT Wind III and one from Port Ann GSP), and install a second Islay – Jura submarine cable	• Install a new 33kV circuit from BAT Windfarm I - Port Ellen by 2028 (10km from BAT - Muasdale, 36km submarine from Muasdale - Kilnaughton Bay, 0.5km from Kilnaughton Bay - Port Ellen). Includes 8-panel switchgear at Port Ellen, 8Mvar STATCOM, extension of BAT Wind I switchgear to add one circuit breaker and one 3Mvar reactor. • Install a new 33kV circuit from BAT Windfarm 3 - Port Ellen by 2028 (10.5km Bellochantuy - BAT Wind Farm 3, 36km submarine Bellochantuy - Kilnaughton Bay, 0.5km Kilnaughton Bay - Port Ellen). Requires a new 33kV board extension at BAT Wind 3 and installation of new circuit breaker and 3.5Mvar reactor to compensate for the charging current. The new circuit will be connected into a new 33kV circuit breaker at Port Ellen 33kV substation. • Install auto-close scheme at Port Ellen 33kV substation by 2033. • Install a new 33kV circuit breaker at Port Ann (Craig Murrail) and a new 33kV circuit from Port Ann to Islay by 2033 (18km Port Ann - Tayvallich, 5km overhead line and 8.5km submarine for Tayvallich – Lussagiven route, 33.12km Lussagiven - Jura South). Also replace 3.61km of overhead line to 150sqmm Copper operating at 75^0C between Islay and Islay-Jura submarine landing. Reconfigure the existing connection with a PMCB connected off the existing Lochgilphead circuit, splitting the supply to Islay and feeding the Islay network off the new circuit. The Jura network (Lussagiven and Tarbert Jura) will remain supplied off the existing Lochgilphead circuit. • Install a new 33kV circuit from Jura to Islay (2.02km of 500sqmm Copper submarine and 3.61km of 150sqmm Copper overhead line), including upgrading the Tayvallich regulator to 30MVA (including bypass circuit breaker and disconnectors) to form two circuits from Port Ann GSP by 2033. • Reinforcement of the existing Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits by 2040. Also carry out voltage reinforcement by installing additional STATCOMs at Port Ellen and Knocklearach.
3. Install two new 33kV circuits to Islay (one from BAT Wind I and one from Port Ann GSP), one new 132kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation by 2028 • Install new 33kV circuit from BAT Windfarm - Port Ellen by 2028 (10km from BAT - Muasdale, 36km submarine Muasdale - Kilnaughton Bay, 0.5km Kilnaughton Bay - Port Ellen). Includes 8-panel switchgear at Port Ellen, 8Mvar STATCOM, extension of BAT switchgear to add one circuit breaker and one 3Mvar reactor. • Install new 33kV circuit breaker at Port Ann (Craig Murrail) and new 33kV circuit from Port Ann to Islay by 2028 (18km Port Ann - Tayvallich, 5km overhead line and 8.5km submarine for Tayvallich – Lussagiven route, 33.12km Lussagiven - Jura South). Also replace 3.61km of OHL to 150sqmm Copper operating at 75^0C between Islay and Islay-Jura submarine landing. Reconfigure the connection with a PMCB connected off the existing Lochgilphead circuit, splitting the supply to Islay and feeding the Islay network off the new circuit and Jura. The Jura network (Lussagiven and Tarbert Jura) will remain supplied off the existing Lochgilphead circuit.

Name	Summary

	• Install new 33kV circuit from Jura to Islay (2.02km of 500sqmmCu submarine and 3.61km of 150sqmm Copper overhead line), including upgrading Tayvallich regulator to 30MVA (including bypass circuit breaker and disconnectors) to form two circuits from Port Ann GSP by 2033.
	• Install new 132kV circuit from Crossaig – Claggain Bay – Port Ellen by 2033.
	  ○ Install new 132kV circuit breaker at Crossaig 132kV substation (include substation extension costs).
	  ○ Install 132kV circuit between Crossaig to Ronachan (16km) and then to Claggain Bay (30km submarine).
	  ○ Install new 132/33kV substation at Claggain Bay landing point comprising one 132/33kV GT, one 33kV GT circuit breaker and one 33kV feeder breaker. Includes costs for switchroom building.
	  ○ Install new 33kV circuit (overhead line and Cable) for approximately 15km route from Claggain Bay substation to Port Ellen.
	  ○ Install new 33kV circuit breaker at Port Ellen to accommodate the new 33kV feeder circuit.
	• Reinforcement of the existing Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits by 2040. Also carry out voltage reinforcement by installing additional STATCOMs at Port Ellen and Knocklearach

4. Install two new 33kV circuits (one from BAT Wind I and one from Port Ann GSP), one new 66kV circuit from Crossaig to Islay, and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation by 2028
	• Install new 33kV circuit from BAT Windfarm - Port Ellen by 2028 (10km from BAT - Muasdale, 36km submarine Muasdale - Kilnaughton Bay, 0.5km Kilnaughton Bay - Port Ellen). Includes 8-panel switchgear at Port Ellen, 8Mvar STATCOM, extension of BAT switchgear to add one circuit breaker and one 3Mvar reactor.
	• Install new 33kV circuit breaker at Port Ann (Craig Murrail) and new 33kV circuit from Port Ann to Islay by 2028 (18km Port Ann - Tayvallich, 5km overhead line and 8.5km submarine for Tayvallich – Lussagiven route, 33.12km Lussagiven - Jura South). Also replace 3.61km of overhead line to 150sqmm Cu operating at 75^0C between Islay and Islay-Jura submarine landing. Reconfigure the connection with a PMCB connected off the existing Lochgilphead circuit, splitting the supply to Islay and feeding the Islay network off the new circuit and Jura. The Jura network (Lussagiven and Tarbert Jura) will remain supplied off the existing Lochgilphead circuit.
	• Install new 33kV circuit from Jura to Islay (2.02km of 500sqmmCu submarine and 3.61km of 150sqmm Copper overhead line), including upgrading Tayvallich regulator to 30MVA (including bypass circuit breaker and disconnectors) to form two circuits from Port Ann GSP by 2033.
	• Install new 66kV circuit from Crossaig – Claggain Bay – Port Ellen by 2033
	  ○ Install a new 132kV circuit breaker at Crossaig. From here install a 132kV circuit(0.5km) to a new 132/66kV substation around Crossaig. This will comprise one 132/66kV GT, one 66kV GT circuit breaker and one 66kV feeder circuit breaker.
	  ○ Install 66kV circuit between Crossaig to Ronachan(16km) to Claggain Bay(30km submarine).

Name	Summary
	○ At Claggain Bay, install a new 66/33kV substation comprising one 66/33kV GT, one GT circuit breaker and one feeder circuit breaker. ○ Install new 33kV circuit (overhead line and Cable) for approximately 15km route from Claggain Bay substation to Port Ellen. ○ At Port Ellen install a new 33kV circuit breaker to accommodate new circuit from Claggain Bay. • Reinforcement of the existing Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits by 2040. Also carry out voltage reinforcement by installing additional STATCOMs at Port Ellen and Knocklearach.
13. Install two new 33kV circuits to Islay (one from BAT Wind I and one from new Crossaig 132/33kV) and second Islay – Jura submarine cable	• Install auto-close scheme at Port Ellen 33kV substation by 2028. • Install a new 33kV circuit from BAT Windfarm I - Port Ellen by 2028 (10km from BAT - Muasdale, 36km submarine from Muasdale - Kilnaughton Bay, 0.5km from Kilnaughton Bay - Port Ellen). Includes 8-panel switchgear at Port Ellen, 8Mvar STATCOM, extension of BAT Wind I switchgear to add one circuit breaker and one 3Mvar reactor. • Install a new 33kV circuit breaker at Port Ann (Craig Murrail) and a new 33kV circuit from Port Ann to Islay by 2028 (18km Port Ann - Tayvallich, 5km overhead line and 8.5km submarine for Tayvallich – Lussagiven route, 33.12km Lussagiven - Jura South). Also replace 3.61km of OHL to 150sqmm Copper operating at 75^{0}C between Islay and Islay-Jura submarine landing. Reconfigure the existing connection with a PMCB connected off the existing Lochgilphead circuit, splitting the supply to Islay and feeding the Islay network off the new circuit. The Jura network (Lussagiven and Tarbert Jura) will remain supplied off the existing Lochgilphead circuit. • Install a new 33kV circuit from new Crossaig 132/33kV substation by 2033 comprising: ○ Installation of 132kV circuit breaker at Crossaig 132kV. ○ From here install 0.5km underground cable to new 132/33kV substation comprising one 132/33kV GT, one 33kV GT circuit breaker and one 33kV feeder circuit breaker. ○ Install a 33kV circuit from Crossaig to Ronachan(16km) and submarine route from Ronachan to Claggain Bay(30km). ○ At Claggain Bay install a new 33kV substation comprising one incomer circuit breaker and one feeder circuit breaker. ○ Install a 2.5Mvar reactor to compensate for the 33kV cable charging current. ○ Install new 33kV circuit (overhead line and cable) for approximately 15km route from Claggain Bay to Port Ellen. Terminate the new circuit into a new 33kV circuit breaker at Port Ellen 33kV substation. • Install a new 33kV circuit from Jura to Islay (2.02km of 500sqmmCu submarine and 3.61km of 150sqmmCu OHL), including upgrading the Tayvallich regulator to 30MVA (including bypass C/B and disconnectors) to form two circuits from Port Ann GSP and install voltage compensation at Port Ellen by 2033.

Name	Summary
	• Reinforcement of the existing Lochgilphead - Knocklearach and Bowmore - Knocklearach circuits by 2040. Also carry out voltage reinforcement by installing additional STATCOMs at Knocklearach substation

7 Detailed option analysis

7.1 Option 1: Do Nothing

Lochgilphead 2L5 33kV circuit is an approximately 70km radial feed which serves the Islay and Jura network, comprising of Lussagiven, Tarbert Jura, Port Askaig, Bowmore, and Port Ellen Primary substations. At Bowmore Primary there is [redacted] MW of diesel generation connected at 11kV, [redacted] This will be increased to [redacted] MW in RIIO-ED2 in line with load growth on the islands. Studies show that the 2L5 33kV circuit [redacted] by 2028, [redacted] and demand (DFES CT scenario forecasting plus distillery demand) will increase to [redacted], [redacted].

In addition, there has been a sharp rise in new connection activity on Islay in recent years, which is a contributing factor to [redacted] network constraints, [redacted]. These new connections have been managed by offering curtailed/DSR connection offers for non-domestic customers, [redacted]. There are multiple new connection applications totalling 5.92MW, which are now unable to connect to the Islay network due to these constraints. [redacted]

Doing nothing in this instance will have multiple implications such as:

- [redacted]
- [redacted]
- [redacted]
- New connections will not be able to connect to the grid endangering customer relations and the ability to support economic growth and net zero plans would be impacted.

This option is not progressed to CBA.

7.2 Option 2: Add two new 33kV circuits from Carradale – Port Ellen, install a new circuit from Port Ann – Knocklearach, install a second Jura – Islay submarine cable and reconductor the Lochgilphead – Knocklearach circuit

This option is to install three new 33kV circuits to Islay [redacted] This will be in addition to the existing circuit infeed from Lochgilphead 33kV substation. The new circuit 1 will be from Port Ann GSP to Islay and the new circuits 2 and 3 will be from the Carradale GSP 33kV Network. The fourth circuit will be the existing Lochgilphead – Knocklearach circuit (involves installation of a second Islay – Jura submarine cable). This is represented by the schematic diagram below, Figure 10.

The two 33kV circuits from the Carradale GSP network will start off from BAT Wind I and BAT Wind III 33kV substations and will require onshore underground cables, overhead lines and submarine cables to reach Port Ellen 33kV substation on Islay. The third circuit will start from Port Ann GSP (Craig Murrail) comprising overhead lines (59.61km which includes replacement of the Knocklearach – Islay North overhead line) and reinforcement of the Mainland – Jura submarine cable route (8.5km) to reach Jura, connecting onto the existing Jura – Islay submarine circuit. There will also be additional reconductoring of the existing Lochgilphead – Knocklearach circuit and one of the Bowmore – Knocklearach 33kV circuits to ensure thermal compliance under N-2 conditions. Furthermore, the addition of a second Islay – Jura circuit (overhead line and submarine) will increase the number of circuit infeed to Islay from one to four 33kV circuits by 2040. This option requires the installation of STATCOMs at both Port Ellen and Knocklearach 33kV substations [redacted] on the Islay network.

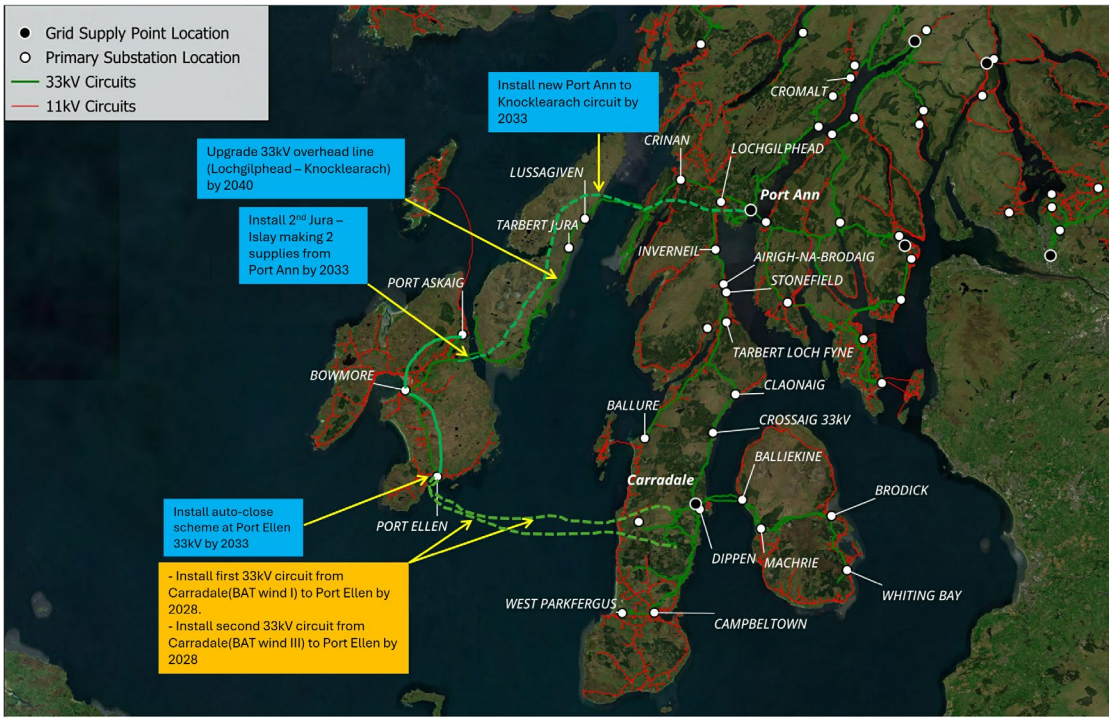


Figure 10 - Islay Proposed Route Map – Option 2.

Cost

The estimated capital cost components of this option are the three circuit routes (comprising submarine, onshore cable and overhead line) and the upgrading the existing Lochgilphead – Knocklearach and one Bowmore – Knocklearach circuits. The total cost is [redacted].

Table 18 - Option 2 cost breakdown (2021 prices)

Line Items	Route	Cost (£m)
Substation Upgrade - BAT Wind I	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	BAT WIND I – Port Ellen 33kV	[redacted]
Submarine cable (Muasdale - Kilnaughton Bay incl. HDD)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	BAT WIND I - Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ellen	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - BAT Wind III	BAT WIND III – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	BAT WIND III – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	BAT WIND III – Port Ellen 33kV	[redacted]
Submarine cable (Bellochantuy - Kilnaughton Bay incl. HDD)	BAT WIND III – Port Ellen 33kV	[redacted]

Line Items	Route	Cost (£m)
Onshore - 33kV U/G Cable	BAT WIND III – Port Ellen 33kV	[redacted]
Substation Upgrade - New CB(Port Ellen and Knocklearach)	BAT WIND III – Port Ellen 33kV	[redacted]
Auto-close Scheme (Port Ellen)	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ann GSP	Port Ann - Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Port Ann - Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Port Ann - Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Port Ann - Knocklearach 33kV	[redacted]
Substation Upgrade - Knocklearach(Port Ann - Knock route)	Port Ann - Knocklearach 33kV	[redacted]
Submarine cable (Jura - Islay submarine)	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach 33kV	[redacted]
Substation Upgrade - New CB(Port Ellen and Knocklearach)	Lochgilphead – Knocklearach 33kV	[redacted]
Voltage Compensation - STATCOM(Knocklearach) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Tayvallich	Lochgilphead – Knocklearach 33kV	[redacted]
Voltage Compensation - STATCOM(Port Ellen) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Voltage Compensation - STATCOM(Knocklearach) 4Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement(33kV OHL)	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement(33kV Poles)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV U/G Cable	Lochgilphead – Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Lochgilphead – Knocklearach 33kV	[redacted]

Line Items	Route	Cost (£m)
Total Cost		[redacted]

Benefits

This option resolves [redacted] the DFES 2050 CT and LW load forecasting and will remove the reliance on the back up diesel sets at Bowmore [redacted].

Limitations

The main limitation of this option is the need to install a new overhead line route across Jura [redacted].

7.3 Option 3: Add one new 33kV from Carradale - Port Ellen, one 132kV from Crossaig – Port Ellen, one 33kV from Port Ann – Knocklearach, install second Jura – Islay circuit and reconductor the Lochgilphead – Knocklearach circuit

This option is to install two new 33kV circuits and one new 132kV circuit to Islay [redacted]. This will be in addition to the existing circuit infeed from Lochgilphead 33kV substation. The new circuit 1 will be from Port Ann GSP to Islay, the new circuit 2 will be from the Carradale GSP 33kV Network and new circuit 3 will be from Crossaig 132kV. The fourth circuit will be the existing Lochgilphead – Knocklearach circuit (involves installation of second Islay – Jura circuit). This is represented by the schematic diagram below, Figure 11.

The 33kV circuit from the Carradale GSP network will start off from BAT Wind I 33kV substation and will require underground cables, overhead lines and submarine cable route to reach Port Ellen 33kV substation on Islay. The second circuit will start from Port Ann GSP (Craig Murrail) comprising overhead lines and submarine cable route to reach Knocklearach 33kV substation on Islay. The third circuit will start from Crossaig 132kV substation, running as a 132kV route (includes overhead line, underground cable and submarine cable) until it lands at Claggain Bay (on Islay) where a new 132/33kV substation will be installed. From this Claggain Bay 33kV substation, the circuit will run as overhead line and underground cable up to Port Ellen 33kV substation. There will also be additional reconductoring of the existing Lochgilphead – Knocklearach circuit and one of the Bowmore – Knocklearach 33kV circuits [redacted]. Furthermore, the addition of a second Islay – Jura circuit (overhead line and submarine) will increase the number of circuit infeed to Islay from one to four 33kV circuits by 2040.

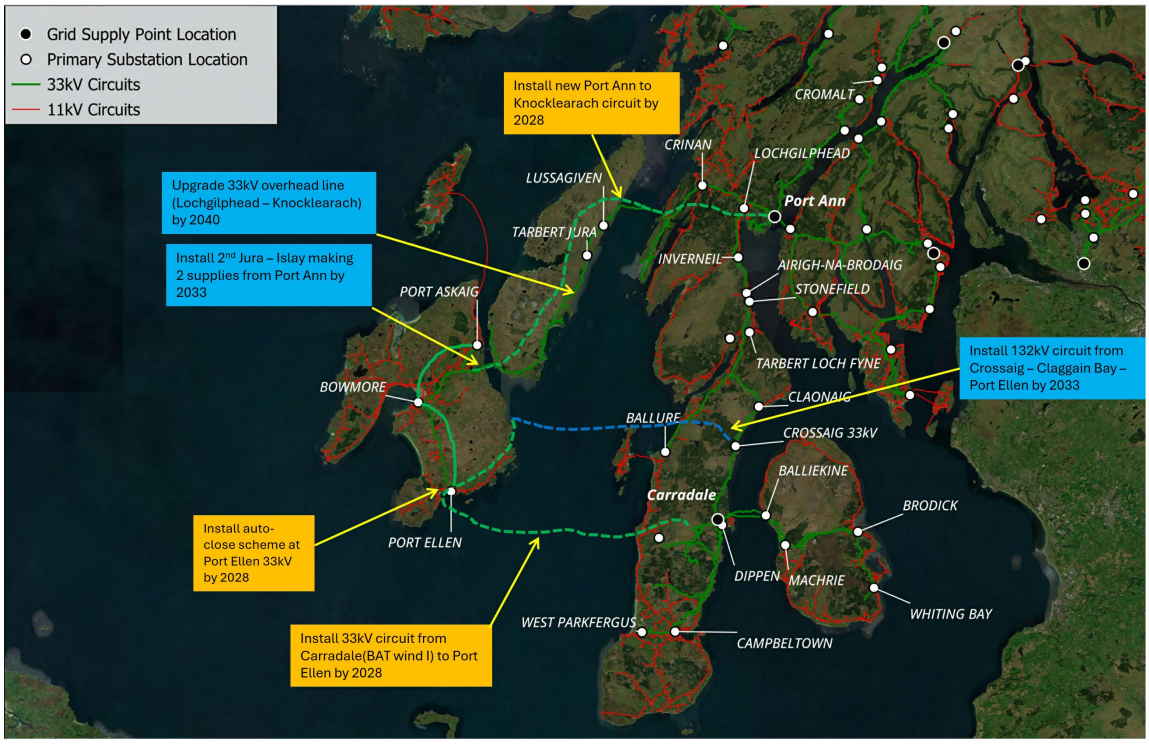


Figure 11 - Islay Proposed Network SLD – Option 3.

Cost

The estimated capital cost components of this option are the three circuit routes (submarine, onshore cable and overhead line) and the upgrading of the existing Lochgilphead – Knocklearach and one Bowmore – Knocklearach circuit. The total cost is [redacted].

Table 19 - Option 3 cost breakdown (2021 prices)

Line Items	Route	Cost (£m)
Auto-close Scheme (Port Ellen)	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - BAT Wind I	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	BAT WIND I – Port Ellen 33kV	[redacted]
Submarine cable (Muasdale - Kilnaughton Bay incl. HDD)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ellen	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ann GSP	Port Ann – Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Port Ann – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Port Ann – Knocklearach 33kV	[redacted]

Line Items	Route	Cost (£m)
Submarine cable (Tayvallich - Jura submarine)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade – Knocklearach (Port Ann - Knock route)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade - Crossaig 132kV	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Onshore - 132kV OHL	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Onshore - 132kV Poles	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Onshore - 132kV U/G Cable	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Submarine cable (Ronachan - Claggain Bay incl. HDD) 132kV	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Substation Upgrade - Claggain Bay 132/33kV	Crossaig 132kV – Claggain Bay 132/33kV substation	[redacted]
Onshore - 33kV OHL	Claggain Bay 132/33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	Claggain Bay 132/33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	Claggain Bay 132/33kV – Port Ellen 33kV	[redacted]
Substation Upgrade - New circuit breaker (Port Ellen and Knocklearach)	Claggain Bay 132/33kV – Port Ellen 33kV	[redacted]
Submarine cable (Jura - Islay submarine)	Lochgilphead – Knocklearach	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach	[redacted]
Substation Upgrade - New CB (Port Ellen and Knocklearach)	Lochgilphead – Knocklearach	[redacted]
Voltage Compensation – STATCOM (Knocklearach) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Tayvallich	Lochgilphead – Knocklearach	[redacted]
Voltage Compensation – STATCOM (Port Ellen) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]

Line Items	Route	Cost (£m)
Voltage Compensation – STATCOM (Knocklearach) 4Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV OHL)	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV Poles)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV U/G Cable	Lochgilphead – Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Lochgilphead – Knocklearach 33kV	[redacted]
Total Cost		[redacted]

Benefits

This option resolves [redacted] the DFES 2050 CT and LW load forecast and will remove the reliance on the back up diesel sets at Bowmore [redacted].

Limitations

The main limitation of this option is the need to install a new overhead line route across Jura [redacted]. [redacted] the increased capital costs to design and install a 132kV circuit route (comprising overhead line, cable and submarine) compared to a 33kV route option.

7.4 Option 4: Add one new 33kV from Carradale - Port Ellen, one 66kV from Crossaig – Port Ellen, one 33kV from Port Ann – Knocklearach, install second Jura – Islay circuit and reconductor the Lochgilphead – Knocklearach circuit

This option is to install two new 33kV circuits and one new 66kV circuit to Islay [redacted]. This will be in addition to the existing circuit infeed from Lochgilphead 33kV substation. The new circuit 1 will be from Port Ann GSP to Islay, the new circuit 2 will be from the Carradale GSP 33kV network and new circuit 3 will be from a new Crossaig 132/66kV substation close to the existing Crossaig 132kV. The fourth circuit will be the existing Lochgilphead – Knocklearach circuit (involves installation of second Islay – Jura circuit). This is represented by the schematic diagram below, Figure 12.

The 33kV circuit from the Carradale GSP network will start off from BAT Wind I 33kV substation and will require underground cables, overhead lines and submarine cable route to reach Port Ellen 33kV substation on Islay. The second circuit will start from Port Ann GSP (Craig Murrail) comprising overhead lines and submarine cable route to reach Knocklearach 33kV substation on Islay. The third circuit will start from Crossaig 132kV substation where we establish a new 132/66kV substation in close proximity. We will then install a 66kV route (including overhead line, underground cable and submarine cable) to Claggain Bay (on Islay) where a new 66/33kV substation will be installed. From Claggain Bay 33kV substation, the circuit will run as overhead line and underground cable up to Port Ellen 33kV substation. There will also be additional reconductoring of the existing Lochgilphead – Knocklearach circuit and one of the Bowmore – Knocklearach 33kV circuits [redacted].

Furthermore, the addition of a second Islay – Jura circuit (overhead line and submarine) will increase the number of circuit infeed to Islay from one to four 33kV circuits by 2040.

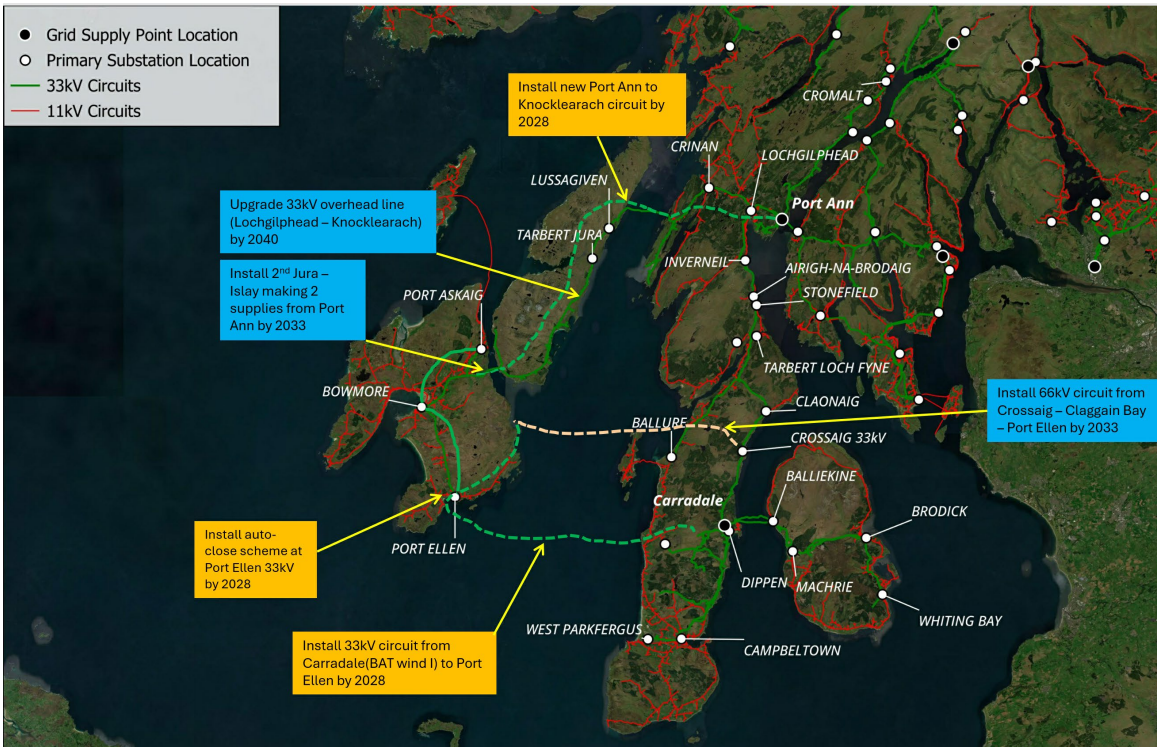


Figure 12 - Islay Proposed Network SLD – Option 4.

Cost

The estimated capital cost components of this option are the three circuit routes (submarine, onshore cable and overhead line) and to the upgradation of the existing Lochgilphead – Knocklearach and one Bowmore – Knocklearach circuit. The total cost is [redacted].

Table 20 - Option 4 cost breakdown (2021 prices)

Line Items	Route	Cost (£m)
Auto-close Scheme (Port Ellen)	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - BAT Wind I	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	BAT WIND I – Port Ellen 33kV	[redacted]
Submarine cable (Muasdale - Kilnaughton Bay incl. HDD)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ellen	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ann GSP	Port Ann – Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Port Ann – Knocklearach 33kV	[redacted]

Line Items	Route	Cost (£m)
Onshore - 33kV Poles	Port Ann – Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade - Knocklearach(Port Ann - Knock route)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade - Crossaig 132kV	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Onshore - 132kV U/G Cable	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Substation Upgrade - Crossaig 132/66kV	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Onshore - 66kV OHL	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Onshore - 66kV Poles	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Onshore - 66kV U/G Cable	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Submarine cable (Ronachan - Claggain Bay incl. HDD) 66kV	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Substation Upgrade - Claggain Bay 66/33kV	Crossaig 132/66kV - Claggain Bay 66/33kV	[redacted]
Onshore - 33kV OHL	Claggain Bay 66/33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	Claggain Bay 66/33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	Claggain Bay 66/33kV – Port Ellen 33kV	[redacted]
Substation Upgrade - New CB (Port Ellen and Knocklearach)	Claggain Bay 66/33kV – Port Ellen 33kV	[redacted]
Submarine cable (Jura - Islay submarine)	Lochgilphead -Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead -Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead -Knocklearach 33kV	[redacted]
Substation Upgrade - New CB (Port Ellen and Knocklearach)	Lochgilphead -Knocklearach 33kV	[redacted]
Voltage Compensation – STATCOM (Knocklearach) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]

Line Items	Route	Cost (£m)
Substation Upgrade - Tayvallich	Lochgilphead -Knocklearach 33kV	[redacted]
Voltage Compensation – STATCOM (Port Ellen) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Voltage Compensation – STATCOM (Knocklearach) 4Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV OHL)	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV Poles)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead -Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead -Knocklearach 33kV	[redacted]
Onshore - 33kV U/G Cable	Lochgilphead -Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Lochgilphead -Knocklearach 33kV	[redacted]
Total Cost		[redacted]

Benefits

This option resolves [redacted] the DFES 2050 CT and LW load forecast and will remove the reliance on the back up diesel sets at Bowmore [redacted].

Limitations

The main limitation of this option is the need to install a new overhead line route across Jura [redacted]. Another limitation is the increased capital costs to design and install a 66kV circuit route (comprising overhead line, cable and submarine) compared to a 33kV route option.

This option is progressed to the CBA.

7.5 Option 13: Add one new 33kV from Carradale - Port Ellen, one 33kV from Crossaig – Port Ellen, one 33kV from Port Ann – Knocklearach, install second Jura – Islay circuit and reconductor the Lochgilphead – Knocklearach circuit

This option is to install three new 33kV circuits to Islay [redacted] on the 33kV Network. This will be in addition to the existing circuit infeed from Lochgilphead 33kV substation. The new circuit 1 will be from Port Ann GSP to Islay, the new circuit 2 will be from the Carradale GSP 33kV Network and new circuit 3 will be from a new Crossaig 132/33kV substation close to the existing Crossaig 132kV GSP. The fourth circuit will be the existing Lochgilphead – Knocklearach circuit (involves installation of second Islay – Jura circuit). This is represented by the schematic diagram below in Figure 13.

The 33kV circuit from the Carradale GSP network will start off from BAT Wind I 33kV substation and will require underground cables, overhead lines and submarine cable route to reach Port Ellen 33kV

substation on Islay. The second circuit will start from Port Ann GSP (Craig Murrail) comprising overhead lines and submarine cable route to reach Knocklearach 33kV substation on Islay. The third circuit will start from Crossaig 132kV substation where we establish a new 132/33kV substation in close proximity. We will then install a 33kV route (includes overhead line, underground cable and submarine cable) to Claggain Bay (on Islay) where a new 33kV substation will be installed. From Claggain Bay 33kV substation, the circuit will run as overhead line and underground cable up to Port Ellen 33kV substation. There will also be additional reconductoring of the existing Lochgilphead – Knocklearach circuit and one of the Bowmore – Knocklearach 33kV circuits [redacted]. Furthermore, the addition of a second Islay – Jura circuit (overhead line and submarine) will increase the number of circuit infeed to Islay from one to four 33kV circuits by 2040.

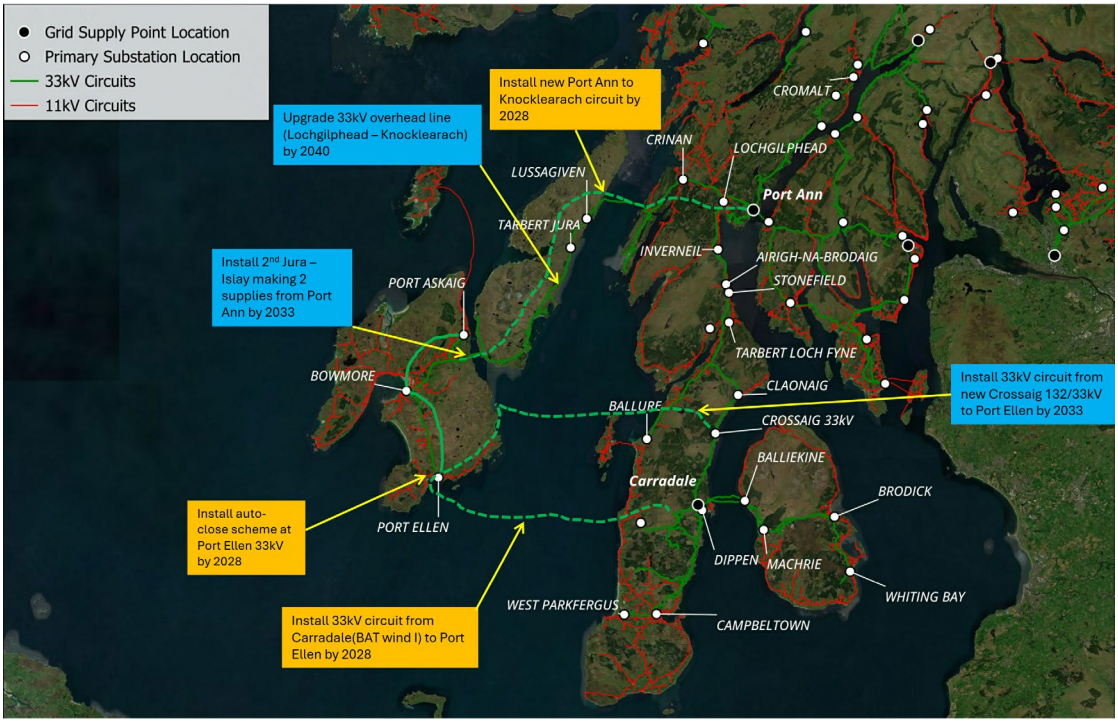


Figure 13 - Islay Proposed Network SLD – Option 13.

Cost

The estimated capital cost components of this option are the three circuit routes (submarine, onshore cable and overhead line) and the upgradation of the existing Lochgilphead – Knocklearach and one Bowmore – Knocklearach circuit. The total cost is [redacted].

Table 21 - Option 13 cost breakdown (2021 prices)

Line Items	Route	Cost (£m)
Auto-close Scheme (Port Ellen)	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - BAT Wind I	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	BAT WIND I – Port Ellen 33kV	[redacted]
Submarine cable (Muasdale - Kilnaughton Bay incl. HDD)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	BAT WIND I – Port Ellen 33kV	[redacted]

Line Items	Route	Cost (£m)
Substation Upgrade - Port Ellen	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Port Ann GSP	Port Ann – Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Port Ann – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Port Ann – Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade – Knocklearach (Port Ann - Knock route)	Port Ann – Knocklearach 33kV	[redacted]
Substation Upgrade - Crossaig 132kV	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Onshore - 132kV U/G Cable	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Substation Upgrade - Crossaig 132/33kV	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Onshore - 33kV OHL	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Onshore - 33kV Poles	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Onshore - 33kV U/G Cable	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Submarine cable (Ronachan - Claggain Bay incl. HDD) 33kV	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Substation Upgrade - Claggain Bay 33kV	Crossaig 132/33kV – Claggain Bay 33kV	[redacted]
Onshore - 33kV OHL	Claggain Bay 33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV Poles	Claggain Bay 33kV – Port Ellen 33kV	[redacted]
Onshore - 33kV U/G Cable	Claggain Bay 33kV – Port Ellen 33kV	[redacted]
Substation Upgrade - New CB (Port Ellen and Knocklearach)	Claggain Bay 33kV – Port Ellen 33kV	[redacted]
Submarine cable (Jura - Islay submarine)	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach 33kV	[redacted]

Line Items	Route	Cost (£m)
Substation Upgrade - New CB (Port Ellen and Knocklearach)	Lochgilphead – Knocklearach 33kV	[redacted]
Voltage Compensation – STATCOM (Knocklearach) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Substation Upgrade - Tayvallich	Lochgilphead – Knocklearach 33kV	[redacted]
Voltage Compensation – STATCOM (Port Ellen) 8Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Voltage Compensation – STATCOM (Knocklearach) 4Mvar	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV OHL)	BAT WIND I – Port Ellen 33kV	[redacted]
Bowmore - Knocklearach reinforcement (33kV Poles)	BAT WIND I – Port Ellen 33kV	[redacted]
Onshore - 33kV OHL	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV Poles	Lochgilphead – Knocklearach 33kV	[redacted]
Onshore - 33kV U/G Cable	Lochgilphead – Knocklearach 33kV	[redacted]
Submarine cable (Tayvallich - Jura submarine)	Lochgilphead – Knocklearach 33kV	[redacted]
Total Cost		[redacted]

Benefits

This option resolves [redacted] the DFES 2050 CT and LW load forecast and will remove the reliance on the back up diesel sets at Bowmore [redacted].

Limitations

The main limitation of this option is the need to install a new overhead line route across Jura which [redacted]

This option is progressed to the CBA.

7.6 Flexible Solution

The islands of Islay and Jura have recently had a sharp increase in large connection applications which include several non-domestic loads, [redacted]. The total capacity of the contracted jobs yet to connect is approximately [redacted]. [redacted] lso, the [redacted] network c[redacted] is dependent on operating the Bowmore diesel standby generator with the associated operational, running and carbon emission costs. Using the CEM tool, the flexibility NPV calculation indicates that procuring this level of flexibility in addition to running Bowmore diesel generation would not defer RIIO-ED2 network reinforcements. See Figure 14 and Figure 15 below for the cumulative NPV of deferral vs baseline strategy and the marginal NPV of deferring from one period to the next.

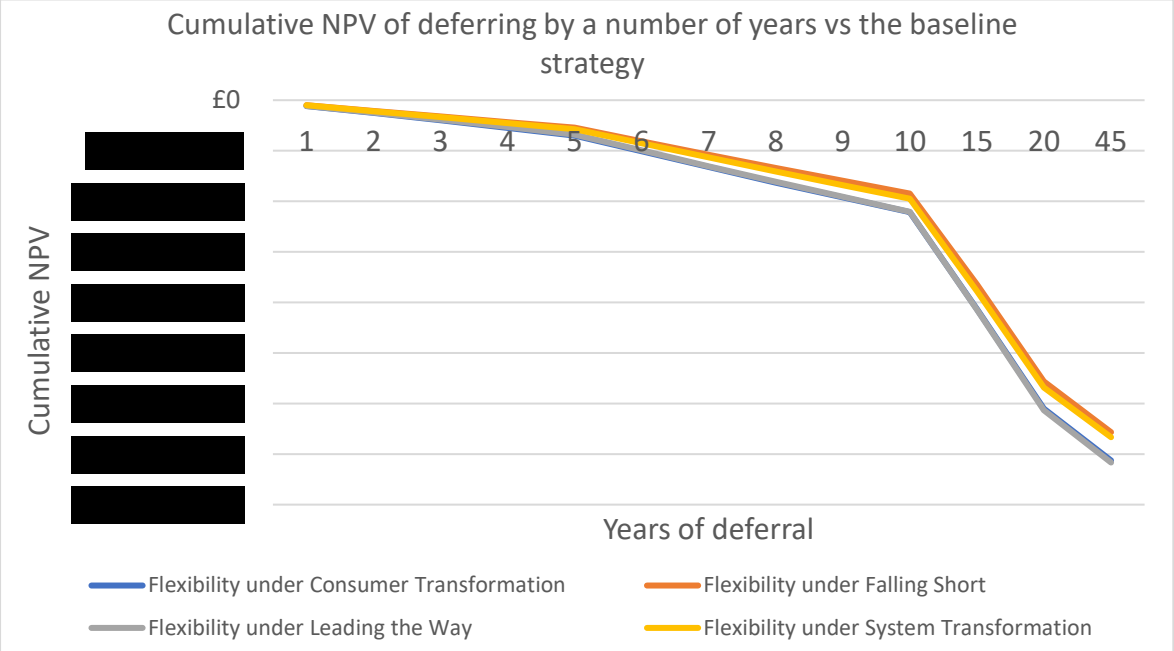


Figure 14 – Cumulative NPV of deferral vs baseline strategy

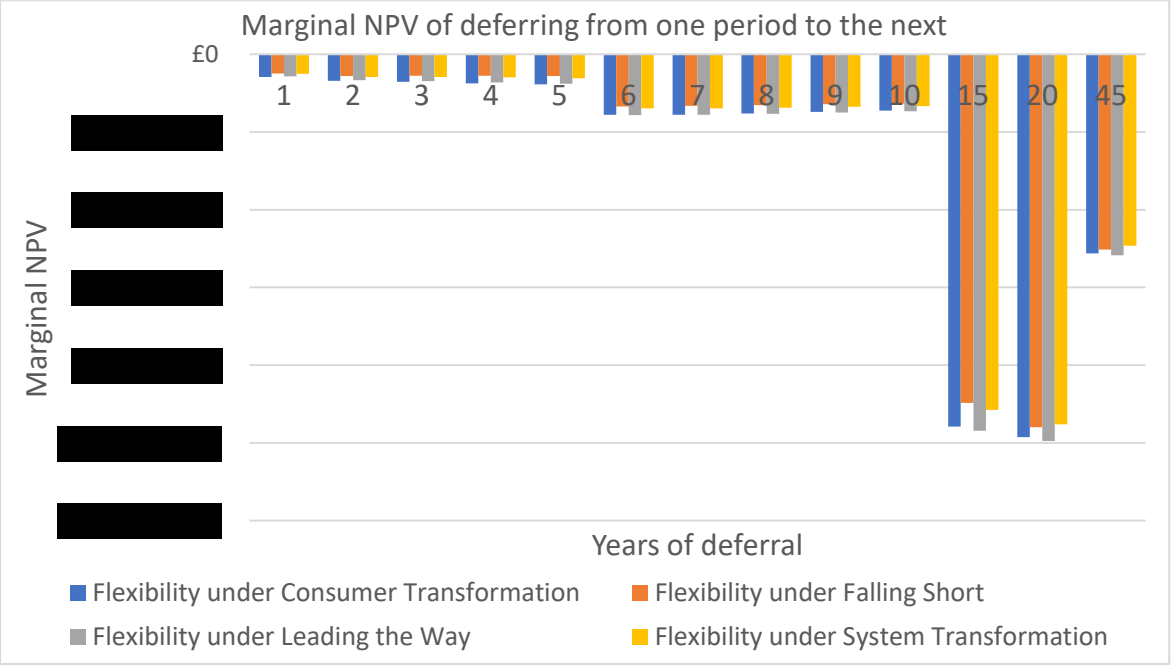


Figure 15 – Marginal NPV of deferring from one period to the next

The use of flexibility to defer RIIO-ED2 network reinforcement has therefore been discounted as uneconomical.

7.7 Option Summary

We have undertaken a front-end optioneering style approach based on high quality data, expert informed judgement and financially robust costing appraisals using optioneering. This structured approach to identifying schemes is built on the knowledge gained from various areas of the business and the different licence areas we operate.

The table below provides, and overall summary of the options considered or shortlisted for financial and CBA appraisal and includes options discounted.

Table 22 - Option Summary Table

Options	Contributes to Primary Driver	Contributes to SSEN Net Zero/SBT Commitment	Technically Feasible	Cost Effective	Confident in Outcome	Delivery Risk	Take Option Forward to CBA
Baseline	No	No	Yes	No	No	[redacted]	No
Option 2	Yes	Yes	Yes	Yes	Yes	[redacted]	Yes
Option 3	Yes	Yes	Yes	No	Yes	[redacted]	Yes
Option 4	Yes	Yes	Yes	No	Yes	[redacted]	Yes
Option 13	Yes	Yes	Yes	Yes	Yes	[redacted]	Yes

8 Cost Benefit Analysis (CBA)

This section will outline the process undertaken and the output of the Cost Benefit Analysis (CBA). We have conducted a full CBA for each option that was technically feasible. From this list, we have then considered the options with the highest NPVs. Therefore, this EJP considers options 2,3,4 and 13.

The approach that we have taken to conduct the CBA is strictly aligned to the guidance given by Ofgem utilising the latest guidance document and CBA model.

- RIIO-ED2 Engineering Justification Paper Guidance
- Re-opener Guidance and Application Requirements Document
- RIIO-ED2 Cost Benefit Analysis (CBA) Guidance
- RIIO-ED2 Data Templates and Associated Instructions and Guidance | Ofgem

The capital costs, operating costs and assumptions have been carefully costed, [redacted]. These are set out in Table 23.

8.1 CBA of investment options

The expenditure components, as displayed in Table 23, are split by Capex and Opex for the next three price control periods. The vast majority of costs are made up of capital costs, with operating costs accounting for a smaller fraction of total expenditure. The bulk of the operating expenditure for the short-listed options is a consequence of operating the DEG on standby and emergency running, which is treated as an operating cost in this table.

Table 23 - Cost Summary - 2021 Prices (£m)

	RIIO-ED2			RIIO-ED3			RIIO-ED4		
Options	**Capex**	**Opex**	**Totex**	**Capex**	**Opex**	**Totex**	**Capex**	**Opex**	**Totex**
Option 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

	RIIO-ED2			RIIO-ED3			RIIO-ED4		
Options	Capex	Opex	Totex	Capex	Opex	Totex	Capex	Opex	Totex
Option 4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 13	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

8.2 CBA Results

The output of the CBA is displayed below in Table 24.

Table 24 - Net Present Value at different intervals (£m, 2021 prices)

Options	10 years	20 years	30 years	45 years	Whole life (55 years)
Option 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Option 13	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

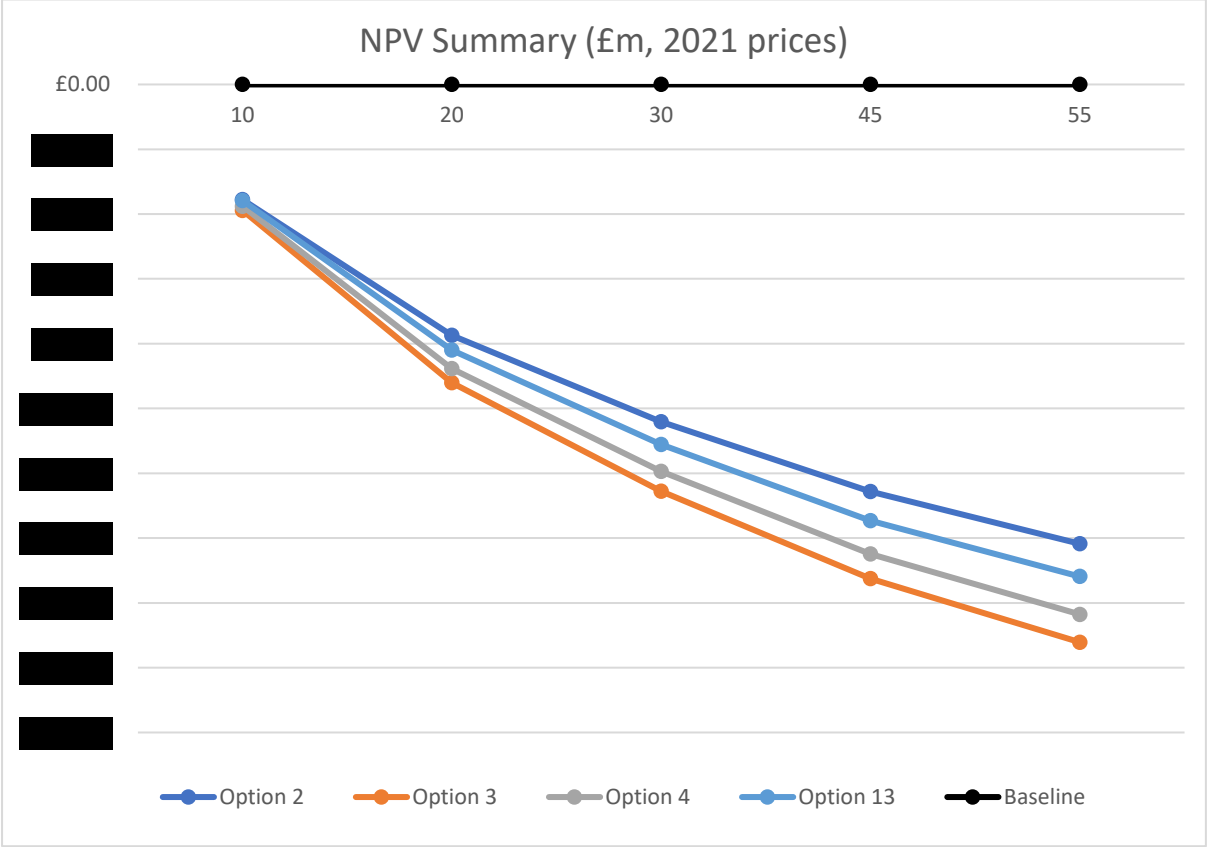


Figure 16 - NPV Summary for Options

The NPV is heavily driven by capital expenditure, which therefore logically leads to Option 3 producing the least positive result and Option 2 displaying the most positive NPV.

The output tables below display the whole life cost and benefit of each option. As we have used a 55-year appraisal period (as per Ofgem's CBA guidance), this does include a portion of renewals, as the asset life of a submarine cable is modelled at 45 years. Note also that these costs are not discounted to present values. The societal benefits are net negative due to the increased cable volume and associated losses.

Table 25 - Option Whole Life Costs (£m, 2021 prices)

Options	Capex	Opex	DEG	Totex
Option 2	[redacted]	[redacted]	[redacted]	[redacted]
Option 3	[redacted]	[redacted]	[redacted]	[redacted]
Option 4	[redacted]	[redacted]	[redacted]	[redacted]
Option 13	[redacted]	[redacted]	[redacted]	[redacted]

As in Table 25, Option 2 has the lowest expected Totex costs over the whole life of the assessment period (55 years). Option 3 (132kV option) is the most expensive option.

Table 26 - Option Whole Life Benefits (£m, 2021 prices)

Options	Total Societal Net Benefits	Total DNO Net Benefits
Option 2	[redacted]	[redacted]
Option 3	[redacted]	[redacted]

Option 4	[redacted]	[redacted]
Option 13	[redacted]	[redacted]

The societal benefits of Option 13 are the most positive of all options considered. The DNO net benefits for Options 2 are greater than those of Option 3, 4 and 13.

9 Preferred Option

The preferred option for this EJP is Option 2. This 33kV option is successful in providing a solution to the needs case, delivers the best value of network options to customers and is the most economical. [redacted]o ensure we achieve cost savings for our customers and deliver a more economic, efficient and coordinated network solution. This allows the removal of reliance on the existing Bowmore diesel units to align with SHEPD, island and government net zero ambitions. The scheme also contributes towards a more resilient network [redacted] for current and future customers, [redacted].

10 Deliverability and Risk

This section documents the approach to delivery and lists any potential deliverability constraints and any necessary mitigation strategies that will need to be undertaken to minimise the risk. The output of this EJP is for the works required within the RIIO-ED2 price control period. As such we propose to install 33kV cables and associated onshore OHL, UG cable and substation infrastructure that appropriately reflect the demand and export requirements of the region.

10.1 Delivery Strategy

[redacted]

The supply chain required to deliver the project has been tested through delivery of RIIO-ED1 and RIIO-ED2 projects. [redacted]

To deliver the submarine cable package [redacted] he marine route surveys will be progressed [redacted] to inform the detailed design and to allow earlier route engineering to take place. [redacted]

SHEPD have also been developing a land delivery framework for our large capital delivery programmes.

[redacted]

10.1.1 Project Plan

The submarine cable programme is to survey the proposed marine routes in 2025 and complete the design and engineering following this across 2025 and 2026. On completion of the submarine cable route design, all consent applications will be prepared and applied for in 2026. Procurement of the submarine cable is planned to commence mid to end of 2026 enabling submarine installation in 2027.

[redacted]

The land works will follow a separate timeline with design and consents taking place across 2025 and 2026 with installation works taking place from late 2026 into the end of March 2028 to allow full circuit energisation within the RIIO-ED2 price control period. [redacted]

10.2 Procurement and Contracting Strategy

This section details the procurement and contracting strategy for the Carradale – Port Ellen 1 and 2 project elements, setting out the completed, ongoing, and planned procurement activities, and summarising and explaining the proposed contracting strategy for each.

Several factors are considered in determining an approach that will deliver and achieve the optimum outcome. These include the most efficient form of Work Packages, including considerations of any technical constraints and elements of scope that could potentially drive value from self-delivery where SHEPD assumes responsibility of the principal contract and manage the sub-contractors direct via frameworks that are in place.

There are several complexities associated with the Carradale - Port Ellen 1 and 2 cable project which require consideration in context of the procurement strategy and process:

1) [redacted]

The section highlights the contracting approach undertaken by SHEPD for the Carradale – Port Ellen 1 and 2 installations. It highlights the key activities, completed to date and key activities to be progressed.

It should be noted that SHEPD is required to comply with the Utilities Contract (Scotland) Regulations 2016 and as such a regulated tender process for the works shall be followed.

[redacted]

In the meantime, and to progress the project, [redacted]

[redacted]

10.2.1 Work undertaken in RIIO-ED1 & ED2

[redacted] The final desktop study will be complete in early 2025.

The marine survey which is a significant percentage of the development expenditure has been issued out to tender with the intention to progress marine surveys when the weather and contractor availability allows in summer 2025.

Other ongoing works as part of the development funding include environmental onshore and offshore desktop studies to understand the environmental constraints associated with the project.

10.2.2 Managing and Monitoring Delivery

The project will be managed under SSE's Large Capital Project governance framework. This framework ensures that all large capital investment projects for the SSE Group are governed, developed, approved, and executed in a safe, consistent, sustainable and effective manner.

Delivery of the project will be led by the Lead Project Manager who will manage a project team made up of key disciplines such as Engineering, Consents, Procurement and Commercial, Safety, Environmental and Planning. This project team will be supported by other disciplines such as Quality, Operational Personnel, Risk Management, and others as required.

The dedicated Project Manager will set the project baseline programme at the beginning of the project and monitor progress throughout. Progress will be informed by the project team and by contractors who will submit their programmes to the project planner regularly identifying any delays and changes.

The Project Manager will utilise the following Key Performance Indicators (KPIs) to monitor the status of the project, cost, and outcomes:

1) **Cost Performance Index (CPI):** Compares the actual cost of work performed to the budgeted cost, indicating cost efficiency.
2) **Schedule Performance Index (SPI):** Measures the efficiency of schedule performance by comparing actual progress to planned progress.
3) **Quality Performance:** Tracks adherence to quality standards and identifies defects or rework needed.
4) **Safety Incident Rate:** Measures the frequency of safety incidents or accidents on the construction site.
5) **Resource Utilisation:** Evaluates how effectively labour, equipment, and materials are used.

6) **Customer Satisfaction:** Assesses client satisfaction through feedback and project outcomes.
7) **Change Order Rate:** Tracks the frequency of changes requested during the project and their impact on cost and schedule.
8) **Earned Value (EV):** Compares the value of work completed against the planned value, providing insight into project progress.

10.3 Cost of preferred option

To manage cost there will be procurement, insurance and legal reviews held at each key stage of the project. This will define the contract strategy and ensure that SHEPD agree well defined contracts that both protect SHEPD and manage risks appropriately. Costs will be estimated at each stage of the project and will include tendered costs to achieve accurate estimates. Regular review of expenditure and forecast will be done throughout the project to monitor this and deliver the project within budget.

The estimated total cost for all elements of the preferred solution is [redacted]. This breaks down to a [redacted] during RIIO-ED2 and [redacted] beyond RIIO-ED2.

10.3.1 Regional variations in cost

The implementation of submarine cables in the Port Ann GSP presents unique challenges and cost considerations compared to onshore or underground installations. [redacted]

10.3.2 Ensuring Cost Robustness of Preferred Option

Furthermore, SHEPD has undertaken a comprehensive cost assurance process to ensure the robustness of estimated costs for this EJP. This approach involves various stages of cost validation. [redacted] Through these procedures, SHEPD has developed a robust cost estimate for this EJP.

10.4 Risks and Mitigations

Risk will be managed in accordance with the Large Capital Governance framework to ensure risks are identified, assessed, mitigated and monitored. This is done using a risk management system that the project team uses to capture this process and to review the risks regularly. The risk cost will be determined using Quantitative Cost Risk Analysis to provide a realistic appraisal of the potential value.

10.4.1 Risk and Mitigations

A list of the risks and mitigations are provided below.

1) **Delivery:** The challenges for delivery of the submarine cable include limited vessel availability suitable to install the lengths of submarine cable proposed. [redacted]
    a. **Mitigations:** [redacted]
2) **Remote location:** The Scottish islands have various logistical challenges due to their remote location including but not limited to accessibility, small local supply chain,

marine/environmental/ecological challenges, variable and uncertain weather conditions due to proximity to the Atlantic.

   a. **Mitigations:** [redacted]

3) **Unprecedented cost increase:** Resource constraints have driven up labour costs, while the Ukraine Conflict has disrupted the global supply chain, causing price hikes and material scarcity. Additionally, high oil prices are elevating day rates for installation vessels.
   a. **Mitigations:** [redacted]
4) **Challenging insurance market:** [redacted]
   .
   a. **Mitigations:** [redacted]
5) **Capacity of cable manufacturers:** [redacted]
   a. **Mitigations:** [redacted]

Our rigorous risk assessment process, comprehensive mitigation planning, and strategic allocation of risks enable us to proactively manage potential threats to our delivery.

11 Outlook to 2050

The nature of the Islay and Jura network leads to a need for whole systems thinking ensuring coordination between transmission and distribution to find the optimal solution. With the uncertainty around the level of [redacted]decarbonisation and the generation scenario on the island, the recommended option 2 still provides suitable network capacity up to 2050 with two new 33kV circuits from Carradale GSP, one new circuit from Port Ann – Knocklearach together with reconductoring of the existing Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits. The planned staged approach will ensure we can flex our proposals to meet future load forecasts and change in stakeholder needs.

The currently preferred option ensures we can meet net zero through increased network infrastructure.

12 Conclusion and Recommendation

SHEPD has identified that the best option for the Islay and Jura network will be Option 2 which proposes the following:

- New 33kV circuit from BAT Wind I (Carradale GSP) – Port Ellen.
- New 33kV circuit from BAT Wind III (Carradale GSP) – Port Ellen.
- Auto-close scheme at Port Ellen 33kV.
- New 33kV circuit from Port Ann – Knocklearach.
- Upgraded the existing Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits.
- Install second Jura – Islay circuit and voltage compensation at Knocklearach and Port Ellen substations.

The first two Carradale GSP circuits will be delivered within RIIO-ED2 [redacted]. Following this reinforcement, Bowmore diesel will not be utilised [redacted] due to the adequate capability of the new 33kV circuits. This will significantly reduce emissions from the site.

The new Port Ann – Knocklearach circuit and second Jura – Islay circuit together with voltage compensation at Knocklearach will occur in RIIO-ED3 [redacted].

Beyond RIIO-ED3, there will be a need to reconductor the Lochgilphead – Knocklearach and Bowmore – Knocklearach circuits and install voltage compensation at Port Ellen and Knocklearach [redacted]. Up to 2050, the network will be secure with the above reinforcements in place.

The capital cost of this option will be [redacted] during RIIO-ED2 and [redacted] beyond RIIO-ED2. This option meets all the primary drivers, is the most cost-effective option and provides the region with [redacted] capacity in addition to providing sufficient capacity for demand growth until at least 2050.

In conclusion, SHEPD aims to pursue option 2 ensuring that we continue to provide a resilient network, with sufficient capacity, and lower carbon footprint all whilst ensuring a cost-effective engineering solution.

13 References

The documents detailed in Table 27, Table 28 and Table 29 should be used in conjunction with this document.

Table 27 - Scottish and Southern Electricity Networks Documents

Reference	Title
	HOWSUM-Core Re-opener Narrative

Table 28 – External Documents

Reference	Title
	Technical Report of Port Ann Network Analysis

Table 29 – Miscellaneous Documents

Title
N/A

14 Revision History

Table 30 - Revision history

No	Overview of Amendments	Previous Document	Revision	Authorisation
01				
02				

Appendix A Definitions and Abbreviations

Table 31 – Definitions and Abbreviations

Acronym	Definition
AIS	Air-insulated Switchgear
ASCR	Aluminium Conductor Steel Reinforced
BSP	Bulk Supply Point
CBA	Cost Benefit Analysis
CBRM	Condition Based Risk Management
CEM	Common Evaluation Methodology
CI	Customer Interruptions
CML	Customer Minutes Lost
CNAIM	Common Network Asset Indices Methodology
CT	Consumer Transformation
DEG	Distributed Embedded Generation
DFES	Distribution Future Energy Scenarios
DNO	Distribution Network Operator
EJP	Engineering Justification Paper
EoL	End of Life
ESA	Electricity Supply Area
EV	Electric Vehicle
FCO	First Circuit Outage
FES	Future Energy Scenarios
GIS	Geographic Information System
GM	Ground Mounted
GSP	Grid Supply Point
GT	Grid Transformer
HI	Health Index
HDD	Horizontal Directional Drilling
HOWSUM	Hebrides and Orkney Whole System Uncertainty Mechanism
IDP	Investment Decision Pack
IIS	Interruptions Incentive Scheme
LA	Local Authority
LCT	Low Carbon Technology
LEP	Local Enterprise Partnership
LI	Load Index
LRE	Load Related Expenditure
LW	Leading the Way
MD	Maximum Demand
NPV	Net Present Value

OHL	Overhead Line
PM	Pole Mounted
PMCB	Pole Mounted Circuit Breaker
PV	Photovoltaics
RFI	Request for Information
RIIO-ED2	Current Electricity Distribution Price Control
RIIO-ED3	The next Electricity Distribution Price Control
RIIO-ED3+	Future Electricity Distribution Price Controls
RSN	Relevant Section of Network
SBT	Science Based Targets
SCO	Second Circuit Outage
SHEPD	Scottish Hydro Electric Power Distribution
SSEN	Scottish and Southern Electricity Network
SP	Steady Progression
ST	System Transformation
VfM	Value for Money
TO	Transmission Operator
U/G	Underground
XLPE	Cross-linked Polyethylene