Scottish & Southern Electricity Networks

RIIO ED2 Engineering Justification Paper (EJP)

Jura – Islay – Asset Replacement

Investment Reference No: 441_SHEPD_SUBSEA_JURA_ISLAY

Scottish & Southern Electricity Networks

Contents

Definitions and Abbreviations

Acronym	Definition
EJP	Engineering Justification Paper
CBA	Cost Benefit Analysis
CBRM	Condition Based Risk Management
IDP	Investment Decision Pack
EfW	Energy from Waste
ESA	Electricity Supply Area
EV	Electric Vehicle
FES	Future Energy Scenarios
GIS	Geographic Information System
GW	Gigawatt
kW(h)	kilowatt (hour)
MW	Megawatt
OHL	Overhead Line
PEV	Pure Electric Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
PV	Photovoltaics
BSP	Bulk Supply Point
GSP	Grid Supply Point
LRE	Load Related Expenditure
LCT	Low Carbon Technology
SSEN	Scottish and Southern Electricity Network
UG	Underground Cable
HDD	Horizontal Directional Drilling

1 Executive Summary

This Engineering Justification Paper (EJP) for Scottish Hydro Electric Power Distribution (SHEPD) covers the asset replacement investment required to manage the Jura - Islay 33kV subsea cable.

A number of subsea cable circuits have failed during RIIO-ED1, causing significant impact on customer interruptions, constrained generation, and have resulted in impact costs for temporary generation and CO2 emissions. There has been a review of the approach taken to attempt to identify and pre-empt the impact of subsea cable failure by using a 'monetised risk-based approach' alongside a traditional CBRM approach, which was not viewed as identifying the critical circuits for the strategic programme effectively on its own.

Delivering a safe, resilient and responsive network

Following optioneering and detailed analysis, as set out in this paper, the proposed scope of works for the Jura – Islay circuit are as follows:

- Replace the existing cable with an HDD solution.

The estimated cost to deliver the preferred solution is £[redacted] m. The delivery programme for all subsea cables in ED2 will be determined through detailed planning and engagement with marine installation contractors and cable procurement opportunities. For simplicity, where required, the delivery year is assumed as 2025/26 in this EJP and this will be refined as our programme develops.

This scheme delivers the following outputs and benefits:

- Enhanced security of supply, with a cable installed out with the marine environment. Removing a cable from a hostile marine route with low life expectancy.
- Improves reliability, reducing potential of customer interruptions.
- Reduces the risk of incurring impact costs, including costs for constrained generation, temporary generation and CO_2 impacts.
- Reduces the monetised risk forecast by the end of ED2 to be £1,942,774 with no intervention, to £63,452 following intervention.

All subsea cable EJPs should be read in conjunction with the ***Scottish Islands (Annex 8.1)*** of our RIIO-ED2 Business Plan.

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

<table>
<tr><td>Name of Programme</td><td colspan="3">Jura - Islay Asset Replacement</td></tr>
<tr><td>Primary Investment Driver</td><td colspan="3">The Primary Investment Driver described within this EJP is the requirement to reduce the overall monetised risk associated with the loss of the existing subsea cable.</td></tr>
<tr><td>Investment reference/mechanism or category</td><td colspan="3">Cost Benefit Analysis:
441_SHEPD_SUBSEA_JURA_ISLAY</td></tr>
<tr><td>Output reference/type</td><td colspan="3">As above</td></tr>
<tr><td>Cost (£m)</td><td colspan="3">£[redacted]</td></tr>
<tr><td>Delivery year</td><td colspan="3">ED2 (2025/26)</td></tr>
<tr><td>Reporting Table</td><td colspan="3">CV7 Asset Replacement</td></tr>
<tr><td>Outputs included in RIIO ED1 Business Plan</td><td colspan="3">No</td></tr>
<tr><td rowspan="2">CV7 Asset Replacement RIIO ED2 Spend (£m)</td><td>Asset Category</td><td>ED2 (£m)</td><td>Total (£m)</td></tr>
<tr><td>HV Subsea Cable</td><td>[redacted]</td><td>[redacted]</td></tr>
</table>

3 Introduction

This Engineering Justification Paper (EJP) for Scottish Hydro Electric Power Distribution (SHEPD) covers the investment required to manage the performance of the Jura - Islay 33kV subsea cable.

The Jura - Islay 33kV subsea cable provides supplies to 2,785 customers. In the event of a subsea cable fault, all customer supplies are restored from Bowmore Diesel Power Station.

The monetised risk value for the Jura - Islay 33kV subsea cable is currently £349,771 and without intervention may increase to £1,942,774 at the end of ED2. If there were a failure on the subsea cable a large number of customers would lose their supply and diesel generation from Bowmore Power Station would require to be implemented in order to restore supplies. This would incur an impact cost totalling £5,566,049. Therefore, this subsea cable has been identified for pre-emptive investment to mitigate this risk. This EJP evaluates the appropriate options to provide the required mitigation.

The Primary Investment Driver described within this EJP is based on reducing the overall monetised risk associated with this circuit which has been determined from the “Strategic Subsea Cable CBA Model” developed to determine the overall replacement / augmentaiton strategy for all subsea cables by mitigating the monetised risk associated with the subsea cable assets. The model evaluates the probabilty of failure, the cost of intervention and the impact cost and used this assesment across the asset population to determine the initial investment method to be considered. Further detail on the Strategic Subsea Cable CBA Model is provided in the ***Scottish Islands (Annex 8.1).***

Section 4 provides high-level background information for this subsea asset category and explains the importance of this asset for our electricity distribution network and our network customers, and the motivation for ensuring our subsea cables are in good health over the course of RIIO-ED2 and beyond.

Sections 5 and 6 provide a summary of the corresponding intervention options which can be deployed as a solution to these condition related investment drivers.

Section 7 provides a detailed analysis then describes the cost and volumes arising from the preferred intervention options as supported by the Cost Benefit Analysis (CBA) results which complements this EJP.

Section 8 provides an overview of the deliverability and risk management considerations being adopted for the transition from RIIO-ED1 in to RIIO-ED2, and the delivery of subsea cable asset replacement projects.

Section 9 provides an overview of the information presented throughout the EJP and concludes a proposed solution recommended to manage the business case presented.

4 Background Information and Analysis

4.1 How Do We Determine Our Intervention Priorities

introduced our Condition Based Risk Management (CBRM) system in 2014 following the RIIO-ED1 Business Plan submission. However, since August 2017, we switched over fully to maximise utilisation of the Common Network Assets Indices Methodology (CNAIM) modelling for all asset classifications applicable for the RIIO-ED1 requirements with the data inputs outlined in the Information Gathering Plan (IGP).

The RIIO-ED2 Business Plan submission has been based on the latest version of the industry standard CNAIM v2.1 which was approved for use in RIIO-ED2 by Ofgem in April 2021. The supporting data used in the modelling of this submission is based on the reported position of our asset condition for RIIO-ED1 Year 6 at the end of August 2021.

The full details of the Energy Network Association's NARMs Electricity Distribution Working Group (NEDWG) publication on CNAIM v2.1 is available on Ofgem's website. For further detail on our RIIO-ED2 NARMS strategy please see ***Safe and Resilient (Annex 7.1).***

Our proposed investment programme in ED2 is asset data led; refined and iterated by overlaying the industry standard risk management methodology with enhanced risk modelling and cable specific cost benefit analysis. We are proposing planned replacement of cables where the certainty of need is highest driven by high probability and impact of failure in ED2.

We have adopted a four-step funnel approach, as shown below, to determine the interventions required on the network. This approach allows us to filter from an initial examination of the complete list of subsea cables we operate to a credible and deliverable list of interventions which are supported by robust analysis. Steps 1 to 3 are set out in detail within our ***Scottish Islands (Annex 8.1).***

This EJP covers Step 4 for the Jura to Islay cable which has qualified as requiring intervention. We set out here our approach to clearly justify why the circuit design approach is being proposed and associated costs are the most economic and efficient and what work would be required to deliver on these investments.

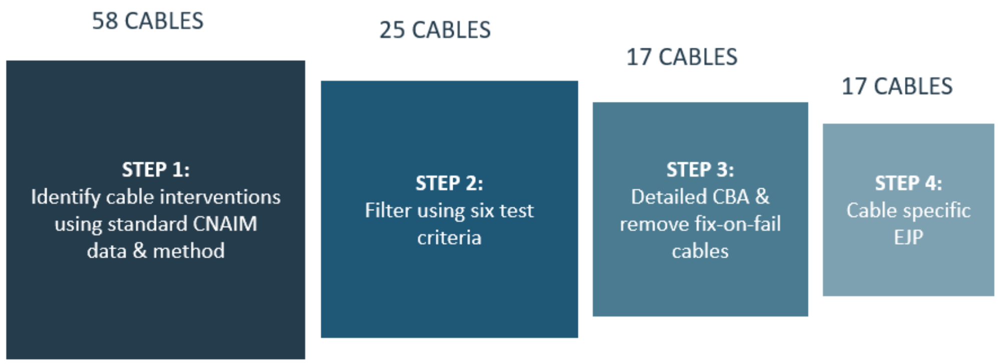

Figure 1: Cable Selection Filter Process

4.2 Existing Network Arrangement

The subsea cable under investigation is located in the Sound of Islay between the South-West of Jura and the North-East of Islay. The existing subsea cable is 1.98km long and can be seen in figure 2 & 3.

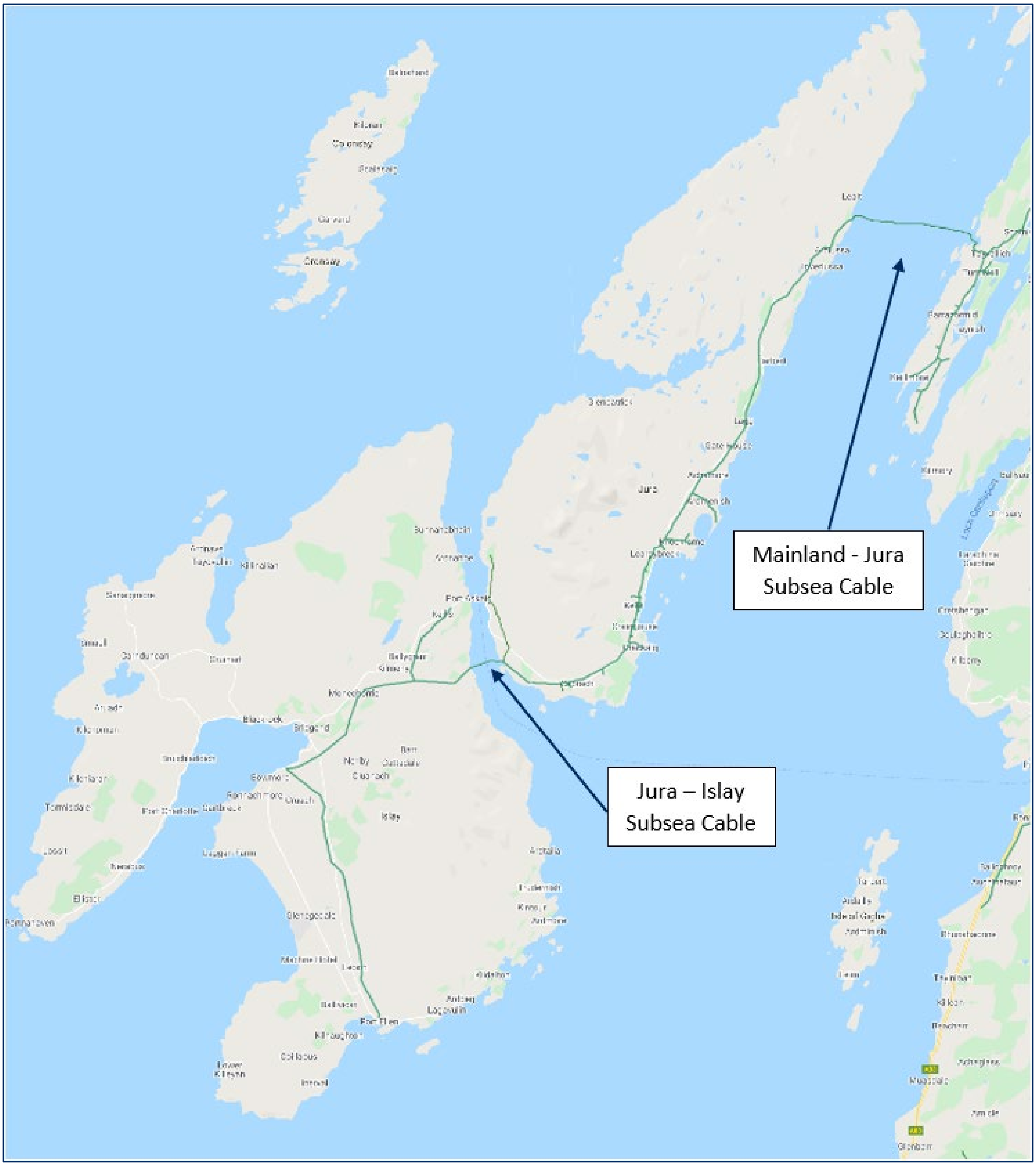

Figure 2: Overview of Lochgilphead 33kV Feeder Including Jura - Islay Subsea Cable

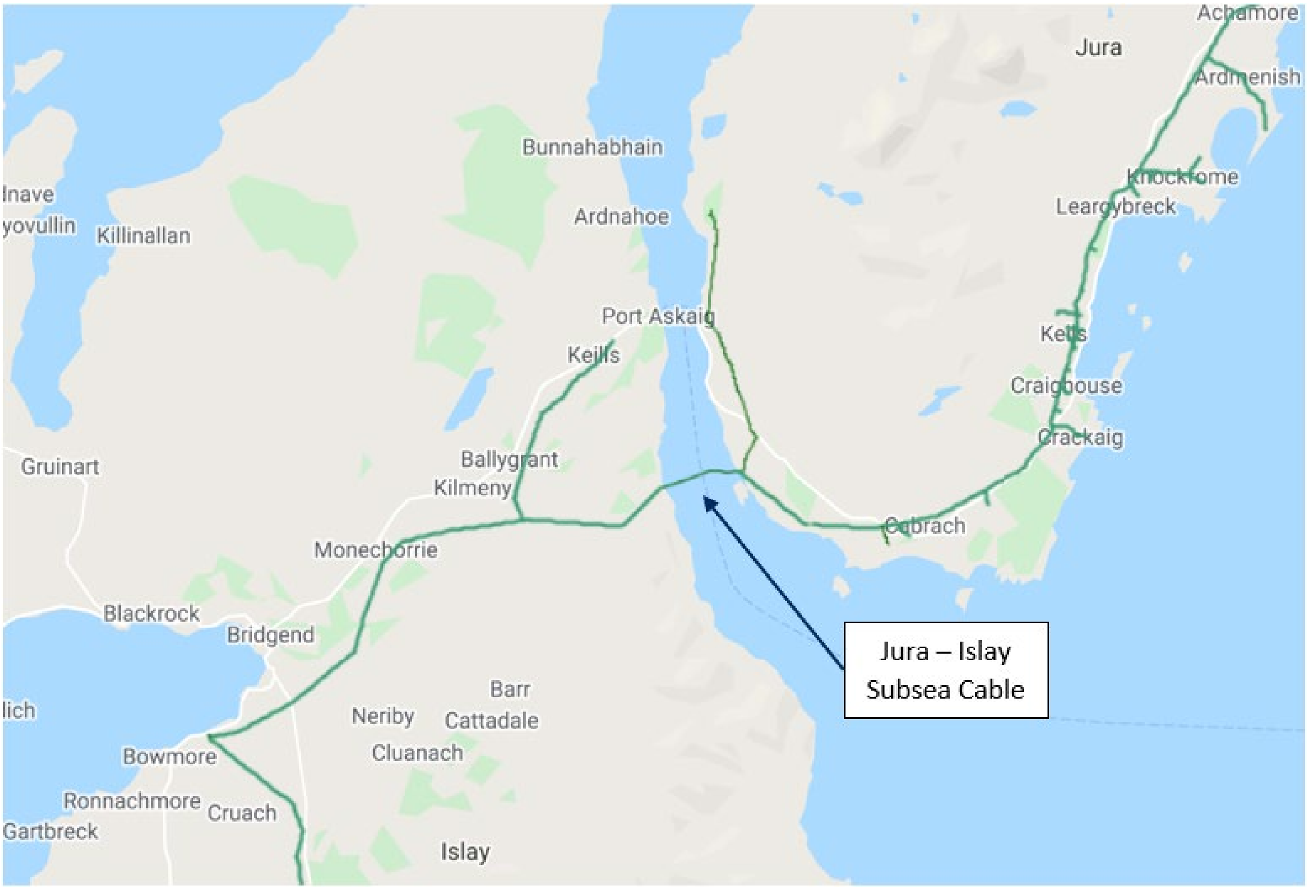

Figure 3: Location of Jura - Islay Subsea Cable

The existing network serving Islay is a very long 33kV radial feeder which is supplied from Port Ann GSP via Lochgilphead 33kV Primary S/S on mainland Scotland. The existing network is made up of subsea cables, overhead line and underground cable. This includes a circa 8km subsea cable between Mainland Scotland and Jura which has been replaced in ED1 following a fault. This 33kV network has been found to have low volts under certain conditions, but this should be rectified within ED1 as part of the Islay North of Scotland Resilience (NOSR) scheme.

4.3 Existing Asset Condition

The Common Network Asset Indices Methodology (CNAIM) models maintained by SSEN provide a Health and Criticality Index for each individual asset. This is calculated using a variety of asset-specific data which includes basic parameters in addition to the observed and measured condition (where available) of each asset.

The Jura - Islay 33kV subsea cable is a 33kV 70mm^2 PILC 'HSL' DWA cable and was installed in 2011. The Health Index of the subsea cable is HI5 with a Criticality Index of C2. This subsea cable route is one of the worst performing routes in terms of faults and life expectancy across SHEPD.

The existing Jura - Islay subsea cable is the sixth cable which has been laid in this location. Previous installations were in 1961, 1966, 1975, 1986, 1998 and 2011. Across the 5 previously installed cables prior to 2011 there were 5 recorded faults, all of which have been noted as abrasive wear. No fault record could be found for the 1986 installed cable, but it is believed this would have been abandoned at the time of the 1998 install. Where it is recorded in fault logs, all indicate faults occurring towards the Jura end of the cable. The 2011 cable, to date, has not experienced any faults but has been recorded as being in a critical condition following visual inspections in April 2021, with multiple areas of armour damage identified. Any new cable installed in this area should explore alternative options, more protected routes, or increases in cable protection. Given the high number of cable installations, faults and repairs in this area. Should there be an opportunity to remove this cable from the marine environment, i.e. through Horizontal Directional Drilling, this should be seriously considered. The average cable life in this area is 10 years. Given the existing cable was installed in 2011, this cable is likely to experience a fault in the near future if left without intervention, the 1998 cable was the longest in service surviving 13 years prior to faulting, this was the installation previous to the current cable.

4.4 Demand Forecast and Generation

The Jura - Islay 33kV subsea cable is part of a 33kV circuit fed from Port Ann GSP via Lochgilphead 33/11kV Primary S/S on Mainland Scotland. It provides supplies to a number of Primary S/S on Islay, serving 2,785 customers in total.

In the event of an outage on the Jura - Islay 33kV subsea cable, there is no network alternative supply for downstream customers. Supply restoration is provided via diesel generation from Bowmore Power Station.

The subsea cable is rated at 12MVA. The current demand on the subsea cable is 8.15MVA, 67.9% of the cable rating. The forecasted demand growth in this area is 3.71% per year on average. Therefore, the forecasted demand at the end of ED2 is expected to be 10.91MVA, 90.9% of the cable rating. Detailed load assessments will be made during the development and refinement phase of any future project to ensure the cable will be suitably rated to provide capacity over the anticipated lifetime of the asset.

In the event of an outage of the cable the following impact costs would be incurred:

- Impact cost: £5,566,049

5 Summary of Options Considered

This section of the report sets out the investment options that have been considered for intervention on the existing cable. The approach taken has been to ensure investment options demonstrate best value for money for network customers.

5.1 Summary of Options

The table below provides a high-level summary of the investment options that have been considered along with the advantages and disadvantages associated with each. A more detailed description of each option is then provided within the following sub-sections.

Table 2: Summary of Investment Options

Option	Description	Advantages	Disadvantages	Results
1. Do Minimum	Replace on failure – Maintaining current route	Low initial cost.	Availability of material and resource when required. High cost associated with an emergency replacement. Remains single circuit security. Does not address the risk of a failure. Impact costs would be high in the event of a failure. Asset remains in location known for poor cable life expectancy	Rejected
2. Replace similar size cable	Replace the cable with a similar sized cable on a new route	Improved HI and PoF. Low initial cost.	Remains single circuit security. Asset remains in location known for poor cable life expectancy	Rejected
3. Replace larger size cable	Replace the cable with a larger sized cable on a new route	Improved HI and PoF. Allows for future capacity and load growth	Higher initial cost than above. Remains single circuit security. The similar sized cable would be sufficient for the forecasted load growth, a larger cable may not be fully utilised. Asset remains in location known for poor cable life expectancy	Rejected
4. Augmentation similar size cable	Augmentation of the existing cable with a second similar sized cable along a new route	Improved HI and PoF. Improved security of supply for the remainder of the existing cable life.	Similar cost to option 2 due to existing onshore infrastructure already being in place for a second cable. Increased cable monitoring and maintenance costs. Asset remains in location known for poor cable life expectancy	Rejected
5. Augmentation larger size cable	Augmentation of the existing cable with a second larger sized cable on a new route	Improved HI and PoF. Improved security of supply for the remainder of the existing cable life. Allows for future capacity and load growth	Higher initial cost than above. The similar sized cable would be sufficient for the forecasted load growth, a larger cable may not be utilised. Asset remains in location known for poor cable life expectancy	Rejected

Option	Description	Advantages	Disadvantages	Results
6. Install 2 new cables on alternative route	Replace the existing cable with two new cables along a new route.	Improved HI and PoF. Higher initial cost than other options due to two new cables being installed. N-1 against a subsea fault	Higher initial cost. Having to find two new routes. Asset remains in location known for poor cable life expectancy	Rejected
7. Replace cable with HDD	Replace the existing cable with a standard land cable via an HDD duct.	Improved HI and PoF. Higher initial cost than other options due to the length of HDD required. Lower PoF compared to a simple subsea cable replacement. Removes asset from the marine environment Should increase anticipated asset life.	Remains single circuit security. Subject to an HDD feasibility study being conducted to determine if this is feasible.	Recommended option

6 Analysis and Cost

For all subsea options considered, it is anticipated that any new cable installed would follow a similar route to the existing cable route shown previously.

6.1 Option 1: Do minimum – replace on failure

Under this option the subsea cable would not be proactively replaced. Instead, the cable would continue to operate as it has been with minimal repairs being made as required until the point where the subsea cable fails in service.

At the time of failure, the subsea cable would then be replaced with a new subsea cable of similar size to the existing one following the same route as the existing cable. Given this would be under a fault scenario and restoration time would drive option selection, this would be the only route with existing consents, agreements and infrastructure.

This option avoids any initial cost of intervention and, should the cable not fault during the next price control, may defer expenditure beyond ED2. However, the cost of an emergency replacement would be higher than a planned replacement if the cable fails and it would incur the following impact costs:

- Impact cost: £5,566,049

For the purposes of assessing this option using the Cost Benefit Analysis (CBA), it was assumed that the subsea cable would fail at the end of ED2, in 2028.

After replacing the cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

This option was rejected as it would incur impact costs and reputational damage. In addition, the replacement in an emergency would be [redacted] % higher than the cost of an equivalent planned replacement. This option would also leave the cable in an area known for poor life expectancy; it is anticipated SHEPD would have to return within 10 years to conduct another cable replacement.

6.2 Option 2: Replace the cable with a similar sized cable

This option involves replacing the cable with a new similar sized subsea cable. This would improve the Health Index and Probability of Failure of the circuit, resulting in a change to the characteristics set by the age and condition. The location of both the Jura and Islay landing points would be determined during detailed design once site investigations have taken place.

The proposed replacement cable would be installed and the existing cable would be disconnected and capped.

After replacing the cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

This option was rejected as the risk of loss of supply to customers due to a single subsea cable fault would remain high due to the single circuit security. This option would re-install a seventh cable in the same location and would be anticipated to only last approximately 10 years.

6.3 Option 3: Replace the cable with a larger sized cable

This option is similar to the previous one, however a larger sized cable would be installed.

After replacing the cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

This option was rejected as the risk of loss of supply to customers due to a single subsea cable fault would remain high due to single circuit security and a cable still installed in a rough marine environment. This option would re-install a seventh cable in the same location and would be anticipated to only last approximately 10 years. This option would provide additional capacity over options 1 & 2 for future demand growth.

6.4 Option 4: Augmentation of the existing cable with a second similar sized cable

This option involves laying a new 95mm^2 subsea cable, similar to option 2, but also retaining the existing connection. The existing cable would remain connected and continue to be maintained until failure. Additional 33kV onshore infrastructure would be needed to connect the second cable however, these works are not anticipated to be significant given the location of existing network infrastructure nearby.

The existing cable would continue to operate until it develops a fault, at which point there would be an evaluation as to the possible options for that cable. However, at the time of the fault customer supplies would still be maintained through the new cable and therefore avoid any impact costs.

This option would improve the security of supply to the connected customers until the existing cable fails. For the purposes of assessing this option using the CBA, it was assumed that the existing subsea cable would fail at the end of ED2, in 2028.

The cost of this option is as option 2, plus additional costs for some onshore infrastructure to tie-in the subsea cable at new network points.

The anticipated capital cost of this option is:

- Option cost: £[redacted]

After installing the new cable there would be an improvement in the PoF and a reduction in the monetised risk.

This option provides an improvement to the security of supply whilst the original cable remains in service however, this is not anticipated to last very long. This option was rejected as the risk of loss of supply to customers due to a single subsea cable fault would remain high due to single circuit security and a cable still installed in a rough marine environment. This option would re-install a seventh cable in the same location and would be anticipated to only last approximately 10 years.

6.5 Option 5: Augmentation of the route with a second larger sized cable

This option is similar to option 4, however a larger sized cable would be installed.

The cost of this option is very similar to option 3 but with some increased inspection and maintenance costs whilst two cables are in service.

This option would improve the security of supply to the connected customers until the existing cable fails. For the purposes of assessing this option using the CBA, it was assumed that the existing subsea cable would fail at the end of ED2, in 2028.

After installing the new cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

This option would re-install a seventh cable in the same location and would be anticipated to only last approximately 10 years. This option would provide additional capacity over options 1, 2 & 4 for future demand growth. This has not been selected as the preferred option due to cable remaining in the marine environment with high risk of low life expectancy.

6.6 Option 6: Installation of two new cables on a new route

This option was considered due to the improvement in reliability and security provided by two new cables which would ensure that in the event of a subsea cable fault supplies would be maintained to Islay.

The laying of the two new cables together under the same contract is expected to allow cost saving of 10% on the second cable compared to the first.

This has been estimated on 95 mm² cables and would provide duplicate supplies onto Islay direct from Jura.

After installing the new cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

This option was rejected as although there were technical benefits over options 1 to 5, there is a significantly higher initial capital cost which is deemed unnecessary at this time. This option also has the second worst NPV behind fix on fail.

6.7 Option 7: Replace the cable with an underground HDD cable installation

This option involves replacing the cable with a land-based cable installed via Horizontal Directional Drilling (HDD) underneath the Sound of Islay. The improvement in the PoF of the circuit after these works would be better than the previous options, as an HDD cable installation is considered to have the same failure rates as a buried cable, rather than a subsea cable and is predicted to have 40+ years of anticipated life.

HDD solutions can often be more expensive compared to subsea cable replacement solutions, however when the length of cable needed is short, then the HDD solution becomes viable. A previous HDD study was conducted in this area that deemed an HDD possible, subject to ground investigations. This was not progressed at the time as the previous cable failed and had to be replaced in an emergency, which resulted in a new subsea cable being installed.

After installing the new cable there would be an improvement in the PoF and a reduction in the monetised risk. The anticipated capital cost of this option is:

- Option cost: £[redacted]

Given the life expectancy of subsea cables in this marine environmental area, repeated faults and failures over a number of installations, this option is proposed as the preferred solution. This would remove the asset from the marine environment and avoid return visits for fault rectification or replacement investment every 10 years on average.

This option does not have the highest NPV in the CBA, however, the CBA does not consider multiple capital investments, against all other options every 10 years. This would greatly decrease options 1-6 NPV values against this option. This is deemed to be the best whole-life solution for this area.

7 Summary of Cost Benefit Analysis

This section of the report provides an overview for each option from the Cost Benefit Analysis (CBA). A detailed exercise has been undertaken to support the investment strategy that is described within this EJP.

7.1 Option Costs

Our RIIO-ED2 Business Plan costs are derived from our outturn RIIO-ED1 expenditure. For our Subsea cable projects, our Unit Costs have been derived from analysing costs pertaining to delivered projects completed during RIIO-ED1 and are therefore based on actual costs. For cable installation activities the delivered projects were competitively tendered utilising our Subsea Cable Installation Framework and cable costs have been benchmarked against recently completed tender events. By tying our costs back to reported, outturn, real life data this approach provides multiple data points and provides a high level of cost confidence in our Business Plan cost forecast for RIIO-ED2.

As our Business Plan has developed, project scopes and costs have been refined, especially with the input of valuable stakeholder feedback on our draft proposals. This final Business Plan submission cost forecast contains that refinement, and the changes are captured within our supporting plan documentation. The generic Unit Cost rates used in the draft Business Plan have now been revised following extensive analysis. This is further defined within ***Scottish Islands (Annex 8.1).***

A summary of the costs for each option is given in the table below.

Table 3: Summary of Option Costs

Options	Unit	2023/24	2024/25	2025/26	2026/27	2027/28	Total
1. Do minimum	£m	-	-	-	-	[redacted]	[redacted]
2. Replace similar size	£m	-	-	[redacted]	-	-	[redacted]
3. Replace larger size	£m	-	-	[redacted]	-	-	[redacted]
4. Augmentation similar size	£m	-	-	[redacted]	-	-	[redacted]
5. Augmentation larger size	£m	-	-	[redacted]	-	-	[redacted]
6. Two new cables	£m	-	-	[redacted]	-	-	[redacted]
7. Install HDD cable	£m	-	-	[redacted]	-	-	[redacted]

7.2 CBA Comparisons

The results of the 45 year NPV from the CBA for the different options are presented in Table 4 below.

Table 4: Summary of Option NPVs

Options	45 Year NPV (£m)
1. Do minimum	43.80
2. Replace similar size	54.55
3. Replace larger size	54.41
4. Augmentation similar size	54.43
5. Augmentation larger size	54.29

6. Two new cables	53.49
7. Install HDD cable	53.56

7.3 Volume of Preferred Option

The preferred option requires a new land cable to be laid within a duct, under the Sound of Islay, following a Horizontal Directional Dill. The new cable will be connected into the existing 33kV network. There may be a requirement for additional onshore works to allow connection into the network to be possible, but this cannot be confirmed until drilling locations are confirmed. The volume of new assets needed for this option are indicated in Table 5.

Table 5: Volume of Assets for Preferred Option

Asset Category	Unit	2023/24	2024/25	2025/26	2026/27	2027/28	Total
6.6/11kV UG Cable	km	0	0	[redacted]	0	0	[redacted]

8 Deliverability & Risk

Our ***Deliverability Strategy (Annex 16.1)*** describes our approach to evidencing the deliverability of our overall plan as a package, and its individual components. Testing of our EJPs has prioritised assessment of efficiency and capacity, and this has ensured that we can demonstrate a credible plan to move from SSEN’s RIIO-ED1 performance to our target RIIO-ED2 efficiency.

We have also demonstrated that SSEN’s in house and contractor options can, or will through investment or managed change, provide the capacity and skills at the right time, in the right locations. This assessment has been part of the regular assessment of our EJPs, IDPs and BPDTs. For the investment proposed under our subsea cable related EJPs, we have been developing our RIIO-ED2 Commercial & Deliverability Strategy and engaging with our supply chain to ensure we can deliver the solutions proposed, while identifying and managing the risks presented by the complex and challenging nature of the projects.

Our deliverability testing has identified major strategic opportunities which is relevant to all subsea EJPs.

- In RIIO-ED2, SSEN will change the way Capital Expenditure is delivered, maximising synergies within the network to minimise disruptions for our customers. This is particularly relevant for a Price Control period where volumes of work are increasing across all work types.
- The principle is to develop and deliver programmes of work, manage risk and complexity at programme level and to develop strategic relationships with our suppliers and partners to enable efficiency realisation. This potentially includes refining our contracting strategies to improve our risk profiles.
- Transparency with the supplier in terms of constraints, challenges, outage planning and engineering standards will capitalise on efficiencies, supported by a robust contracting strategy.

The delivery programme for all subsea cables in RIIO-ED2 will be determined through detailed planning and engagement with marine installation contractors and cable procurement opportunities. In addition, early stakeholder engagement will significantly de-risk project schedules and deliver value.

We are already identifying opportunities for improved efficiency and improved risk management of our projects and associated programmes. As part of the planning for our final Business Plan submission, we have explored subsea cable project ‘bundling’ by cable type and geographic location. Our delivery year for each EJP is based on this initial assessment, which will be further explored and then refined with our supply chain in early 2022 to identify the optimal equilibrium of project deliverability and risk management.

9 Conclusion

The purpose of this Engineering Justification Paper (EJP) has been to provide the investment justification and option selection for the 33kV subsea cable from Jura to Islay.

Due to the number of subsea cable faults in RIIO-ED1, including the Pentland Firth East Cable, the approach taken for EIIO-ED2 has been to pre-empt failures where possible. The creation of the monetised risk CBA model allows for the circuits which are likely to have the biggest impact, should a failure occur, to be addressed. This approach considers the subsea population within the generic CBA model to help identify the appropriate circuits to be replaced.

The monetised risk value for the Jura – Islay 33kV subsea cable is currently £349,771 and, without intervention, may increase to £1,942,774 at the end of ED2.

If there were a failure on the subsea cable a large number of customers would lose their supply and back up supplies would be required by running Bowmore Diesel Power Station, with the total impact cost totalling £5,566,049. Therefore, this subsea cable has been identified for pre-emptive investment to mitigate this risk.

Having identified the need for intervention, seven options were considered as shown:

- Option 1: Do minimum – replace on failure
- Option 2: Replace the cable with a similar sized cable
- Option 3: Replace the cable with a larger sized cable
- Option 4: Augmentation of the route with a second similar sized cable
- Option 5: Augmentation of the route with a second larger sized cable
- Option 6: Install two new cables on an alternative route
- Option 7: Install underground cable via HDD

These options were considered to cover the least cost option, the enhanced capacity option, and the enhanced security option.

The preferred option is option 7, installation of an underground cable via an HDD. This option is the only one that removes the cable from the marine environment and should improve the security of supply to customers with a reduced PoF and less external factors effecting cable health.

With the intervention proposed in this EJP the monetised risk value will reduce to £63,452.

The anticipated initial cost of the preferred option is £[redacted].

CV Table	Asset Category	ED2 (£m)
CV7 Asset Replacement	6.6/11kV UG Cable	[redacted]