Scottish & Southern Electricity Networks

RIIO ED2 Engineering Justification Paper (EJP)

Tarbert and Stockinish Primary Substations

Worst Served Customer Proposal

Investment Reference No: 384_SHEPD_REGIONAL_WSC_TARBET

Contents

Definitions and Abbreviations

Acronym	Definition
EJP	Engineering Justification Paper
CBA	Cost Benefit Analysis
IDP	Investment Decision Pack
WSC	Worst Served Customer
NoSR	North of Scotland Resilience
SSEN	Scottish and Southern Electricity Network
NRN	Network Reference Number
EHV	Extra High Voltage (33kV)
CBRM	Condition Based Risk Management
MDG	Mobile Diesel Generator
HV	High Voltage
PM	Pole Mounted
CB	Circuit Breaker

1 Executive Summary

This Engineering Justification Paper (EJP) covers the strategic investment required to address the high volume of interruptions on the Tarbet and Stockinish networks. Tarbert primary supplies 1000 customers of which 252 are WSCs. Stockinish primary supplies 447 customers of which 55 are WSCs. Customers at Tarbet and Stockinish have experienced up to 16 interruptions over the three consecutive years between 2017 and 2019 with average interruption length of up to three hours.

Following optioneering and detailed analysis, as set out in this EJP, the proposed scope of works to address the WSC issue at Tarbet and Stockinish are as follows:

- For Tarbet circuits, build 3km of new covered conductor OHL on Isle of Scalpay and small section of OHL at Cluer spur;
- For Stockinish primary, install one new 33kV Grid CB at Harris Grid substation.

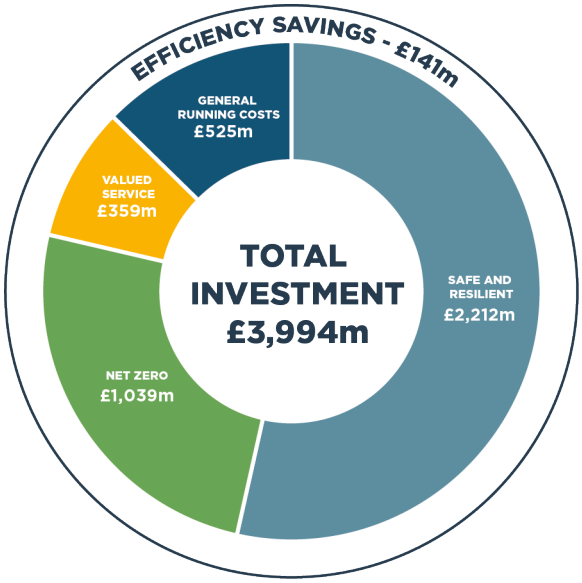
Delivering a safe, resilient and responsive network

The anticipated cost to deliver the proposed solution is £0.99m. Tarbet and Stockinish primaries are in a remote area of Scotland and on average, access to this area can take a significant of time which results in longer fault interruption lengths Due to other WSC schemes having higher network investment priority scores, this scheme is planned for delivery in Year 4 of ED2 period with the refinement phase commencing in the early years of ED2.

The scheme delivers following outputs and benefits:

- Improved network performance for the 307 WSCs at Tarbet and Stockinish by installing a new 33kV Grid CB at Harris Grid, a new 11kV OHLs to split the existing 11kV networks; this is expected to take all 307 WSC out of this classification;
- Improved CI/CML performance as a result of the works with expected volume reductions of 1413 CI and 99560 CMLs in the SHEPD area per year;
- Improves the fault resilience of the Tarbet and Stockinish customers when 33kV and 11kV faults do occur by providing auto change over schemes or potential remote control fault resilience options and alternative network arrangements.

This Non-Load investment sits within the Safe and Resilient Totex.



2 Investment Summary Table

Table 1 below provides a high level summary of the key information relevant to this Engineering Justification Paper (EJP).

Table 1: Investment Summary

Name of Scheme/Programme	Tarbert and Stockinish Substation WSC Proposal					
Primary Investment Driver	North of Scotland Resilience					
Scheme reference/mechanism or category	*384_SHEPD_REGIONAL_WSC_TARBET*					
Output reference/type	As above					
Cost	*Cost for the selected Investment is £0.99m*					
Delivery year	2025/26					
Reporting Table	CV15 North of Scotland Resilience (SHEPD)					
Outputs included in RIIO ED1 Business Plan	**No**					
Spend Apportionment (£m)	**2023**	**2024**	**2025**	**2026**	**2027**	**Total**
	0	0	0	0.99	0	**0.99**

3 Introduction

This EJP provides high-level background information for this proposed WSC scheme explaining the data and analysis undertaken, the existing network arrangement, the proposed works and improvements to the network, the expected outcomes from these works and justifications for the proposals with the Paper.

In order to establish the most economic and efficient solution, the EJP provides an exhaustive list of the options considered through the optioneering process. This is based on the background information and fault data analysis detailed in section 4. Each option is described in detail in section 6, with the EJP setting out the justification for those options which are deemed unviable solutions, and therefore not taken forward to the Option Analysis in section 7.

The Primary Investment Driver described within this EJP is CV15 – North of Scotland Resilience and the proposed investment will improve the Tarbet and Stockinish networks. Post improvement works, due to lower numbers of faults impacting the Tarbet and Stockinish customers, all of the customers will be removed from WSC classification. Tarbet and Stockinish have consistently featured in the WSC list ED1. In year 2019, 307 customers out of total 1447 customers at Tarbet and Stockinish are in the WSC category. These customers experienced high volumes of interruptions, with interruptions of up to 16 over the 3-year period. This clearly is not acceptable to both our customers and ourselves.

4 Background Information and Analysis

4.1 Existing Network

Tarbert and Stockinish substation supplies the south end of the Isle of Harris, Western Isles. Both sites are supplied from Harris Grid 647 302 33kV circuit. Tarbert primary has three 11kV circuit and two of these have WSCs. Stockinish primary has effectively one 11kV circuit which has the WSC (there is a 2nd 11kV circuit out of Stockinish primary, but this is for back up purpose only as the circuit is interconnected with Tarbet 662 034 circuit).

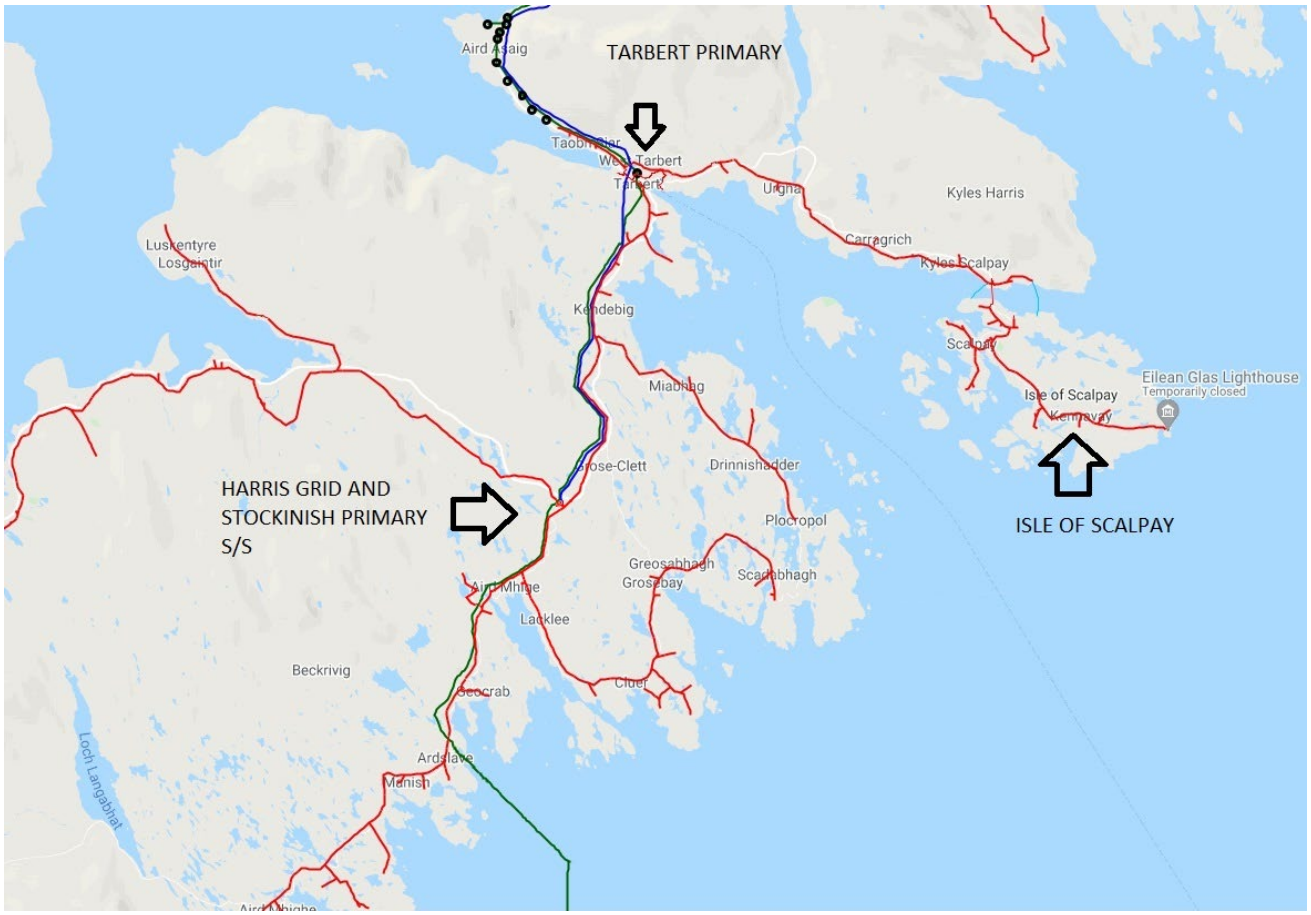


Figure 1: The Harris Grid, Stockinish and Tarbet networks.

The Tarbet and Stockinish 11kV circuits of interest are summarised in the table below. As shown, all three circuits have significant amount of overhead line network supplying the customers.

Table 2: Tarbert and Stockinish WSCs 11kV Circuits

Primary	11kV Circuit	Number of connected customers	Number of PSR customers	Length of OHL (km)	Length of UG cable (km)
Tarbert	**662-031**	437	89	19.87	2.32
Tarbert	**662-034**	384	67	52.28	1.17
Stockinish	**658-011**	447	64	40.41	0.60

4.2 WSC Network Performance

For Tarbert 662 031 11kV circuit, all 243 WSCs are on the Isle of Scalpay. For Tarbert 662 034 11kV circuit, 8 out of the 9 WSCs are on the Collam/Cluer spur. Stockinish 658 011 11kV circuit has 55 WSCs and for all circuits they have experienced interruptions of between 12 and 16 over the three-year period.

The circuits which have experienced interruptions between 12 and 16 interruptions over the three year period as detailed within this paper can be shown listed below with corresponding WSC numbers:

- Tartbet 662 031 11kV Circuit has 243 WSCs on the Isle of Scalpay
- Tarbert 662 034 11kV circuit, 8 out of the 9 WSCs are on the Collam/Cluer spur.
- Stockinish 658 011 11kV circuit has 55 WSCs.

The average interruption length for this circuit is significantly higher than the average SHEPD circuit. This is due to the relative remoteness of the area and the lack/low levels of interconnection. It requires a minimum of 1 hour driving time to reach the Tarbet primary substation from Stornoway depot and approximately an additional 45 mins in good weather to reach the furthest away point of the Stockinish circuit. Personnel, vehicles or equipment required to respond to a damage fault are dispatched from Stornoway depot.

The table below shows the WSC network performance on the 11kV circuit basis (although this also counts 33kV interruptions which impacted the respective 11kV circuit as well). It shows the WSC number and the range of interruptions over the 3-year period from the reporting year 2019/20 against each circuit. As part of the feedback from the stakeholder engagement event, the interruption duration and the customer vulnerability are also considered as key factors in scheme proposal. These are also shown in the table.

Table 3: WSC Network Performance

Primary	**11kV Circuit**	**WSC No.**	**Range of interruption No. over 3-year**	**Average interruption length (mins)**	**Network Investment Priority score (high score = more vulnerable)**
Tarbert	**662-031**	243	12-15	173	4.1
Tarbert	**662-034**	9	13-14	193	3.9
Stockinish	**658-011**	55	15-16	145	3.7

4.3 Fault Data Analysis

The table and figure below show where faults have affected higher customer numbers across the proposed area for investment, there are other lower customer number faults that have occurred during the identified WSC time period which have not been listed.

Table 4: Fault Data Analysis

Date	Fault Description	No. Customers Impacted
2017	Tarbert 031 11kV fault: Safety Restriction, Deliberate Disconnection due to fire	239
2017	Tarbert 031 11kV fault: Deterioration, Faulted PMT	243
2017	Tarbert 031 11kV fault: Wind and Gale, Pole leaning - new stays installed	191
2018	Tarbert 031 11kV fault: Safety Restriction, Broken LV earthwire for PMT	40

2018	Tarbert 031 11kV fault: Deterioration, Broken OHL stay	304
2017	Harris 302 33kV fault: Deterioration, Burnt pole due to broken OHL tapping, (all of Harris Grid 33kV connected customers affected)	1545
2018	Harris 302 33kV fault: Deterioration, Regulator bushing failure, (all of Harris Grid 33kV connected customers affected)	1561
2018	Harris 302 33kV fault: Wind and Gale, Faulted fuse units	144
2018	Ardmore 301/132kV fault: Affected by National Grid, OHL tower failure on Skye	28864
2018	Harris 302 33kV fault: Unknown fault, Harris Grid Regulator failure, (all of Harris Grid 33kV connected customers affected)	1564
2019	Harris 302 33kV fault: Lightning, Harris Grid CB lockout due to Lightning, (all of Harris Grid 33kV connected customers affected)	1568
2019	Ardmore 301/132kV fault: Affected by National Grid, Lightning strike on 132kV caused 33kV Grid CBs lockouts	13638
2017	Stockinish 011 11kV fault: Deterioration, Broken OHL insulator	279
2017	Stockinish 011 11kV fault: Deterioration, PMT failure	279
2018	Stockinish 011 11kV fault: Birds, Bird Strike caused broken OHL conductors	279
2019	Stockinish 011 11kV fault: Wind and Gale, Broken OHL conductors	352

The 33kV and 11kV faults have been a contributory factor to the WSC performance at Tarbert and Stockinish during the 2017 and 2019 period. Dependent on the primary substation being assessed, this determines whether 11kV or 33kV investment is the preferred option. As the overall fault numbers are not significantly over the threshold for WSC classification then it is likely that proposals that will mitigate either 11kV or 33kV potential faults would achieve the required improvement to network performance.

For Stockinish Primary, due to its proximity to Harris Grid substation, a 33kV option has superior economic and technical viability than an 11kV option and therefore 11kV proposals for Stockinish have not been developed further.

Tarbet 662 031 11kV faults, a number of 11kV faults have occurred on the Isle of Scalpay and this is where all of the WSC for this circuit are located or on the immediate other side of road bridge to the island. As Tarbet primary is approximately 7km from Harris Grid and the 33kV circuit continues up to Stornoway Grid, this makes a 33kV option economically and technically unviable as compared to an 11kV proposal.

The Tarbet 662 034 11kV faults have not been shown or listed above as the investment proposal to resolve the WSC on this circuit is focused in a small area of the circuit which is detailed in section 6.

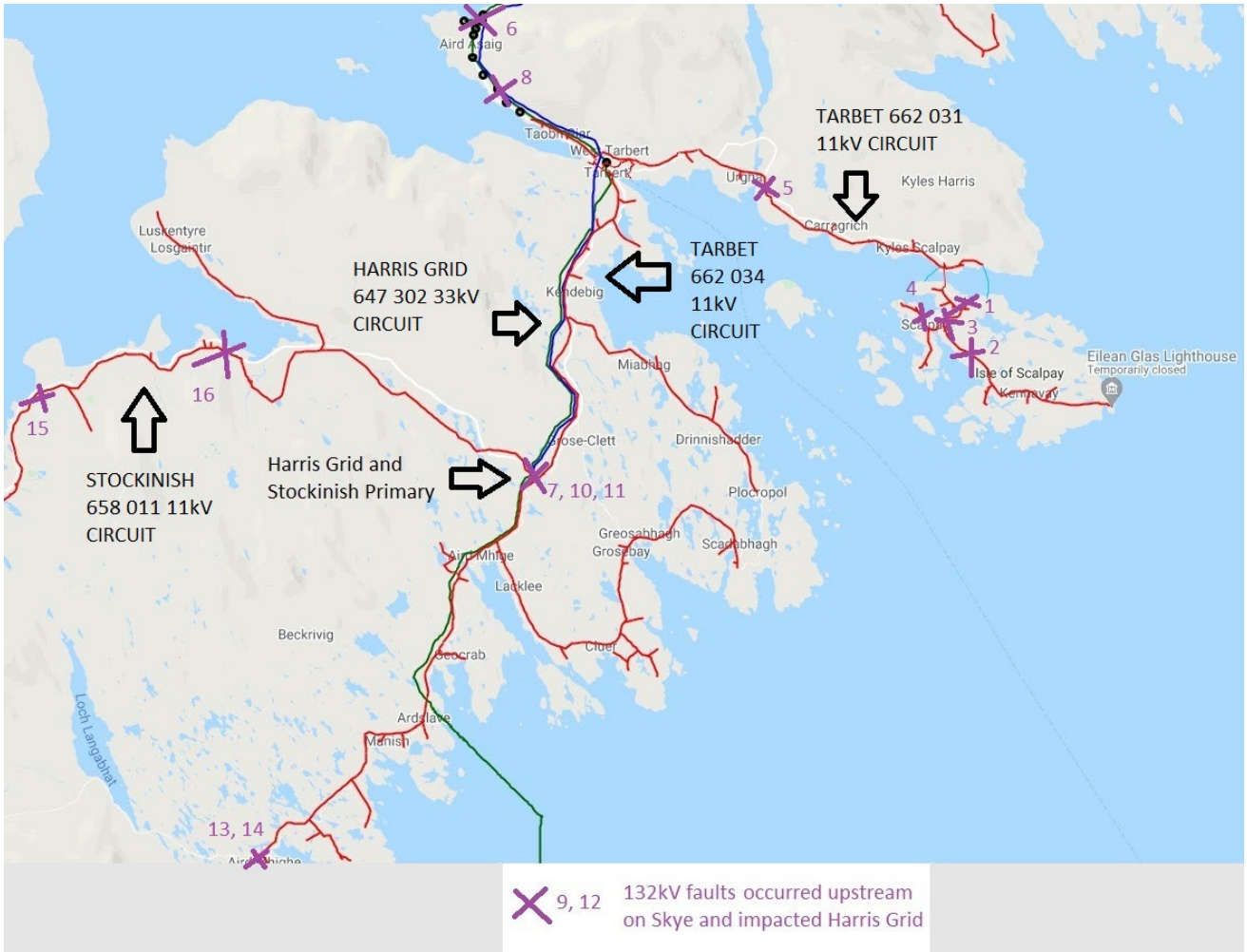


Figure 2: Location of faults affecting Stockinish and Tarbet customers

5 Optioneering

This section of the report sets out the investment options that are considered when resolving the WSC issues. As described below a holistic approach is taken to ensure investment options which are both least regrets and represents best value for money for network customers are identified.

5.1 Summary of Options

Table below provides a high-level summary of the 5 investment options under consideration along with the advantages and disadvantages associated with each. A more detailed description of each option is then provided within the proceeding sub-sections.

Table 5: Summary of WSC Investment Options

Option	Description	Advantages	Disadvantages	Result
1. Do Nothing (Baseline)	No upfront action taken to improve the network performance.	No additional cost	WSCs will continue experiencing high number of interruptions.	Rejected

	Maintenance and Inspection activities continue as normal.			
2. Enhanced Maintenance and/or Inspection (Refurbishment)	Enhanced inspection and maintenance to improve asset condition or slow the rate of ageing.	Cost effective over short time period No large upfront CAPEX	Additional maintenance resource required Significant proportion of customers remain as WSCs Increase in OPEX	Taken forward to further assessment.
3. Re-build existing lines (Replacement)	Rebuilding the existing network where the WSCs are to reduce the probability of failure on components.	Improve the network performance over short term No further maintenance or inspection required	Increase in CAPEX Lower utilisation of existing assets WSCs will fall back in this category over short period of time. No new fault resilience added	Taken forward to further assessment.
4. Reinforcing existing network (Reinforcement)	Installation of additional assets to mitigate the risk of interruptions due to circuit supply arrangements	WSCs unlikely to return to this category as new fault resilience added Long term investment Wider benefits to network users including Net Zero targets	Often costly when compared with other options Longer delivery time due to the likely requirement of additional consent	Taken forward to further assessment/preferred option.
5. Flexible solutions	Use battery storage or other alternative mean to support the network and mitigate interruptions	Reduced requirement of reinforcing the network Competitive cost comparing to the reinforcement option	Technology and mechanism is yet to be proven Limited sites that can utilise such arrangement to improve WSC performance	Option rejected.

6 Analysis and Cost

6.1 Option 1: Do Nothing

Estimated Cost: £0k

This group of customers associated to the circuits as detailed within this paper are supplied by remote 11kV network which has consistently demonstrated that its performance is within WSC classification. Without any intervention, the WSCs will experience similar or higher level of 11kV and 33kV interruptions into ED2 and beyond. Therefore, this option is not considered viable.

6.2 Option 2: Enhanced Maintenance and/or Inspection (Refurbishment)

Estimated Cost: £122k

The second options will look to employing enhanced maintenance on both the Tarbet and Stockinish circuits. The maintenance will target the assets that have poor health condition scores and the sections of network that have been highlighted through refurbishment plots (Faults and D poles).This is likely to improve the network performance for a small portion of the WSCs. However, given that are a number of faults are due to external factors, such as wind and gale, birds and transient events, then this option will not resolve these potential faults. It is likely that significant number of customers would remain as WSCs as no fault resilience is added to the circuit in the form of circuit interconnection or splitting the circuit.

Due to the lack of significant network improvement, the Brae customers could experience WSC equivalent performance during the full ED2 period. Taking account of the anticipated post works deterioration in network performance, the likely outcome is that the Option 2 refurbishment in ED2 would have to be followed by the Option 4 reinforcement in ED3.

6.3 Option 3: Re-build existing lines (Replacement)

Estimated Cost: £414k

Under this option, it is considered that the worst performing sections of the network are re-built and this will include approximately [redacted] of the 11kV network on Scalpay island, [redacted] of the Cluer spur on feeder 034 and [redacted] of the Stockinish circuit between Leverburgh and Gatehouse Rodil spurs.

As a result of the proposed works, it is expected that the network performance will result in reasonable improvements however the network performance would deteriorate over time for the Tarbet and Stockinish circuits. It is likely that significant number of customers would remain as WSCs as no fault resilience is added to the circuit in the form of circuit interconnection or splitting the circuit and so the Tarbet and Stockinish circuits would remain exposed to faults arising from external factors.

During the proposed Option 3 works, it is likely that the proposals would be built as an 'online' build which requires circuit outages that would impact the respective WSC and potentially wider area customers. Also, it would lead to an increase in diesel usage and CO_2 emissions due to usage of mobile generation to ensure customers were not off supply for excessive periods of time during the works.

It is assumed that 20 years post carrying out the Option 3 works, due to deteriorating performance of the circuit, that the bulk of the Option 4 reinforcement proposal would have to be implemented at that point in the future.

6.4 Option 4: Reinforcing existing network (Reinforcement)

Estimated Cost: £823k

For the Tarbet 662 031 11kV circuit, it is proposed to build a new 3km new covered conductor OHL between pole 106 and 140 and reconfigure the 11kV network on the Isle of Scalpay with additional provision new PMCB and normal open point (NOP) as indicated in drawing below. This would enable the 11kV radial section on the Isle of Scalpay to be split this into 2 separate sections as part of normal network operation.

The proposed option will help reduce the number of individual 11kV faults on the Isle of Scalpay which impacts all customers on the island as it splits the network into two different 11kV sections, this will limit the impact of any 11kV fault in any one section. This therefore reduces the total number of faults experienced per year by the customers and provides new options for backfeed arrangements, including possible remote-control recovery options.

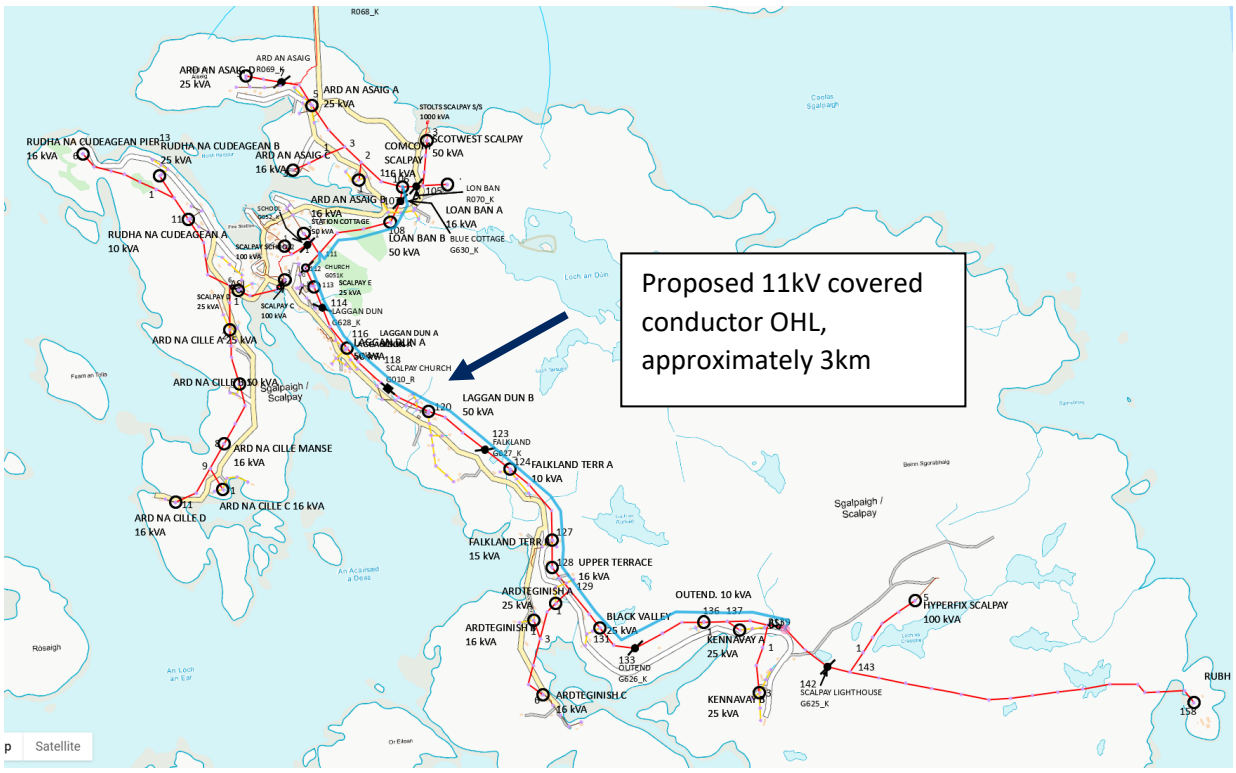


Figure 3: Proposed Option 4 works for Tarbert 662 031 11kV circuit

As outlined previously, a 33kV option is the preferred solution for Stockinish primary substation. The proposed option will involve the installation of a new indoor 33kV CB at Harris Grid substation and a short section of 33kV cable. This will be routed to Stockinish primary substation and take the place of the existing 33kV spur cable from the nearby pole 1 which will be abandoned.

This ensures that 33kV faults which occur on the existing Harris Grid 647 302 33kV circuit (which will continue to supply Tarbet Primary) will no longer impact Stockinish primary and therefore reduce the overall number of interruptions experienced by all of the Stockinish customers.

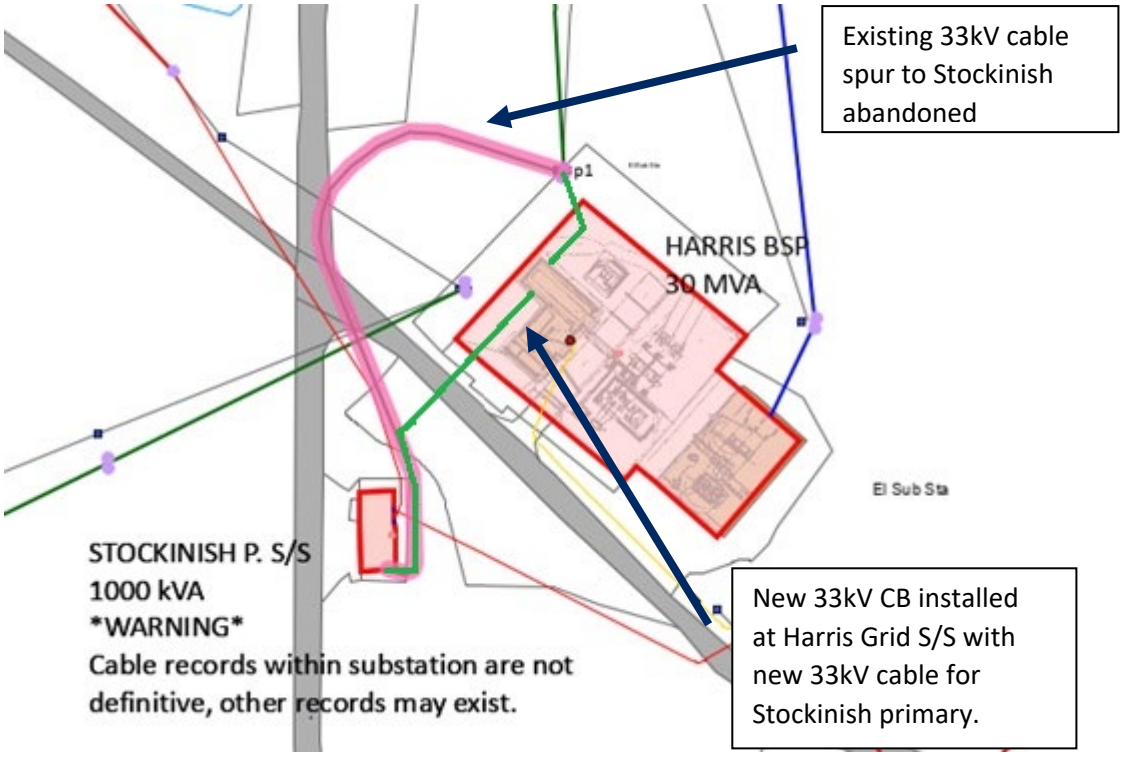


Figure 4: Proposed Option 4 works for Stockinish Primary

For Tarbet 662 034 11kV circuit, it is proposed to install approximately 2km of 11kV overhead line to connect Scadabay and Plockrapool spurs as shown in Figure 5. This will bring significant improvement to the WSCs on these spurs. It is also proposed to install approximately 200m new OHL to connection pole 5 to the main line pole 44. This new line will supply Cluer B, Cluer C and Cluer D with ASLs as shown in figure 6. A new NOP should be created by installing a new switch at pole 1.

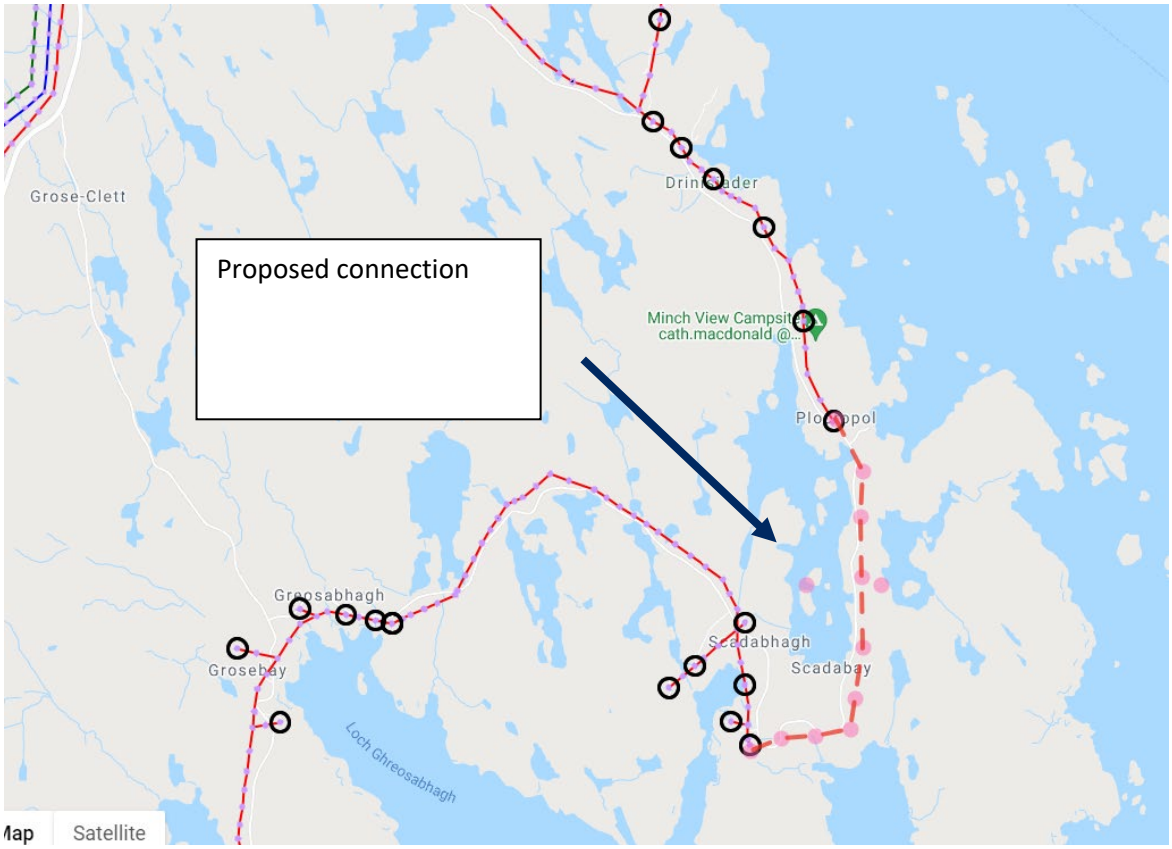


Figure 5: Proposed connection between Scadabay and Plockrapool

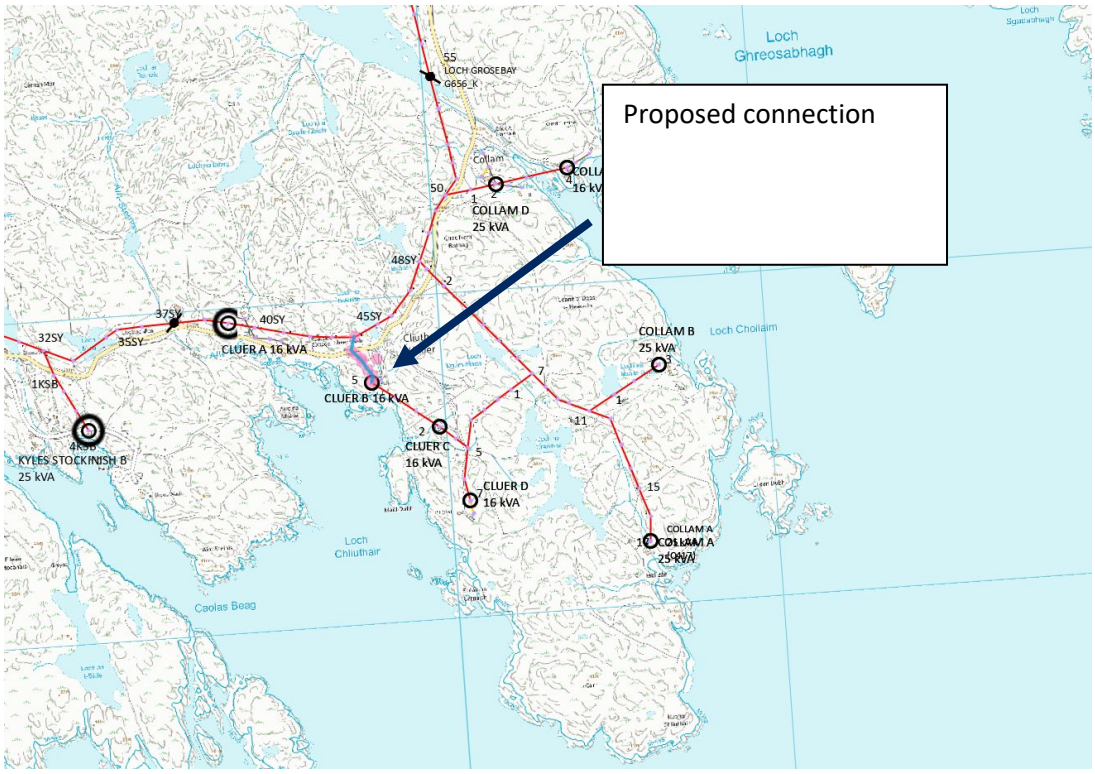


Figure 6: Proposed Option 4 works for Tarbert 662 034 11kV circuit

During the proposed Option 4 works, as the proposal is to build new infrastructure, the majority of new equipment can be constructed as 'offline' build. This would minimise the requirement for circuit outages that would impact the respective WSC and potentially wider area customers. As there would be less requirement for outages, this would result in lower amounts of diesel usage and CO_2 emissions due to usage of mobile generation as compared to Option 3.

Therefore, taking account of these factors, this is the preferred option.

6.5 Option 5: Flexible Solution

Estimated Cost: £397k

Flexible services could be used to support some of the remote substations in the 11kV fault scenario. The flexible solution needs to be made available throughout the year and be able to support the network over the period to allow the restoration. This period can be up to 2 hours based on the fault history.

The estimated cost is based on the energy storage service to support 0.5MW load at each location at Tarbert and 1MW load at Stockinish with maximum utilisation of 30 days per annum starting from year 4 in ED2. The details costing is attached in appendix 4. The technology is still unproven for a solution that can support the network of this size for this duration. Due to the nature of the 11kV faults and the network, there will also be the challenge in identifying the best location for this service in the network. Under this option, it is unlikely to improve the performance for all WSCs. Therefore, this option is not considered viable.

7 Option Analysis

This section of the report provides an overview of the CI/CML results and analysis for each option. It provides an overall comparative review and analysis of the options, confirmation of the EJP preferred option and the associated justifications. The figures presented below represent the expected percentage improvement of the Ofgem CI & CML methodology ratio figures for SHEPD area per year and the expected actual volume reductions of CI and CMLs in the SHEPD area per year. Due to the small investment and number of WSC involved for Tarbet 662 034, then CI/CMLs have not been considered for this circuit.

7.1 CI/CML Analysis of refurbishing the existing line (Option 2)

It is expected that following Customer Interruption (CI) and Customer Minutes Lost (CML) improvements will be achieved under this option. These figures are too low to improve the number of WSC and will make no discernible impact on the quality of supply and network performance. The assumption is that these benefits will diminish over a period of five years, by when the reinforcement option would be necessary to address the WSC issue.

Table 6: CI/CML Analysis for Option 2

	CI Improvement % (Actual Volume)	CML Improvement % (Actual volume)
Tarbet 662 031	0.002 (26)	0.004 (3097)
Stockinish 658 011	0.004 (51)	0.005 (4042)
Total	0.006 (77)	0.009 (7139)

7.2 CI/CML Analysis of re-building of the existing line (Option 3)

It is expected that the CI & CML improvements for the re-build option would be higher than the refurbishment option but are remain low CI & CML values due to the same network arrangement being retained. The assumption is that these benefits will diminish over a period of twenty years and at this future point the reinforcement option would be necessary to address the WSC issue.

Table 7: CI/CML Analysis for Option 3

	CI Improvement % (Actual Volume)	CML Improvement % (Actual volume)
Tarbet 662 031	0.01 (92)	0.003 (2144)
Stockinish 658 011	0.012 (142)	0.016 (12754)
Total	0.022 (234)	0.019 (14718)

7.3 CI/CML Analysis of reinforcement of the network (Option 4)

The expected CI and CML improvements based on this option is as shown in the table below. The table shows a significant improvement for CI/CML and network performance relative to the customer numbers involved and this will remove all Brae customers from WSC classification.

Table 8: CI/CML Analysis for Option 4

	CI Improvement % (Actual Volume)	CML Improvement % (Actual volume)
Tarbet 662 031	0.028 (223)	0.025 (20065)
Stockinish 658 011	0.149 (1190)	0.099 (79495)
Total	0.177 (1413)	0.124 (99560)

From the above tables, it is evident that the CI/CML improvement from the reinforcement option is significantly higher than the other proposed options. This confirms the case that Option 4 is the most preferable option as it delivers the required level of improvement to the network and will permanently remove those customers from WSC classification.

7.4 Summary of Cost

Table 9: Summary of Cost

Options	Unit	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Option 1 – Do Minimum	£m	0	0	0	0	0	0
Option 2 – Enhanced Maintenance and Inspection	£m	0	0	0	0.12	0	0.12
Option 3 – Asset Replacement	£m	0	0	0	0.41	0	0.41
Option 4 – Reinforcement	£m	0	0	0	0.99	0	0.99
Option 5 – Flexible Solution	£m	0	0	0	0.20	0.20	0.40

Our RIIO ED2 Business Plan costs are derived from our outturn RIIO ED1 expenditure. We have modified costs per activity, capturing and reporting those adjustments in our cost-book. By tying our costs back to reported, outturn, real life data this approach provides multiple data points on which both the Regulator and we can benchmark cost efficiency.

It provides a high level of cost confidence in our Business Plan cost forecast for RIIO ED2. Through our benchmarking analysis, we recognised that not all Non-Load related RIIO-ED1 actual unit costs sit within the upper quartile efficiency band. Where this is the case, we have applied a catch-up efficiency to those cost categories.

Further detail on our unit cost approach, cost efficiency and cost confidence for RIIO-ED2 can be found within our ***Cost Efficiency (Annex 15.1).*** Following our draft Business Plan, we have continued to develop project volumes and costs, utilising valuable stakeholder feedback. We have included developments of our Commercial Strategy within the updated project scope and delivery strategy.

7.5 Cost Benefit Analysis comparisons

As outlined in the EJP, due the remoteness of the Tarbet and Stockinish area at the south of the Isle of Harris, this significantly lengthens the fault interruption duration experienced by the customers because the travel time to reach the area. Therefore, any enhancements which can improve fault resilience of the affected circuits will be of significant benefit.

The discussion above demonstrate that the reinforcement option is the preferred option as the other options are either rejected as non-viable, or have no improvement in the recovery of the CI/CML performance. As Options 2 and 3 do not introduce any new fault resilience to the Tarbet and Stockinish circuits; they only deliver marginal improvement in CI/CML and network performance; which will deteriorate in future years and therefore they cannot be chosen as the preferred option.

The preferred option allows the customers to benefit from investment in ED2 and improved CI/CML and network performance. Both Option 2 and Option 3 are envisaged to incorporate the works in Option 4 with reinforcement in the future years to achieve the improved performance delivered by Option 4.

As such, it is understood that delaying the investment does not provide the best value for money solution, reinforcing the case for Option 4.

7.6 Volume on Preferred Option

Table 10: Volume of Preferred Option

Asset Category	Unit	2023/24	2024/25	2025/26	2026/27	2027/28	Total
11kV OHL (Covered Conductor)	Km	0	0	0	6.2	0	6.2
11kV Poles	#	0	0	0	89	0	89
11kV CB (PM)	#	0	0	0	3	0	3
11kV Switch (PM)	#	0	0	0	3	0	3
33kV UG Cable (Non Pressurised)	Km	0	0	0	1	0	1
33kV CB (Gas Insulated Busbars)(ID)(GM)	#	0	0	0	1	0	1
11kV Pole Refurbishment	#	0	0	0	155	0	155

8 Validate investment plans and benefits with Stakeholders

This section of the EJP describes the stakeholder engagement strategy that has been implemented to inform SSEN's RIIO-ED2 submissions. This includes the engagement activities that have been undertaken, the stakeholder groups that have been approached, and the feedback that has been gathered from this stakeholder engagement.

The intention of this exercise was to identify the appetite from our stakeholders for SSEN in carry out the investment described within this document during RIIO-ED2 to improve the condition of SSEN's network assets and the quality of supply for customers in during ED2 and beyond.

We conducted audience research with stakeholders via online workshops/open forums to co-create our strategies and priorities in RIIO-ED2 for improving the network for WSCs. Following insights were derived:

- Stakeholders suggested that, based on the remote location of some Scottish islands, investment for the WSCs there should be a priority, as it will potentially take far longer to restore power there compared to mainland areas.
- There was no consensus on whether investment in worst-served circuits should be prioritized according to: number of WSCs; number of interruptions; level of customer vulnerability; or potential of low carbon technology (LCT) take-up.
- Stakeholders, however, expressed concern about the impact of power cuts on customers in vulnerable situations, and on this basis focusing investment efforts on reducing the number of worst-served vulnerable customers was supported.
- The interruption duration which is currently not considered in Ofgem's WSC definition is recognized as an important factor by our stakeholders.
- Stakeholders suggested that an annual WSC report would be welcome and raise the profile of the issue but might give the incorrect impression that these are the areas where there will be investment.
- Some stakeholders were concerned about the impact of worst-served circuits on generation as well as supply customers.

The lack of consensus on stakeholders on how to prioritise worst-served areas for improvement clearly suggests that being worst-served is a substantial detriment to all such customers, albeit playing out in different ways and therefore remedying these is extremely important. Therefore, we are committing to remove at least 75% of customers from this list in ED2; this ambitious proportion represents all circuits where cost benefit analysis warrants investment; the remaining 25% of WSCs are distributed over so many circuits that the benefit derived from each circuit investment would be limited to very few customers.

We will also ensure that we communicate effectively during power outages, particularly for remote communities where electricity is heavily relied upon, promote the PSR and the 105-power outage number, and produce an annual WSC report to be shared with wider stakeholders to embed resilience partnerships.

Based on the stakeholder feedback, the average Customer Minutes Lost (CML), Priority Service Register (PSR) and the vulnerability score from the Customer Mapping Tool are also factored in the scheme consideration.

9 Deliverability and Risk

Between our draft and final Business Plans we have carried out a more detailed deliverability assessment of our overall plan as a package and its component investments. Using our draft Business Plan investment and phasing as a baseline we have followed our deliverability assessment methodology. We have assessed any potential delivery constraints to our plan based on:

- In-house workforce capacity and skills constraints based on our planned recruitment and training profile and planned sourcing mix as well as the efficiencies we have built into our Business Plan (detailed in our ***Ensuring Deliverability and a Resilient Workforce (Chapter 16)*** and ***Cost Efficiency (Chapter 15)***
- Assessment of the specific lead and delivery timelines for the asset classes in our planned schemes
- We have evaluated our sourcing mix where there were known delivery constraints to assess opportunities to alleviate any constraints through outsourcing
- We have engaged our supply chain (detailed in our ***Supply Chain (Annex 16.2)***) to explore how the supply chain could support us to efficiently deliver greater volumes of work and how we could implement a range of alternative contracting strategies to deliver this
- We have also engaged with the supply chain on the delivery of work volumes that sit within Uncertainty Mechanisms to ensure we have plans in place to deliver this work if and when the need arises
- We have assessed the synergies between our planned load, non-load and environmental investments to most efficiently plan the scheduling of work and minimise disruption to consumers
- Based on our assessment of delivery constraints and potential solutions to resolve them, we have revised our investment phasing accordingly to ensure our Business Plan is deliverable, meets our consumers' needs and is most cost efficient for our consumers

Scottish National Heritage and Scottish Environment Protection Agency may object to OHL circuits or elements of them and request undergrounding of sections of the OHL proposed routes or impose various conditions related to archaeological or environmental or ecological requirements to carry out the works.

It is also assumed at Harris Grid there is space and it is technically feasible to extend the existing 33kV switchboard for the new 33kV CB panel to feed Stockinish. This would need to be studied and confirmed in the refinement phase.

10 Conclusion

The purpose of this Engineering Justification Paper (EJP) has been to describe the overarching investment strategy that SSEN intends to take during RIIO ED2 for the NoSR related investment in Tarbert and Stockinish substation.

Five investment options have been described which could be carried out to address the WSC issue at these sites. As detailed within Section 7, a holistic approach is taken when selecting the most viable option for each investment, where the primary and secondary investment drivers are assessed together within the Option Analysis and Assessment section. This includes careful consideration of the financial, safety, and environmental implications of each investment option.

- Option 1: Do Minimum
- Option 2: Enhanced Maintenance and Inspections
- Option 3: Asset Replacement
- Option 4: Asset Reinforcement
- Option 5: Flexible Solution

A thorough stakeholder engagement exercise was undertaken to gather feedback on each of these strategies to determine which approach should be proposed within SSEN's RIIO ED2 business plans.

As a result, the following costs and volumes are proposed for delivery during RIIO ED2. The preferred investment for Tarbert and Stockinish substation in RIIO ED2 is Option 4: Reinforcement.

Table 11: Summary of CV Table

CV Table	Unit	2023	2024	2025	2026	2027	Total
CV15 North of Scotland Resilience **RIIO ED2 Spend**	£m	0	0	0	0.99	0	0.99

11 Appendix 1 List of Indicators of Vulnerable Characteristics and Weighting System

These indicators are applied when producing combined indexes of vulnerability.

Indicator of vulnerable characteristic	Network investment priority: score (high score = more vulnerable)
Under 5 years	0.5
Under 16 years	0
Over 65 years	0.1
Over 75 years	0.4
Over 85 years	0.6
Fuel poverty levels (Scotland; 1=low, 4=v.high)	0
Fuel poor households (England)	0
Dwellings without a mains gas connection	0
Dwellings without central heating system	0
Dwellings rated in EPC bands EFG	0
Households with no car	0
Combined distances to services (Score; high=most remote)	0
Children in low income households	1
People with low qualifications	0
People in low income employment	1
Long-term unemployment	1
Disability benefits	1
Child disability benefits	1
Mental health benefits	1
Universal credit claimants	0
People in bad or very bad health	0.5
People whose health condition limits activities a lot	0.5
Access to health services (Score; 0=best access, 100=worst access)	0
People providing over 20hrs/week of care	0.5
Number of residential care homes	0
Number of care home beds	0
Households in privated rented dwellings	1
Lone parents	1
Ethnic minorities	1
Unable to speak English well or at all	0
Lone pensioners	1

12 Appendix 2: Relevant Policy, Standards, and Operational Restrictions

TG-NET-NPL-012.pdf

13 Appendix 4. Assumptions for Flexible Solutions Costing

Tarbert 031

Contract Year	Availability Price – CMZ Secure (£/MW/Day)	Capacity offered (MW)	Potential Days Required	Maximum Total Availability price paid	Utilisation Price – CMZ Secure (£/MWh)	Maximum Potential Energy Required (MWh)for 30 days per annum	Total Utilisation Cost (£) per annum	Yearly total	
Year 1	[redacted]	0.5	365		[redacted]	360			
Year 2	[redacted]	0.5	365		[redacted]	360			
Year 3	[redacted]	0.5	365		[redacted]	360			
Year 4	[redacted]	0.5	365	[redacted]	[redacted]	360	[redacted]	[redacted]	[redacted]
Year 4	[redacted]	0.5	365	[redacted]	[redacted]	360	[redacted]	[redacted]	

Tarbert 034

Contract Year	Availability Price – CMZ Secure (£/MW/Day)	Capacity offered (MW)	Potential Days Required	Maximum Total Availability price paid	Utilisation Price – CMZ Secure (£/MWh)	Maximum Potential Energy Required (MWh)for 30 days per annum	Total Utilisation Cost (£) per annum	Yearly total	
Year 1	[redacted]	0.5	365		[redacted]	360			
Year 2	[redacted]	0.5	365		[redacted]	360			
Year 3	[redacted]	0.5	365		[redacted]	360			
Year 4	[redacted]	0.5	365	[redacted]	[redacted]	360	[redacted]	[redacted]	[redacted]

	Year 4	[redacted]	0.5	365	[redacted]	[redacted]	360	[redacted]	[redacted]	

Stockinish

Contract Year	Availability Price – CMZ Secure (£/MW/Day)	Capacity offered (MW)	Potential Days Required	Maximum Total Availability price paid	Utilisation Price – CMZ Secure (£/MWh)	Maximum Potential Energy Required (MWh)for 30 days per annum	Total Utilisation Cost (£) per annum	Yearly total	
Year 1	[redacted]	1	365		[redacted]	720			
Year 2	[redacted]	1	365		[redacted]	720			
Year 3	[redacted]	1	365		[redacted]	720			
Year 4	[redacted]	1	365	[redacted]	[redacted]	720	[redacted]	[redacted]	[redacted]
Year 4	[redacted]	1	365	[redacted]	[redacted]	720	[redacted]	[redacted]	

[redacted]