SP Energy Networks

Storm Arwen Reopener

Submission

Main Document

Abstract

This submission is made under the Storm Arwen Reopener Distribution Special Licence Condition 3.2 Part J. This is a single submission for SP Energy Networks and provides sufficient detail on the requirements for investment in both SPD and SPM with costs and working called out for each licence throughout this document.

This submission has been reviewed to ensure it is valid against all licence and reopener guidance detail, and where we have been unable to provide information, we have given justification as to why this is the case. We have met the requirements around Ofgem pre-engagement, having first notified Ofgem of our intention to make a submission in October 2023 and via subsequent engagement prior to the reopener application window. Appendix 1 includes a mapping table of all requirements and their location within this submission with glossary of terms located in Appendix 2. Cost detail compliance is outlined in Appendix 3 and CBA & EJP compliance is outlined in Appendix 4.

The expenditure included in this reopener is all to be incurred after 1st April 2023 and represents additional activity which is over and above that already provided by relevant ex-ante allowances, or that which will be provided through other uncertainty mechanisms. Costs have been developed using our RIIO-ED2 unit cost manual where possible and with recent quotes for other activity, ensuring our proposed costs are accurate and efficient.

A redacted version of this submission has been provided separately for wider publication.

Any questions or requests for supplementary information should be directed as below:

Matthew Jones, Head of Asset Management & Investment

Network Planning & Regulation

[redacted]

1. Contents

SP Energy Networks

2. Executive Summary

Recent history shows us that the next major UK weather event could happen at any time. In the days before this submission, we have recovered from the disruption of Storms Isha and Jocelyn, the 9th and 10th named storms of the 2023/24 season, marking the most active storm season since Met Office records began. These led to UK-wide Met Office yellow weather warnings and wind speeds of around 100mph. The widescale disruption to road, rail, and power served as a keen reminder of the vulnerability of our national infrastructure to severe weather and of the unpredictable effects of Climate Change. This is set against a context of ever-increasing reliance on electricity and a growing societal expectation for uninterrupted supplies as we transition to Net Zero.

Storms are one of the most demanding tests placed on Distribution Network Operators (DNOs), they push our asset planning & resilience, operational resources, and customer services capability to extremes. They are amongst the most disruptive and distressing scenarios for our customers, especially the most vulnerable who are less resilient to power cuts, or the rurally isolated who are the most likely to be impacted. The scale, severity and location of network damage all contribute to extended restoration times as we manage exceptional fault volumes in challenging and isolated terrain. We size our business to manage these events and ramp up our operational and support response to deal with them.

Occasionally we face a generationally significant storm that pushes our previously tested boundaries to the limit. This occurred on Friday 26 November and into Saturday 27 November 2021 when Storm Arwen hit the UK.

Storm Arwen was unusual in the combination of extremely high wind speeds, the extended duration of the storm and the northerly wind direction. The combination of these effects meant that Storm Arwen caused significant damage to electricity, road, rail and telecommunications infrastructure, and was the most severe storm to affect our licence areas since 1953[1]. It was the first time the SP Distribution (SPD) and SP Manweb (SPM) distribution areas ever experienced concurrent 'Category 2' Severe Weather Events.

Storm Arwen caused over 1,300 faults and nearly 200,000 customer interruptions across our networks, and although we restored 96% within 48 hours, in the worst cases customers were off supply for nearly 7 days. Other GB DNOs were similarly affected with over 1m customers interrupted in total and final restorations completed in 13 days. Our network and operational response stood-up well comparatively but the devastating level of damage and protracted restorations are a clear signal that we need to improve.

Following the storm, Ofgem commenced a review into the network's response[2], alongside a separate review by the Energy Emergencies Executive Committee (E3C)[3] commissioned by the Secretary of State for Business, Energy & Industrial Strategy. These reviews set out 67 recommendations for Government, Ofgem and DNOs. We have undertaken an extensive improvement regime across our planning, operational and customer business units in response. This has validated and informed our processes; from stress-testing our telephony platforms, and submitting enhanced pre-winter readiness reports to Ofgem and Government, to reviewing industry pole health assessment metrics.

We have also identified a series of new and/or enhanced activities aligned with these recommendations and with the key themes of 1) Enhanced Network Storm Resilience, and 2)

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[1] *Microsoft Word - 2021_07_storm_arwen.docx (metoffice.gov.uk) – Historical Context Section*
[2] *Final report on the review into network' response to Storm Arwen (ofgem.gov.uk)*
[3] *Storm Arwen electricity distribution disruption review: terms of reference - GOV.UK (www.gov.uk)*

Improvements in Customer Service During Storms. This reopener application details our proposals for 13 initiatives, requiring an additional expenditure of £38.6m in SP Distribution (SPD) and £37.3m in SP Manweb (SPM) under the Storm Arwen reopener adjustment.

This investment will deliver enhanced storm resilience asset programmes, vegetation management and additional generation opportunities, as well as improvements in customer service focussing on customer welfare and communications. Each of these initiatives will benefit our customers by reducing the probability of power cuts arising from severe weather events, improving time to restoration when faults do occur, and supporting, empowering and informing those without power during these events.

Table 1. Initiatives proposed under Storm Arwen Reopener

#	INITIATIVE	SPD COST	SPM COST	SPEN COST
1*	Enhanced HV Pole Storm Resilience	£3.3m	£4.7m	£8.0m
2*	Innovative OHL Smart Solutions	£2.1m	£2.5m	£4.6m
3*	Interconnection across DNOs	£2.1m	£1.2m	£3.3m
4	OHL Digital Twin Storm Modelling	£0.4m	£0.4m	£0.7m
5*	Reflecting ETR 132 Updates	£4.0m	£6.5m	£10.5m
6*	New Generation Connection Points	£1.9m	£1.2m	£3.1m
7	Keeping Customers Connected – Power Packs	£0.2m	£0.2m	£0.4m
8	Increased Customer Welfare Support	£0.5m	£0.4m	£1.0m
9	Digital Switchover Support for Vulnerable Customers	£7.4m	£6.0m	£13.4m
10	Proactive Support - Medical Equipment Back-Ups	£12.9m	£10.6m	£23.5m
11	Proactive Support - Hospital Beds	£0.0m	£0.0m	£0.0m
12	Warm Customer Communication Hubs	£1.3m	£1.0m	£2.3m
13	Increased Contact Centre Ramp Up	£1.0m	£0.9m	£1.9m
*	Associated Indirects for * initiatives	£1.4m	£1.7m	£3.2m
Total SARt Modification		**£38.6m**	**£37.3m**	**£75.9m**

This document sets out the needs case and alignment of initiatives with official Storm Arwen Recommendations, the optioneering analysis undertaken for each to demonstrate works are justified, proportional and efficient, the supporting stakeholder engagement we have undertaken, and details on the deliverability and risk assessment for each programme.

This document alongside our supporting annexes and Cost Benefit Analysis forms our application under Special Licence Condition 3.2, Part J.

3. Background

3.1. Storm Arwen Impact

Storm Arwen was one of the most severe storms to affect Scotland, Wales, and northern England in over 20 years, and the worst to impact SPEN networks since 1953. It was particularly damaging to electrical infrastructure due to a combination of sustained high winds speed and gusts, from an atypical northerly direction.

Storm Arwen impacted multiple GB DNOs, including both SPD and SPM, with over 1,300 fault incidents across the SPEN distribution network. Despite the severity, SPEN's network performed well compared to past similar events with over 96% customers restored within 48 hours and no interruptions caused by faults on the 33kV or 132kV network, demonstrating the benefits of SPEN's long-term Asset Management strategy and leading OHL investment programme[4,5].

However, for some customers the interruptions from Storm Arwen took longer to restore, with the final SPEN customers restored 7 days after the storm began. Storm Arwen found vulnerabilities in distribution networks, and exposed gaps in investment strategies that had not been revealed by previous severe weather events in the past two decades.

3.1.1. SPEN Performance during Storm Arwen

The total number of customer interruptions recorded during Storm Arwen in SPD and SPM was 84,939 and 106,969, with the timeline of these interruptions shown in Figure 1.

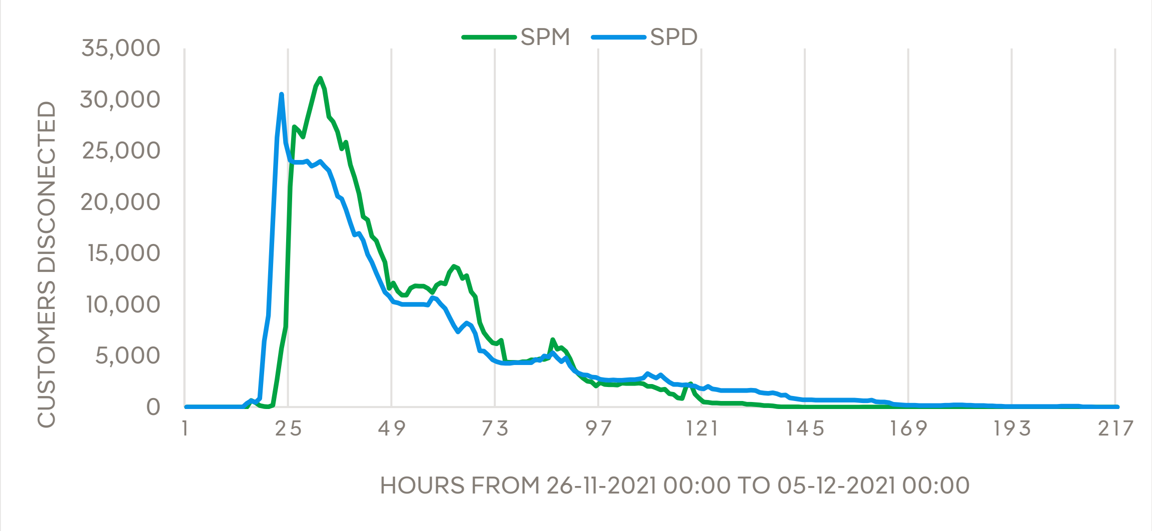

Figure 1. Timeline of net customers without power supply

The impact of the storm onset rapidly in the evening of the 26th November 2021, with the high winds continuing to cause damage for over 24 hours.

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[4] *ENA Letter to Darren Jones MP, 16th December 2021, comparison based on Resilience only investment and expenditure normalised by DNO network size and customer numbers.*
[5] *This is outlined in Annex 4A.13 OHL and ESQCR Strategy – Issue 2, submitted alongside RIIO-ED2 business plans.*

Our EHV overhead performed exceptionally well throughout Storm Arwen with limited damage and without the loss of any Primary substations, and there was no damage to the 132kV distribution network in SPM or to the transmission network in SPT.

Most faults were due to damage on HV and LV overhead lines, with HV main lines causing short supply interruptions which were able to be restored quickly through automation and switching. HV spur lines and LV overhead lines had longer restorations but with lower numbers of affected customers as these tend to supply more rural network areas with limited network redundancy. During the later stages of repair and restoration, fault repair prioritisation was more challenging as there were fewer affected customers per fault. It was therefore rural communities who experienced the longest interruptions.

An external independent review, undertaken by Arcadis, confirmed that most of the faults were due to windborne debris, vegetation, and pole damage – with over 250 wooden poles replaced in the aftermath of the storm. The review also found that spur lines saw a greater proportion of these faults than main lines, in part due to reduced application of ETR 132 activity on spurs[6].

Relevant key statistics setting out the storm characteristics and SPEN's network performance is set out below:

- Maximum wind speed of 98mph in SPD, and 78mph in SPM
- Greater than 60mph wind speeds for 9 hours in SPD and 18 hours in SPM
- Over 1,300 LV and HV network faults (over **50x** the typical daily average)
- 138,000 customer calls received (over **40x** the typical daily average)
- Over 950 staff and contractors assessing the network
- 240,000 customers had their power restored in under three minutes (7% of our customer base)
- Over 350 generators deployed (the highest of any GB DNO during the storm)
- 88% of customers impacted were reconnected within the first 24 hours of the storm
- 96% of customers impacted were reconnected within 48 hours.

3.1.2. SPEN After Storm Response

SPEN were the first DNO to provide an additional proactive compensation payment to households off supply for over 48 hours, as an apology for the disruption. This payment was an extra £150 for all customers off for longer than 48 hours - on top of Guaranteed Standard of Performance (GSOP) payments.[7]

SPEN also launched a comprehensive post storm review of network performance and operational response, with a particular focus on communications with customers and the support provided to rural communities without power for extended periods. This included the independent review by Arcadis to provide an assessment of SPEN's technical and operational preparedness and performance to set out potential areas of improvement. SPEN additionally commissioned an independent review of the preparations ahead of Storm Arwen and its aftermath, led by former UK Energy Minister Rt Hon Charles Hendry CBE, with a particular focus on rural communities which were worst affected.[8]

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[6] ETR 132 is the industry standard for resilience to severe weather for Overhead Lines, at the time of writing it is under review as part of a Storm Arwen recommendation. Part of the rationale for this review is that previous iterations prioritised lines with high customer numbers, the future iteration will also consider customer isolation and rurality as a driver for resilience interventions.

[7] Storm Arwen Review - SP Energy Networks

[8] Independent review on our response to Storm Arwen published - SP Energy Networks

These reviews engaged with local authority emergency planning teams, local resilience partnership forums, and with Scottish and Welsh Government resilience teams.

SPEN have further carried out additional engineering analysis and developments, which have informed the initiatives within this reopener, described in Section 3.2.2.

3.2. Approach to this Reopener Application

3.2.1. RIIO-ED2 and Links to our Reopener Proposals

Due to the timing of Storm Arwen, it was not possible to include our reopener proposals within the current regulatory settlement as RIIO-ED2 business plans[9] were submitted in December 2021, while the restoration efforts for Storm Arwen were still ongoing.

SPEN's RIIO-ED2 business plan submission was our most comprehensively developed business plan for our distribution networks, and set out over £3bn of investment to facilitate our customers' transition to Net Zero. This included ambitious plans to improve our network resilience and customer service offering which form part of our baseline programme. Our baseline storm resilience activities are captured within Annex 4A.5 Network Performance Strategy, Annex 4A.4 Network Risk Strategy, and Annex 4A.20 Network Operating Costs.

Storm Arwen has highlighted requirements for new activities that are not funded within this baseline RIIO-ED2 programme, but which will further benefit our customers and improve storm resilience. The initiatives proposed in this submission are aligned to these findings and are over and above the activity within the RIIO-ED2 business plan.

To ensure there is clarity on the difference between the RIIO-ED2 funded investment and Storm Arwen reopener proposals, this submission outlines the proposed additional expenditure under the Storm Arwen reopener, as well as detailing the existing funding for related activities within our RIIO-ED2 final submission. In addition, to keep this separation clear SPEN will record any outputs delivered through the reopener separately from baseline RIIO-ED2 outputs. This is discussed in further detail in Section 4.5.1.

We are also carrying out a series of wider improvements aligned with the Storm Arwen Recommendations for which funding is not included within this reopener[10]. As an example of this, we are planning to further deploy the use of drones to assess condition of overhead lines during storms and provide insight into faults prior to staff getting access on foot. We will be flying more drones and training more drone pilots as part of this, this will be funded through our baseline RIIO-ED2 allowances. We have included references to all our initiatives, whether planned under BAU or reopener, in Appendix 5.

Additionally, an innovation project that we are working on is Predict4Resilience, a data and digitalisation project funded through SIF to provide accurate fault insights and forecasts. This project is outlined in Appendix 6 and will also support enhanced storm resilience funded separately to the Storm Arwen reopener.

[9] Our RIIO-ED2 Business Plan - SP Energy Networks
[10] Storm Arwen Actions - SP Energy Networks

3.2.2. New Developments Informing our Reopener Proposals

We have developed several new tools following lessons learned from Storm Arwen and these have helped us to target and propose initiatives in ways that were not available to us within our RIIO-ED2 baseline submission. These are outlined in Section 3.4.1 and include:

- Developing a new network **Rurality Index Metric**
- Re-defining our **Severe Weather Areas** using satellite and image processing technology
- Defining a new **Protection Zone Modelling** technique for our GIS systems.

These tools have assisted our analysis and allowed us to develop the comprehensive proposals within this submission aligned with Storm Arwen Recommendations, providing benefits that are over and above those from baseline programmes.

Funding is not requested for the development of these tools, but they have been key enablers to the initiatives within this reopener submission.

3.2.3. Case for a Future Reopener Window and Further Work

As there is currently one Storm Arwen reopener window listed in the licence, this submission is our primary opportunity to present investment proposals to Ofgem. As such it includes proposals where we have a high degree of confidence in the need and scope of the activities, and where the supporting evidence and the link to the Storm Arwen recommendations are established. However, we expect that other areas may emerge or strengthen within the RIIO-ED2 period. We therefore support a second reopener window for Storm Arwen expenditure to accommodate these at a later stage within RIIO-ED2.

For example, DNOs have agreed that the national shared power cut map (NEOP) is not currently sufficiently developed for inclusion in the January 2024 Storm Arwen reopener window. As this project develops, costs would directly relate to recommendation 11 from Ofgem's report, and we would support these costs being captured under a later Storm Arwen reopener window.

SPEN have also not included expenditure for a review of ETR 138 flood compliance within RIIO-ED2. Any additional expenditure proposed because of that review, which should be undertaken ahead of the start of RIIO-ED3, should also be considered for inclusion within a later reopener window e.g., if this requires further works to be undertaken during RIIO-ED2.

The Engineering Technical Report for improving resilience of overhead networks under abnormal weather conditions, ETR 132, is currently being updated by the ENA working group to EREC G132. As outlined in Section 4.1.2, despite the updated report not yet being in its final form, we have applied our working knowledge of the update to include no-regrets aspects of the proposed reform in this submission. However, if additional changes are made to the ETR 132 drafting following the Storm Arwen reopener submission then DNOs may need to include additional costs associated with this in a later reopener window. Planned updates to ETR 132 are given in Appendix 7.

3.3. Structure of the Reopener Submission

To avoid repetition, we have structured the detailed needs case for our 13 initiatives into two overarching themes, which in turn have a number of focus areas:

Theme 1: Enhanced Network Storm Resilience, i.e., reducing the likelihood of power cuts affecting our customers during severe weather through a focus on 1) asset resilience, 2) vegetation management and 3) provision of generation; and

Theme 2: Improvements in Customer Service During Storms, i.e., 1) enhanced focus on welfare for those customers that are off supply, and 2) improved customer communication before and during severe weather events.

We have included all 13 initiatives and their area and theme in Figure 2.

Each initiative is individually mapped to at least one Storm Arwen Recommendation within the Needs Case in Sections 4.1 and 5.1, with subsequent detail provided on the Optioneering, Stakeholder Engagement, Costs and Deliverability/Risk for each initiative in consecutive sections.

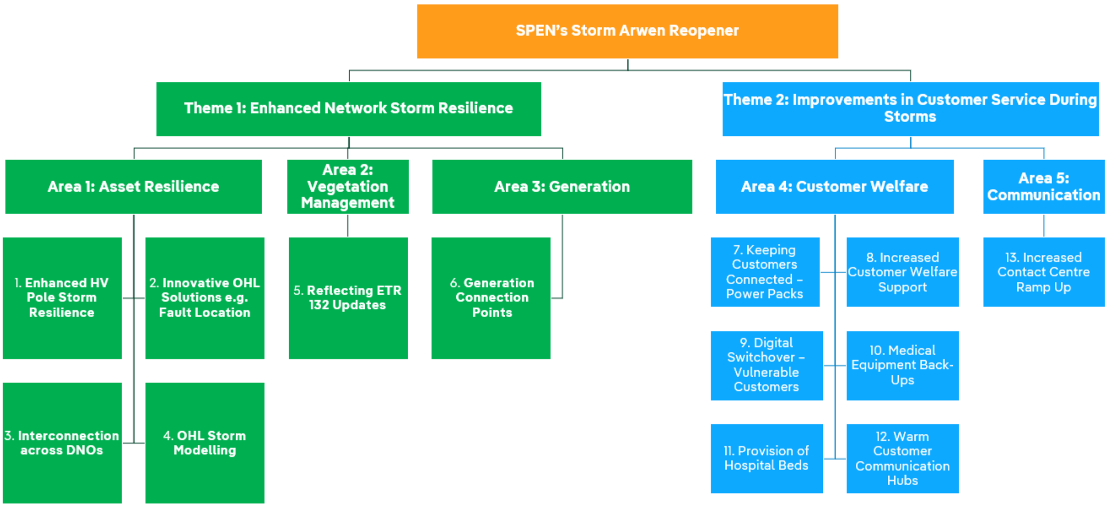

Figure 2. Structure of SPEN's Reopener Submission

3.3.1. Storm Resilience

The overarching needs case of this application is the impact and consequence of Storm Arwen. As detailed in Section 3.1, this remains the most significant storm that SPEN has experienced since 1953, and is a powerful reminder of the risk of future severe weather events and the potential impact to customer supplies. Section 3.2 also explains that allowances for the activities within this submission could not be included within baseline funding due to the timing of the storm – predicating the needs case for this reopener.

As shown in Figure 3, storms are, by their nature, unpredictable in severity and frequency. But recent experience demonstrates the ongoing risk of significant damage to electricity networks, and the need to support customers (especially the most vulnerable, and rurally isolated) during these events. This uncertainty is compounded by the effects of climate change, which is having an unprecedented effect on weather in the UK. Our RIIO-ED2 Climate Resilience Annex, Annex 4A.7, demonstrated projections for weather factors such as wind and precipitation. This shows that changes in climate could lead to increasing storm activity in higher latitudes – meaning the number and severity of severe weather events in the UK are likely to increase in future.

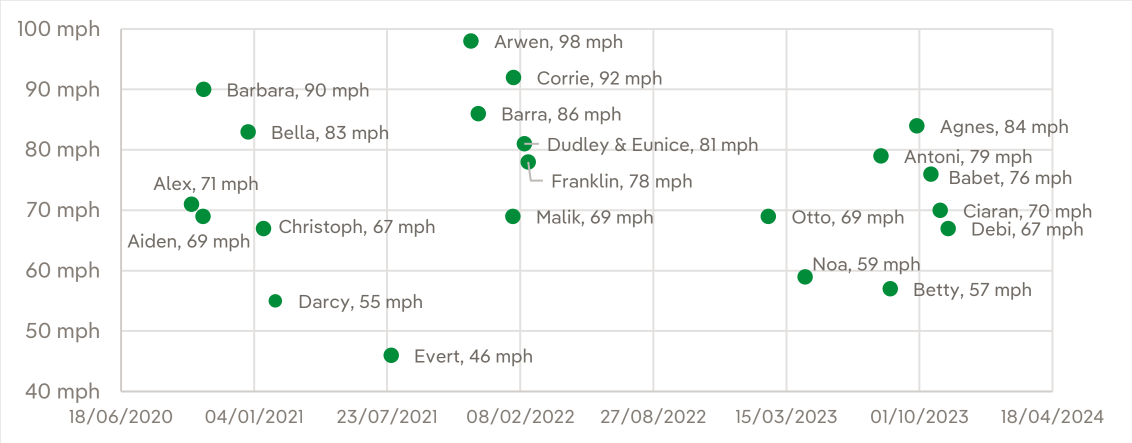

Figure 3. UK Named Storms and Max Gust Speed, 2020/21 – 2023/24

Storms are not only unpredictable in timing and severity, but also geography. This makes it challenging to model the exact impacts of a severe weather event, nevertheless there are some certainties that can be expected:

- Some areas are more susceptible to storms (severe weather areas)
- OHL networks are more susceptible to severe weather than underground networks due to their exposure to the weather/windborne debris
- Rurally isolated customers are more impacted by severe weather power cuts as they are typically supplied by OHL, and they may take longer to repair and restore
- Vulnerable customers are disproportionately impacted as they are more reliant on electricity for medical equipment, communications, and heating.

The lack of power caused by a storm can result in additional impacts for those in rural areas due to compounding social impacts. These communities tend to be geographically isolated with limited road access (which could be blocked by damage from the storm), and power cuts may also affect water/gas pumping stations, and communication towers. This in turn can restrict access to food, water and medicine, and limit the ability of people to leave the area, or contact friends/family or emergency services. We strongly believe these communities should be a focus of severe weather resilience, as well as welfare provisions in the hours and days following an unavoidable power outage.

Our approach to severe weather planning in this reopener, and focus on rural and vulnerable customers, is aligned with the recently published National Audit Office (NAO) report on Cross-Government Resilience to Extreme Weather[11]. This examined how well prepared the UK is for future extreme weather events including storms. The report recommends a co-ordinated and prioritised approach to investment in additional resilience, ensuring cost-effectiveness and achievement of the greatest benefits.

3.3.2. Storm Arwen Review Recommendations

Following Storm Arwen, the Energy Emergencies Executive Committee (E3C) and Ofgem produced two reports which outlined 67 Storm Arwen Recommendations (herein referred to as the 'Storm Arwen Recommendations').

We have undertaken an extensive business-wide review of the Storm Arwen Recommendations to identify the scopes of work required to deliver against them. Our

[11] Government resilience: extreme weather (nao.org.uk)

Customer Service directorate has led a 12-month programme of action implementation to deliver these across our business[12]. The Storm Arwen Recommendations have been assigned to individual owners with responsibility to implement the required changes, with a central programme manager to routinely measure progress and delivery.

In preparing for this reopener application, we have undertaken a further line-by-line assessment of each Storm Arwen Recommendation, completed a stakeholder engagement review with our Independent Net Zero Advisory Committee (INZAC), cross-referenced and triangulated records of customer engagement from Storm Arwen, and hosted cross-DNO working group discussions to identify a range of potential activity that could meet the expectations of these recommendations. In some cases, this exercise has identified works that require additional investment that is over and above our RIIO-ED2 baseline allowances, and cannot be incorporated into our BAU activity through process or programme efficiency – we have called these our Storm Arwen Initiatives.

This reopener details our 13 Storm Arwen Initiatives, each over and above our existing RIIO-ED2 investment plans, and in turn linked to specific recommendations. We are not seeking funding for the actions we are undertaking against other Storm Arwen Recommendations where the costs for these can be absorbed through process efficiency or where there are no material cost increases. Actions that have either already been incorporated through a series of improvements within our BAU activities or remain underway e.g., development of ETR 132 into EREC G132, are not included within this submission but a brief summary of our progress against all the Storm Arwen Recommendations can be found in Appendix 8.

3.4. Options Selection Methodology and Assessment Approach

This section will explain the overarching methodology used for the selection and assessment of options, and the criteria for selecting the preferred option.

SPEN have followed paragraph 3.1.3 of Ofgem's Reopener Guidance and Application Requirements document[13] in the selection and assessment of options for each initiative.

Each initiative therefore details the range of options considered and their key features, including for those that were not adopted. This will include a do-minimum option in each case to provide a quantitative or qualitative counterfactual to the initiative.

In some cases, our do-minimum option is the deferral of investment to RIIO-ED3 and in some cases we have not assessed deferral. This is because storms are unpredictable in frequency, geography, severity, and impact. Any perceived benefit from the option value of deferred investment is undermined as the next 'Arwen-like' storm could occur at any time. Consequently, we intend to begin delivery of all initiatives as early as funded to.

Due to the nature of the works proposed within this reopener, market-based alternatives (e.g., non-build / flexibility solutions) have not been identified and are therefore not discussed.

Under each initiative we will describe how the options have been selected, and explain the relevant criteria used to compare them, this assessment is complemented by associated Cost Benefit Analysis (CBA), including sensitivity analysis, where applicable.

In general, our approach has been to select a credible range of options for each initiative, these are based on our experience and stakeholder engagement following Storm Arwen, internal subject matter experts, new scenario assessment tools, and options provided have been

[12] Storm Arwen Actions - SP Energy Networks
[13] Re-opener Guidance and Application Requirements Document: Version 3 | Ofgem

developed with other DNOs and specialist providers. Some of the initial options were discounted immediately, whilst the others have been taken to detailed assessment. The options selection for each initiative is outlined in each relevant section.

3.4.1. Tools used to inform our Optioneering

We have also used criteria from our newly developed Rurality Index Metric and updated Severe Weather Areas to develop options for a number of initiatives.

Rurality Index Metric

This approach is used in options analysis for Initiatives 1, 2, and 6.

SPEN have developed a new methodology for assessing the rurality of pole-mounted substations and their customers for use in certain options selection. This assessment of rurality has allowed identification and prioritisation of interventions for customers in more rural areas, as they are often the most adversely impacted by storm related power cuts.

We have banded all our pole-mounted transformers into four categories, with R1 being the least rural and R4 being the most. The assessment uses the following measures:

- Number of connected customers
- ADMD (After Diversity Maximum Demand – the estimated load of transformers after taking demand diversity into account)
- Transformer capacity and forecast demand in 2050
- Distance from nearest train station (proxy for how well-connected a community is)
- Distance from nearest ground-mounted substation (typically supplying at least 200 homes this is a measure of a more developed area, typically with some cable network)
- LSOA (Lower Layer Super Output Area – defined by government)
- Volume of off-gas grid customers connected to the transformer (typically off-gas grid properties are more rural as the gas network was not developed to reach them)
- 2011 Rural-Urban Classification for Small Area Geographies (England and Wales)[14]
- 2020 Urban Rural Classification (Scotland)[15].

The approach we have taken to develop and apply the rurality index to our pole mounted transformer asset base is discussed in more detail in Appendix 9.

The Rurality Index has been assigned to poles and circuits by assessing the proportion of PM transformers on the circuit which are Rurality Index R4, with any circuit with greater 25% considered highly rural and anything between 0% and 25% considered average rurality. The pole volumes and their rurality metrics are given in Table 2.

Table 2. Pole volumes and rurality

LICENCE	NOT RURAL	AVERAGE RURALITY	HIGH RURALITY
SPD	87,099	31,303	61,969
SPM	97,967	32,529	28,129

Updated Severe Weather Areas

This approach is used in options analysis for Initiatives 1 and 5.

Following lessons learned from Storm Arwen, SPEN have completed a self-funded innovative project to redefine the severe weather areas in both licence areas. The impact of storms such as Storm Arwen highlighted that the existing maps were limited in their ability to assess the

[14] Rural Urban Classification - GOV.UK (www.gov.uk)
[15] Scottish Government Urban Rural Classification 2020 - gov.scot (www.gov.scot)

impact of climate risk on the network, and so required modernisation. This project has updated our severe weather maps using satellite image climate data from the past 10 years to establish weather patterns and forecast this effect 10-15 years into the future. The updated severe weather maps (as shown in Figure 4) use 10-year hourly satellite data for the following factors:

- Wind speed & prevailing direction
- Temperature
- Precipitation
- Wind gust & direction
- Line icing
- Lightning

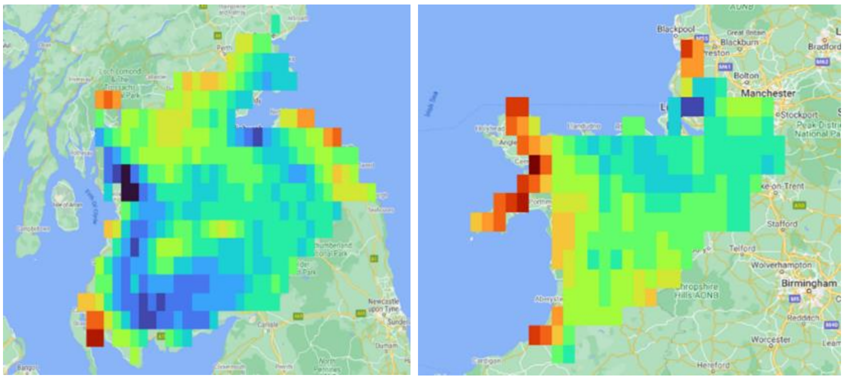

Figure 4. Example screenshots of updated severe weather maps for SPD (L) and SPM (R)

SPEN have layered the updated severe weather areas over our GIS systems to identify assets within these areas. This process has informed the initiatives outlined in this reopener by allowing prioritisation of assets located in areas with historical poor weather. The severe weather areas are also being used to inform equipment specification for our BAU asset modernisation.

Further detail on our updated severe weather areas can be found in Appendix 10.

Protection Zone Naming Convention

Discussed in Appendix 11 is our innovative approach to protection zone naming, which has been developed following submission of our RIIO-ED2 business plan. The outputs of this can support with identification of specific sections of overhead line for prioritised intervention as part of the proposed reopener initiatives.

4. Theme 1: Enhanced Network Storm Resilience

4.1. Needs Case

4.1.1. Area 1: Asset Resilience

This is the first area within Theme 1. The below Storm Arwen Recommendations have led us to propose prioritised investment to enhance the resilience of network assets and supplies, including additional proactive replacement of poles, installation of new OHL smart technologies, and development of interconnection opportunities across DNO boundaries. These initiatives will reduce the likelihood of customer interruptions during storms, and will reduce the time off supply when there is an interruption.

Our stakeholder engagement outlined in Section 4.3 shows support for initiatives to enhance resilience of the network to storms, as raised by our Independent Net Zero Advisory Committee (INZAC), customers and key stakeholders.

Table 3. Related Storm Arwen Recommendations for Asset Resilience

NO.	INITIATIVE	RECOMMENDATION
1	**Enhanced HV Pole Storm Resilience**	**Ofgem 1 / E3C E2:** E3C should review current network infrastructure standards and guidance, including those for vegetation management and overhead line designs, to identify economic and efficient improvements that could increase network resilience to severe weather events. **Ofgem 2:** DNOs and Ofgem should commission a review into how pole health is assessed, to identify changes that will improve pole condition reporting
2	**Innovative OHL Smart Solutions**	**Ofgem 6 / E3C R1**: E3C should review and update industry best practice for identifying faults and assessing the extent of network damage, to reduce customer restoration times. This review should include the role of smart meter data and technology for this task.
3	**Interconnection across DNOs**	**Ofgem 6 / E3C R1**: E3C should review and update industry best practice for identifying faults and assessing the extent of network damage, to reduce customer restoration times. This review should include the role of smart meter data and technology for this task. **Ofgem 7 / E3C R5**: E3C should identify other appropriate areas where mutual aid could be appropriately and effectively deployed to reduce customer restoration times and enhance customer support during power outages.
4	**OHL Digital Twin Storm Modelling**	**Ofgem 2**: DNOs and Ofgem should commission a review into how pole health is assessed, to identify changes that will improve pole condition reporting **Ofgem 6 / E3C R1**: E3C should review and update industry best practice for identifying faults and assessing the extent

NO.	INITIATIVE	RECOMMENDATION
		of network damage, to reduce customer restoration times. This review should include the role of smart meter data and technology for this task.

Initiative 1: Enhanced HV Pole Storm Resilience

As part of the Storm Arwen Recommendations, improvements to the assessment of pole health were recommended, this initiative is a result of the analysis we have done in this area.

There are two main pole programmes in our RIIO-ED2 baseline plan, one for HV overhead line circuit modernisation (CV7), and one for removal of defects by repairing and maintaining poles (CV31). This initiative proposes a new programme, following the Storm Arwen Recommendations and a review of our business strategy to improve network resilience to storms, to replace additional stand-alone poles based on their vulnerability to severe weather. These will be identified using a combination of factors to identify poles that would perform poorly during storms that otherwise wouldn't be captured under one of our BAU programmes.

During Storm Arwen, faults on overhead lines were caused by sustained high winds combined with falling and windborne debris; in these conditions damage can be incurred on conductors, pole mounted equipment, or poles themselves. Repairing damaged poles is a time consuming and resource intensive activity typically requiring specialised vehicles, and multiple resources as the pole and grounded conductor must be replaced/repaired. This has repercussions on restoration time of other faults as resources are occupied with pole replacement. As such, reducing the likelihood of pole failure during storms has a compound benefit of avoiding the pole fault, and releasing resource capacity for other fault repairs.

Although severe windborne debris is indiscriminate to asset condition, we confirmed a strong correlation between asset health and damaged poles. During Storm Arwen, over 250 HV poles were sufficiently damaged to require replacement, analysis indicates that HI5 poles were disproportionately damaged compared to HI1 poles, e.g., 5% of SPM poles are categorised as HI5 but this population represented 42% of the Storm Arwen failures. Similarly, 6% of SPD poles are categorised as HI5 but represented 25% of the failures. Overall, 38% of all HV poles failures in Storm Arwen were HI4/5 – whereas only 19% of all SPEN HV poles are HI4 or HI5[16]. Whilst some of these faults are unavoidable due to windborne material and extreme wind speeds, there is a clear link to failure between pole condition and the weather.

There are also certain types of pole defects which can be judged through engineering assessment to increase the likelihood of failure during high winds e.g., pole lean and broken stays. Although some of these defects will contribute towards asset health score, their presence can be used to further prioritise a storm resilience replacement programme. The proactive replacement of these standalone poles is intended to remove the weakest links on overhead line, reducing the risk of interruption through storm damage.

Improved targeting of poles using enhanced asset risk modelling, to avoid network damage and reduce interruptions is well aligned with recommendations Ofgem 1 / E3C E2, and Ofgem 2 and represents a clear needs case for this initiative.

Initiative 2: Innovative OHL Smart Solutions

As noted within the Storm Arwen Recommendations, there is a clear needs case to enhance our ability to identify network faults, and in particular nested faults to assess the extent of network damage, and in turn reduce customer restoration times.

[16] 63,619 poles out of 338,996, using CNAIM v2.1 data extracted in October 2023

Installation of smart technologies on targeted areas of the overhead line network could provide benefits during storm events such as avoiding loss of supply for rural customers and accelerating restoration of supplies through faster fault location and network automation. As the maximum time to restoration for SPEN customers during Storm Arwen was 7 days[17], there is a clear justification for smart devices that can support with reducing the time off supply.

Customers would experience the greatest benefit by the installation of smart solutions on overhead circuits with poor fault history. SPEN have entered in discussions with Kelvatek on two new technologies for use on the overhead line network.

1. **Perch** – An LV OHL re-closing device to restore transient/conductor clash faults which would traditionally require an on-site fuse replacement.
2. **LineSight** – An HV OHL network monitoring device using combined sensor and communication technology to detect the presence and location of HV OHL faults, including nested damages.

Following review of these solutions, we have discounted the Perch solution prior to full Options Assessment due to similarities to existing technology being rolled out as part of our RIIO-ED2 BAU activity, see Appendix 5 for details.

Initiative 2 is focussed on Kelvatek's LineSIGHT device: an OHL HV Network Fault Location and Management Solution. This monitoring and fault management system can provide the location of faults and clearance issues as well as detect asset deterioration. There are three key components within this solution, including monitoring hardware, centralised data collection system and control room integration. These units are deployed along HV main lines, typically with between five to eight units per circuit, located within each protection zone to allow monitoring of current flow and to identify nested faults - including those on spur lines.

The ability to identify nested faults, allowing quicker repair and restoration, aligned with recommendations Ofgem 6 / E3C R1 represent a clear needs case for this initiative.

Initiative 3: Interconnection across DNOs

The Storm Arwen Recommendations highlighted that areas for mutual aid should be identified to reduce customer restoration times and enhance customer support during power outages.

In response, we have been collaborating with our adjacent DNOs to identify areas of networks at the boundaries of our licence areas which could benefit from, or provide benefit to, the adjoining DNO through interconnection between licence areas. SPEN share boundaries with NGED and ENWL in SPM, and with ENWL, NPg and SSEN in SPD.

Along these boundaries, there are sections of network that can be described as radially-fed overhead network spur lines without redundancy. These will typically have longer restoration times during faults and storm events due to limited network rearrangement options. These areas also tend to be located further away from operational depots than the rest of the network, increasing time for operational staff to attend site, assess faults and restore supplies.

As part of the boundary networks assessment, sites have been selected where there are limited or no options to interconnect within SPEN's own network, as circuits can be far apart and with limited capacity.

This initiative proposes the installation of a small number of interconnecting circuits run normally open between DNOs with specific protection arrangements. In some cases, installing circuits between DNOs is cheaper than finding interconnection within each DNO due to the isolated locations along network boundaries, with closest circuits located several km away

[17] GHD - Storm Arwen Review Main Report.pdf (ofgem.gov.uk)

whilst the other DNO network may be closer. These interconnectors can be made live if required during storms to provide customers with a back-fed supply and reduce time off supply in the event that the primary DNO infeed suffers a fault.

The ability to reduce restoration times through DNO collaboration and provision of mutual aid (through network capacity as opposed to traditional resources) is well-aligned with recommendations Ofgem 7 / E3C R5 and represents a clear needs case for this initiative.

Initiative 4: OHL Digital Twin Storm Modelling

The Storm Arwen Recommendations suggested updating best practice within industry for assessing the extent of network damage, including through technology.

We have been engaging with Neara on their enterprise software platform for use in modelling the HV overhead line network to perform circuit risk management analysis and storm resilience analysis. Neara is a cloud-based enterprise platform that builds 3D engineering-grade network models, using finite element analysis (FEA) to provide a digital twin of the physical system. This allows for several use cases including design and vegetation management, but critically allows for the modelling of the application of mechanical forces e.g., wind speed, on network assets to determine likelihood of failure under storm conditions.

Developing a dynamic model in Neara enables SPEN to maximise value from multiple existing data sets including Asset Health, LiDAR, and complimentary network risk data, resulting in useful insights (e.g., asset failure or vegetation risk) and 'what-if' analysis by providing simulation of weather impact on asset integrity. Performing 'what-if' weather analysis allows us to understand the impact of simulated severe weather on network structural integrity. This also includes assessing impact of remediation options such as adding stays to poles. This can be done at-scale, enabling both strategic and tactical decisions on improving the network's weather resilience.

The application of digital technology to reduce restoration times by avoiding asset failures, and to develop new ways to assess asset health (e.g., through simulated 'what if' analysis) is well-aligned with recommendations Ofgem 6 / E3C R1 and Ofgem 2 and represents a clear needs case for this initiative. This initiative assesses various options for the roll-out of this platform for our HV OHL network.

4.1.2. Area 2: Vegetation Management

This is the second area within Theme 1. As discussed in Section 3.2.3, ETR 132 is the industry technical report produced by the ENA to provide a risk-based methodology to guide DNOs on how to improve resilience of overhead networks under abnormal weather by upgrading resilience to vegetation related faults. This is being reviewed in response to the Storm Arwen Recommendations.

The updated report is in draft at the time of this submission but is near final and expected to be issued as EREC G132 in early 2024. We have included relevant extracts of the draft text in Appendix 7. These extracts show that a focus of the update is to encourage improved resilience for customers that are not prioritised under the previous guidance. Specifically, this addresses the most rurally isolated customers on circuits with lower customer numbers that may not warrant investment under a conventional Cost Benefit Analysis (CBA).

Our proposal under this reopener is to improve resilience for rural customers, in line with the issue of EREC G132. Whilst the revised guidance is not in final form, we are confident that it will reflect the importance of improving resilience for rural customers. This is separate to our existing RIIO-ED2 baseline plan, which is aligned to current guidance, and will reduce the likelihood of faults on overhead main lines by removing the risk of vegetation falling.

Our stakeholder engagement outlined in Section 4.3 shows that the priorities of our stakeholders include improved management of tree growth, also recommended by customers following the impacts of Storm Arwen.

Table 4. Related Storm Arwen Recommendations for Vegetation Management

NO	INITIATIVE	RECOMMENDATION
5	**Reflecting ETR 132 Updates**	**Ofgem 1/E3C E2**: E3C should review current network infrastructure standards and guidance, including those for vegetation management and overhead line designs, to identify economic and efficient improvements that could increase network resilience to severe weather events.

Initiative 5: Reflecting ETR 132 Updates

The Storm Arwen Recommendations state that infrastructure standards and guidance are to be reviewed for vegetation management, with ETR 132 currently being updated by the ENA to highlight importance of resilience for new customer groups.

During storms, a significant number of faults on the overhead network are caused by vegetation and other debris falling due to high winds. The consequences of these faults are most significant for those in rural communities with no alternative power supply arrangement, who are often located along spur and sub-spur lines which are many kilometres long. Faults caused by vegetation along these circuits can have long restoration times due to access, fault location identification and the possibility of multiple nested faults.

Within this reopener, we are proposing additional investment to enhance vegetation management for both licences with additional overhead lines being made compliant with ETR 132 and its update, EREC G132.

The application of the updated vegetation infrastructure resilience standard EREC G132 to increase resilience to severe weather is well-aligned with recommendations Ofgem 1/E3C E2 and represents a clear needs case for this initiative.

4.1.3. Area 3: Generation

This is the third area within Theme 1. Additional opportunities for deployment of temporary generation and battery supplies can support vulnerable customers and rural communities during high volume of faults and complex repairs. Our proposals in this area will allow for:

- Rural community temporary restoration through single large generator deployment, reducing time taken to deploy high volumes of smaller generators to restore the same number of customers, and releasing resource to undertake network repairs.
- Individual high priority / vulnerable customer equipment to continue working, such as ventilators, CPAP, dialysis, feeding pumps and automated medication devices.

Our stakeholder engagement outlined in Section 4.3 highlighted the use of temporary supply restoration devices and distributed generation and storage devices as a priority.

Table 5. Related Storm Arwen Recommendations for Generation

NO	INITIATIVE	RECOMMENDATION
6	**New Generation Connection Points**	**Ofgem 8/E3C R2**: E3C to identify options to enhance the use of mobile generators in reducing the length of power disruption, covering the population of mobile generators held by DNOs and resourcing options to transport, install, refuel and remove

Initiative 6: New Generation Connection Points

The Storm Arwen Recommendations encouraged the identification of options to enhance the use of mobile generators in reducing the length of power disruption.

When loss of supply occurs for customers on the network for any unplanned incidents, time to restoration may be extended due to the location and complexity of the fault. SPEN currently have a small fleet of LV generators which can be used to temporarily restore supplies to single premises or multiple properties depending on the generator and demand size. This allows us to restore supplies temporarily whilst faults are located and repaired in a prioritised way.

Our existing volume of generators is given in Table 6. The typical minimum generator we supply to restore a property is a 6kVA pod generator, though our forecasts of average demand illustrate a property will require 8.5kVA[18], based on this demand we can restore 543 supplies with the current generator fleet.

Table 6. SPEN existing generator fleet

GENERATOR SIZE	SPD VOLUME	SPM VOLUME
<5kVA	4	-
6kVA	107	31
40kVA	11	22
50kVA	1	-
55kVA	1	-
60kVA	8	-
100kVA	9	8
200kVA	-	1
Total	**141**	**62**

During storm events, the location of this fleet of generators is tracked to ensure fuel reserves are managed and they can be re-deployed after repair works are completed. Smaller LV generators tend to need fuel levels topping up every 8-12 hours, which can take up a significant amount of time for operational engineers who must travel between multiple locations. Time to install generators can also be significant, especially when restoring supplies to multiple properties as there are specific earthing arrangements and risk assessments required. This is time the operational engineers cannot spend repairing and restoring the network.

This initiative sets out the targeted installation of permanent connection points for generators on the HV overhead network. These generator connection points (GCPs) would include pre-installed HV earthing arrangements, cable terminations, poles, concrete plinths, and any HV ground-mounted or pole-mounted switchgear required. This would reduce the time taken to restore temporary supplies as the generator could be landed, connected and tested in a single installation e.g., a single well-positioned 500kVA generator could offset the need to install 30-40 smaller 6-40kVA generators, significantly reducing the install time and the re-fuelling burden. The demand fed by the generators is pre-assessed, avoiding requirements for local calculation or network reconfiguration required to ensure sufficient capacity.

Alongside several GCPs, a small number of large capacity generators would be purchased to supplement the existing fleet for use at these locations. The generators could either be HV with an air-break switch (ABSW), or LV with a package ground-mounted secondary transformer and RMU, this would be able to feed significantly more customers than the existing fleet of small generators. Both options have been investigated as part of this proposal.

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[18] *From the average demand per customer on HV overhead lines, forecasting demand out to 2050.*

These additional generators could also be used at sites not proposed as one of the GCPs if required during an exceptional event, though there would be a longer installation time.

This enhanced approach for mobile generator seployment, which also reduces the operational burden of deployment and enables faster restoration, is well-aligned with recommendations Ofgem 8/E3C R2 and represents a clear needs case for this initiative.

4.2. Optioneering

This section sets out the consideration of options for each of our 6 initiatives under Theme 1.

Section 3.4 presents the overarching methodology used to identify the range of initiative options, including detail on new tools used to develop options for a subset of initiatives. We will then present the detailed optioneering for each initiative in the following subsections.

The optioneering sections for each initiative are structured as follows; if applicable we first set out comparable outputs and allowances within our baseline RIIO-ED2 programme, this is to take account of any interactions between the initiatives and existing programmes, and to ensure there is no duplication or impact of allowances within initiatives. We then present the option criteria, a summary of the options considered, and finally detail on the preferred option.

4.2.1. Initiative 1: Enhanced HV Pole Storm Resilience

This initiative targets the replacement of stand-alone HV poles with the highest susceptibility to failure from severe weather, excluding those targeted for modernisation within RIIO-ED2. The main driver for this initiative is to identify poles with higher susceptibility to failure from severe weather.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

The following section outlines activity we are already undertaking within RIIO-ED2 which has similar outputs to this initiative. This is presented to demonstrate the proposed initiative outputs will be over and above baseline outputs without duplication, and that delivery of this initiative will not have any consequential reduction on baseline allowance activity.

As mentioned in Section 4.1.1, the RIIO-ED2 modernisation plan for overhead lines is based on whole circuit intervention, e.g., all poles, overhead conductor, and pole-mounted equipment. This is to provide targeted efficient interventions along entire feeders to modernise equipment of similar ages and conditions. Our RIIO-ED2 allowance and outputs does not include scope for standalone pole replacements outside of these planned circuits. The RIIO-ED2 baseline programme was discussed in detail within the engineering justification paper ED2-NLR(A)-SPEN-002-OHL-EJP LV & HV Overhead Lines – Issue 2. Extracted costs and volumes of HV pole replacements are given in Table 7 below.

Table 7. RIIO-ED2 Condition Driven HV Pole Replacement, 2020/21 prices (CV7)

LICENCE	FINAL SUBMISSION	
	£M	VOLUME
SPD	38.4	16,604
SPM	30.7	13,252

The RIIO-ED2 plan for HV pole defect clearance was discussed in detail within Annex 4A.20 Network Operating Costs – Issue 2, and focusses on all defect types. The investment proposed for SPM in RIIO-ED2 was an uplift on that from RIIO-ED1 (59% higher p.a.[19]), due to a high number of defects discovered in this licence. SPD's RIIO-ED2 investment was roughly in line with RIIO-ED1. The costs and volumes for this are shown in Table 8.

Table 8. RIIO-ED2 HV Pole Defect Clearances, 2020/21 prices (CV31)

LICENCE	FINAL SUBMISSION	
	£M	VOLUME
SPD	6.2	56,250
SPM	11.7	106,350

Baseline investment and volumes in these two areas in RIIO-ED1 are shown in Figure 5 and Figure 6, alongside RIIO-ED2 baseline spend.

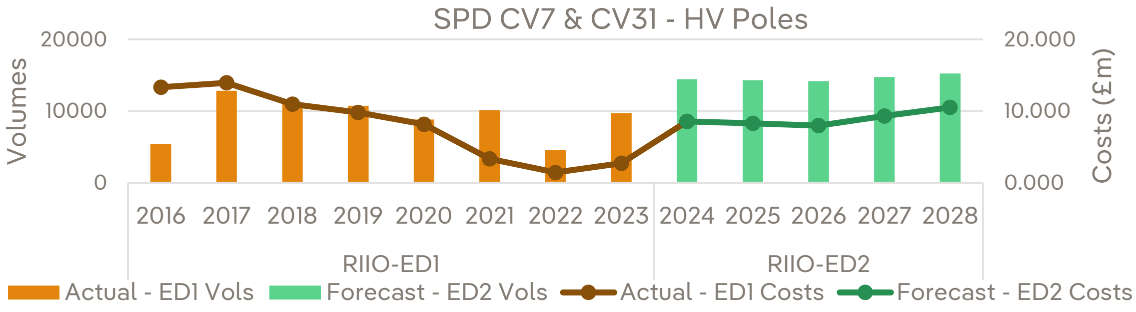

Figure 5. SPD Track Record for HV Pole Replacement and HV Pole Defect Clearance

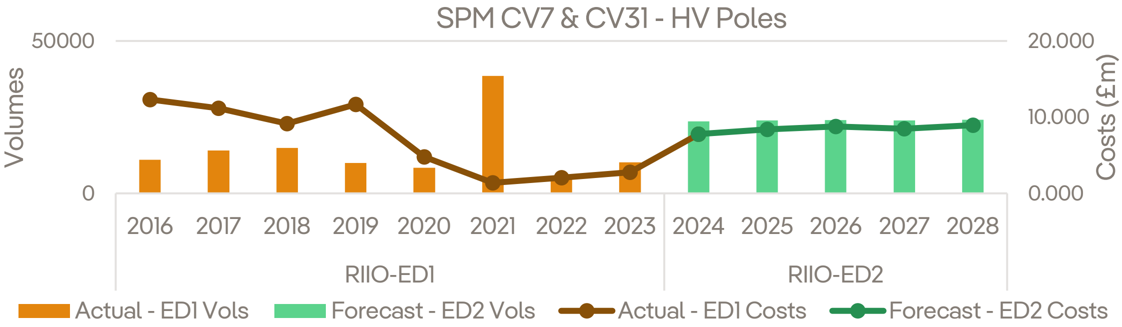

Figure 6. SPM Track Record for HV Pole Replacement and HV Pole Defect Clearance

To ensure this initiative is over and above RIIO-ED2 allowances, options within this initiative should exclusively target poles which combine poor health index with presence of specific storm resilience defects. This can be achieved by excluding all circuits planned within our baseline replacement plan and by ensuring poles with defects will be replaced rather than simply clearing the defect, as per the baseline defect clearance allowance.

The volume of poles replaced as part of this initiative will be recorded separately to those replaced under the RIIO-ED2 baseline plan, as will the NARMs risk point benefit. The proposed method of capturing these costs and outputs is discussed in Section 4.5.1.

[19] *£2.34m p.a in ED2 compared with £1.47m p.a. in ED1, using CV31 HV pole costs*

Options Criteria

We have identified four criteria to select options for this initiative. These are our new severe weather areas, our Rurality Index Metric, Health Index using CNAIM V2.1[20] methodology, and the presence of specific asset defects linked to storm resilience. We consider these to be the most useful characteristics to determine the likelihood of exposure to, and failure from, severe weather. Key information relating to each criterion is set out below.

Table 9 shows the current volumes of storm resilience defects on the network.

Table 9. Existing Storm-Related HV pole defects

DEFECT	SPD VOLUME	SPM VOLUMES
Pole off plumb	33,448	27,138
Pole badly off plumb	1,285	832
Pole planting Depth shallow	4,278	6,763
Broken stay	2,628	5,956
Slack stay	4,017	2,553
Total	**45,656**	**43,242**

Volumes of all HI4 and HI5 HV poles are shown in Table 10, as well as the volume of HI4 and HI5 poles with storm-related defects. This can be considered as the initial subset of assets suitable for consideration under this proposal:

Table 10. HI4/5 HV poles (future health score, CNAIM v2.1)

DESCRIPTION	SPD VOLUME	SPM VOLUME
Total HV Pole Population	180,371	158,625
HI5 HV poles	16,197	20,310
HI4 HV poles	18,657	13,204
HI5 poles with storm-related defects	6,605	7,048
HI4 poles with storm-related defects	10,917	9,132

The volume of HV poles in each new SPEN severe weather area band is also shown in Figure 7. As can be seen the vast majority are in the lower severity weather bands of 3-6.

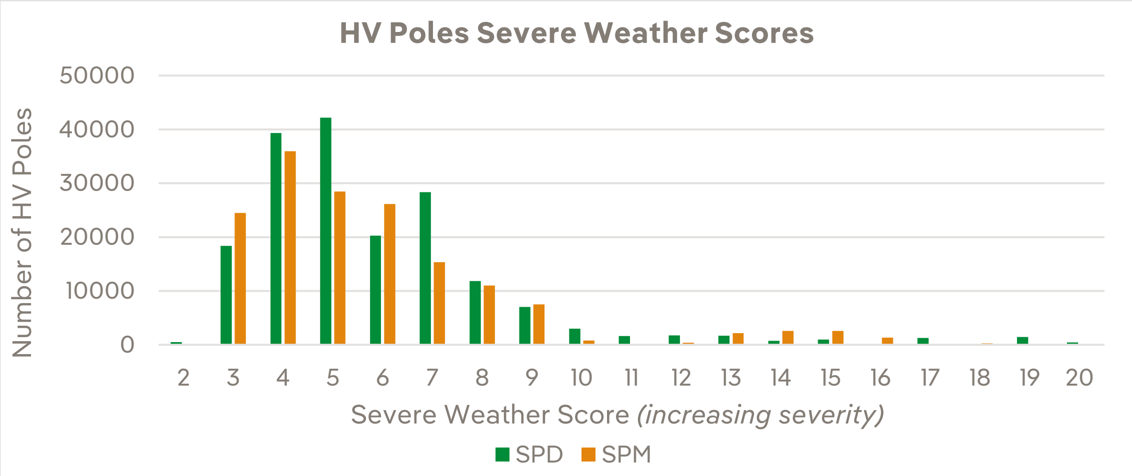

Figure 7. HV Poles Severe Weather Scores (all HIs)

[20] https://www.ofgem.gov.uk/sites/default/files/docs/2021/04/dno_common_network_asset_indices_methodology_v2.1_final_01-04-2021.pdf

The rurality of HV poles has also been considered within this initiative, for brevity we have not re-produced this detail as it is presented in Table 2 of Section 3.4.1.

Finally, consideration has also been given to replacement of associated lengths of overhead conductor where consecutive runs of poles are identified for replacement within this initiative.

Options Considered

We have developed 5 options under this initiative, including a do-minimum and sensitivity analysis. The thresholds for the options selected have been chosen to represent a diverse range of engineering solutions to the challenge of storm vulnerable poles including targeted asset replacement, line rebuild and undergrounding.

Table 11 summarises these options, with the selected option discussed in further detail in the Preferred Option section.

Table 11. Optioneering for Enhanced HV Pole Storm Resilience

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the "do minimum" option.
1	Replace all poles which meet the following criteria: • HI4 or HI5 • Not identified for replacement within ED2 • Presence of at least one of the five storm-related defects • Severe weather score greater than 6 • High circuit rurality. This is 1,116 poles in SPD, 2,540 poles in SPM	Considered	Severe weather score of 5.88 is the average of all HV poles – anything with this score or above is treated as a more severe weather area. High circuit rurality is defined as over 25% of the pole-mounted transformers along the circuit being banded as rurality metric R4 (the most rural).
1a	Sensitivity analysis on Option 1 – reducing SPM's volume of poles to account for the large uplift in CV31 funding for pole defect clearance, when comparing ED1 annual costs to ED2 annual costs. This is 1,116 poles in SPD, 1,597 poles in SPM.	Considered	ED2 p.a. is 59% higher than ED1 p.a. in CV31. To avoid double funding in this initiative it is assumed 59% of the remaining SPM defects will be resolved through CV31 baseline programmes and will not require Storm Arwen funding.
2	Replace poles highlighted for replacement under Option 1a with additional funding for overhead line where multiple poles are located in a row along the same circuit. This is 1,116 poles & 7.3 km OHL in SPD, and 1,597 poles & 8.1 km OHL in SPM.	Excluded	Same poles as outlined in Option 1a with additional overhead line included, assuming 5 spans per circuit are required (with average length of span 79m in SPD and 81m in SPM). Excluded due to limited justification behind assumed length of overhead conductor required, plus

#	OPTIONS	DECISION	COMMENT
			deliverability concerns over completing conductor replacements on top of pole volumes (see Section 4.5.2 for discussion over risk of conductor being required).
3	Underground circuits identified in Option 2, rather than completing overhead line additions.	Excluded	Excluded due to costs and time required to design and deliver undergrounding schemes for all highlighted circuits. Reduction in CI/CML is possible whilst keeping circuits overhead, and does not require large change to asset base.

Preferred Option

The preferred option is Option 1a, this is assessed to meet the requirements of the needs case, offer a positive NPV, and manage the deliverability and risks of the programme. The factors used to select this option are set out below:

- Health Index – HI4 and HI5 poles considered for intervention, as poor condition contributes to lower resilience against storms. HI4 and HI5 assets are approaching or are at end-of-life and so targeting these poles avoids replacing assets early.
- RIIO-ED2 plan – Only circuits that are outside of the planned RIIO-ED2 asset modernisation programme have been highlighted for pole replacement under the reopener, to ensure the volumes and investment proposed under this initiative are additional to that which has already been provided.
- Defects – Only poles that currently have one of the storm-related defects in Table 9 outstanding have been included under this initiative, as these defects will reduce pole resilience to storms and other severe weather.
- Severe Weather Score – All poles have been assigned a severe weather score based on their geographical location, any pole with a score of 6 or higher is included within this initiative. 6 has been chosen for the cut-off, as the average severe weather score of all HV poles is 5.88. Anything above this score can be considered as more likely to experience severe weather, and so is justified for targeted pole replacement.
- Rurality – Each pole-mounted transformer has a specific rurality metric, from R1 to R4. A circuit's rurality can be considered by calculating the % of pole-mounted transformers along that circuit which are R4, with anything with >25% considered more rural due to having more transformers than expected in that band (R4 is ¼ of the rurality bands and so on average, HV circuits should have ¼ of all transformers in that band).
- Defect Reduction Factor (SPM Only) – As discussed in earlier sections, the RIIO-ED2 baseline programme for defect clearance (CV31) is a step-up in SPM in comparison to RIIO-ED1 delivery. This is due to the large number of outstanding defects on overhead lines in SPM.

We have completed a CBA to justify this initiative, the results are given in Table 12.

Table 12. CBA Results for Proposal for Enhanced HV Pole Storm Resilience

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Replace HV poles	10.77	Rejected	(£2.35)	(£0.64)	£1.04	£3.20	£3.90
Option 1a	Replace HV poles with volume reduction in SPM	7.99	Adopted	(£1.41)	£0.01	£1.35	£3.04	£3.57
Option 2	Replace poles with OHL conductor	0.00	Rejected					
Option 3	Underground circuits	0.00	Rejected					

The CBA indicates that Option 1 and the sensitivity analysis (Option 1a) result in a positive whole life NPV result. Option 1 is the most NPV positive, £3.90 greater than the baseline scenario whilst Option 1a is £3.57m greater than the baseline scenario. Despite the marginally reduced NPV, Option 1a has been selected over Option 1 as it ensures there is no overlap with existing allowances and improves the deliverability of this initiative alongside baseline programmes.

As the intervention is forecast to carry >45-year asset life expectancy, the positive CBA at this time justifies the intervention to replace HV poles which are HI4/5, have a storm defect, are of high rurality, in severe weather areas, and not included in the RIIO-ED2 baseline plan.

This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission. Key milestones are the yearly delivery of planned costs, volumes and risk points. These are set out below:

The forecast cost and volume profiles for this proposal are given in Table 13.

Table 13. Costs Profile for Enhanced HV Pole Storm Resilience, 2020/21 prices

LICENCE	COST PROFILE £M						VOLUME PROFILE					
	23/24	24/25	25/26	26/27	27/28	TOTAL	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.82	0.82	0.82	0.82	**3.29**	-	279	279	279	279	**1,116**
SPM	-	1.18	1.18	1.18	1.18	**4.71**	-	399	399	399	400	**1,597**

The delivery profile for this initiative is linear, roughly in line with the baseline plan profiles (Figure 5 and Figure 6) to ensure this is deliverable on top of existing programmes of work and does not require additional resource in a particular year. Any under-delivery of this programme (i.e., fewer volumes) will result in remaining allowances (actuals deducted from forecast) being returned to customers as part of the proposed reporting mechanism (Section 4.5.1). The increase in pole replacements as a result of this initiative will not impact the existing CV31 programme, as discussed in Section 4.5.2.

Initiative costs are based on the SP Energy Networks RIIO-ED2 Unit Cost Manual (Annex 5A.5 of our RIIO-ED2 Business Plan), which uses a bottom-up cost assessment of the components of activity detailed within the RIGs Annex A for the activities, our contractual rates for delivery, market available rates and historic spend levels. The unit cost has been adapted to accurately represent costs when carrying out standalone pole replacement rather than replacement of multiple poles along a circuit, as shown in Table 14.

Table 14. Unit cost for HV Pole Replacement, 2020/21 prices

COST TYPE	UNIT COST MANUAL, £K	REOPENER UNIT COST, £K	COMMENT
Materials	1.05	1.05	Material costs of pole installation do not change.
Contractor	1.27	1.90	Based on a team of contractors taking 50% longer to replace 2 HV poles at different locations in comparison to 2 HV poles located sequentially along a circuit.
Total	**2.31**	**2.95**	There are no additional indirect labour costs included in this unit cost.

The monetised risk point benefit associated with this investment is given in Table 15.

Table 15. Risk Point Benefit of this proposal

LICENCE	RISK POINT BENEFIT
SPD	9,918,524
SPM	17,434,969

This investment will address the needs case by reducing the likelihood of HV overhead line faults during storm events, by removing weak assets with condition factors and defects that can affect resilience, improving performance for customers. This meets the Storm Arwen Recommendations by re-assessing how pole health is viewed in terms of storm resilience, as well as identifying improvements to overhead line resilience.

Option 1a includes the lowest volumes out of all options considered, with volumes assessed as deliverable on top of RIIO-ED2 baseline programmes. Option 2 was discounted due to limited data to forecast volume of overhead conductor required, there is a possibility that a small volume of overhead conductor is required when carrying out the proposed pole replacements. Any costs associated with this will need to be captured under this reopener with an associated reduction in pole volumes, removing the lowest priority assets to account for the cost of intervention, this is addressed in the deliverability and risk assessment of this initiative in Section 4.5.2.

4.2.2. Initiative 2: Innovative OHL Smart Solutions

This initiative covers the deployment of OHL smart sensor equipment (the Kelvatek LineSIGHT device) to enable to detection and faster restoration of network faults, including nested damages. The main driver for this is to reduce length of interruption for customers following a fault, improving CML performance and customer satisfaction.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

Although we are undertaking some comparable activity in RIIO-ED2, this programme is a new technology for SPEN and the detection of pre-fault and nested damages on HV OHL networks is over and above our baseline plans.

Our CV15 Quality of Supply plan includes funding for deployment of Network Controllable Points (NCPs) at strategic network points to provide greatest benefit to customers by reducing the number and length of interruptions. Our RIIO-ED2 baseline programme is discussed in detail within the engineering justification paper ED2-NLR(A)-SPEN-001-QOS-EJP Quality of Supply – Issue 2. Costs and volumes of NCP installations are given in Table 16 below.

Table 16. RIIO-ED2 NCP Programme, 2020/21 prices (CV15)

LICENCE	FINAL SUBMISSION	
	£M	VOLUME
SPD	12.3	1,126
SPM	14.1	1,027

At final determination for RIIO-ED2, Ofgem awarded DNOs with no allowances for CV15 programmes, meaning there is no duplication or impact on funding for this activity.

Under CV11 Operational IT & Telecoms we are installing LV Monitors. The RIIO-ED2 baseline programme is discussed within ED2-NLR(O)-SPEN-001-MON-EJP LV Network Monitoring – Issue 2. Costs and volumes of LV monitor installations are given in Table 17 below.

Table 17. RIIO-ED2 LV Monitors Programme, 2020/21 prices (CV11)

LICENCE	FINAL SUBMISSION	
	£m	Volume
SPD	15.5	7,749
SPM	12.8	6,353

Whilst some of the benefits of installing LineSIGHT are like those for NCPs and LV Monitors (supply restoration, monitoring, fault location), the main driver is its ability to identify nested faults. This is not currently possible with any technology included in our baseline RIIO-ED2 plans, and the investment is separate from our baseline OHL smart solution plans.

The volume of smart solutions installed under the Storm Arwen reopener will be recorded separately to any NCPs or LV monitors installed under the RIIO-ED2 baseline plan. Investment in NCPs and LV Monitors in RIIO-ED1 and in the RIIO-ED2 baseline plan is shown in Figure 8 and Figure 9.

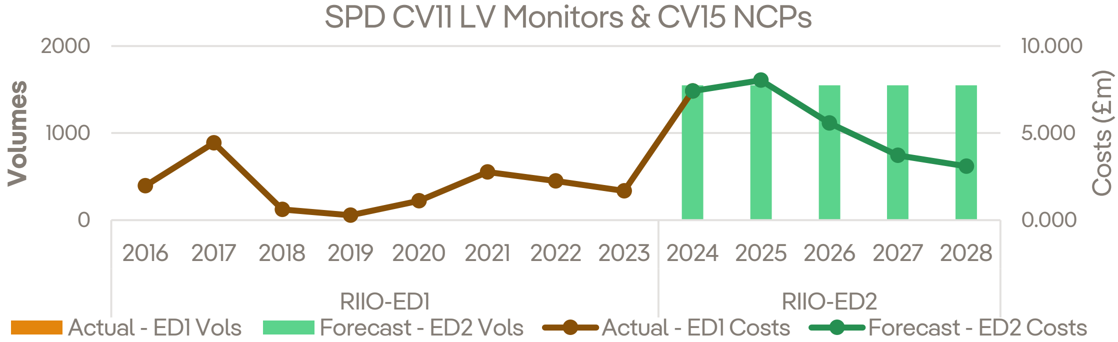

Figure 8. SPD Track Record for LV Monitors and NCPs

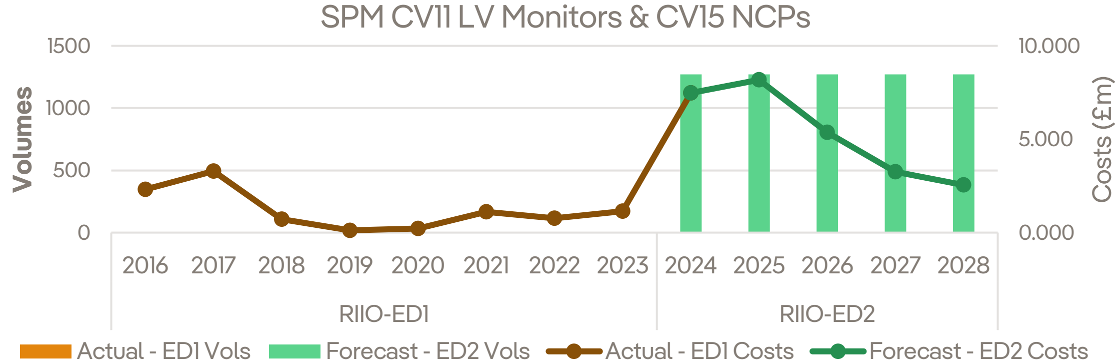

Figure 9. SPM Track Record for LV Monitors and NCPs

Options Criteria

A HV circuit prioritisation model has been developed with input from Kelvatek to identify circuits targeted for LineSIGHT installation. This model has assessed several factors, including:

- Number of connected customers
- Circuit characteristics e.g., length (main and spur), % OHL and storm fault performance
- Incidents in last 3 years (CI / CML history)
- Presence in the RIIO-ED2 modernisation plan
- Rurality Index Metric.

The circuits highlighted as highest priority for intervention were identified within two groups:

1. The first group highlighted circuits with significant outages during Storm Arwen based on rurality, length, CML/CI ratio and the RIIO-ED2 plan. This highlighted 7 circuits for prioritisation.
2. The second group highlighted circuits that would likely fault in the remaining years within RIIO-ED2 to allow assessment of the benefits of this technology. This highlighted 17 circuits for prioritisation.

The methodology to arrive at these circuits is discussed in more detail in Appendix 12.

Consideration was given to including asset health in this prioritisation model, however it was decided to focus primarily on consequence of failure when identifying circuits for LineSIGHT installation rather than probability of failure. Reducing probability of failure is captured under the initiative for Enhanced HV Pole Storm Resilience in Section 4.2.1.

A second device, PERCH, was also considered for inclusion in this reopener, as discussed in Appendix 5. Following further investigation it has not been deemed appropriate for inclusion within this submission and there is crossover with our baseline LV Monitor plan.

Options Considered

We have developed 5 options under this initiative, including a do-minimum scenario. The thresholds for the options selected have been chosen to represent ascending deployment ambition by prioritising circuits that are modelled to return the greatest benefit.

The following options have been selected using the criteria above and through discussions with Kelvatek on the most beneficial circuits for installation, as well as the optimal number and location of devices along each circuits. Final volumes are described in further detail in the Preferred Option section.

Table 18. Optioneering for Innovative OHL Smart Solutions

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the “do minimum” option.
1	Install LineSIGHT along highest priority circuits for initial small-scale roll-out (4 in SPD, 3 in SPM)	Considered	7 circuits have been identified for this initial roll-out. Benefits assessment assumes one severe weather event per year.
2	Install LineSIGHT along identified small scale roll-out circuits plus roll-out to another 17 circuits (trial circuits in Option 1 plus additional 7 in SPD, 10 in SPM)	Considered	An additional 17 circuits have been identified as beneficial for LineSIGHT installation. Benefits assessment assumes one severe weather event per year.

#	OPTIONS	DECISION	COMMENT
2a	Sensitivity analysis on Option 2, assessing benefit with reduced frequency of storms.	Considered	Benefits assessment assumes one severe weather event every other year.
3	Install LineSIGHT along all HV OHL circuits that could see a potential benefit, following Kelvatek evaluation criteria (358 circuits)	Excluded	SPEN have chosen to only consider the highest priority circuits for the initial roll-out of this technology, postponing full roll-out until benefits can be seen and quantified. Whilst all circuits identified may see some benefit, in order to ensure cost efficiency for customers and deliverability we are rejecting this option.

Preferred Option

The preferred option is Option 2, to install LineSIGHT along the 24 priority circuits identified as beneficial as part of an initial roll-out of this technology. This provides the greatest NPV positive return and is assessed to meet the needs case. The option has also been assessed for deliverability and risk in Section 4.5.2.

We have completed a CBA for this initiative. As this is a new smart technology with limited data it has not been possible to include evidenced benefits. Therefore, the CBA assumes that the benefit will be a reduction in the CML/CI ratio from 300 (as per options criteria) down to the average for HV OHL (92) for 1 fault per circuit per year. Only CML improvements have been considered as nested fault location will reduce restoration time rather than avoid customer interruptions. CBA results are given in Table 19.

Table 19. CBA Results for Innovative OHL Smart Solutions

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 YRS	20 YRS	30 YRS	45 YRS	WHOLE LIFE
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install LineSIGHT along 7 circuits	1.02	Rejected	£0.17	£0.73	£1.06	£0.96	£0.95
Option 2	Install LineSIGHT along 24 circuits	4.62	Adopted	(£0.06)	£1.64	£2.63	£2.20	£2.16
Option 2a	Sensitivity Analysis on Option 2	4.62	Rejected	(£1.12)	(£0.76)	(£0.56)	(£0.99)	(£1.02)
Option 3	Install on all highlighted circuits	0.00	Rejected					

The CBA option with the highest whole life NPV value is Option 2, £2.16m above the baseline scenario. Option 1 is also positive, £0.95m above the baseline. Option 2a, the sensitivity analysis, is £1.02m below the baseline. This option assumes that each circuit with LineSIGHT only experiences one storm-related fault every two years, which is a conservative assumption, and does not include any wider benefits for reduction in non storm-related interruptions.

The intervention is forecast to carry a 25-year asset life expectancy, the positive CBA at this time justifies the intervention to install LineSIGHT along 24 targeted HV circuits. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Key milestones are the yearly delivery of planned costs and volumes. The forecast cost and volume profiles for this proposal are given in Table 20.

Table 20. Costs Profile for Innovative OHL Smart Solutions, 2020/21 prices

LICENCE	COST PROFILE £M						VOLUME PROFILE					
	23/24	24/25	25/26	26/27	27/28	TOTAL	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	1.94	0.06	0.06	0.06	**2.12**	-	**11**	**-**	**-**	**-**	**11**
SPM	-	2.29	0.07	0.07	0.07	**2.50**	-	**13**	**-**	**-**	**-**	**13**

The delivery profile has been front-loaded with all devices delivered in the first year of allowances. This has been discussed with the supplier to ensure devices can be provided and installed in a single year. In front-ending this programme, the benefits of this technology can be seen as soon as possible.

We will design all 24 circuits and finalise the location of all devices within 3 months of approval of this initiative. This should allow sufficient time to install all devices within the second year of RIIO-ED2, with a key delivery milestone in April 2025. Benefits of installation can be assessed thereafter. This ensures three years of data is available for RIIO-ED3 planning.

Costs have been provided by Kelvatek[21] following detailed analysis of the seven trial circuits and estimated costs and volumes for the following 17 circuits. This includes costs for the devices, as well as communications links, project management, installation and commissioning costs. SPEN are confident this represents the efficient cost for the proposal. [redacted].
Any over-delivery of this programme (i.e., delivery of all volumes for lower cost) will result in allowances being returned to customers as part of the proposed reporting mechanism (Section 4.5.1).

This investment will address the needs case by reducing the time off supply for customers experiencing a fault due to enhanced fault detection and location as well as identification of nested faults. This will benefit customers by restoring supplies more quickly following a fault as our operational staff will have key information about the network prior to arrival on site. This meets the Storm Arwen Recommendations to use smart technology for fault identification and to assess the extent of network damage, reducing customer restoration times.

4.2.3. Initiative 3: Interconnection across DNOs

This initiative focuses on the installation of interconnecting circuits between DNOs to provide back-up supply during extreme weather events e.g., storms. The main driver is enhanced resilience of the most rural areas of network, providing another method of in-feed to reduce time off supply to improve system performance for customers.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

There are no initiatives within existing RIIO-ED2 investment plans to install interconnecting circuits across DNOs. All costs associated with installation of these interconnectors are proposed to be included in the reopener, including but not limited to asset replacement, network reinforcement, protection upgrades and comms surveys.

[21] *Indexation rate of 1.248743 used to convert from 2023/24 to 2020/21 prices*

Options Criteria

DNOs have engaged extensively through bi-laterals and workshops to identify potential circuits for interconnection (through visual network boundary assessment), complete initial benefit studies and develop draft costs for both the interconnector and any additional work required e.g., upstream reinforcement.

These circuits have been used to inform our options analysis. Each potential interconnector is discussed in detail in Appendix 13. Only interconnectors which create benefit for both DNOs, or a significant benefit for one DNO, are included within this reopener proposal.

Cost apportionment for proposed interconnectors has been agreed based on benefit, and ownership of assets has been agreed separately. The interconnectors identified in this proposal, are consistent with the schemes proposed by others and can be read in conjunction with our neighbouring DNO Storm Arwen reopener submissions.

A summary of the final proposed interconnectors and estimated costs are outlined in Table 21.

Table 21. Costs of Interconnection across DNOs, costs in 2020/21 prices

SPEN LICENCE	OTHER DNO	INTERCONNECTOR NAME	TOTAL COST, £K	SPEN COST, £K	ADDITIONAL SPEN REINFORCEMENT, £K
SPM	ENWL	Blundell House	38.52	19.26	0.00
SPM	ENWL	Fiddlers Ferry	275.79	211.09	0.00
SPM	ENWL	Heath House Croft	61.05	26.87	59.26
SPD	NPg	Doddington Lowick A	859.51	420.25	25.83
SPD	NPg	Killham Downham	788.80	384.90	22.69
SPD	NPg	Milfield Airfield	682.74	331.87	149.72
SPD	NPg	Smeafield	706.31	343.65	71.23
SPD	SSEN	Meadowhead Farm – Morland Farm Cleish	95.52	47.76	26.90
SPD	SSEN	Quinloch – Blairquhosh	78.66	39.33	111.66
SPD	SSEN	East Auchencarrock PTE – Blairquhomrie	61.79	30.89	46.19
SPD	SSEN	Westerton House PTE – Blairnyle	52.09	26.04	25.38
SPM	NGED	Blackhurst Farm – Middle Morrey	33.95	33.95	57.10
SPM	NGED	Vyrnwy cottage – Cross lane cottage tran	40.51	0.00	95.16
SPM	NGED	Railway Bungalow – Glyn Farm	55.67	55.67	111.66
SPM	NGED	Garth Fawr – Glanyrafon	92.17	0.00	197.94
SPM	NGED	Chapel House – Dernol Bungalow	42.39	42.39	158.61
SPM	NGED	Sandyford beurton – Sandyford	40.84	0.00	38.07
SPM	NGED	Calverhall – pool farm	40.84	0.00	3.30
SPM	NGED	Pen-y-borfa - Sarn poultry	45.75	0.00	4.57
SPM	NGED	Maen Arthur cottage – pontrhydygroes	45.75	0.00	44.41
Total			**£4.14m**	**£2.01m**	**£1.25m**

Costs are based on the SP Energy Networks RIIO-ED2 Unit Cost Manual (Annex 5A.5 of our RIIO-ED2 Business Plan), which uses a bottom-up cost assessment of the components of activity detailed within the RIGs Annex A for the activities, SP Energy Networks contractual rates for delivery, market available rates and historic spend levels. Full breakdown of these costs can be found in Appendix 13.

Options Considered

The following options have been selected through discussions with other DNOs on which potential interconnectors will have sufficient benefit for either/both DNO(s). The proposed list of interconnectors was initially narrowed down through several bi-laterals and investigation into the technical requirements, costs, and potential benefits to customers. Table 22 gives the options considered for this initiative.

Table 22. Optioneering for Interconnection across DNOs

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the "do minimum" option.
Option 1	Install interconnectors at all potential locations, identified by initial network boundary visual assessments	Excluded	The initial network assessment highlighted 60 potential interconnectors between SPEN and other DNOs. These do not all provide an obvious benefit and are therefore unjustified, and there are deliverability concerns about developing full designs for 60 new interconnecting circuits.
Option 2	Install interconnectors at locations which provide sufficient benefit to both DNOs, or which provide a significant benefit to one DNO (See Table 23 below). Benefits assessed are annual CI/CML benefit.	Considered	Following the initial round of independent DNO assessments, multiple interconnectors have been rejected as not providing sufficient benefit to either DNO. The remaining interconnectors (20 locations) are located in areas in need of additional network arrangements to restore power, based on fault history, length of circuit, number of customers, capacity, location, and strength of neighbouring DNO's network. The benefits in this option assess the CI/CML annual benefit with no forecast severe weather event resulting in maximum GSOP payment.
Option 2a Option 2b	Install same number of interconnectors as Option 2, with sensitivity analysis on the benefits of these (using maximum GSOP payment)	Considered	Sensitivity analysis on Option 2. These options assess the benefit of the interconnector is a maximum GSOP event occurs either 1 or 10 years after interconnector installation, rather than looking at annual fault rate benefits. This ensures that the investment is justified even if a severe weather event doesn't occur for years after the interconnector installation.

Preferred Option

The preferred option is Option 2, to install interconnectors at locations which provide sufficient benefit to one or both DNOs. The method that led to adoption of this option is outlined below.

We initially identified a long list of potential locations for interconnectors with each neighbouring DNO by visually assessing the boundary network. This long list was reduced following a detailed benefit assessment by each DNO; this considered customer numbers, local demand, length of radial, length of proposed interconnector, conductor types, phasing and voltage, and network type (underground/overhead). Each DNO applied a low/medium/high score to each suggested interconnector, based on the expected benefit. These were continued or discounted based on the criteria in Table 23.

Table 23. Interconnector Benefit Scores and Result

BENEFIT SCORE 1	BENEFIT SCORE 2	RESULT
Low	Low	Discount
Low	Medium	Discount
Low	High	Continue to high level costing
Medium	Medium	Continue to high level costing
Medium	High	Continue to high level costing
High	High	Continue to high level costing

The progressed interconnectors were then assessed based on location of assets, interventions required, high level costs and network design. This led to some interconnectors being further discounted based on feasibility, or as the perceived benefit reduced. Those that were carried forward from this stage have been included in this reopener.

SPEN have carried out Cost Benefit Analysis to justify this initiative, completing one CBA per boundary with other DNOs (ENWL, SSEN, NPg, NGED) i.e. four CBAs in total for this initiative. Due to general network design in each area, the design solutions across each DNO boundary are similar and so costs, benefits and avoided costs are comparable. Therefore, each CBA is considered representative for other interconnector locations on the same cross-DNO boundary. SPEN have chosen the second most expensive interconnector to assess through CBA for each boundary (when assessing initial interconnector cost). If this is justified, every interconnector at that DNO boundary has been considered justified.

The results from each CBA are shown in the following tables.

Table 24 shows the CBA results for one example interconnection between ENWL and SPM. The interconnector used for this analysis is Heath House Croft, full detail in Appendix 13. The cost for this interconnector is given in Table 21 and includes roughly 50% of the total cost for the interconnector, and upstream reinforcement costs.

This CBA includes sensitivity analysis to compare a range of different approaches used to calculate the benefits in terms of avoided costs, with Option 2 showing avoided costs if this circuit could be back fed from ENWL for every forecast fault, and Options 2a and 2b showing avoided costs if there was a single storm event that would have led to the maximum GSOP payment being required (plus associated CI/CML) for all SPEN customers along that circuit. The initial costs to install the interconnector are the same for each of these options.

Table 24. CBA Results for Proposal for Interconnection across DNOs – ENWL Heath House Croft

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install all interconnectors	0.00	Rejected					
Option 2	Install justified interconnector, using expected fault rate per	0.09	Adopted	£0.08	£0.22	£0.32	£0.43	£0.50

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
	year as avoided costs							
Option 2a	Sensitivity analysis on Option 1, using maximum GSOP payment in year after intervention as avoided costs	0.09	Rejected	£0.31	£0.46	£0.55	£0.62	£0.64
Option 2b	Sensitivity analysis on Option 1, using maximum GSOP payment 10 years after intervention as avoided costs	0.09	Rejected	(£0.04)	£0.21	£0.32	£0.41	£0.45

The CBA indicates that Option 2 and both sensitivity analyses (Options 2a and 2b) result in a positive whole life NPV results. Option 2a is the most NPV positive, £0.64m greater than the baseline scenario whilst Option 2 is £0.50m greater than the baseline scenario. The requested investment is the same for all three of these options, with the only difference being the measure of benefits against the baseline. Therefore, Options 2a and 2b are not technically rejected, but the modelling used to justify the investment was being tested due to uncertainty.

As the intervention is forecast to carry at least a 45-year asset life expectancy, the positive CBA at this time for all options justifies the intervention to install interconnectors across the boundary between ENWL and SPM. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Table 25 shows the CBA results for interconnection between NPg and SPD. The interconnector used for this analysis is Kilham Downham, full detail in Appendix 13. The cost for this interconnector is given in Table 21, and includes 50% of the total cost (excluding voltage regulator costs which each DNO will pay for), as well as upstream reinforcement costs.

This CBA includes sensitivity analysis to compare the investment costs with a range of different approaches, this is consistent with the ENWL example in Table 24.

Table 25. CBA Results for Proposal for Interconnection across DNOs – NPg Kilham Downham

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install all interconnectors	0.00	Rejected					
Option 2	Install justified interconnector, using expected fault rate per year as avoided costs	0.41	Adopted	(£0.09)	(£0.01)	£0.06	£0.14	£0.20
Option 2a	Sensitivity analysis on	0.41	Rejected	(£0.01)	£0.01	£0.02	£0.03	£0.04

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
	Option 1, using maximum GSOP payment in year after intervention as avoided costs							
Option 2b	Sensitivity analysis on Option 1, using maximum GSOP payment 10 years after intervention as avoided costs	0.41	Rejected	(£0.19)	(£0.12)	(£0.10)	(£0.08)	(£0.06)

The CBA indicates that Option 2 and sensitivity analysis Option 2a result in a positive whole life NPV results. Option 2 is the most NPV positive, £0.20m greater than the baseline scenario whilst Option 2a is £0.04m greater than the baseline scenario. Option 2b is £0.06m below the baseline solution, though is getting closer to being NPV positive over each year. The requested investment is the same for all three of these options, with the only difference being the measure of benefits against the baseline. Therefore, Options 2a and 2b are not technically rejected, but the modelling used to justify the investment was being tested due to uncertainty.

As the intervention is forecast to carry at least a 45-year asset life expectancy, the positive CBA at this time for Option 2 justifies the intervention to install interconnectors across the boundary between NPg and SPD. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Table 26 shows the CBA results for interconnection between SSEN and SPD. The interconnector used for this analysis is Quinloch-Blairquhosh, full detail in Appendix 13. The cost for this interconnector is given in Table 21, and includes 50% of the total cost for the interconnector as well as upstream reinforcement costs.

This CBA includes sensitivity analysis to compare the investment costs with a range of different approaches, this is consistent with the ENWL example in Table 24.

Table 26. CBA Results for Proposal for Interconnection across DNOs – SSEN Quinloch-Blairquhosh

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install all interconnectors	0.00	Rejected					
Option 2	Install justified interconnector, using expected fault rate per year as avoided costs	0.15	Adopted	(£0.02)	£0.02	£0.05	£0.08	£0.11
Option 2a	Sensitivity analysis on Option 1, using maximum GSOP payment in year after intervention as avoided costs	0.15	Rejected	£0.03	£0.05	£0.06	£0.07	£0.07

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Option 2b	Sensitivity analysis on Option 1, using maximum GSOP payment 10 years after intervention as avoided costs	0.15	Rejected	(£0.07)	(£0.02)	(£0.01)	£0.00	£0.01

The CBA indicates that Option 2 and both sensitivity analyses (Options 2a and 2b) result in a positive whole life NPV results. Option 2 is the most NPV positive, £0.11m greater than the baseline scenario whilst Option 2a is £0.07m greater than the baseline scenario and Option 2b is £0.01m greater. The requested investment is the same for all three of these options, with the only difference being the measure of benefits against the baseline. Therefore, Options 2a and 2b are not technically rejected, but the modelling used to justify the investment was being tested due to uncertainty.

As the intervention is forecast to carry at least a 45-year asset life expectancy, the positive CBA at this time for all options justifies the intervention to install interconnectors across the boundary between SSEN and SPD. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Table 27 shows the CBA results for interconnection between NGED and SPM. The interconnector used for this analysis is Chapel House – Dernol Bungalow, discussed in detail in Appendix 13. The cost for this interconnector is given in Table 21, and includes the full capital cost of the installation of this interconnector as agreed with NGED, as well as upstream reinforcement costs.

This CBA includes sensitivity analysis to compare the investment costs with a range of different approaches, this is consistent with the ENWL example in Table 24.

Table 27. CBA Results for Proposal for Interconnection across DNOs – NGED Chapel House

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install all interconnectors	0.00	Rejected					
Option 2	Install justified interconnector, using expected fault rate per year as avoided costs	0.20	Adopted	£0.92	£2.16	£3.05	£3.95	£4.51
Option 2a	Sensitivity analysis on Option 1, using maximum GSOP payment in year after intervention as avoided costs	0.20	Rejected	£0.12	£0.19	£0.23	£0.26	£0.27
Option 2b	Sensitivity analysis on	0.20	Rejected	(£0.09)	£0.03	£0.08	£0.13	£0.15

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
	Option 1, using maximum GSOP payment 10 years after intervention as avoided costs							

The CBA indicates that Option 2 and both sensitivity analyses (Options 2a and 2b) result in a positive whole life NPV results. Option 2 is the most NPV positive, £4.51m greater than the baseline scenario whilst Option 2a is £0.27m greater than the baseline scenario and Option 2b is £0.15m greater. The requested investment is the same for all three of these options, with the only difference being the measure of benefits against the baseline. Therefore, Options 2a and 2b are not technically rejected, but the modelling used to justify the investment was being tested due to uncertainty.

As the intervention is forecast to carry at least a 45-year asset life expectancy, the positive CBA at this time for all options justifies the intervention to install interconnectors across the boundary between NGED and SPM. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Key milestones for this initiative are the forecast cost and volumes for each proposed interconnector, given in Table 28.

Table 28. Costs Profile for Proposed Interconnectors, SPEN Apportionment

LICENCE	OTHER DNO	INTERCONNECTOR	SPEN COST PROFILE £M					
			23/24	24/25	25/26	26/27	27/28	TOTAL
SPM	ENWL	Blundell House	-	-	-	-	0.019	**0.019**
SPM	ENWL	Fiddlers Ferry	-	-	0.070	0.070	0.070	**0.211**
SPM	ENWL	Heath House Croft	-	-	0.013	0.013	0.059	**0.086**
SPD	NPg	Doddington Lowick A	-	-	0.149	0.149	0.149	**0.446**
SPD	NPg	Killham Downham	-	-	0.136	0.136	0.136	**0.408**
SPD	NPg	Milfield Airfield	-	-	0.161	0.161	0.161	**0.482**
SPD	NPg	Smeafield	-	-	0.138	0.138	0.138	**0.415**
SPD	SSEN	Meadowhead Farm Saline-Morland Farm Cleish	-	-	0.025	0.025	0.025	**0.075**
SPD	SSEN	Quinloch-Blairquhosh	-	-	0.050	0.050	0.050	**0.151**
SPD	SSEN	East Auchencarroch PTE-Blairquhomrie	-	-	0.026	0.026	0.026	**0.077**
SPD	SSEN	Westerton House PTE-Blairnyle	-	-	0.017	0.017	0.017	**0.051**
SPM	NGED	Blackhurst Farm - Middle Morrey	-	-	-	0.017	0.074	**0.091**
SPM	NGED	Vyrnwy cottage - Cross lane cottage tran	-	-	-	-	-	**-**
SPM	NGED	Railway Bungalow - Glyn Farm	-	-	0.056	0.056	0.056	**0.167**
SPM	NGED	Garth Fawr - Glanyrafon	-	-	-	-	-	**-**
SPM	NGED	Chapel House - Dernol Bungalow	-	-	0.021	0.180	-	**0.201**

LICENCE	OTHER DNO	INTERCONNECTOR	SPEN COST PROFILE £M					
			23/24	24/25	25/26	26/27	27/28	TOTAL
SPM	NGED	Sandyford beurton - Sandyford	-	-	-	-	-	-
SPM	NGED	Calverhall - pool farm	-	-	-	-	-	-
SPM	NGED	Pen-y-borfa - Sarn poultry	-	-	-	-	-	-
SPM	NGED	Maen arthur cottage - pontrhydygroes	-	-	-	-	-	-
SPD Total			0.000	0.000	0.701	0.701	0.701	**2.104**
SPM Total			0.000	0.000	0.355	0.435	0.369	**1.159**
SPEN Total			**0.000**	**0.000**	**1.056**	**1.137**	**1.071**	**3.264**

Additional milestones include regular bi-laterals with other DNOs to finalise the design and development of each interconnector, including detailed designs and finalisation of asset ownership, operation and Control Room responsibilities.

Initiative costs are based on our RIIO-ED2 Unit Cost Manual and are accurate, efficient and reasonable. We have a high degree of confidence in each cost as they have been developed at a component level. This is discussed in detail in RIIO-ED2 Annex 5A.5 - Unit Cost Manual Issue 2. Following publication of Ofgem's RIIO-ED2 expert view unit costs, we are confident that we are comparable to these and that our unit costs fully reflect the best costs to deliver these activities. A comparison to Ofgem final determination unit costs is shown in Table 29.

Table 29. Comparison of SPEN Unit Cost Manual unit costs and Ofgem Expert View unit costs

ASSET	SPEN UC (£K)	OFGEM UC (£K)
6.6/11kV CB (PM)	11.542	11.344
6.6/11kV OHL (Conventional)	25.377	25.383
6.6/11kV Pole	2.313	2.373
6.6/11kV Switchgear - Other (PM) ABSW	1.961	2.002
6.6/11kV RMU	24.187*	15.249
6.6/11kV CB Secondary	40.218*	12.360

** These costs are higher than the Ofgem expert view unit cost as they are for our SP Manweb region, which has a unique, interconnected design and results in additional costs due to the complexity. This is discussed in Annex 4A.25 SP Manweb Company Specific Factors – Issue 2.*

SPEN regularly design and install comparable circuits and are confident in delivering these efficiently, as discussed in Section 4.5.2. It is difficult to align this work with any existing programmes, but any interconnectors proposed in similar areas can be bundled together to improve efficiencies. Any over-delivery of this programme (i.e. delivery of all interconnectors for lower cost than the proposed expenditure) will result in costs being returned to customers as part of the proposed reporting mechanism (Section 4.5.1).

This investment will address the needs case by reducing the time off supply for customers experiencing a fault in the outskirts of our network, by providing a secondary network configuration to restore supply. This meets the Storm Arwen Recommendations to provide mutual aid across Network Operators, with SPEN able to support other DNOs and to receive support where needed. This initiative will benefit customers by avoiding extended periods of no supply and strengthens the UK network through a whole systems approach to provide the best solution regardless of customer location. This is a relatively new initiative and may require some complex designs, but provided the costs outlined in this submission are available to DNOs, this is an achievable proposal which will improve performance for our customers in areas that have limited alternatives during power outages.

4.2.4. Initiative 4: OHL Digital Twin Storm Modelling

This initiative proposes the development of a simulated network with enhanced engineering analysis capability, by combining network risk with environmental scenarios to identify solutions to improve overhead network resilience. The main driver is to improve network resilience through proactive interventions, based on modelling weather conditions over assets and identifying likely failures prior to faults occurring.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

SPEN have completed an initial proof-of-value (PoV) project to develop an OHL digital twin following Storm Arwen. Following this successful PoV, the wider scale roll-out is proposed for inclusion under this reopener as the benefits will support our response to storms and exceptional events by identifying at-risk areas and forecasting fault locations and timings.

The benefits of this project above our existing RIIO-ED2 baseline investment for OHL are:

- **Ability to model weather patterns on our existing asset base using its most recent condition** – currently we assess the condition of our assets using CNAIM v2.1 for poles and our internal condition-based assessment for other overhead equipment. This tells us the probability of failure in general, but does not take into account specific circumstances such as high winds from a particular direction. This fully physics enabled digital twin will allow us to apply weather conditions on our overhead network and forecast effects and predicted asset failures. Given that the effects of Storm Arwen were so impactful in part due to the unusual direction of wind, having the ability to model this and other weather characteristics on our network assets is a major benefit. It allows proactive risk assessment and strategy development, such as mobilisation of additional operational staff to a certain area, preventative maintenance, repair and storm resilience investment, and predictive movement of generators to highly affected areas. It is not currently possible to use a localised digital model of asset failure to inform our proactive storm management activities.
- **Single model showing LiDAR vegetation data, asset health data, geographical features all in one place** – currently we gather data from multiple sources in order to extract value and build a picture of overhead assets and their risks. This model would allow maximum value extraction from multiple existing data sets, presenting all requirements in a single location with all outputs. Combining all models reduces time for project design, investment decision making, operational response planning and another important business processes. It also creates opportunity for new value streams which are not identifiable when information is separated.
- **Ability to assess impact of remediation options such as adding stays to poles** – currently intervention options are considered on single assets with limited ability to assess the effect of intervention in detail. This model would allow assessment of remediation options for assets at scale, with benefits assessed by comparing results of scenario analysis before and after proposed remediation, including during specific weather conditions. This assessment is currently not possible, even for individual assets.

Options Criteria

SPEN have engaged Neara on a potential modelling platform solution for the HV OHL network to deliver this functionality. The key criteria considered under this initiative are the scale and scope of platform implementation.

SPEN have recently completed a proof-of-value project with Neara on ~100 km of the HV overhead line network. The project has demonstrated Neara's ability to unify multiple network risks and consequences in a single platform, allowing prioritisation of network modernisation and option analysis including for severe weather scenarios. The results of this proof-of-value are discussed in Appendix 14.

Following the benefits seen from the proof-of-value project, especially in relation to storm analysis, SPEN propose rolling this out on a wider population of HV circuits to gain useful insights and perform innovative storm resilience analysis across the network.

Options Considered

The following options have been selected through engagement with Neara, and assessment of the OHL network to compare varying levels of implementation ambition and network coverage. The initiative options selected are set out in Table 30.

Table 30. Optioneering for OHL Digital Twin Storm Modelling

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the “do minimum” scenario.
1	Roll out digital twin across up to 3,000 km of most high-risk areas.	Considered	With circuits to be identified using circuit length, customer numbers, historical network performance, RIIO-ED2 modernisation plans, asset health, LiDAR data quality and region. Calculates CI/CML benefit of proactively replacing poles prior to failure as identified by Neara model. Assumes model is suitable for 8 years.
2	Roll out digital twin across whole HV OHL network (~20,000 km)	Considered	Full HV network modelling, with circuits prioritised using methodology outlined in Option 1. Calculates CI/CML benefit of proactively replacing poles prior to failure as identified by Neara model. Assumes model is suitable for 8 years.
2a	Sensitivity Analysis on Option 2, assess benefit if software only lasts for 6 years rather than 8	Considered	Due to uncertainty over lifetime of specialised software
3	Purchase new software type with similar capability to Neara model	Excluded	Following market assessment of available technology solutions, Neara is the only available modelling software which can fulfil all SPEN requirements. SPEN and Neara have completed a successful Proof-of-Value demonstrating the viability of the solution.

Preferred Option

The preferred option for this initiative is Option 2, to roll out the digital model across the whole HV OHL network within RIIO-ED2. This has been selected as the most NPV positive option, supported by risks identified with alternative options.

We have completed a CBA for this initiative, assessing the reduction in CI/CML where implementation of the OHL digital twin identifies poles which will fail during future storms (modelled wind-speeds and direction), allowing for proactive asset replacement prior to failure. We have also developed a sensitivity analysis due to uncertainty over the expected lifespan of this software solution.

The results from this are given in Table 31.

Table 31. CBA Results for Proposal for OHL Digital Twin Storm Modelling

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 YRS	20 YRS	30 YRS	45 YRS	WHOLE LIFE
Baseline	Do Nothing	0.00	Rejected					
Option 1	Build model for 3,000km of HV OHL network	0.10	Rejected	£3.45	£3.43	£3.42	£3.41	£3.41
Option 2	Build model for entire HV OHL network	0.73	Adopted	£4.36	£3.98	£3.76	£3.58	£3.54
Option 2a	Sensitivity Analysis on Option 2 with reduced lifespan of software	0.73	Rejected	£3.33	£3.05	£2.88	£2.74	£2.72
Option 3	Assess other technology solutions	0.00	Rejected					

The CBA indicates that Option 2 has the greatest positive NPV benefit, £3.54m above the baseline scenario. This is above Option 1, which is £3.41m greater than the baseline scenario. Option 2a was also NPV positive, £2.72m above the baseline scenario.

Although the NPV benefit for Option 2 is only marginally greater than Option 1, it is assumed that the modelled benefits are conservative and that other benefits including supporting operational responses during storms will be much greater under a whole-network model. For instance, modelling weather forecasts 24-48 hours in advance, can inform deployment of operational resources. We also consider a risk with Option 1 being the limited geographical application of the solution e.g., if storms occur in areas other than the modelled network areas.

This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Key milestones include forecast cost and volume profiles for this proposal, given in Table 32.

Table 32. Costs Profile for OHL Digital Twin Storm Modelling, 2020/21 prices

LICENCE	COST PROFILE £M						VOLUME PROFILE					
	23/24	24/25	25/26	26/27	27/28	TOTAL	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.06	0.10	0.10	0.10	**0.37**	-	-	-	-	-	**-**
SPM	-	0.06	0.10	0.10	0.10	**0.37**	-	-	-	-	-	**-**

This delivery profile assumes full model development is completed in one year, the second year of RIIO-ED2, with the following years allocated enduring licencing costs.

Additional milestones include the prioritisation of circuits for model development, which will be completed within 3 months of submitting the Storm Arwen reopener. Based on the PoV, it is anticipated the full model will be completed prior to April 2025.

Costs have been provided by Neara[22] following analysis of the volumes of HV OHL within SPEN and following the proof of value project. [redacted]

It is unlikely that there could be any over-delivery of this programme (i.e. delivery of the model for lower cost than the proposed expenditure), but any that does arise will result in costs being returned to customers as part of the proposed reporting mechanism (Section 4.5.1).

This investment will address the needs case by enhancing our capability to analyse the HV OHL network and the effects of weather on our assets, leading to investment and operational decisions that will improve resilience for customers. This meets the Storm Arwen Recommendations to improve how pole health is assessed, as well as developing a new practice for fault identification through the use of smart technology.

Option 2 will require SPEN to share existing LiDAR and asset data with Neara, with some internal testing to be completed. There is limited training required as the proof of value project included training for internal staff, and so limited time will be required during model development. Following discussions with Neara, it is achievable for the full model to be built within the second year of RIIO-ED2. This is discussed in more detail in Section 4.5.2.

4.2.5. Initiative 5: Reflecting ETR 132 Updates

This initiative proposes additional storm resilient vegetation management with focus on spur lines. The main driver is storm related damage reduction as measured through network interruptions because of vegetation.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

We undertake ENA-TS 43/8 vegetation safety clearance cuts on all OHL on a minimum 3-year cycle, this ensures safety compliance with vegetation but does not ensure fault resilience under severe weather conditions to falling or windborne vegetation debris. Our RIIO-ED2 baseline strategy includes funding for ETR 132 vegetation management, aligned with our overhead line modernisation plans. Our existing strategy targets interconnected main line compliance with ETR 132, but does not allow for ETR 132 activity on radial or spur lines.

The costs associated with all vegetation management in RIIO-ED2 are shown in Table 33.

Table 33. RIIO-ED2 Vegetation Management Investment, 2020/21 prices (CV29)

LICENCE	FINAL SUBMISSION £M
SPD	23.8
SPM	58.2

The investment under this reopener is separate from our baseline RIIO-ED2 plan as it focuses on ETR 132 (EREC G132) spur line compliance. The costs and volumes of spur line compliance under this proposal will be recorded separately to our RIIO-ED2 baseline plan. The proposed method of capturing these costs and outputs is discussed in Section 4.5.1.

Investment in vegetation management in RIIO-ED1 and in the RIIO-ED2 baseline plan is shown in Figure 10 and Figure 11.

[22] *Indexation rate of 1.248743 used to convert from 2023/24 to 2020/21 prices*

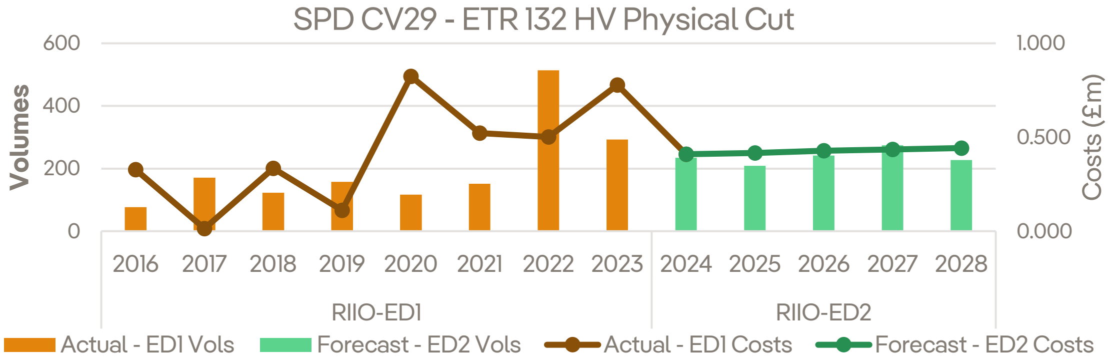

Figure 10. SPD Track Record for ETR 132 HV Physical Cut

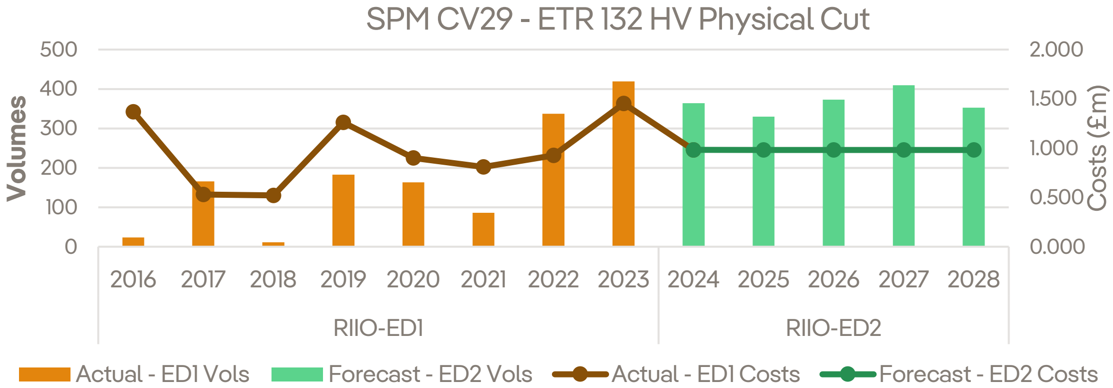

Figure 11. SPM Track Record for ETR 132 HV Physical Cut

Options Criteria

The criteria used to select options for this initiative include 1) our new severe weather areas, and 2) spur lines with greater proximity to vegetation.

Our LiDAR data provides us with number of vegetation intrusions per length of OHL on a per circuit basis. This data identifies the count of branches or other vegetation within 5 metres of the OHL, but outside of 2 m (our minimum clearance distance for 11kV, as per OHL-03-080, Specification for Overhead Line Vegetation Management Works). We have modelled intrusions along the full length of the circuit in our prioritisation model. The histogram in Figure 12 shows the distribution of vegetation intrusions per circuit, with the peak (most common number of vegetation intrusions) at 0.15-0.225 intrusions per m (highlighted in orange). The midpoint of this peak provides a threshold for defining circuits with more frequent intrusions (anything above 0.1875 intrusions per m), with roughly an even number of circuits on either side of the peak as per a bell curve. Another possible threshold for defining number of circuits is the use of the upper quartile, which is at 0.38 in SPD, and 0.41 in SPM.

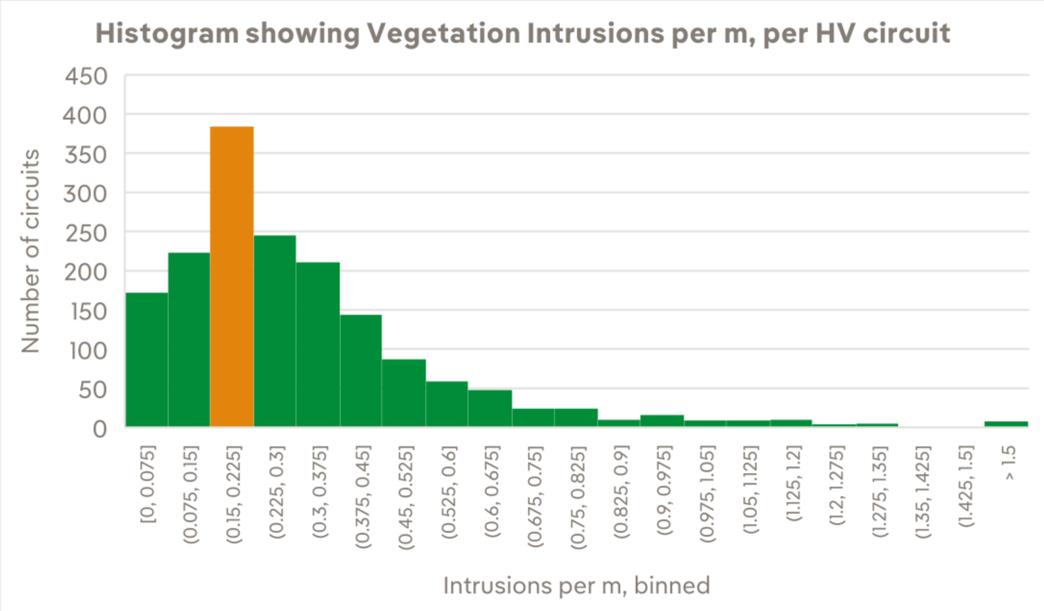

Figure 12. Histogram of Vegetation Intrusions per m, per HV circuit (LiDAR data)

Options Considered

The following options have been selected using the criteria set out above: latest LiDAR data and severe weather scores. These factors affect the probability of HV overhead line faults due to increased likelihood of vegetation damage and line proximity. The thresholds chosen to identify circuit options are described in Table 34 and in detail in the Preferred Option section.

Table 34. Optioneering for Reflecting ETR 132 Updates

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the "do minimum" option.
1	Invest in additional ETR 132 vegetation management for spur lines with vegetation intrusions per unit length above the set threshold, and with a higher-than-average severe weather score (168 circuits and 1,786km in SPD, 141 circuits and 2,908km in SPM)	Considered	Vegetation intrusions threshold is set at 0.1875 per m as per the distribution histogram in Figure 12. Severe weather score average calculated across all circuits with any circuits above average considered sufficiently justified for prioritisation.
1a	Sensitivity Analysis on Option 1, using upper quartile as vegetation intrusions cut off rather than the peak threshold	Considered	Upper quartile for vegetation intrusions is 0.38 in SPD, and 0.41 in SPM.
1b	Sensitivity Analysis on Option 1, introducing a new managed cycle for spur line vegetation management. The costs	Considered	Vegetation management is not a one-off investment, with main line ETR 132 cuts made every 3 years. A new managed cycle of 6 years is proposed for spur lines as

#	OPTIONS	DECISION	COMMENT
	and benefits from Option 1 are repeated 6 years later.		there is lower customer benefit than for main line compliance, but this investment is required to improve resilience for customers fed from overhead networks.

Preferred Option

The preferred option is Option 1b, to carry out vegetation management on spur lines with number of vegetation intrusions above the distribution peak, and with higher-than-average severe weather score. This option is NPV positive and ensures an enduring improvement to network storm resilience.

The factors used to narrow down volumes for each option are:

- RIIO-ED2 plan – The RIIO-ED2 vegetation management programme for ETR 132 compliance focusses on main line compliance, rather than spur line. By identifying spur lines for investment in this initiative, this ensures the volumes and investment proposed does not duplicate or impact the activity in our RIIO-ED2 baseline programmes.
- Severe Weather Score – All poles have been assigned a severe weather score based on their geographical location, which has been summed along each HV circuit and then averaged across the total number of poles. The average severe weather score was 5.29 across all HV circuits, anything above this score can be considered as more likely to experience severe weather, and so is justified for targeted vegetation management.
- Vegetation Intrusions – Higher number of vegetation intrusions as given in LiDAR data, increases the probability of tree branches falling on overhead lines during strong winds. Circuits with more intrusions are therefore higher priority for vegetation management, as they are at higher probability of a fault. To define the minimum number of intrusions per m for circuits to be considered, the data was plotted as in Figure 12, and the upper quartile was calculated. Using the upper quartile significantly reduces the number of circuits identified for vegetation management, due to the combination of this factor with the severe weather score. Using the peak of the distribution provides circuits that provided a more significant customer benefit, and was still prioritising circuits with greater number of intrusions.

SPEN have carried out a Cost Benefit Analysis to determine the best option and the delivery profile for this initiative, the results from this are given in Table 35.

Table 35. CBA Results for Proposal for Reflecting ETR 132 Updates

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Vegetation Management for circuits with higher than peak intrusions	10.52	Rejected	£0.68	£0.28	£0.05	(£0.12)	(£0.08)
Option 1a	Vegetation Management for circuits with	3.37	Rejected	£2.61	£3.70	£4.36	£4.88	£5.00

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
	higher than upper quartile intrusions							
Option 1b	Vegetation Management for circuits with higher than peak intrusions, maintaining a 6-year managed cycle	10.52	Adopted	(£0.38)	£0.85	£0.88	£0.94	£1.17

The CBA indicates that both Sensitivity Analysis Options (1a and 1b) result in a positive whole life NPV result. Option 1a is the most NPV positive, £5.00m greater than the baseline scenario whilst Option 1b is £1.17m greater than the baseline scenario. Option 1b has been chosen rather than Option 1a as the greater initial investment will provide resilience improvements for a higher number of customers – 187,228 rather than 66,216. Whilst Option 1b includes investment every 6 years, only the costs expected to be borne in RIIO-ED2 are included in this reopener request, with future funding to be included in RIIO-ED3 CV29 allowance.

The positive CBA justifies the intervention to complete vegetation management on spur lines, on top of existing RIIO-ED2 baseline programmes for main lines ETR 132 compliance. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

Key milestones for this initiative include forecast cost and volume profiles, given in Table 36.

Table 36. Costs Profile for Reflecting ETR 132 Updates, 2020/21 prices

LICENCE	COST PROFILE £M						VOLUME PROFILE (KM)					
	23/24	24/25	25/26	26/27	27/28	TOTAL	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	1.00	1.00	1.00	1.00	**4.00**	-	446	446	446	446	**1,786**
SPM	-	1.63	1.63	1.63	1.63	**6.52**	-	727	727	727	727	**2,908**

The delivery profile for this programme is linear, roughly in line with the existing RIIO-ED2 ETR 132 programme for main lines (Figure 10 and Figure 11). This ensures that this new programme can be overlayed on existing plans without risking delivery of either. The works can also be aligned where there are similar locations identified for vegetation management.

An additional milestone for this initiative is prioritisation of circuits for intervention and alignment with existing ETR 132 main line programmes to identify geographically close lines, which should be completed within 3 months of this initiative being approved.

Costs within this proposal are based on the unit cost included in SPEN's RIIO-ED2 business plan submission, which are outlined in Table 37. These are considered to be efficient unit costs, as they are based on extensive experience of this activity in RIIO-ED1.

Table 37. Unit cost for vegetation management, 2020/21 prices

LICENCE	UNIT COST, £K	SOURCE	COMMENT
SPD	1.80	From RIIO-ED2 CV29 Tree-Cutting Row91, ETR132 HV Physical Cut	-
SPM	2.68		-
SPEN	2.24	Average unit costs.	Used in reopener for consistency

SPEN have a well-developed programme for vegetation management on main lines. The proposed spur line initiative will be aligned with the existing programme for delivery in close locations. Any over-delivery of this programme (i.e., delivery of all volumes for lower cost than the proposed expenditure) will result in costs being returned to customers as part of the proposed reporting mechanism (Section 4.5.1).

This initiative will address the needs case by reducing the likelihood of HV overhead line faults during storm events, by removing trees and vegetation intrusions along high-risk spur lines, improving performance for customers. This meets the Storm Arwen Recommendations by re-assessing vegetation management guidance, as well as identifying improvements that could increase network resilience to severe weather events.

4.2.6. Initiative 6: New Generation Connection Points

This initiative proposes the installation of permanent generator connection points (GCPs) at prioritised locations along the HV overhead network, to allow rapid connection of large-scale generation to feed multiple pole-mounted transformers and their customers. As part of this, a small number of large capacity generators are also proposed for purchase. The main driver for this initiative is to restore supplies more quickly, by providing temporary supply following faults during storm events. This will improve performance for customers.

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

We are undertaking investment in RIIO-ED2 to purchase replacement LV generators to maintain our current fleet. These costs are captured under C6 – Vehicles and Transport (Non-Operational).

This initiative differs from RIIO-ED2 baseline investment as it focuses on proactive intervention to reduce time off supply if a fault does occur, rather than reactively responding to faults. The generators proposed for purchase under this initiative are significantly larger than any existing generators that SPEN own, with the aim of restoring supply to large numbers of customers with a single temporary connection.

Generator connection points have not been deployed before as the severity of past storms has not highlighted a need for this proactive investment over the existing reactive response.

Options Criteria

The criteria considered within this initiative includes: the balance of costs between LV and HV generator sets and network GCPs, and the location for GCP installation e.g., network rurality, number of connected customers, and level of network demand that can be met by a large-scale generator.

The first criteria assessed is the balance between LV and HV generators. Quotations for LV and HV large-scale generators suitable for use in this scenario are given in Table 38.

Table 38. Generator quotations

MODEL	SIZE	VOLTAGE	FUEL	PRICE (23/24)	PRICE (20/21)[23]
Himoinsa HFW500	500kVA	400V	Diesel	[redacted]	[redacted]
Kohler V550IV	500kVA	400V	Diesel	[redacted]	[redacted]
Pramac GDW510V	500kVA	400V	Diesel	[redacted]	[redacted]
Pramac GSW510DO	500kVA	400V	Diesel	[redacted]	[redacted]
Average 500kVA LV Generator				[redacted]	[redacted]

[23] Indexation rate of 1.248743 used to convert from 2023/24 to 2020/21 prices

MODEL	SIZE	VOLTAGE	FUEL	PRICE (23/24)	PRICE (20/21)[23]
Pramac GSW1010M	1MW	11kV	Diesel	[redacted]	[redacted]
Pramac GSW1130P	1MW	11kV	Diesel	[redacted]	[redacted]
Himoinsa HTW1260	1MW	11kV	Diesel	[redacted]	[redacted]
Average 1MVA HV Generator				[redacted]	[redacted]

There is a significant price difference between the LV and HV generators, whereas the GCP costs are similar due to the requirement for HV switchgear for an LV generator, and a bund if a HV generator is to be used. The costs of the GCPs are given in Table 39.

Table 39. Costs of GCPs, 2020/21 prices

ITEM	COST £K		SOURCE
	HV GCP	LV GCP	
ABSW	£1.96k	N/A	RIIO-ED2 Unit Cost Manual
HV Earthing	£0.98k	£0.98k	RIIO-ED2 Unit Cost Manual
Cable Termination	£0.10k	£0.10k	RIIO-ED2 Unit Cost Manual
HV Pole	£2.31k	£2.31k	RIIO-ED2 Unit Cost Manual
Concrete Plinth	£5.51k	N/A	Recent quotation reduced to 2020/21 prices[24]
Traffic Management	£0.26k	£0.26k	RIIO-ED2 Unit Cost Manual
HV RMU	N/A	£24.19k	RIIO-ED2 Unit Cost Manual
Package Substation (HV Transformer and GRP)	N/A	£31.25k	RIIO-ED2 Unit Cost Manual
Bund	£53.12k	N/A	RIIO-ED2 CV22 Oil Pollution Mitigation Unit Cost (average SPD and SPM)
Land purchase	£10.00k	£10.00k	RIIO-ED2 Unit Cost Manual (Buried Transformers Unit Cost)
Total	**£74.24k**	**£69.09k**	

Additional costs will be considered for the purchase of HV generators, as there is a requirement to develop new training and authorisation procedures, and for refreshers for all authorised staff. LV generators will not require any additional training costs as staff are already authorised to connect these on the SPEN network.

To identify potential locations for GCPs, circuits have been assessed using the rurality index of all pole-mounted transformers along the circuit, with forecast demand in 2050, and number of connected customers.

The number of circuits with rurality index R4 PM transformers on is shown in Table 40.

Table 40. Number of circuits with R4 pole-mounted transformers

LICENCE	NO R4 PM TXS	NO CCTS WITH R4
SPD	5,302	168

[24] *Indexation rate of 1.248743 used to convert from 2023/24 to 2020/21 prices*

LICENCE	NO R4 PM TXS	NO CCTS WITH R4
SPM	4,486	98

To further prioritise the GCPs, the PM transformers demand has been assessed to ensure that a 500kVA / 1MVA generator can meet capacity requirements. We have used forecast demand in 2050 from our DFES[25] to ensure GCPs are future-proofed.

Circuits have further been assessed against the number of connected customers, prioritising circuits with a higher number of customers as it will increase benefit per GCP installation.

The initial costs of installing the GCP (for both an LV GCP and a HV GCP) can then be compared against the maximum penalty that could be incurred during a storm event – the £2,000 GSOP cap and the CI/CML penalties for the length of time taken to reach the cap. This is equivalent to £5,562.84 per customer (calculation available in supporting cost benefit analysis). Circuits with a lower customer number have lower maximum penalties for outages, and so financially these circuits are less likely to warrant a GCP installation e.g., maximum theoretical penalty is less than the installation cost.

A final consideration is how many additional large-capacity generators will be required to supply the newly established GCPs. This has been calculated based on the average fault rate of HV OHL circuits using the last 3 years of fault data. Anything with an average annual fault rate of >1 was capped at 1, with the average shown in Table 41.

Table 41. Average annual fault rate of HV OHLs (last 3 years)

LICENCE	AVERAGE ANNUAL FAULT RATE
SPD	0.722
SPM	0.705

These average fault rates were multiplied by the number of circuits highlighted for a GCP, to provide the number of generators for purchase. This is based on the assumption that roughly 70% of these circuits (as per the table) would fault at the same time during a storm or severe weather event. Therefore, not every circuit needs a generator to itself, with each generator able to be used at any number of locations.

Options Considered

The following options have been selected based on the available generator technology, future circuit demand, and rurality index metric. This initiative targets those circuits facing higher consequences from power cuts (using the rurality index metric), but is constrained by the capacity of available generators. The number of locations identified for intervention are discussed in further detail in the Preferred Option section.

Table 42. Optioneering for New Generation Connection Points

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	This is the “do minimum” option.
1	Install permanent HV generator connection points at 74 locations with 53 HV generators	Considered	These volumes have been calculated using rurality, future demand, initial capex cost compared to GSOP savings, as described in Options Criteria section
2	Install permanent LV generator connection points at 29 locations with 21 LV generators	Considered	

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#	OPTIONS	DECISION	COMMENT
2a	Sensitivity Analysis on Option 2, including same volumes with additional costs for updating an existing training course	Considered	
3	Install a mixture of LV and HV generator connection points and purchase a mixture of generators	Excluded	This option requires the substantial costs for HV generators and training with less flexibility over deployment locations due to some GCPs requiring an LV generator.

Preferred Option

The preferred option is Option 2, the installation of permanent generator connection points including ground-mounted switchgear and the purchase of LV generators.

The factors used to determine volumes for the options are:

- Rurality – Each pole-mounted transformer has a specific rurality metric, from R1 to R4. A circuit's rurality can be considered by calculating the % of pole-mounted transformers along that circuit which are R4, with anything with >25% considered more rural due to having more transformers than expected in that band (R4 is ¼ of the rurality bands and so on average, HV circuits should have ¼ of all transformers in that band).
- Future demand – Generators can only be installed where the demand will not exceed the capacity. Therefore, circuits with 2050 demand > generator capacity have been removed from consideration for this initiative.
- Initial CAPEX costs vs. customer number – GCPs will provide a temporary supply for customers on rural networks which would otherwise see long time to restoration with high associated penalties. GCPs are only viable on circuits with enough customers that the potential penalty is greater than the initial cost of GCP installation. This figure is different for LV and HV GCPs.

SPEN have carried out Cost Benefit Analysis to determine the best option for this initiative, the results from this are given in Table 43.

Table 43. CBA Results for Proposal for New Generation Connection Points

#	OPTION	OPTION COST, £M	DECISION	NPVS BASED ON PAYBACK PERIOD				
				10 yrs	20 yrs	30 yrs	45 yrs	Whole life
Baseline	Do Nothing	0.00	Rejected					
Option 1	Install HV GCPs	21.49	Rejected	(£11.34)	(£16.43)	£6.49	£4.81	£4.73
Option 2	Install LV GCPs	3.09	Adopted	(£1.52)	(£2.16)	£4.94	£5.02	£5.15
Option 2a	Sensitivity on Option 2	3.13	Rejected	(£1.54)	(£2.19)	£4.91	£4.98	£5.12

The CBA indicates that all options result in a positive whole life NPV, with Option 2 the greatest at £5.15m above the baseline scenario. Option 1 is £4.73m above the baseline and Option 2a is £5.12m above the baseline. As a result, Option 2 has been chosen as the optimal solution. Although the NPV benefit is only marginally greater, an additional benefit of Option 2 is the procurement of large-scale LV generators which can be utilised at other times on the SPEN network during storm and non storm-related scenarios by already authorised staff. These benefits have not been quantified within the CBA as they are not related to the Storm Arwen Recommendations, but have been considered as a wider benefit.

The positive CBA justifies the intervention to install permanent GCPs along HV overhead lines comprising of dedicated HV earthing, civils e.g., plinths, and HV/LV package substations capable of rapidly facilitating temporary supplies for large customer groups. This initiative also includes the purchase of large-capacity LV generators. This investment is not predicated on a particular scenario and will go ahead as targeted investment following approval of the reopener submission.

The key milestones include forecast cost and volume profiles, as per Table 44 and Table 45.

Table 44. Costs Profile for New Generation Connection Points, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.36	0.73	0.41	0.41	**1.92**
SPM	-	0.21	0.48	0.28	0.28	**1.17**

Table 45. Volumes Profile for New Generation Connection Points, 2020/21 prices

LICENCE	VOLUME OF GENERATORS						VOLUME OF GCPS					
	23/24	24/25	25/26	26/27	27/28	TOTAL	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	7	6	-	-	**13**	-	-	6	6	6	**18**
SPM	-	4	4	-	-	**8**	-	-	4	4	3	**11**

The delivery profile for this initiative is linear across the last 3 years of RIIO-ED2 for installation of GCPs, whilst purchase of generators is included across the second and third year of the price control period. This ensures that some generators are available at the time that GCPs are delivered, but also considers likely lead times on the assets.

An additional milestone for this initiative is the identification of the optimal location along the chosen circuits for installation of the GCP. This will be completed for all circuits within 6 months of approval of this initiative within the reopener.

Costs are based on Table 38 and Table 39. SPEN have received multiple quotes for generator purchase and are confident that the proposed costs within this initiative are efficient. GCP installation requires purchase and commission of secondary switchgear, this is a routine activity and we are confident it can be delivered efficiently. Any over-delivery (i.e. delivery of all volumes for lower cost than the proposed expenditure) will result in costs being returned to customers as part of the proposed reporting mechanism (Section 4.5.1).

This investment will address the needs case by reducing the time off supply for rural customers following a fault in severe weather events, improving performance for customers. This meets the Storm Arwen Recommendations by enhancing the use of mobile generators in reducing the length of power disruption.

4.3. Stakeholder Engagement

4.3.1. Independent Net Zero Advisory Committee

In preparation for the Storm Arwen reopener, we engaged with our Independent Net Zero Advisory Committee (INZAC) to gather their feedback on the scope of the reopener and the relevant reports from the E3C, Ofgem and Charles Hendry. The INZAC provided insight into what they expected SPEN to propose either through the reopener or through BAU activity to improve reliability and storm resilience.

The INZAC highlighted four main areas for improvements:

1. Operational Resilience (as evidenced in Initiatives 1, 4, 5)
2. Fault Resolution (as evidenced in Initiatives 2, 3, 6)
3. Customer Service (not included under Theme 1)
4. Telecommunications including Digitisation of PSTN (not included under Theme 1)

Table 46. INZAC engagement and links to initiatives

NO	INITIATIVE	ENGAGEMENT
1	Enhanced HV Pole Storm Resilience	The INZAC discussed the benefits of climate and weather forecasting, suggesting that this could be combined with local aps to evaluate threats within areas of likely impact. Our initiative to replace HV poles in severe weather areas with storm-related defects is built upon this methodology, with the threats to the network (poor condition poles) removed prior to weather events for enhanced resilience.
2	Innovative OHL Smart Solutions	The INZAC suggested the use of devices to allow reconfiguration of the network to respond to events and isolate problematic areas, such as auto-reclosers. The INZAC also suggested interaction with other network operators including internationally to learn from their network investments. This initiative is aligned with this recommendation through the use of smart devices which can support with locating overhead faults and allowing isolation and reconfiguration of the network to restore customers without re-energising lines with faults. This product has previously been installed by ENWL in RIIO-ED1 as an innovation and is being carried into RIIO-ED2 through their 11kV OHL Safety Management System (EJP Ref No BA EJP 1 – Safety). LineSIGHT devices were installed in ENWL primarily to enhance safety performance by detecting conductors which fall to the ground or are low-hanging, though there were additional benefits including fault detection, improved network reliability, nested faults, resource dispatching and load forecasting. SPEN have proposed the use of LineSIGHT following discussions with ENWL about their initiative. The INZAC also suggested the use of smart technology such as drones for line inspections and for storm response, to provide information and preliminary visuals as well as learn about any nested faults. Kelvatek's LineSIGHT devices will improve the levels of information provided to staff prior to full fault investigations, allowing us to identify nested faults and assess the condition of some of these assets.
3	Interconnection across DNOs	The INZAC mentioned the benefit of mutual aid arrangements, for example with operational engineers supporting other networks during faults. Our initiative to install interconnecting circuits and provide

NO	INITIATIVE	ENGAGEMENT
		power across DNO boundaries for faster restoration of supply is of mutual benefit or provides a substantial benefit to a single DNO, and has the potential to be used outside of storm scenarios as well. This is an example of a whole systems solution.
4	OHL Digital Twin Storm Modelling	The INZAC suggested finding ways to carry out regular risk assessment exercises to remove vulnerabilities in areas which are regularly stressed in storm scenarios. The INZAC also suggested updates to our resilience mapping for other dependencies such as roads prone to flooding, as well as reviewing intelligent logistics planning for mobilisation of staff during storms. Neara's model will allow risk assessment of the OHL network and to model weather conditions on assets to assess the effect. The INZAC suggested developing scenarios to test operational resilience to storm scenarios, evaluating readiness to react and recover. Neara's storm forecasting model predicts how weather conditions will affect the network, with the results of this analysis leading to resource management and allocation based on which locations are likely to be most affected.
5	Reflecting ETR 132 Updates	The INZAC discussed the benefits of climate and weather forecasting, suggesting that this could be combined with local aps to evaluate threats within areas of likely impact. Our initiative to complete additional vegetation management on spur lines with high number of intrusions in severe weather areas is built upon this methodology as it targets tree-cutting on circuits likely to see poor weather and with known nearby vegetation from LiDAR survey data. Managing vegetation along these circuits improves resilience by removing the threat of falling trees.
6	New Generation Connection Points	The INZAC recommended SPEN use learnings from network faults to identify where distributed generation and storage could have supported network resilience if deployed, and design the network to achieve this improved level of resilience. Installing GCPs will allow distributed generation to support HV networks during fault scenarios.

4.3.2. RIIO-ED2 Customer and Stakeholder Engagement

As part of the RIIO-ED2 business plan submission, robust stakeholder engagement was undertaken to identify customer priorities and gain insights from key stakeholders. This is outlined in our Annex 3.2a Stakeholder Engagement. This engagement ensured that our business plans reflected the views and needs of all customers and stakeholders. Both internal governance and external assurance procedures are outlined in Appendix 15.

This feedback has been considered throughout the development of this reopener, to ensure proposals remain in line with these expectations and with our RIIO-ED2 baseline strategies. Relevant feedback for the proposed investment is outlined below, with links to the specific initiatives that are supported.

Customer Feedback

Our customer feedback highlighted the following:

a) "Network resilience, not having a power cut" was ranked the second most important priority by both domestic and commercial customers. Resilience of supply is extremely important to customers, especially for those over 70 or who are classed as vulnerable.

Stakeholder Feedback

The key points from our stakeholder feedback were as follows:

b) Stakeholders suggested more emphasis on fault prediction within RIIO-ED2, and discussed the impact of faults on customers and importance of reducing fault rates.
   i. They advised that investment in additional network control was a priority for them, as well as use of a wide range of solutions on main feeders and spurs to improve CI and CML performance.
   ii. Stakeholders preferred for SPEN to invest more now to reduce costs in the future, such as in AI-based fault detection and fault location, with these targeted on worst performing feeders to provide greatest benefit to customers.
   iii. One suggestion was to invest in technology which could provide advanced notice or knowledge of what is happening at a fault location prior to staff arriving on site.

c) Stakeholders' highest priorities included investment for managing tree growth, enhancing storm resilience and preparing for severe weather events.

Links from RIIO-ED2 Feedback to Reopener Submission

Table 47. RIIO-ED2 feedback and links to initiatives

NO	INITIATIVE	ENGAGEMENT	LINK
1	Enhanced HV Pole Storm Resilience	a)	Additional investment to remove failure modes of overhead line assets is key to reducing the likelihood of customers experiencing loss of supply during storms. Removing the "weak link" assets on overhead line networks will reduce the likelihood of an interruption occurring.
2	Innovative OHL Smart Solutions	a)	The use of smart solutions on the overhead network enhances resilience by identifying spans with risk of low clearance, transient faults and component deterioration.
		b)	This product will support with fault prediction and fault location which will both avoid loss of supply and reduce time off supply by supporting operational and control room staff with fault prevention and fault detection, as well as providing initial data prior to arrival on site.
3	Interconnection across DNOs	a)	The installation of interconnectors across DNO boundaries will improve network resilience for customers by providing additional feeds to restore supply
4	OHL Digital Twin Storm Modelling	b)	This initiative supports enhanced modelling capability by allowing us to

			model our network and trial certain weather conditions to identify which assets are at risk of failing.
5	Reflecting ETR 132 Updates	a)	One of the main failure modes of overhead lines during severe weather is falling vegetation, reducing the amount of vegetation in surrounding areas of overhead line network will reduce the likelihood of an interruption occurring.
		c)	This initiative will improve the resilience of supplementary areas over and above existing plans. This is in line with stakeholder and customer priorities by reducing the likelihood of storm-related outages for a higher proportion of customers. By identifying circuits for enhanced vegetation management using a different prioritisation method to our RIIO-ED2 baseline plan, we can cover and reduce a wider variety of tree-related risks across a greater customer base.
6	New Generation Connection Points	a)	GCPs support with power restoration to vulnerable customers when fault repairs cannot be completed quickly. This initiative is a form of temporary resilience, providing essential power to customers and allowing fault repairs to be carried out safely and in a prioritised manner without risking the welfare of vulnerable customers

4.3.3. Storm Arwen Customer Feedback

The following feedback was collected following Storm Arwen from customers affected. These are representative and capture themes from those who requested improvements to storm resilience. This input has informed the initiatives developed within this reopener.

Table 48. Storm Arwen feedback and links to initiatives

SUMMARY OF COMMENT	LINK TO REOPENER INITIATIVE
Customer suggested increase vegetation management on overhead lines which are only source of power for customers	Initiative 5, to carry out vegetation management on spur lines, aligns with this customer feedback, with circuits prioritised based on how likely it is poor weather will affect that area.
Customer requested commitment of better general maintenance of trees in rural areas which could cause damage to overhead lines	

SUMMARY OF COMMENT	LINK TO REOPENER INITIATIVE
Customer was off supply along with a small number of other houses whilst rest of village had power restored, due to being located along spur line with fallen vegetation on line	
Customer was off supply alongside half of remote village whilst other half had power restored, due to tree falling on overhead spur line	
Customer was unable to access property as trees fell on overhead line and on only road to property	This supports the methodology in the development of our Rurality Index, with focus on those which are located in areas that are isolated geographically as well as being located along radial overhead networks.
Customer was unable to leave property as trees fell on only road to property, and there was no electricity due to vegetation falling on overhead line	
Customer was off supply for 5 days and hired own generator to restore supply to property	Initiative 6, installation of generator connection points, aligns with this – removing requirement for customer to source generator and providing temporary restoration for all properties
Customer was off supply for 3 days and used own generator to restore supply to property	
Customer had own generator but this did not work during Storm Arwen so was off supply	

4.3.4. UK DNO Engagement

SPEN have been involved in several bilaterals with UK DNOs, both to discuss the overarching reopener submission as well as specific initiatives. SPEN have also engaged with ENWL about the learnings from their RIIO-ED1 innovation project to install Kelvatek's LineSIGHT solution, to identify if this is a worthwhile initiative to pursue under the reopener.

Whilst engaging with other DNOs, SPEN have been open about planned initiatives, scale of investment requests and engineering justification backing up this submission, seeing this reopener as potential to improve storm resilience at a UK level rather than just within SPEN.

SPEN have also guided the direction of bilaterals relating to our interconnectors initiative, ensuring that engineering scrutiny has been applied to these and that only fully justified circuits have been developed for submission through the reopener.

4.4. Total Costs

Table 49 and Table 50 give the total costs proposed under the reopener for Theme 1, broken down by initiative. Our initiatives include only the direct costs associated with the delivery of the preferred options. Indirect costs are discussed in Section 4.4.1.

Table 49. Theme 1 Total costs proposed under reopener - SPD

NO	INITIATIVE	COST £M					
		23/24	24/25	25/26	26/27	27/28	TOTAL
1*	Enhanced HV Pole Storm Resilience	0.00	0.82	0.82	0.82	0.82	**3.29**
2*	Innovative OHL Smart Solutions	0.00	1.94	0.06	0.06	0.06	**2.12**
3*	Interconnection across DNOs	0.00	0.00	0.70	0.70	0.70	**2.10**
4	OHL Digital Twin Storm Modelling	0.00	0.06	0.10	0.10	0.10	**0.37**
5*	Reflecting ETR 132 Updates	0.00	1.00	1.00	1.00	1.00	**4.00**
6*	New Generation Connection Points	0.00	0.36	0.73	0.41	0.41	**1.92**
*	Associated Indirects	0.00	0.44	0.36	0.32	0.32	**1.45**
	Total SPD	**0.00**	**4.62**	**3.77**	**3.41**	**3.41**	**15.24**

Table 50. Theme 1 Total costs proposed under reopener – SPM

NO	INITIATIVE	COST £M					
		23/24	24/25	25/26	26/27	27/28	TOTAL
1*	Enhanced HV Pole Storm Resilience	0.00	1.18	1.18	1.18	1.18	**4.71**
2*	Innovative OHL Smart Solutions	0.00	2.29	0.07	0.07	0.07	**2.50**
3*	Interconnection across DNOs	0.00	0.00	0.36	0.43	0.37	**1.16**
4	OHL Digital Twin Storm Modelling	0.00	0.06	0.10	0.10	0.10	**0.37**
5*	Reflecting ETR 132 Updates	0.00	1.63	1.63	1.63	1.63	**6.52**
6*	New Generation Connection Points	0.00	0.21	0.48	0.28	0.28	**1.17**
*	Associated Indirects	0.00	0.57	0.40	0.39	0.38	**1.74**
	Total SPM	**0.00**	**5.95**	**4.22**	**4.08**	**4.01**	**18.17**

4.4.1. Indirect Costs Calculation

All costs calculated in Section 4.2 are direct costs associated with the delivery of these initiatives. However, there will be additional indirect costs borne as a result of these programmes. SPEN propose to reflect the Indirects Scalar outlined by Ofgem in Section 6.84 of RIIO-ED2 Final Determination Overview Document for use in load-related uncertainty mechanisms within RIIO-ED2.

This scalar, set at 10.8%, is an automatic mechanism for varying Closely Associated Indirects (CAI) costs associated with the Secondary Reinforcement volumes driver, LV Services volume driver, and overall Load-Related Expenditure (LRE) reopener.

Given that the proposed interventions within this reopener will also affect CAIs, we believe that applying the 10.8% scalar to a number of our initiatives is also justified.

4.5. Deliverability and Risk

This section discusses our deliverability confidence for each initiative under Theme 1 and addresses concerns identified with risks associated with the proposed initiatives, alongside any mitigation actions to be carried out. As these initiatives are over and above core activities, these risks are incremental to our RIIO-ED2 programmes.

This section first outlines the regulatory mechanism that we propose for recording costs, volumes and outputs associated with the reopener and the impacts of implementation of preferred options can be found in Appendix 16.

4.5.1. Proposed Reporting Mechanism

SPEN proposes the use of a Price Control Deliverable or a ring-fenced Use it or Lose It (UIOLI) mechanism for all final allowances approved by Ofgem under this reopener application. All allowances and outputs should be separated from equivalent activities we are delivering through RIIO-ED2 baseline programmes, including risk points.

SPEN propose that any risk point targets set for the reopener should be proportional to final allowances as approved by Ofgem, and that this risk points should be held separate to the licences risk point target through baseline RIIO-ED2 allowances.

We are happy to work with Ofgem on the appropriate reporting mechanism for this reopener and the RIIO-ED2 close-out methodology during the 2024/25 regulatory reporting year. SPEN propose a memo table within the annual Regulatory Reporting Pack (RRP), to record progress against each initiative in terms of costs, volumes and any additional outputs such as risk points.

We are submitting this request for allowances on the basis of a UIOLI funding mechanism, we intend to deliver the investment as described within this reopener submission. Across the number of initiatives included within our submission there are various outputs and volumes of activity, these will form the basis of our planned delivery to ensure we achieve the planned level of additional network storm resilience. This may mean that some of the planned expenditure varies across activities as we deliver the investment and the exact scope of works is refined, but all reopener allowances will be hypothecated to the initiatives detailed within this submission.

4.5.2. Area 1: Asset Resilience – Deliverability & Risk

Initiative 1: Enhanced Pole Storm Resilience

Option 1a, replacement of HV poles with a reduced volume in SPM, has been adopted for this initiative. This option includes the lowest volumes of activity of all considered options and is therefore considered the most deliverable.

SPEN have delivered a significant volume of HV pole replacements in RIIO-ED1 and are confident in the efficient delivery of these costs. The work proposed under this initiative will be delivered alongside existing RIIO-ED2 OHL programmes to ensure maximum efficiency for delivering all programmes.

Given that poles for replacement under this programme have already been identified, design and delivery of the works can begin quickly following approval of the initiative within the reopener. We well refresh the defect and health data annually to ensure the list of poles for replacement is accurate.

As provided in Table 7, almost 30,000 poles are being replaced in RIIO-ED2 under CV7 Asset Modernisation. This initiative proposes an additional 2,713 pole replacements within RIIO-ED2, linearly distributed across the final four years of the price control period. This is less than a 10% uplift on previously planned volumes and will remove high risk assets that would likely otherwise cause faults during severe weather events. The reduction in fault volumes will reduce reactive work for existing operational staff, with more time available for proactive works such as targeted pole replacement. Therefore, there are no concerns that this programme will be undeliverable on top of existing RIIO-ED2 programmes.

Related to this, the volume of additional pole replacements targeting storm-related defects will not affect the delivery of our baseline RIIO-ED2 plan for defect clearance. The volume of defects cleared through Storm Arwen Initiative 1 is lower than the total number of outstanding defects on the network, allowing for storm-related defects to be targeted whilst the baseline programme focuses on other HV pole defects. Both programmes can be delivered in full without crossover or duplication, with remaining defects on the network to continue to be targeted in programmes within RIIO-ED3 and later price controls.

A risk associated with this programme is the requirement for a small volume of overhead conductor to require replacement alongside sequential poles highlighted for intervention. If this situation does arise, the costs associated with this overhead conductor can be captured under the reopener by removing a small volume of pole replacements deemed to be of lowest priority.

A similar risk is that on arrival on site to replace poles, surrounding poles are in similar condition with storm-related defects and poor HI, which may not have been captured through the corporate data system. In these cases, an assessment should be made on site of whether to replace any additional poles to improve the storm resilience of this circuit, these interventions will deliver the same output as planned through this initiative, so the risk is deemed to be low.

A final risk corresponds to the unit cost for each individual pole replacement. Whilst the RIIO-ED2 Unit Cost Manual has been used, this is the efficient cost of replacing multiple poles on the same circuit. Replacing single poles in varying locations will cost more due to travel, equipment movement, planning and other set up costs. This risk has been mitigated by applying a small uplift to the cost rows within this unit cost that are not associated with materials, following discussions with internal staff with experience carrying out standalone pole replacements and working with contractors.

Initiative 2: Innovative OHL Smart Solutions

Option 2, installation of LineSIGHT on 24 circuits, has been adopted for this initiative. This Option includes greater deployment than Option 1, but fewer than rejected Option 3. It is considered to be deliverable both by SPEN and Kelvatek who have confirmed that forecast volumes and installation can be achieved.

We expect the final number and location of devices to vary through detailed design stages, this may also include deployment on different HV circuits to those initially identified e.g., as our fault history data is updated. However, we are confident of the forecast benefits as this technology will only be installed in locations that are modelled to beneficial (as per appended report from Kelvatek).

This initiative requires the installation of smart devices on poles in rural areas of the network. In confirming these devices can communicate correctly, comms surveys must be carried out at each location. There is a risk that the optimal network location for installation of the units will not have sufficient signal to allow communications. Similarly, there may already be equipment located on the optimal pole which cannot be removed (e.g. a pole-mounted switch). In these cases, the devices will be installed on an adjacent pole. This may marginally reduce coverage of the HV circuit, however installation still provides a benefit over not installing the devices at all. The detailed design stage will include comms surveys and assessment of existing switchgear location, after which the optimal location for each device can be finalised and the effects on coverage assessed.

Another risk is the location of devices in rural areas. Deployment requires multiple site visits to survey and install the units, this may be located a long distance from depots or through difficult terrain. This could cause delays to the programme with each circuit taking longer than expected to be completed. SPEN have adopted Option 2 for this initiative, with roll out of 24 circuits. Option 3 (60 circuits) was rejected due to deliverability concerns. Kelvatek have advised that installing devices on 24 circuits is deliverable within a single year, as reflected in the delivery profile. However, if there are delays to this programme, there are still a number of years remaining in RIIO-ED2 that the programme can fall into to ensure all devices are installed in this price control. Therefore, the risk to the overall programme is very slim.

Due to the requirement for individual circuit assessment before confirmation of volumes of devices, the additional 17 circuits included in Option 2 have estimated costs included within this reopener submission. There is a risk that actual costs will surpass the estimates provided by Kelvatek once detailed assessment has been completed. This risk can be managed as the chosen list of circuits may differ during the assessment stage and as fault history is updated. The initial list of 24 circuits can be developed as the benefits are assessed, with any costs offset by identifying other circuits with similar benefits.

A final risk is that the pole chosen for device installation may be in poor condition and may not have sufficient expected life – LineSIGHT units should last for at least 25 years. In these cases, the pole will need to be replaced prior to installation of the device, which will increase costs of the programme. In these cases, the driver to replace the pole is to improve storm resilience of the overhead circuit. SPEN propose that poles identified can be replaced as part of Initiative 1 of this reopener, with costs and volumes included within that initiative. This ensures that LineSIGHT can be rolled out without concerns over longevity.

Initiative 3: Interconnection across DNOs

Installation of a small number of prioritised interconnectors has been adopted as the preferred option for this initiative. These interconnectors are across boundaries with ENWL, NGED, SSE and NPg.

A risk to the delivery of this initiative is the reliance on other DNOs, as the scheme development must give sufficient time to deliver the schemes. SPEN are confident design discussions will conclude within a year of the approval of this reopener, with a milestone of delivering detailed designs by March 2026. Timelines for subsequent installation and commissioning will vary, alongside the completion of upstream reinforcement. SPEN set the volume profile for interconnectors to allow prioritisation of certain circuits rather than attempting to design and deliver all interconnectors at the same time. This is reflected in our cost and volume key milestones for each project (Table 28), though all will be completed within RIIO-ED2. In addition, we have ongoing engagement with all four DNOs to finalise interconnector design, cost apportionment, and asset ownership. All DNOs have agreed to continue to engage and on interconnector development and we believe the risk in this area to be low.

An important process that needs to be defined is the procedure for interactions between control rooms for shared interconnecting circuits. This is to ensure all parties are aware of their responsibilities in managing the network in both fault and normal situations. SPEN have a number of interconnectors already, and so have an existing protocol for inter-system power safety instructions. This is included in the Scottish Power Safety Rules. SPEN and other DNOs will discuss the agreed protocols in remaining bi-laterals before assets are commissioned.

A risk to this programme is the availability of land for purchase for interconnectors which require ground-mounted assets. Difficulty in locating land could result in longer interconnecting circuits, which would increase costs above those included in the reopener. Given that the proposed interconnectors are all in rural and isolated locations with limited surrounding network, it is likely that purchase of land will be feasible. If there are no options, another location can be assessed for the new circuit to provide interconnection.

Initiative 4: OHL Digital Twin Storm Modelling

Option 2, roll out of the digital model for all HV OHL circuits, has been adopted for this initiative. This option required the lowest annual CI/CML improvement for the investment to be considered justified.

This is a new software which will consolidate existing data and models as independent layers, adding additional functionality by interfacing complimentary data and simulating scenarios on the network. The initiative is reliant on a single supply chain link, with some input required from internal staff for testing and to provide information. SPEN staff will also assess the outputs of the model to develop strategies and improve engineering decision-making. [redacted]

A risk surrounding the proposed cost profile is if Neara are unable to finish the model within the second year of RIIO-ED2, with development falling into later years. This will defer the benefits of this model and will result in the annual licence charges not being required until later in the price control period. The risk to investment profile is mitigated as we are proposing a use it or lose it allowance (see Section 4.5.1), meaning any reduction in expenditure due to delays is not claimed. To offset the risk of delay to benefits, SPEN will prioritise circuits for modelling based on data such as fault history, customer number and asset health to build a view of highest priority circuits first. Therefore, benefits of the model can be observed for numerous circuits even when the full OHL network has not been developed.

Another risk is if a new modelling capability is proposed which requires additional costs not included within this reopener. If additional use cases will provide additional benefit to the company but may not reflect Storm Arwen Recommendations or enhanced storm resilience, these will be captured in BAU allowances. If the additional capability is related to Storm Arwen Recommendations, this investment could be included in a later reopener window.

Finally, SPEN have assumed that the model will have a lifetime of 8 years. There is a risk if the software has a shorter lifespan, the benefit will be reduced. This can be mitigated through upfront discussions with Neara during model development to ensure expectations are met. We have also assessed this risk through CBA sensitivity to ensure investment is still justified over a reduced lifetime, therefore the risk is assessed to be low.

The CBA for Initiative 4 assesses the benefit of this tool through proactive replacement of HV poles forecast to fail during modelled weather conditions, avoiding interruptions for customers. These benefits are separate to the benefits assessed for Initiative 1, despite both analysing the avoided CI and CML impact of pole failures. Initiative 4 highlights poles that would otherwise not be replaced, as without this tool we are unable to model how weather events will directly affect our assets. Quantifying the tool's benefits through avoided CI and CML penalties shows the wider picture of how this model can support our operational response to severe weather, with highlighted poles replaced under separate programmes.

4.5.3. Area 2: Vegetation Management – Deliverability & Risk

Initiative 5: Reflecting ETR 132 Updates

Option 1b, vegetation management along spur lines for circuits with high intrusions per km and in severe weather areas, has been adopted for this initiative. This option includes a positive whole life NPV and improves storm resilience for 187,228 customers. Due to the focus on vegetation management within SPEN since Storm Arwen and recent storms, the proposed additional investment for spur line compliance with ETR 132 is deliverable alongside existing RIIO-ED2 baseline allowance for main line compliance. As this is similar to an existing programme, no new processes need to be developed and so volumes can be completed immediately following approval of the initiative.

The chosen option includes the highest volume of vegetation management for the options considered, but is proportional to the vegetation management expenditure in our RIIO-ED2 final submission (£10.5m compared to £82.0m). Given our experience in delivering vegetation management, this is considered to be deliverable, particularly given the increase in focus on this area following extensive Storm Arwen vegetation damage.

A risk associated with this proposal is the reliance on landowners to allow access to their property for tree cutting to be completed. If access is denied, this can delay delivery of the programme. As vegetation management for main lines is an existing programme, there are already processes in place to manage and mitigate the risks if this occurs. Therefore, the disruption to this programme above existing managed levels should be minimal.

Similar to the above, access may be restricted due to the nature of the location. Rural customers along spur lines have been prioritised, which means the overhead circuits requiring vegetation management will likely be in rural areas. Access to these will be more difficult and it may be more time-consuming for tree cutting to be carried out on these circuits. This is mitigated by the low volume of km identified for tree cutting within this reopener, as well as the linear delivery profile across four years. Any delays to individual circuits should be mitigated by the time available to focus on each circuit. If there are unforeseen delays and the full programme cannot be completed within RIIO-ED2, the proposal for reopener funding to be UIOLI means that any costs associated with the uncompleted circuits are not claimed.

A final risk is the unit cost included within this reopener for vegetation management uses the RIIO-ED2 main line ETR 132 unit cost. This may not be sufficient for this initiative as tree cutting along spur lines will likely cost more, due to not being previously cut, as well as location in more rural areas. Unit cost will be monitored throughout this initiative to understand actual unit costs against forecast, and any requirement for additional investment can be included in a later reopener window. If the agreed investment cost is spent without all proposed circuits being completed, the remaining circuits can be included in the RIIO-ED3 business plan in line with the proposal to develop a new managed cycle for spur lines.

4.5.4. Area 3: Generation – Deliverability & Risk

Initiative 6: New Generation Connection Points

Option 2, installation of LV GCPs and purchase of LV generators, was selected for adoption in this reopener. This option includes lower volume of GCP installations than Option 1, and also requires the purchase of a lower volume of generators. This is considered to be deliverable within the last three years of RIIO-ED2, with most intervention required already carried out in the business under different drivers (installation of secondary substations, earthing arrangements for generators). There are no concerns over the delivery of this programme within the required timescales with existing staff.

One risk to this programme is the purchase of land for the installation of HV Switchgear and the placement of the generator. Difficulty finding a suitable location could reduce the number of customers who can benefit from this initiative. However, given that the circuits selected are considered to be in rural locations, it should be feasible to identify locations to purchase for the installation of GCPs and generators.

A second risk is the requirement for access to carry out these works, due to the rural area. The sites may be located a long distance from depots or through difficult terrain. This could cause delays to the programme with each GCP taking longer than expected to be installed. Given that these sites will be accessed whenever a generator needs to be installed, the terrain should be managed suitably to ensure improved access. Any delays to the programme should be manageable due to the small volume of interventions required per year, which can fall into later years to be delivered if delays are significant.

A final risk is that authorisations must be refreshed to allow staff to install generators at the GCPs. This would result in additional programme costs. Given that Option 2 has been adopted, installation of LV generators, there should not be a requirement for any additional training as SPEN already own and install generators. All documentation associated with these generators will be reviewed internally with any necessary points identified and communicated to relevant staff through the usual process (for example safety expresses issued via email and published in the document library), without requiring additional training hours.

5. Theme 2: Improvements in Customer Service During Storms

5.1. Needs Case

5.1.1. Area 4: Customer Welfare

This is the first area within Theme 2. To improve our welfare services for customers during storms and severe weather events, we propose to raise a contract for enhanced operational response in the form of military grade aid, using a new welfare app for door-knocking, and purchasing a small stock of medical beds. These initiatives will support all customers, including medically vulnerable and priority services registered, during long unplanned outages due to storms.

Initiative 7: Keeping Customers Connected in a Power Cut – Power Packs

The Storm Arwen Recommendations suggested additional use of mobile generators in reducing the length of power disruption through temporary supply restoration.

With the transition to Net Zero and the increasing reliance on electricity, compounded by the effects of the 2020 global pandemic with more people working from home than ever before – the number of customers impacted during a day-time interruption is greater than ever before. Despite this, it is not always possible or practical to install generators for all customers properties whilst we carry out repairs.

It is therefore important we can deploy alternative solutions quickly to limit customer disruption during these types of interruption. For this reason, we propose to issue power banks to customers during extended faults as a form of temporary supply restoration. These are to be deployed during fault repair and collected post-restoration.

This enhanced use of mobile generators is well aligned with the Ofgem 8/E3C R2 recommendation and sets out the needs case for this initiative.

Initiative 8: Increased Customer Welfare Support

SPEN have engaged with RE:ACT, a humanitarian response organisation that provides direct assistance to the most vulnerable and hardest to reach communities in the UK and overseas. Whilst SPEN's welfare support in storms and major events is strong, due to Storm Arwen we recognise the need to develop a wider welfare support package over and above our current offering to deliver support to our customers which is fully joined up with resilience partners such as Local Resilience Forums, local volunteer agencies and brings together the best capabilities of the military, blue light services and the humanitarian sector.

We have therefore explored how we could engage an external organisation expert in humanitarian support to supplement our current services and provide dedicated trained teams to provide support in several areas:

- Providing support before, during and after an event
- Visit and update customers in hard-to-reach locations
- Maximise face to face communication & support
- Update SPEN customer data from direct customer interactions
- Deliver food and welfare support directly to customers
- Feed into ongoing improvements in incident planning and customer support services.

Initiative 9: Digital Switchover Support – Vulnerable Customers

Telecoms providers in the UK are decommissioning their analogue services and are moving to fully digital networks. This means that analogue phones in residential and business premises are being replaced with digital networks. This has a direct impact on customers during a power cut because following the switchover, phone services are delivered via the customers router and any interruption to their supply will take down their land line.

Whilst DNOs have lobbied telecoms providers and regulators to ensure there is a solution in place for vulnerable customers, currently no such solution exists and SPEN see daily impacts on customers as a result of this.

Historically SPEN have delivered customers analogue phones as part of our vulnerable packs to ensure they always had a way of contacting us in a power cut. This option is no longer available to us as customers move over to digital services, which is concerning for the vulnerable customers we need to reach. As a result of this, SPEN are exploring innovation projects to look for solutions which would ensure a continuation of the customer's service in a power cut, and are working with other DNOs closely to do this.

A collaborative innovative project underway currently is Smart UPS. This is a small device which would be installed within a customer's property and, in the event of an outage, the UPS would be used to power the customers phone to allow the customer's land line and care links to work normally.

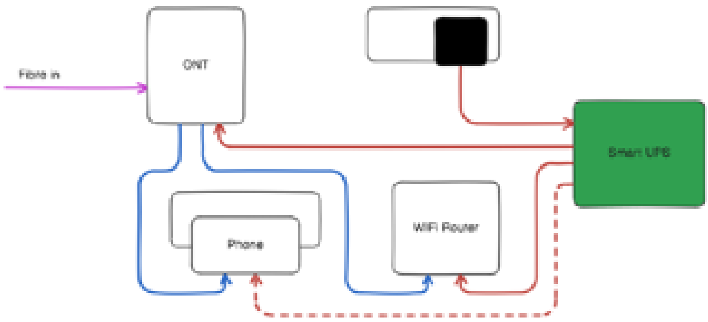

Figure 13. Smart UPS Diagram

It's possible that some innovation funding will allow us to fully explore this solution and trial a small amount of units, however funding won't cover the cost of deploying any solutions. SPEN are keen to progress a solution to ensure we can maintain communications with customers in a power cut to allow us to fulfil our obligations and deliver the best possible service, avoiding impact on the safety of vulnerable customers and the service SPEN are able to deliver.

Initiative 10: Proactive Support Medically Dependent Equipment – Medical Equipment Back-Ups

Protecting our most vulnerable customers must be the highest priority and the best way to do this is reach them proactively and ensure they are prepared in advance for a power cut. Whilst we write to all of our customers every year to prepare them for power cut and emergency scenarios, sometimes customers find it difficult to take practical action and are reliant on family and carer networks to make arrangements for them.

For our most vulnerable households who are medically dependent on electricity, it's important we do what we can to support them in advance of any power cut happening. For this reason, we would like to ensure all customers with Medically Dependent Equipment have back up batteries for their equipment that will last long enough to sustain them through and extended interruption, to ensure they have a continuous supply to their medical equipment whilst we work to restore their supply or get support to them.

SPEN have been running and independent innovation project to look at the different types of medical equipment, the battery life and what would be needed to ensure continuity of supply for our most vulnerable customers.

Initiative 11: Proactive Support Medically Dependent Equipment – Hospital Beds

SPEN have experienced a number of incidents where customers with Medical Beds have been impacted by power cuts and have been dependent on NHS services to support and replace beds for customers in an emergency situation. Whilst we would always look to restore supply to customers with generators whilst repairs were ongoing in these situations, we have seen occasions where beds have been damaged due to age and maintenance and repairs or replacements are needed. To ensure we can proactively help customers whilst we wait for the NHS services to be delivered, we would propose to hold a small stock of beds to be deployed immediately should this happen.

This will make the service we deliver for customers much more proactive and limit any distress to our customers at the most difficult time, for example instances such as end of life care.

Initiative 12: Warm Customer Communication Hubs

We recognise that our customers facing extreme fuel poverty need practical help and support and we also understand Warm Hubs could be an important facility in our communities to provide a safe, accessible and warm environment during the day to help customers reduce heating costs in their own homes and bring customers together in a community space where services can be accessed easily. This could also be a valuable support network for customers during severe weather and a network of community buildings we could link into in times of need.

We also recognise that during Storm Arwen, communities face communication issues during extreme events where mobile masts are down and customers struggle to communicate.

We would therefore like to provide support to warm hubs across our licence areas to support them in opening for a long as possible and provide a means of contacting the DNO directly from the hub.

An innovation project is currently underway to develop a Satellite Phone Courtesy Box for remote communities to provide direct access to their DNO in the event of a complete communication loss in an area. This solution is a one button phone connection to allow customers to communicate with their DNO.

This could also provide wider coverage for staff where there are widespread communication issues such as was seen in Arwen to supplement our satellite network.

The initial phase of our programme would be to map existing warm hubs across our licence areas and carry out analysis on coverage, opening times and services. We will then compare this with our vulnerability mapping to show our most disadvantaged areas, with the view of providing support to the communities most in need for extension of services, support to remain open, extend opening hours and resilience measures.

We propose 2 approaches to this initiative.

1. SPEN identify the priority sites across our 11 Licence areas and
    a) Deliver resilience measures for the site
    b) Install a Satellite Phone Courtesy Box
    c) Identify any gaps in ability to provide support and take steps to close them

d) Actively encourage partners to deliver services from the hubs so customers can access advice and referral services.

2. SPEN would set up a Fund for Communities to bid

a) To make improvements to their building to ensure customers could be supported in the community and this is maximised as much as possible.

5.1.2. Area 5: Communication

This is the second area within Theme 2. These initiatives will improve the ability to pass information to customers who are experiencing a power outage, to provide information about estimated time of restoration, the scale of the outage, welfare support in the area and more.

Initiative 13: Increased Contact Centre Ramp Up

Our contact centres need to be able to cope with huge swings in customer contact between BAU levels and events such as Storm Arwen. We endeavour to do this as efficiently as possible maximising our technology and wider business resource. We have trained staff across our business in departments outside of Customer Services to support our customers in significant events and have deployed new technology to ensure our teams are able to deliver the best experience to our customers.

Whilst we will continue to follow this model and maximise the resource we can across our business to ensure we deliver any peak service in the most efficient way, there are still peak times when we need a large increase in staff to ensure every customer is spoken to and supported fully. Whilst this would not be an efficient model to deploy throughout the year, we would propose to place a ramp up contract to be used in scenarios where we need additional resource quickly, particularly out of hours.

5.2. Optioneering

5.2.1. Initiative 7: Keeping Customers Connected in a Power Cut – Power Packs

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and would be delivered in addition to our current offering and is not included in our baseline funding.

Options Considered

The options assessed for this initiative are discussed in Table 51.

Table 51. Optioneering for Power Packs Initiative

#	OPTIONS	DECISION	COMMENT
Baseline	Do nothing	Considered	
1	200 power packs per district	Considered	

Preferred Option

The preferred option for this initiative is Option 1, providing 200 power packs per district (6 in SPD and 5 in SPM). Devices typically can be used for 12.1hrs on WiFi Router allowing for charge of laptop 3.5 times.

Table 52. Costs for Power Packs Initiative, 20/21 prices

COSTS	VOLUME	UNIT COST	TOTAL COST, £M
Power Packs across 11 Districts (200 per District)	2,200	£160.93	£0.35m
Total			**£0.35m**

Table 53. Costs Profile for Power Packs initiative, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.19	-	-	-	0.19
SPM	-	0.16	-	-	-	0.16

5.2.2. Initiative 8: Increased Customer Welfare Support

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Criteria

This initiative proposes the use of a humanitarian response organisation for support for vulnerable customers during extended power outages. The options assessed for this initiative are the available packages provided by RE:ACT. These are discussed in Table 54.

Table 54. Available support options

PHASE	GOLD	SILVER	BRONZE
Pre-Event	Dedicated resource to provide: Crisis Management training & testing exercises Enhanced contingency planning, data management and system development Winter Planning & Liaison with Resilience Partners	Dedicated resource to provide: Crisis Management training & testing exercises Enhanced contingency planning, data management and system development Winter Planning & Liaison with Resilience Partners	Dedicated resource to provide: Crisis Management training & testing exercises Enhanced contingency planning, data management and system development Winter Planning & Liaison with Resilience Partners
During Event	14 Teams plus management	7 teams plus management	4 teams plus management
Post Event	Evaluation, Learning and update of plans	Evaluation, Learning and update of plans	Evaluation, Learning and update of plans

Options Considered

The following options have been selected through engagement with RE:ACT. The initiative options selected are set out in Table 55.

Table 55. Optioneering for Increased Customer Welfare Support

#	OPTIONS	DECISION	COMMENT
Baseline	Do nothing	Considered	Doing nothing will not move us forward. To fully support customers in the best possible

#	OPTIONS	DECISION	COMMENT
			way in significant events, we require a dedicated joined up approach with resilience partners which can be quickly deployed. Engaging an organisation which is fully integrated with all resilience partners will move our offering to the next level.
1	Gold package	Considered	All options are the same other than the number of support teams deployed across the licence areas. This option delivers the greatest customer reach, 4,420 customers.
2	Silver package	Considered	All options are the same other than the number of support teams deployed across the licence areas. This option will reach 2,210 customers.
3	Bronze package	Considered	All options are the same other than the number of support teams deployed across the licence areas. This options will reach 1,105 customers.

Preferred Option

The preferred option for this initiative is Option 1, the gold welfare package which has the greatest customer reach.

The costs associated with this option are given in Table 56.

Table 56. Cost breakdown for costs associated with Initiative 8, 2020/21 prices

	COST FOR GOLD PACKAGE, £K
Initial Set Up Costs	[redacted]
Monthly Resource Charge Retained	[redacted]
Annual Retained	[redacted]
Daily Resource Charge Ground Teams	[redacted]
Equipment Contingency	[redacted]
Expenses Estimate per Deployment	[redacted]
Overall Cost for 1st Year	[redacted]

Total cost profile is shown in Table 57. The split between SPD and SPM has been proportioned based on number of districts (6 in SPD, 5 in SPM).

Table 57. Costs Profile for Increased Customer Welfare Support, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.14	0.13	0.13	0.13	0.54
SPM	-	0.12	0.11	0.11	0.11	0.44

5.2.3. Initiative 9: Digital Switchover Support – Vulnerable Customers

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Criteria

Each option was chosen based on the number of customers that could benefit from this initiative.

Table 58. Options Criteria for Initiative 9

#	VOLUME OF CUSTOMERS
Baseline	0
1	1,300,000
2	206,000
3	534,000
4	81,500
4a	40,750

Options Considered

The following options have been selected through assessment of the number of customers who may benefit from the investment. The initiative options selected are set out in Table 59.

Table 59. Optioneering for Digital Switchover Support

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	Doing nothing means that once over to digital, customers would lose the ability to use their landline in a power cut. We therefore feel that doing nothing is not an option in the absence of any other solution from the Telecoms companies.
1	Fit to all vulnerable customers.	Considered	A large proportion of these customers have alternative contact methods (mobile).
2	Fit to all MDE customers.	Considered	
3	Fit to all vulnerable customers where only a landline is provided by the customer.	Considered	This ensures our vulnerable customers can always communicate two ways. However, given the size of

#	OPTIONS	DECISION	COMMENT
			our PSR register this is a significant customer base.
4	Fit device for all Medically Dependent customers where only a landline is provided by the customer.	Considered	A subset of Group 3. These are the most at-risk group of customers with no alternative method of communication. This option assumes no
4a	Sensitivity analysis for Option 4, assuming 50% of our medically dependent customers with only a landline will acquire a second form of communication within RIIO-ED2 i.e., a mobile phone	Considered	A subset of Group 4. Our most at-risk group of customers with an assumption on technology take-up.

Preferred Option

The preferred option is Option 4a, to fit the UPS device for 50% of medically dependent customers which only have a landline. This group of customers are vulnerable and would have no other method of communication if power was disrupted.

Table 60. Cost breakdown for costs associated with Initiative 9, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST, £M
Devices	40,750	£0.24k	£9.8m
Installation	40,750	£0.08k	£3.3m
Programme Team	10	£24.14k	£0.2m
Programme Management	2	£40.23k	£0.8m
Total			**£13.4m**

Table 61. Costs Profile for Digital Switchover Support, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	1.85	1.85	1.85	1.85	**7.39**
SPM	-	1.51	1.51	1.51	1.51	**6.05**

5.2.4. Initiative 10: Proactive Support Medically Dependent Equipment – Medical Equipment Back-Ups

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Criteria

Each option was chosen based on the number of customers that could benefit from this initiative.

Table 62. Options criteria for medical equipment back-ups

#	VOLUME OF CUSTOMERS
Baseline	0
1	206,493
2	79,196
3	36,100
3a	18,050

SP Energy Networks

Options Considered

The following options have been selected through assessment of the number of customers who may benefit. The initiative options selected are set out in Table 63.

Table 63. Optioneering for Medical Equipment Back-Ups

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	
1.	Battery back-up for all Medically Dependent Households	Considered	All medically dependent customers should be supported to ensure they remain on supply however a large proportion of these customers experience no or very low interruptions and therefore we propose to focus on those customers most in need.
2.	Battery back-up for all Medically Dependent Households who have experienced a power cut in last 12 months	Considered	This group of customers are in need of support, however they have received only one interruption in the last 12 months and tactical support is still available for them via one to one support with us and generator deployment during an event.
3.	Battery back-up for all Medically Dependent Households who have experienced 2 or more power cuts in last 12 months	Considered	We consider this group to be the most in need as they have medically dependent equipment and have experienced 2 or more interruptions in the last 12 months. Whilst tactical support is still available for this population of customers, we consider proactive action to be preferrable.
3a	Sensitivity analysis on Option 3, assuming that 50% of customers have arranged battery back-up supplies themselves	Considered	A reduction in the volume of customers supplied with battery supplies, prioritising those without their own back-up supply.

Preferred Option

The preferred option is Option 3a, providing battery back-up supplies for half of all medically dependent customers who have experienced at least 2 power cuts in the last 12 months.

Table 64. Cost breakdown for costs associated with Initiative 10, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST £M
Device	18,050	£1.3k	£23.2m
Programme Team	10	£24.1k	£0.2m
Programme Management	2	£40.2k	£0.1m
Total			**£23.5m**

Table 65. Costs Profile for Medical Equipment Back-Ups, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	3.23	3.23	3.23	3.23	12.92
SPM	-	2.64	2.64	2.64	2.64	10.57

5.2.5. Initiative 11: Proactive Support Medically Dependent Equipment – Hospital Beds

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Criteria

Each option was chosen based on the number of beds that may be required per district. An assessment of recent quotations is given in Table 62, with costs scaled to 2020/21 prices.

Table 66. Quotations for Medical Beds, 2020/21 prices

COMPANY	BED,£	FOAM MATTRESS, £	AIR MATTRESS, £	INSTALLATION/ DELIVERY, £	TOTAL, £
Winncare	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Opera	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Shelden	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Complete Care	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sidhill	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Options Considered

The following options have been selected through assessment of the number of beds per district. The initiative options selected are set out in Table 67.

Table 67. Optioneering for Medical Beds

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	Doing nothing would mean we have to wait for NHS services to be provided with the delays that that may bring.
1	11 beds	Considered	One bed per Distribution District Area across the SPEN licences would give adequate cover along with an additional mattress stock.

#	OPTIONS	DECISION	COMMENT
2	22 beds	Considered	Two beds per Distributions District area – this volume is likely not required.

Preferred Option

Option 1 is the preferred option. 11 beds would give good coverage whilst ensuring we can proactively and quickly respond to customer needs.

Table 68. Cost breakdown for costs associated with Initiative 11, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST, £K
Beds	11	£1.6k	£17.7k
Mattresses	33	£0.4k	£13.3k
Total			**£31.0k**

Table 69. Costs Profile for Medical Beds, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.02	-	-	-	0.02
SPM	-	0.01	-	-	-	0.01

5.2.6. Initiative 12: Warm Customer Communication Hubs

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current welfare services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Considered

The following options have been selected through assessment of the number of community hubs per district. The initiative options selected are set out in Table 70.

Table 70. Optioneering for Warm Customer Hubs

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	Doing nothing does not increase the support into communities via their community buildings beyond our current service.
1	Funding Pot for communities to bid	Considered	This option was to purely have a funding pot communities could bid into to improve the overall building resilience and the period buildings could be used.

#	OPTIONS	DECISION	COMMENT
2	2 Stream approach: 1. Community fund allowing communities to bid for support 2. Assessment based on data of coverage and gaps, prioritised based on data mapping. This overall fund would be independently governed (in a similar way to the Net Zero Fund arrangements)	Considered	This provides decision making based on data allowing accurate prioritisation of funding, whilst still allowing an avenue for community groups to come forward for support. Independently governed by and external organisation to ensure funding is directed in the most appropriate way.

Preferred Option

The preferred option is Option 2, a two-stream approach to providing funding for community hubs. We felt option 2 gives a much more informed and well-rounded approach informed by data and utilising the extensive mapping work already in place. The costs associated with this option are given in the following tables.

Table 71. Cost breakdown for costs associated with Initiative 12, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST, £M
Desktop Exercise to Map Warm Hubs	1	£24.1k	£0.02m
Research Programme to understand feedback on gaps in service from end customers and warm home hub staff	1	£24.1k	£0.02m
Resilient Warm Hub Interventions for 10 Warm Hubs per District areas across SPD and SPM. 11 Districts = 110 Warm Hub interventions.	110	£8.0k	£0.89m
Satellite Phone Courtesy Box installed in each Hub	110	£2.4k	£0.27m
Fund for community hubs to bid for any measures to make them more resilient or able to extend opening times	1	£804.6k	£0.80m
Governance structure put in place to be managed independently (in line with the arrangements we have in place for the Net Zero Fund).	4	£80.5k	£0.32m
Total			**£2.3m**

Table 72. Costs Profile for Warm Customer Hubs, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.32	0.32	0.32	0.32	**1.28**
SPM	-	0.26	0.26	0.26	0.26	**1.05**

5.2.7. Initiative 13: Increased Contact Centre Ramp Up

RIIO-ED2 Baseline Investment and RIIO-ED1 Track Record

This proposal will fund services above and beyond current communication services and is not included in our baseline RIIO-ED2 funding, to be delivered in addition to our current offering.

Options Criteria

Options have been selected using out experience and event history to assess level of need, resourcing requirements and timings for additional support.

Options Considered

The initiative options selected are set out in Table 73.

Table 73. Optioneering for Increased Contact Centre Ramp Up

#	OPTIONS	DECISION	COMMENT
Baseline	Do Nothing	Considered	
1	1. Introduce outsource resource across our evening and weekend work patterns at a low level 2. Create a pay-as-you-go model where ramp up requirements beyond our current staff levels and wider business ramp up can be called on in times of significant need	Considered	To ensure we have constant resource, training and development to ensure any partner we bring into our service mix fully understands our business and our work is embedded into their day-to-day work.

Preferred Option

We propose to introduce a continuous resource across evening and weekends to ensure resource is deployed across the periods most at risk in a BAU setting. 30 outsourced resources would be split across the following work patterns:

Table 74. Proposed work hours for additional FTE

TIME	FTE
Weekday	
5pm - 11pm	10
11pm - 7am	2
Weekend	
7am - 3pm	8
3pm - 11pm	8
11pm - 7am	2
Total	**30**

The costs associated with these additional FTE are given in Table 75.

Table 75. Costs for additional outsourced FTE, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST, £M
Outsourced resource of 30 FTE spread across weekday work patterns 5pm to 7am and weekend work patterns 7am to 7am	30 per year	£32.2k	£0.97m
Total			**£0.97m**

We propose to introduce a ramp up resource across all periods on the basis of need, to ensure we can draw on guaranteed trained resource in a significant event such as storms or emergency scenarios. We have calculated a daily outsource cost of £30,909 (2023/24 prices) and have assumed usage of 25 days per annum for this service, calculating a total cost of £772,727 (2023/24 prices) for this element. We would also pay an annual retainer to maintain these resources of £100,000 p.a (2023/24 prices). Based on volumes experienced across Storm Arwen and other less significant events we have calculated the spread of resources as shown in the table below as the maximum needed.

Table 76. Ramp-Up FTE

TIME	FTE
7am - 3pm	75
3pm - 11pm	75
11pm - 7am	20
Total	**170**

Costs associated with the ramp-up FTE are given in Table 77.

Table 77. Costs for additional outsourced FTE, 2020/21 prices

COSTS	VOLUME	UNIT COST, £K	TOTAL COST, £M
Outsourced Ramp Up Costs	170 FTE, 25 days per year	£24.9k	£0.62m
Annual Retainer Fee	4	£80.5k	£0.32m
Total			**£0.94m**

Total costs proposed for this initiative and the delivery profile is given in Table 78.

Table 78. Costs Profile for Increased Contact Centre, 2020/21 prices

LICENCE	COST PROFILE £M					
	23/24	24/25	25/26	26/27	27/28	TOTAL
SPD	-	0.26	0.26	0.26	0.26	1.05
SPM	-	0.21	0.21	0.21	0.21	0.86

5.3. Total Costs

Table 79 and Table 80 give the total costs proposed under the reopener, broken down by initiative. Our initiatives include only the direct costs associated with the delivery of the preferred options.

Table 79. Theme 2 Total costs proposed under reopener – SPD

NO	INITIATIVE	COST £M					
		23/24	24/25	25/26	26/27	27/28	TOTAL
7	Keeping Customer Connected – Power Packs	-	0.19	-	-	-	**0.19**
8	Increased Customer Welfare	-	0.14	0.13	0.13	0.13	**0.54**
9	Digital Switchover Support	-	1.85	1.85	1.85	1.85	**7.39**
10	Proactive Support – Medical Equipment Back-Ups	-	3.23	3.23	3.23	3.23	**12.92**
11	Proactive Support – Hospital Beds	-	0.02	-	-	-	**0.02**
12	Warm Customer Communication Hubs	-	0.32	0.32	0.32	0.32	**1.28**
13	Increased Contact Centre Ramp Up	-	0.26	0.26	0.26	0.26	**1.05**
Total		**-**	**6.01**	**5.79**	**5.49**	**5.49**	**23.39**

Table 80. Theme 2 Total costs proposed under reopener - SPM

NO	INITIATIVE	COST £M					
		23/24	24/25	25/26	26/27	27/28	TOTAL
7	Keeping Customer Connected – Power Packs	-	0.16	-	-	-	**0.16**
8	Increased Customer Welfare	-	0.12	0.11	0.11	0.11	**0.44**
9	Digital Switchover Support	-	1.51	1.51	1.51	1.51	**6.05**
10	Proactive Support – Medical Equipment Back-Ups	-	2.64	2.64	2.64	2.64	**10.57**
11	Proactive Support – Hospital Beds	-	0.01	-	-	-	**0.01**
12	Warm Customer Communication Hubs	-	0.26	0.26	0.26	0.26	**1.05**
13	Increased Contact Centre Ramp Up	-	0.21	0.21	0.21	0.21	**0.86**
Total		**-**	**4.91**	**4.73**	**4.73**	**4.73**	**19.14**

6. Conclusions

The initiatives outlined in this reopener have been developed following review of all Ofgem and E3C Storm Arwen Recommendations to improve storm resilience in SPD and SPM, with focus on customers considered to be rural. All investment proposed is above existing RIIO-ED2 ex-ante allowance, with the drivers and outputs separate and ring-fenced. Investment is sufficiently justified through qualitative reasoning and cost benefit analysis tools, with interventions identified through targeted risk-based approaches considering the impact of extended power cuts on our customers.

This proposal results in total investment of £75.9m across both licences (£38.6m in SPD and £37.3m in SPM).

Table 81. Total SARt Modification

LICENCE	THEME 1 COSTS	THEME 2 COSTS	TOTAL COSTS
SPD	£15.2m	£23.4m	**£38.6m**
SPM	£18.2m	£19.1m	**£37.3m**
SPEN	**£33.4m**	**£42.5m**	**£75.9m**

This is through the roll out of 13 initiatives across asset resilience, vegetation management, generation, customer welfare and communications. All of these proposals were developed reflecting detailed stakeholder and customer engagement and reflect the priorities identified by those stakeholders.

SPEN would support a second Storm Arwen reopener window, for any additional costs or initiatives not suitably developed for inclusion in this window.

7. Summary of Further Evidence

The following documents have been appended to this reopener submission to provide additional information and engineering justification for initiatives:

- **Main Document Appendix**: All appendices referenced in this document have been included in a single Appendix document, submitted as part of the reopener submission.
- **Our RIIO-ED2 Business Plan Submission**: We submitted our 5-year business plan for the period 2023-28 in December 2021. Throughout this reopener application we have referenced the strategies and content of our business plan, and referenced annexes and Engineering Justification Papers where applicable.
- **Cost Benefit Analysis** for Initiatives 1, 2, 3 (4 files), 4, 5 and 6
- **Neara Proof-of-Value Summary**: The final report produced by Neara following completion of the Proof-of-Value project has been included as part of the reopener submission.
- **Severe Weather Map Paper**: The research paper submitted to CIRED in 2023 to discuss the merits of SPEN's severe weather mapping project has been included as part of the reopener submission.
- **Interconnectors Costing Workbook**: The Excel workbook used to calculate costs for Initiative 3, Interconnection across DNOs, has been included as part of the reopener submission.
- **Kelvatek's LineSIGHT Assessment Report**: The report completed by Kelvatek following review of all SPEN's network performance data, to identify the number of circuits for roll-out of LineSIGHT and the benefit of these.
- **S&C Electric's Independent Expert External Assurance Report**: We have commissioned a third-party review of this submission against Ofgem's re-opener application guidance, and the recommendations within the E3C and Ofgem Storm Arwen recommendation reports. Their assessment of this submission and its appended/supporting documents has also been appended.