Scottish & Southern Electricity Networks

RIIO-ED2 Engineering Justification Paper (EJP)

LV UGB

Investment Reference No: 315_SSEPD_NLR_LINKBOXES

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Investment Summary Table

Table 1 below provides a high level summary of the key information relevant to this Engineering Justification Paper (EJP) and the management of our LV Link Boxes (LV UGB).

Table 1: Investment Summary

Name of Programme	LV UGB						
Primary Investment Driver	Non Load – Safety and Resilience						
Investment Reference	315_SSEPD_NLR_LINKBOXES						
Output Reference	Link Boxes						
Cost	£19.1m						
Delivery year	RIIO-ED2						
Reporting Table	The following Cost and Volume (CV) tables correlate to the primary investment drivers for the asset category covered by this Engineering Justification Paper: • CV7: Asset Replacement • CV14: Legal & Safety						
Outputs included in RIIO – 2 Business Plan	No						
Spend Apportionment	**(£m)**	**ED1**		**ED2**		**ED3+**	
	SEPD	-		19.0		-	
	SHEPD	-		0.1		-	
RIIO-ED2 Spend (£m) – LV UGB							
CV7 Asset Replacement RIIO-ED2 Spend (£m)	**Year**	**2024**	**2025**	**2026**	**2027**	**2028**	**Total**
	SEPD	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	SHEPD	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CV14 Legal & Safety RIIO-ED2 Spend (£m)	**SEPD**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	SHEPD	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

1 Executive Summary

Our ***Safe and Resilient (Annex 7.1)*** sets out the methodology used to determine the Non-Load baseline for capital expenditure. This encompasses capital investment to address assets in poor health deemed to be at or near their "end of life". The baseline encompasses all activities and investments required during the RIIO-ED2 period where there is compelling evidence of need.

The primary driver for this category is asset health. This paper identifies the need to provide a baseline to allow intervention on Link Box (LV UGB) assets. These works have been identified using a Condition Based Risk Management (CBRM) tool, developed using the Common Network Asset Indices Methodology (CNAIM). The CBRM tool utilises existing asset information and inspection data to attribute each asset a health and criticality score which corresponds to a Probability of Failure (PoF) and a Consequence of Failure (CoF).

We have used the information from CBRM to establish a Health Score (HS) investment criteria. This criteria is a strategy used to tactically address interventions based upon the Criticality of the asset. The higher the Criticality of the asset the lower the acceptable health score we are willing to accept to ensure the total Risk of Failure is tolerable for network customers.

These data points have then been fed through a sensitivity analysis looking at a range of HS criteria scenarios. Once viewed holistically across all asset categories the preferred sensitivity analysis has been selected, representing the right balance of risk for our network customers.

For LV UGB the options used to address the proposed interventions have been considered in detail in this paper. The outcome from this found that the only viable option is the full replacement of LV UGB assets.

Following the entirety of optioneering and all detailed analysis, as set out in this paper, the proposed scope of works is the replacement of **4,097** "end of life" LV UGB assets in SEPD and SHEPD licence areas. Of the total replacements identified **517** will be replaced with an LV Pillar (OD Not at Substation) which are included in the LV Switchgear EJP (314_SSEPD_NLR_LV_SWGR).

The cost to deliver the preferred solution is **£19.1m** and the works are planned to be completed throughout the ED2 regulatory period.

The benefit of these works revolves around the reduction of risk of failure of these assets, which are integral in the operation of our network. If the condition of a Link Box is permanently left to deteriorate without proactive replacement a disruptive failure is possible which can have serious safety consequences due to some of these assets being located in public areas. As such, it is critical that we maintain the condition of this asset category for the safety of our staff and the public. These replacements are intended to maximise the capacity and availability for all network customers.

2 Introduction

This Engineering Justification Paper (EJP) describes our proposed non-load related investment plan for the LV UGB asset category during RIIO-ED2. The primary driver considered within this paper is the condition of each LV UGB as measured through our inspection and maintenance regimes and our Condition Based Risk Management (CBRM) models which aligns with Ofgem's Common Network Asset Indices Methodology (CNAIM) v2.1.

Section 3 discusses the primary and secondary investment drivers for LV UGB. The main driver being the poor health and condition of the asset. We then provide high-level background information for this asset category and explain the importance of this asset for our electricity distribution network and our network customers as well as providing detail on the systems we use to identify the need for intervention to ensure our LV UGB's are in good health over the course of RIIO-ED2 and beyond.

Section 4 presents a table of intervention options for our LV UGB with additional sections providing greater detail on each option to indicate whether the option is taken forwards or not.

Section 5 provides detailed analysis that describes the cost and volumes arising from the preferred intervention options. The results of a sensitivity analysis are also provided to show the impact on both cost and volumes if a higher or lower tolerance for risk (probability and consequence of failure) was chosen as our RIIO-ED2 strategy.

Section 6 also describes how we have established the cost efficiency of the plan with reference to the unit costs that have been chosen, and the deliverability of the plan with respect to our ability to replace the volume of LV UGB indicated within this paper during RIIO-ED2 for the cost allowance requested.

Section 7 concludes with a summary of the EJP and its recommendations.

Supplementary Appendices are provided. These include a Table of Acronyms and the relevant internal standards and policies.

3 Background Information

This section of the EJP provides background information on our LV UGB asset category. This includes a description of the assets under consideration, the importance of these assets to network customers, and the approach used to identify those that most require intervention during RIIO-ED2.

3.1 LV UGB

There are approximately 41,300 Link Boxes currently operating on our network. Link Boxes are extensively used in the urban underground network and enable the LV network to be flexible. This flexibility allows different parts of the network to be energised or de-energised as required, allowing work to be carried out safely whilst keeping customer disruption to a minimum, for activities such as maintenance or fault work. A Link Box is specifically designed and used for this purpose and may be 2-ways or 4-ways depending on the complexity of the network requirements.

If the condition of a Link Box is permanently left to deteriorate without proactive replacement a disruptive failure is possible which can have serious safety consequences. This is due to some of these assets being located in public areas (i.e. pavements, bus stops, outside shopping centres, football stadiums etc). As such, it is critical that we maintain the condition of this asset category for the safety of our staff and the public. Preventing the end-of-life failure of these Link Boxes will also avoid costly reactive replacement which can be significantly more expensive than the cost associated with planned proactive replacement before failure.

As the Health of each Link Box deteriorates over time the Probability of Failure (PoF) increases. To prevent unwanted failures before they happen and to avoid costly reactive replacement of failed link box, a Health Score is calculated for each asset. This allows us to proactively intervene on these link boxes at lower cost before the total Risk of Failure (Probability of Failure x Consequence of Failure) becomes intolerable for network customers.

Table 2 shows the quantity of Link Boxes within our licenced areas and the average age of the asset category in both regions.

Table 2: Number of LV UGB (Total Volume Table V1: 2021)

	SEPD		SHEPD	
Asset Category	**Average Age**	**No. of Units**	**Average Age**	**No. of Units**
LV UGB	48	36,102	42	5,225

In addition, Figure 1 and Figure 2 show the Age Profile for the asset category in both regions. These show the number of assets installed during each calendar year.

There is a correlation between age and asset health, as the condition of each asset will generally reduce over time. However, our CBRM models calculates a specific Health and Criticality score for each asset and it is these values that are used to determine the number of assets that required condition related intervention each year.

The age profiles below are provided for information purposes only and cannot be used in isolation to justify any investment in the asset category. However, these Age Profiles demonstrate the variance in the rate at which the network was built over time. This variance in the rate at which the network was initially built can result in a sudden increase or decrease in future investment as the link boxes previously installed in the same

time period collectively reach the end of life condition. As a result, it is likely that there will be a shift in the number of link boxes that require intervention from one regulatory period to the next.

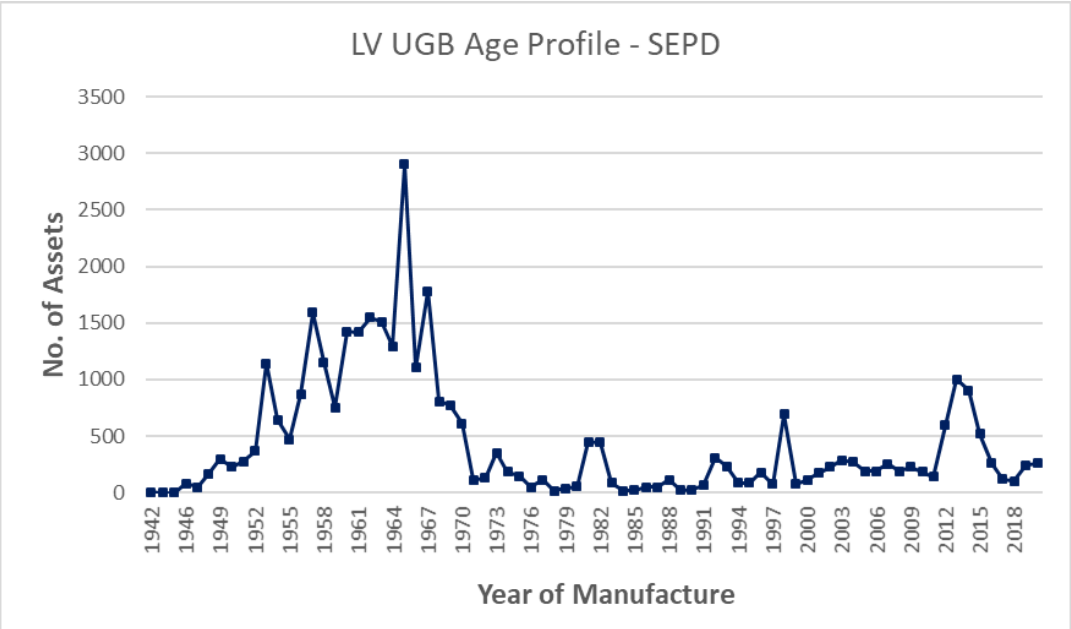


Figure 1: Age Profile for LV UGB – SEPD

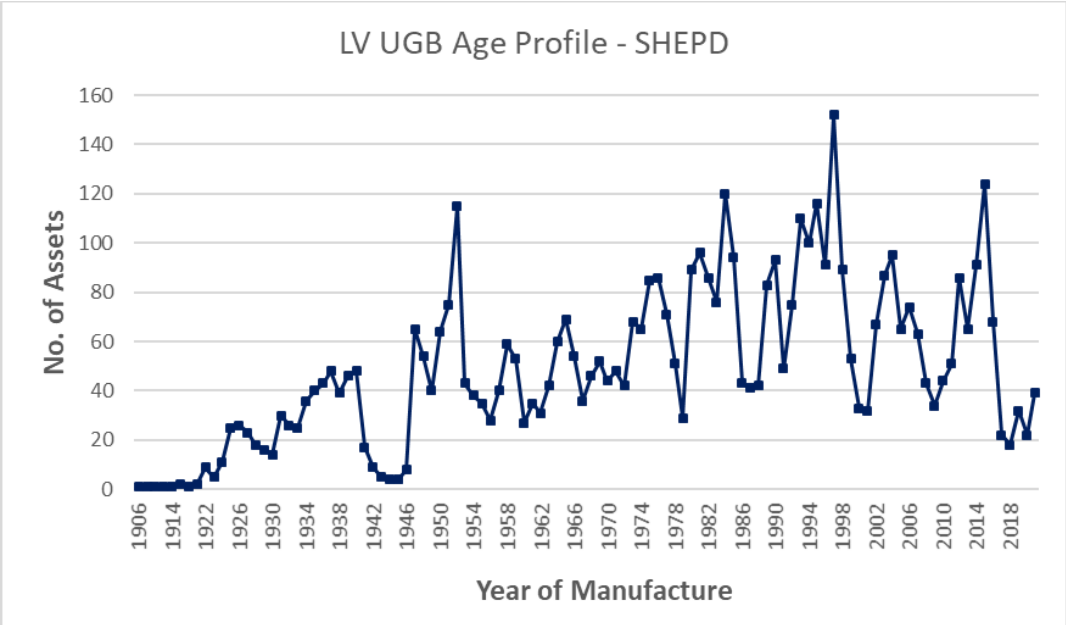


Figure 2: Age Profile for LV UGB – SHEPD

In recent years, there has been a rise in the number of Link Box incidents reported via the ESQCR Regulations across the industry. Although evidence indicates (through the conclusions in the 2017 ENA Position Paper 08 "Management of Link Boxes and Cable Pits on LV Distribution Networks" and Link box Working Group investigations) that only a very small proportion of failures result in a disruptive failure, we have experienced a number of these failures in recent years. Figure 3 shows an example of a disruptive failure in Poole and Bournemouth, respectively.

Figure 3: Disruptive Link Box Failures (Poole High Street and Bournemouth)

Following the issue of the ENA Position Paper during RIIO-ED1, we carried out a review of our Link Box strategy and the end-to-end implementation of this strategy. The aim of the review was to identify clear and meaningful ways of reducing risk in line with the ENA Position Paper and already existing strategy document. The review focused on:

- Identification of high-risk locations;
- Inspections (receiving the correct information back from site);
- Installation of protective fire blankets (are these being fitted and recorded);
- Defect rectification and replacement progress;
- Fault/failure rates (trends and reporting);
- Industry trends (leading, lagging or following); and
- Effectiveness of protective blankets.

Through a risk assessment, we identified our high-risk Link Box locations, as far as reasonably practicable by assessing pedestrian footfall within 15 metres such as shopping high streets or adjacent to public buildings. Additional criteria of what constitutes a high-risk link box (as per our Strategy for Distribution Underground Link Boxes ST-NET-ENG-008) is determined if a fault is present or if the Link Box has a Condition 4 defect identified upon inspection.

We have enhanced our Link Box safety resilience through this strategy, putting in place mitigation measures in high risk link box locations. Every high-risk Link Box must now be fitted with a fire protection blanket as shown in Figure 4. Fitting this temporary mitigation will benefit the public and lessen the impact of any failure if an incident was to materialise. Table 3 shows the number of fire protection blankets installed to date.

Table 3: No. of Fire Blankets Fitted

	SEPD	SHEPD
Asset Category	**No. of Blankets Fitted**	**No. of Blankets Fitted**
LV UGB	913	266

Figure 4: Example of a Fire Protection Blanket Fitted

3.2 Condition Based Risk Management (CBRM)

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

The draft RIIO-ED2 Business Plan submission was based on the latest version of the industry standard CNAIM v2.0 at the time of compiling the key outputs for all the EJPs, however a final version CNAIM v2.1 was subsequently approved by Ofgem. This has been utilised in the final RIIO-ED2 Business Plan submission.

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

The output from CBRM has been used to inform the intervention criteria utilising our internal Network Asset Intervention Methodology (NAIM) on how the assets are selected for prioritised investment. This is based on the assets relative position in the standard CNAIM reporting Risk Index matrix as illustrated by Figure 5 below, which shows the value of Monetised Risk attributed to each asset according to its attributed Health and Criticality within each cell, providing a reference risk value in £. However, consideration is given to the specific Health Score within the selection criteria for a more granular consideration than purely consideration of the wider Monetised Risk (HI/CI) classification.

The specific Health Score Intervention Criteria we have established for this asset category has been developed within a number of internal workshops with our subject matter expert with the objective of finding the optimal balance of risk between proactive and reactive asset intervention. This approach has also been tested and ratified through targeted stakeholder engagement and intends to maximise both the reliability and importantly the affordability of the network for our customers.

A fuller understanding of our NAIM and how the specific Health Score Intervention Criteria for each specific asset category was reached is available in our ***Safe and Resilient (Annex 7.1)*** within section 8 and the associated referenced technical guidance document TG-NET-ENG-026 (NAIM).

Criticality Index		Health Index				
		HI1	HI2	HI3	HI4	HI5
	C1	479	1960	4022	6346	9264
	C2	685	2800	5745	9066	13234
	C3	1027	4200	8618	13599	19851
	C4	1711	7001	14363	22666	33085

Figure 5: Health Index Matrix

The specific selection criteria for each asset classification is detailed more specifically later in this EJP in identifying the volume of the specific asset classification requiring intervention.

Health Index

Analysis carried out has shown that a high number of LV UGBs are still due to be inspected as part of our commitment to inspect all link boxes before the end ED1 (i.e. approximately 13% have been inspected in SEPD and 32% in SHEPD). We have taken this into consideration when calculating the predicted number of link boxes requiring intervention at the end of ED2 following completed inspections.

Figure 6 shows the Health Profile for LV Link Boxes for SEPD at the start and then the end of ED2 without investment using the current number of inspections that have been carried out on the network. The significant increase in the quantity of HI3 assets in SEPD is predominantly due to the ageing factor in the CBRM model which impacts the future health index. Meanwhile, Figure 7 shows the Health Profile for Link Boxes for SHEPD at the beginning of ED2 and by the end of ED2 without investment using the current number of inspections that have been carried out on the network.

Health Index (Current Inspections Completed)

Figure 6: Health Profile for LV UGB – SEPD (Current Inspections)

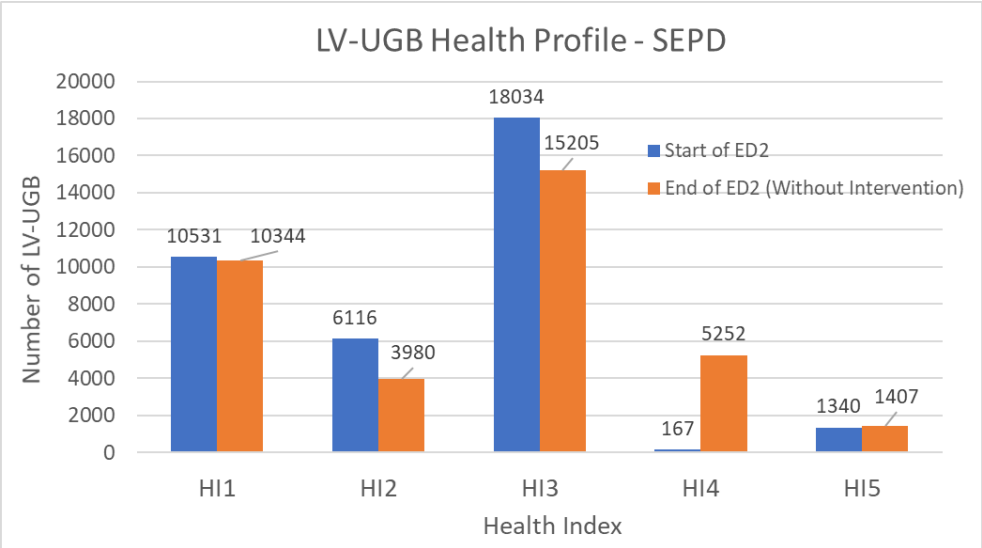
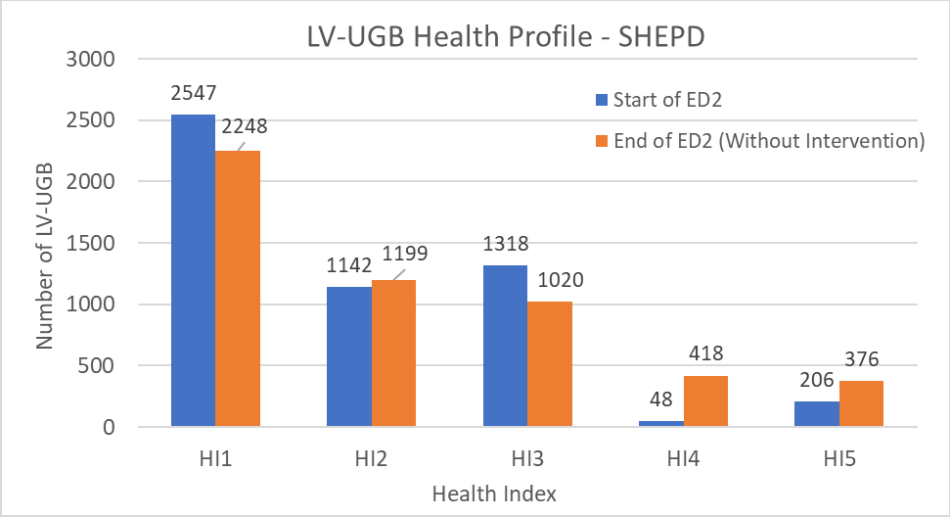


Figure 7: Health Profile for LV UGB – SHEPD (Current Inspections)



Health Index (All Inspections Completed)

We are part way through our inspection cycle for link boxes and have therefore made an assessment for RIIO-ED2 based on the data currently available. Extrapolation from our accessible data has enabled us to forecast the number of HI5 LV UGB on the network at the end of ED2 once the full population of link boxes have been inspected. These can be shown in the figures below which shows a significant increase in the number of HI5 LV UGB forecast once the full population has been inspected.

Figure 8: Health Profile for LV UGB – SEPD (All Inspections)

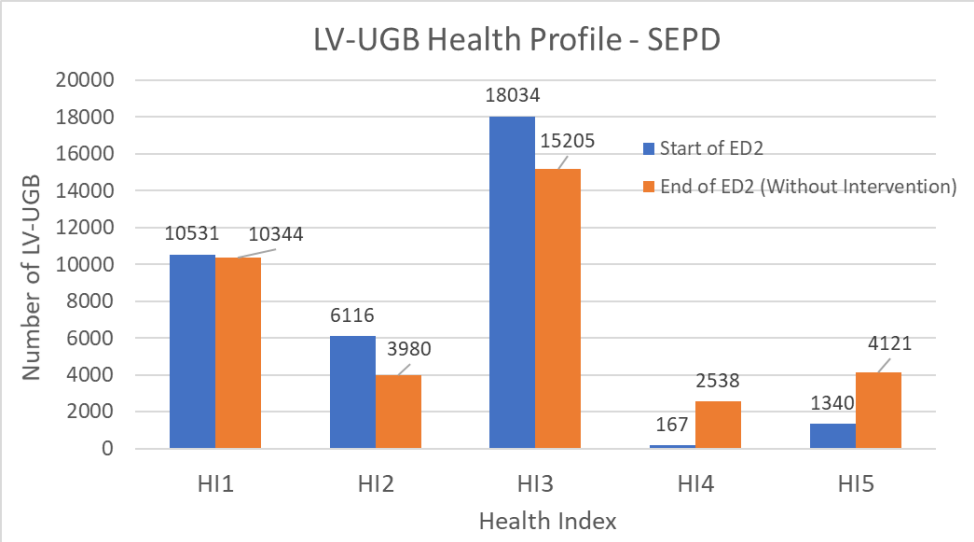
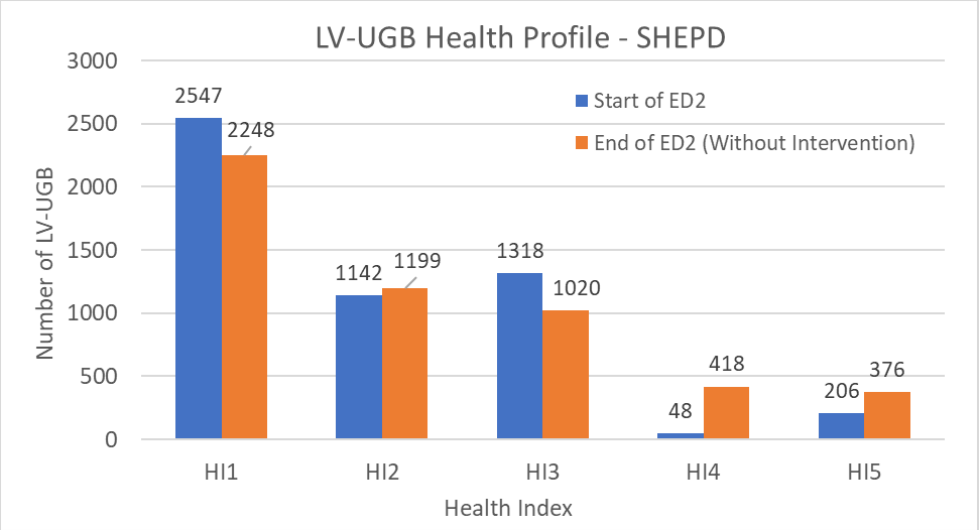


Figure 9: Health Profile for LV UGB – SHEPD (All Inspections)



Criticality Index

The Criticality Index is used to prioritise the replacement, refurbishment, or maintenance of network assets based upon the impact they are likely to have should they fail. Asset criticality is a relative comparison of the consequence of failure. The consequence of failure takes into consideration whether the asset failing would cause an outage, pose a safety concern, pose an environmental concern and the financial impact of the failure. High criticality assets should be replaced ahead of low criticality assets to protect network customers. Once calculated, an Index between C1 to C4 is assigned to each asset, where C1 is the least critical.

Figure 10 and Figure 11 below show the current Criticality Profiles for SEPD and SHEPD Link Boxes. As illustrated, for both licence areas the majority of assets lie in C2 or C3 criticality and in relative terms a small number of C4 assets. It is assumed that the criticality of each asset will remain constant from the beginning to the end of RIIO-ED2, as the consequence of failure is unlikely to change without a significant change in the characteristics of the network (e.g. the number of customers connected to each asset etc).

Figure 10: Criticality Profile for LV UGB – SEPD

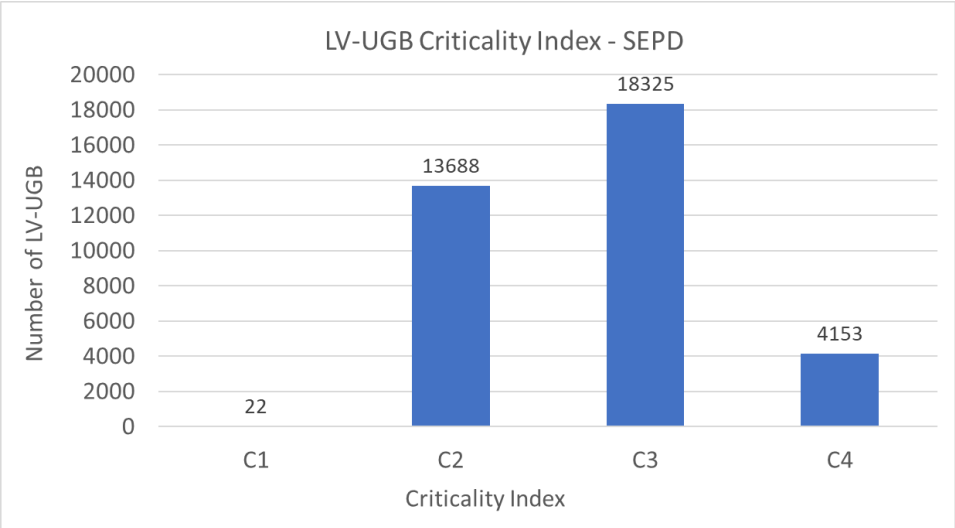
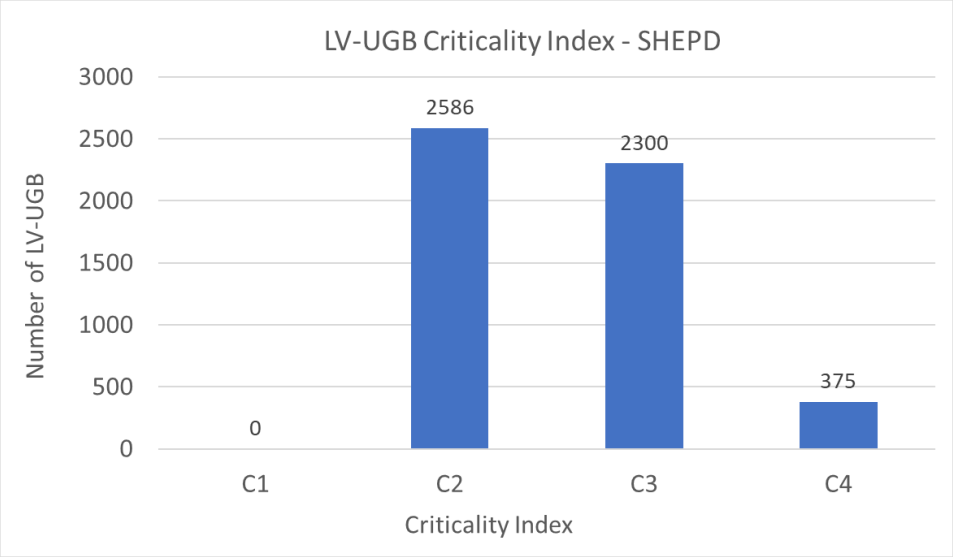


Figure 11: Criticality Profile for LV UGB – SHEPD



Total Risk Score

Similar to the Health Profiles above, Figure 12 and Figure 13 show the Risk Profiles for LV Link Boxes at the start and then the end of ED2 without investment using the current number of inspections that have been carried out on the network.

Total Risk Score (Current Inspections)

Figure 12: Risk Profile for LV UGB – SEPD (Current Inspections)

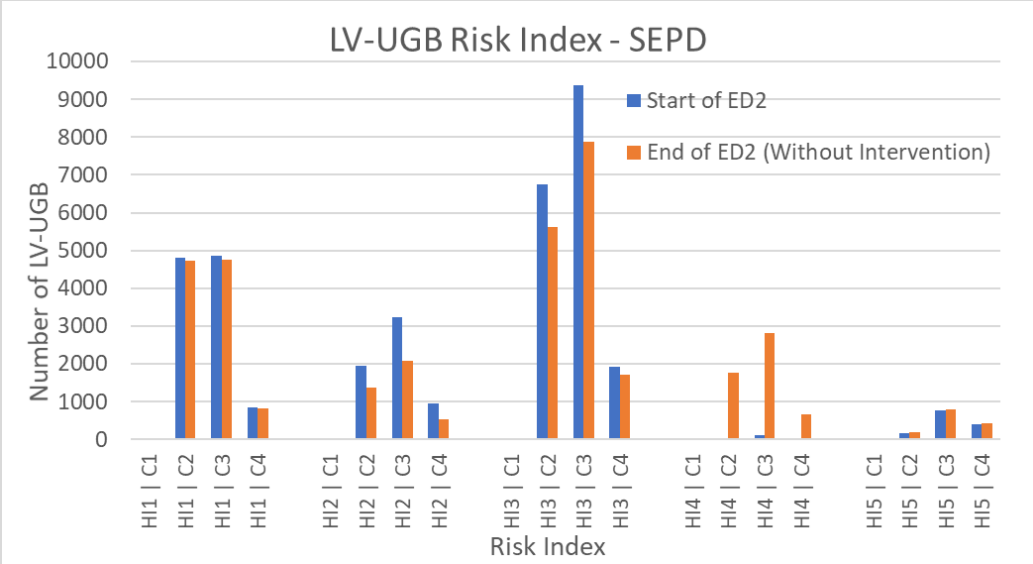
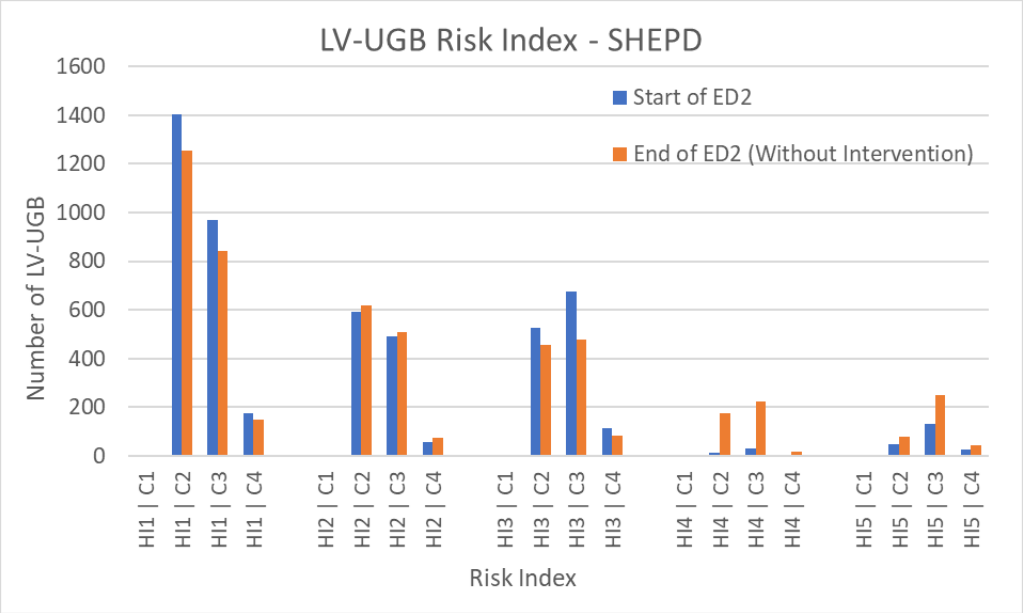


Figure 13: Risk Profile for LV UGB – SHEPD (Current Inspections)



As discussed above, we are part way through our inspection cycle for link boxes and have therefore made an assessment for RIIO-ED2 based on the data currently available. Extrapolation from our accessible data has enabled us to forecast the number of HI5 LV UGB on the network at the end of ED2 once the full population of link boxes have been inspected. The Risk Profiles for LV Link Boxes at the start and end of ED2 without investment for the total population can be shown in Figure 14 and Figure 15.

Total Risk Score (All Inspections)

Figure 14: Risk Profile for LV UGB – SEPD (All Inspections)

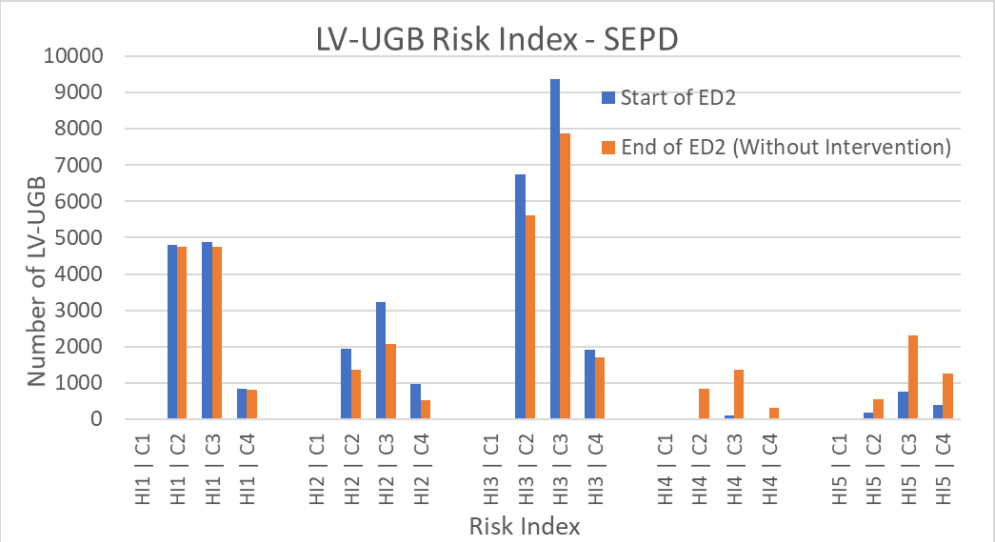
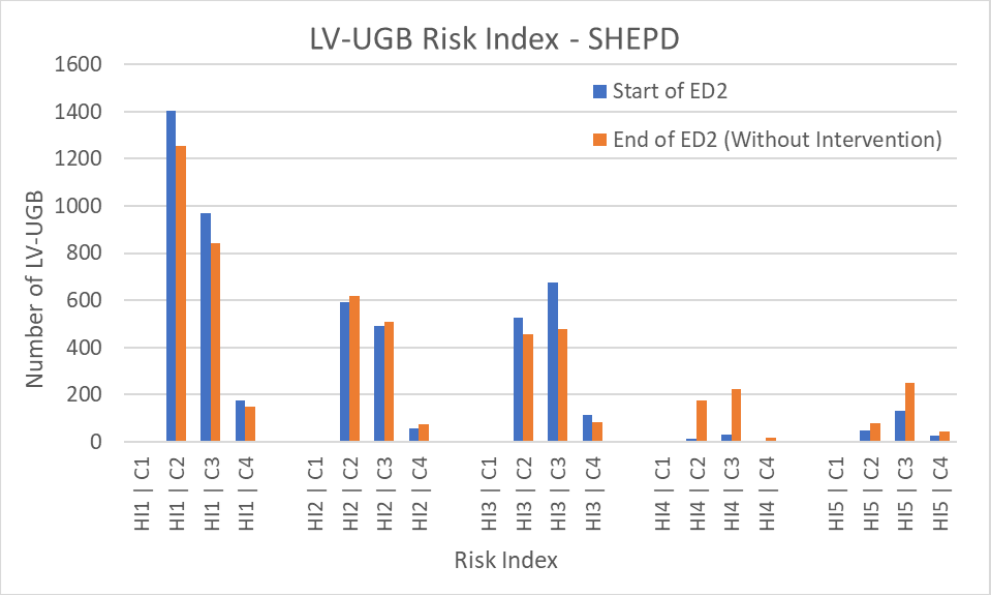


Figure 15: Risk Profile for LV UGB – SHEPD (All Inspections)



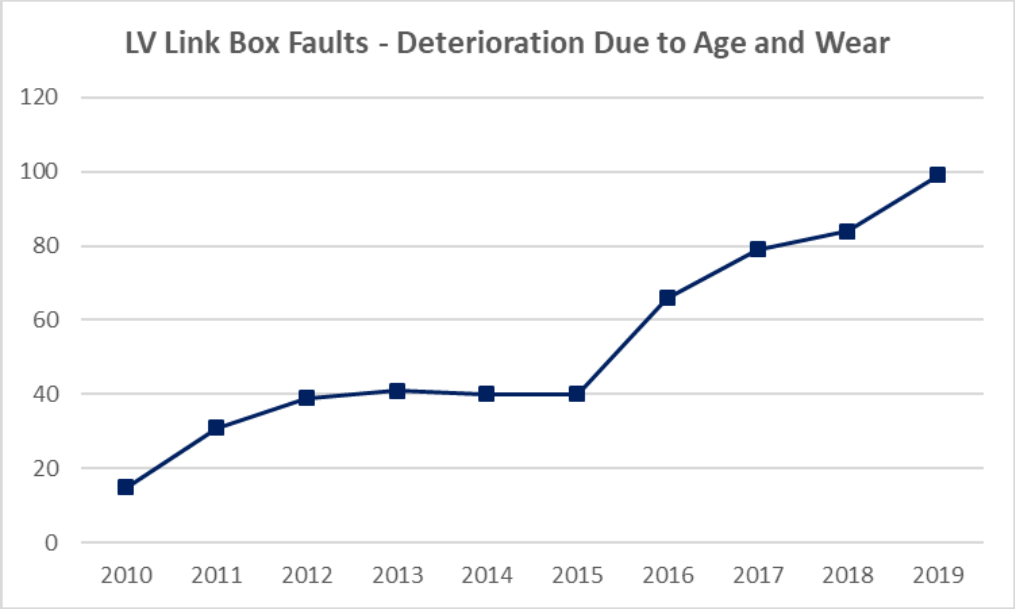
Link Box Inspections

Our current inspection frequency for Link Boxes is every 8 years as defined within our Link Box inspection policy. All high-risk Link Boxes are inspected every 4 years. As described above, the volumes identified for intervention throughout ED2 are shortlisted based on CBRM Health and Criticality scoring which is input from the data collected during the inspection cycles. As we are part way through our inspection cycle for link boxes, we have made an assessment for RIIO-ED2 based on the data currently available. Extrapolation from our accessible data has enabled us to forecast the number of HI5 LV UGB on the network at the end of ED2 once the full population of link boxes have been inspected.

LV Link Box Failures

The evidence in Figure 16 displays the number of Link Box faults that have occurred on our network due to age and wear over a 9-year period. As shown, the trend has been heading upwards which ties in with the increased number HI5s predicted for intervention by the end of ED2.

Figure 16: LV Link Box Faults – Deterioration Due to Age and Wear



LV Link Box Blankets

There is a risk from disruptive failures of link boxes that energy will be expelled through the cover/lid of the link box and into the ground above it (which could be a footpath or road). A barrier to consider when reducing the risk is fitting protection fire blankets to suppress link box disruptive failures. The effectiveness of these protection blankets has been demonstrated by test work commissioned by UK Power Networks at a short-circuit test facility in Hungary. A number of link box failures have occurred since these protection blankets have been installed in high risk rated assets and none of these boxes have suffered a disruptive failure.

During RIIO-ED2, we are proposing to fit a protective safety blanket to any link box deemed to have a fault present, where it has been identified as a condition 4 (i.e. the asset has serious degradation that is considered to significantly increase the probability of failure) during inspection, or where we are required to backfeed due to a fault on the network. There may be savings where blankets can be re-used thus reducing the overall costs.

3.3 Primary Investment Drivers and Associated CV Tables

The primary investment driver for link boxes is to minimise the safety risk to members of the public and operational staff at the most economic cost to customers. Investment decisions are driven by Electricity Safety, Quality and Continuity Regulations (ESQCR) and Health and Safety Executive (HSE) commitments.

This primarily relates to the Health and Criticality of each asset as tracked by our Condition Based Risk Management (CBRM) system. Asset Health for this asset category is driven by the condition of the Link Box. The External Condition includes the steel cover/pit condition, whether water/moisture is present, the insulation condition and the condition of the bell cover.

We also monitor several well-known Link Box defects that can be identified during routine inspection. These defects impact the Health Index for each asset, and as such contribute towards the primary investment driver for this asset category. These defects include the following:

- **Bell cover -** Cracked, broken or not properly seated which can allow water, soil and vermin to enter the pit in which the link box is installed.
- **Stalks & Links -** Damaged, misaligned or corroded stalks can be difficult to insert and remove links. Damaged links can cause overheating, in severe cases leading to insulation degradation and breakdown.
- **Phase barrier -** Damaged or missing phase barriers can cause phase to phase arcing during connection and disconnection of links.
- **Water/moisture present -** Poor cover and pit condition allowing water ingress which can lead to insulation breakdown and potential failure.

The primary investment drivers described above correlate to the following Cost and Volumes (CV) tables within the RIIO-ED2 Business Plan Data Tables (BPDT). The costs and volumes associated with each CV table and the corresponding asset category depend upon the investment strategy and options that are chosen for each primary and secondary investment driver.

- **CV7 – Asset Replacement:** The replacement of network assets due to their health and criticality of each asset as defined by the CBRM policy.
- **CV14 – Legal & Safety:** Fitting fire protection blankets to high risk link boxes. This includes if a fault is present or if the link box has a condition 4 defect identified upon inspection.

The CBRM models maintained provide a Health, Criticality, and Risk score for each individual asset. The risk score (asset health and criticality) attributed to each asset by the CBRM models is a key metric that will trigger a need for investment into this asset category. This is calculated using a variety of asset-specific data which includes basic parameters in addition to the observed and measured condition of each asset.

Table 4 lists the data that may be used to inform whether each Link Box requires investment for non-load related purposes. As seen below, this data is used to calculate the risk score for each asset. However, occasionally the data list below is analysed separately alongside the CBRM scoring to determine if the asset requires non-load related investment.

Table 4: Primary Data Relevant to Condition Led Investment into Link Boxes

Category	Factor	Included within CBRM (Y/N)
Basic Asset Parameters	Asset age	Y
	Expected lifetime	Y
Observed Condition	Steel cover and pit condition	Y
	Water / moisture present	Y
	Bell condition	Y
	Insulation condition	Y
	Signs of heating	Y
	Phase barriers	Y
Measured Condition	Operation adequacy	Y

The images below show link boxes suffering from poor condition/defects:

Figure 17: Link Boxes full of Water

Figure 18: Link Box full of Bitumen and Soil

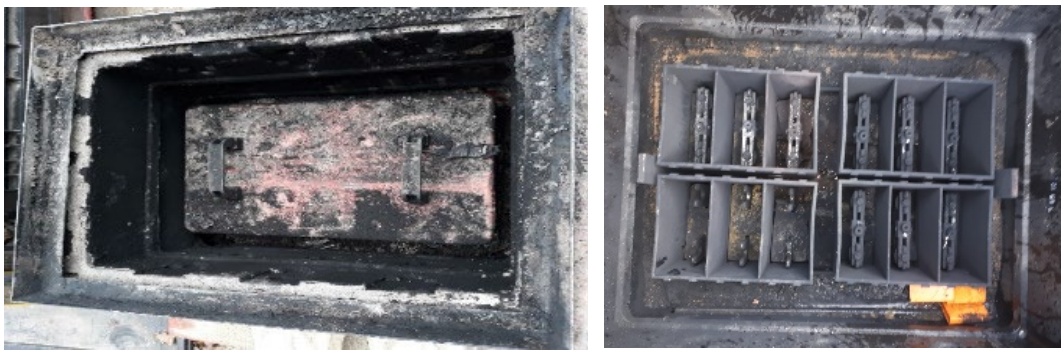


Figure 19: Overheating Leading to Failure

Figure 20: Inoperable Link Boxes

3.4 Secondary investment drivers and associated CV tables

Whilst this investment pack is intended to inform the management of Link Boxes for non-load related purposes, the investment options described within this EJP are also coordinated with several secondary investment drivers that may influence the final investment option that is selected for each Link Box project.

It is important to ensure that these secondary investment drivers are also considered carefully alongside the primary drivers to identify potential efficiencies and to prevent double counting within our RIIO-ED2 business plan.

This includes the analysis of future network trends to ensure sustainable investment decisions are identified which represent best value for money for our network consumers and customers, whilst enabling the transition to Net Zero.

The secondary investment driver which influences this EJP and the investment options that are chosen include quality of supply, future load growth, and network automation. These secondary drivers correlate to the following additional CV tables within the BPDT:

- **CV15 – Quality of Supply:** The addition, replacement or retrofit of network assets specifically to improve customer quality of supply. This can include investment in network automation to improve IIS performance.
- **CV30 – Inspection:** The inspection of network assets as per the inspection policy for each asset category. The cost and volumes of Link Boxes are not directly reported within this table; however, inspection is a key part of the management of Link Boxes through their lifetimes, and the data collected during these inspections helps to inform the asset health calculation.

When selecting the investment option for each individual project, the following factors and secondary investment drivers are also considered to ensure the optimal solution is identified which best represents value for money for network consumers and customers:

- **Number of Customers and Network Outages:** When assessing the investment options available it is also important to consider the number of consumers and customers associated with the Link Box and the number of network outages incurred during previous years. This will inform the criticality of the asset and inform the most appropriate investment solution.
- **Network Load Forecast**: Future network trend analysis must also be carried out for each individual project to determine if sustained load growth can be expected that is associated with the Link Box in question. If load growth can be proven with a high level of confidence, a solution may be chosen which is not like-for-like, but one which can facilitate the future load growth that has been forecast. Similarly, the asset may be decommissioned if it can be demonstrated that other network assets can accommodate the forecasted network demand.

4 Stakeholder Engagement

In preparation for our RIIO-ED2 business plans several stakeholder engagement exercises have been undertaken to better understand what will be important to our network customers during RIIO-ED2 and to ensure the views of our stakeholders are reflected in the cost and volumes we are proposing for each asset category in line with our ***Enhanced Engagement (Chapter 3)***

Below is a summary of the key outcomes from this engagement from some of our critical stakeholders. The summary below provides details of our stakeholder feedback on our ***Safe and Resilient (Annex 7.1)*** and their views on the importance of improving network reliability.

Consumer Feedback

- 88% of stakeholders in SEPD and 72% in SHEPD either agreed or strongly agreed with our asset management proposal to target assets with the highest probability of failure for ED2.
- 71% consumers thought it was very important SSEN are committed to reliability, which was the second highest priority for them (after affordability).
- In terms of reliability, domestic and SME customers' top priorities were 'Restoring the electricity supply as quickly as possible in the event of a power cut' (particularly for those aged 65+ or in vulnerable situations) and 'Keeping my power on with minimal power cuts'.

Local Authority and Government

- Stakeholders strongly urged us to strike a balance between maintain a reliable network by simply fixing older assets now and replacing assets (at a higher cost now) so that the network is ready for future use.
- SSEN needs to ensure reliability and disruptions are minimised, suggesting proactive actions such as providing generators during bad weather and new technologies to 'master' the network.
- Resilience partnerships are a good start for mitigating issues.

Community Energy Groups and Interest Groups

- Both old and new communities need to be resilient - must ensure the transition does not leave people behind.
- SSEN needs to think about current and future populations in areas now in order to plan its investments most effectively.

Summary of Findings

A wide range of stakeholders confirmed that they stakeholders strongly support our proposed approach of prioritising assets with a higher likelihood of failure as part of the ***Safe and Resilient (Annex 7.1).*** In addition, stakeholders also highlighted that network reliability was a high priority, greater than sustainability but below value for money.

Stakeholders communicated that reliability is expected as they depend on electricity for so many things in everyday life, and this is increasing, for example, with more households working from home and the electrification of heating and transport. These expectations and views validate Ofgem's IIS targets and Guaranteed Standards, so on this basis we have set our ambition to meet these levels of network performance.

5 Summary of Options Considered

This section of the report sets out the investment options that are considered when managing Link Boxes. As described below, a combined approach is taken to ensure investment options are chosen which are both least regret and represent best value for money for network customers.

The investment options described below range from no additional investment at all to the full replacement of each Link Box. By analysing all the primary and secondary investment drivers in a holistic manner for each individual project, we can arrive at the optimal investment decision which avoids unnecessary spend and stranding of network assets.

The options described below are chosen with the aim to achieve an optimal balance of intervention throughout RIIO-ED2 to minimise the cost of managing this asset category.

5.1 Summary of Options

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

Table 5: Summary of Investment Options for LV UGB

Option	Description	Advantages	Disadvantages	Results
1. Do Minimum (Baseline)	Continuation of the normal inspection activities associated with Link Boxes. Reactive replacement of equipment following failure	No additional CAPEX spend.	No improvement in asset health. No change in risk of asset failure and associated consequences of failure.	Not considered a viable option for RIIO-ED2
2. Enhanced Inspection, Maintenance, and Monitoring	Enhanced inspection and maintenance to improve asset condition or slow the rate of ageing. Additional monitoring to better understand performance and health of the assets. Increase is part of OPEX portion of Cost and Volumes	Better understanding of asset Health. Potential to prevent premature replacement of asset. Can defer investment over short periods of time.	Additional maintenance resource required Not effective for mechanical wear Increase in OPEX	Not considered a viable option for RIIO-ED2
3. Replacement Like-for-Like	The full like-for-like replacement of the Link Box. According to the latest CBA guidance published by Ofgem, this option is considered baseline as it is currently BAU if a like for like replacement is available.	Maximum improvement in asset lifetime. Improved network reliability.	Higher CAPEX option. Potential disruption to network stakeholders. Civil costs required. Additional carbon footprint.	Chosen investment option for RIIO-ED2
4. Replacement with LV Overground Pillar	The full replacement of the Link Box with an LV Overground Pillar.	Maximum improvement in asset lifetime. Improved network reliability. Improved safety risk.	Higher CAPEX option. Potential disruption to network stakeholders. Civil costs required. Additional carbon footprint.	Chosen investment option for RIIO-ED2
5. Replacement with advanced functionality	Replacement with advanced automation. This could include the installation of LV UGB with switches to improve IIS performance and release extra network capacity through meshing of LV network.	Future proof solution. Minimises outage times.	More expensive for equipment. More expensive to install due to added operational functionality. OPEX is likely to increase to manage telecommunication agreements.	Not considered a viable option for RIIO-ED2

5.2 Option 1: Do-Minimum

In this option a decision is made to accept the risk associated with each Link Box in its current condition without any additional CAPEX or OPEX investment. However, the inspection activities continue as normal as per the relevant policies.

Whilst this option avoids additional CAPEX investment, it does not improve the condition of the Link Box in question. For HI5 assets this option is likely to lead to asset failure which can have safety, environmental, financial and reputational consequences and a reduction in the quality of supply for network customers.

For this reason, during RIIO-ED2 the do-minimum option applies to assets with a CBRM Risk Index of HI5|C1 and above. All other assets will require additional investment to manage the risk of asset failure within acceptable levels.

In relation to link boxes, the do-minimum approach incorporates the impact resulting from reactive replacement of assets following failure. This includes the increased cost to carry out the replacement, CI/CML impact and provision of generation services during replacement.

5.3 Option 2: Inspection, Maintenance & Monitoring

The next option is to undertake additional operational activities to further manage the risk associated with each asset. In the case of link boxes this includes enhanced Inspection & Maintenance. To better manage the risk of asset failure, enhanced inspection and maintenance can also be carried out to slow the rate at which the asset deteriorates. The cost of this additional inspection and maintenance strategy should be balanced against the additional lifetime that can be attributed to this increased OPEX investment and the deferment in the future replacement of the asset. Enhanced inspection and maintenance would fall under the CV30 and CV31 data tables. This option is usually a cost-effective option over short periods of time when compared with the replacement option.

Due to the cost of installing enhanced inspection and monitoring into existing assets the course of action in this instance would remain as a visual inspection, the most commonly utilised method to determine asset condition.

5.4 Option 3: Replacement Like-for-Like

For this option, we are targeting Link Boxes which have been categorised through CBRM risk banding and been put forward as candidates for full like-for-like replacement during RIIO-ED2. This risk scoring indicates certain Link Boxes have reached end of life and that their Health score cannot be improved sufficiently to maximise the useful life whilst managing the risk of failure. This is the existing strategy undertaken.

5.5 Option 4: Replacement with LV Overground Pillar

Link Boxes which have been categorised through CBRM risk banding have been put forward as candidates for full replacement during RIIO-ED2. Where possible, the replacement in the form of an LV Overground Pillar is considered which removes the risk of a disruptive failure occurring underground. This replacement is considered via a risk-based decision. SHEPD have adopted this approach for 95% of the link box replacement during ED1. The Link boxes in the north suffer from the issue of lids freezing in winter making access difficult. They are also prone to snow cover which can also make locating difficult. An advantage in the north is that streets are less congested meaning it’s easier to fit an LV Pillar than in the south, hence the reason we plan to replace 95% of UGBs with LV Pillars.

The LV networks in the South and footpaths are very congested. We look at each site on its own merits and must consider all risks associated with the project and its location and environment. Replacing LV UGBs with LV Pillars introduces other risks (e.g. footpath congestion, safe access and working in live pillars with high public footfall areas, high vehicle traffic areas and increased risk to network damage and public safety). For the above reasons the opportunity to replace LV UGB with LV Pillars are limited in the South.

5.6 Option 5: Replacement LV Automation

Historically, link boxes have been used to manually connect two circuits together using fuses to maintain supplies for faults or maintenance. Assets with advanced automation aims to improve IIS performance and release extra network capacity through the meshing of the LV network. To facilitate remote meshing, controllable switches can be installed in link boxes. To allow the LV switches to be operated it will be necessary to install communications equipment which connects the devices to optimisation software.

This option is considered to be more expensive due to the necessity to add communication paths to the asset. This strategy has not been part of our existing processes in ED1. Inclusion of this as a feasible option remains dependant on the alignment of our automation strategy and the availability of relevant technically advanced equipment. As such, it is not possible to consider this a feasible option at this time.

6 Detailed Analysis

This section of the report provides further detail on the investment strategy that we have designed for Link Boxes over RIIO-ED2 across the chosen investment options through consultation with stakeholders.

6.1 Our Health Score Intervention Criteria

As previously described, the primary investment driver associated with this EJP is the management of Link Boxes for non-load related purposes, specifically asset Health and Criticality. This correlates to the CV7 (Asset Replacement) and CV14 (Legal & Safety) tables within Ofgem's BPDTs.

This section of the report describes the investment strategy that we have chosen for link boxes over RIIO-ED2. This includes justification for the cost and volumes that are required during RIIO-ED2. We have developed its own investment criteria for assets which are deemed to be end-of-life due to their condition. This criterion is applied against the Health and Criticality scores arising from our CBRM models to identify which assets require intervention during RIIO-ED2.

The Health Score as defined by the Ofgem approved Common Network Asset Indices Methodology (CNAIM) can be correlated to a Probability of Failure (PoF). The worse the asset Health the higher the PoF will be. The total Risk for network customers increases as the PoF increases with the condition of the asset.

During ED2, we do not feel it is appropriate to replace all assets that are projected to become Health Index 5 by the end of ED2. This approach would shortlist link boxes for replacement that still have multiple years of useful lifetime before likely failure and could be replaced proactively during RIIO-ED3.

As such, specific Health Score criteria has been developed based upon the Criticality (consequence of failure) of each link box. This is reflected in Figure 21 which shows the minimum Health Score within the Health Index 5 banding before an intervention is deemed necessary for each link box. The higher the Criticality of the asset the lower the acceptable PoF should be to ensure the total Risk of Failure is tolerable for network customers. As such, the minimum Health score varies based on the Criticality of each link box (C1-C4).

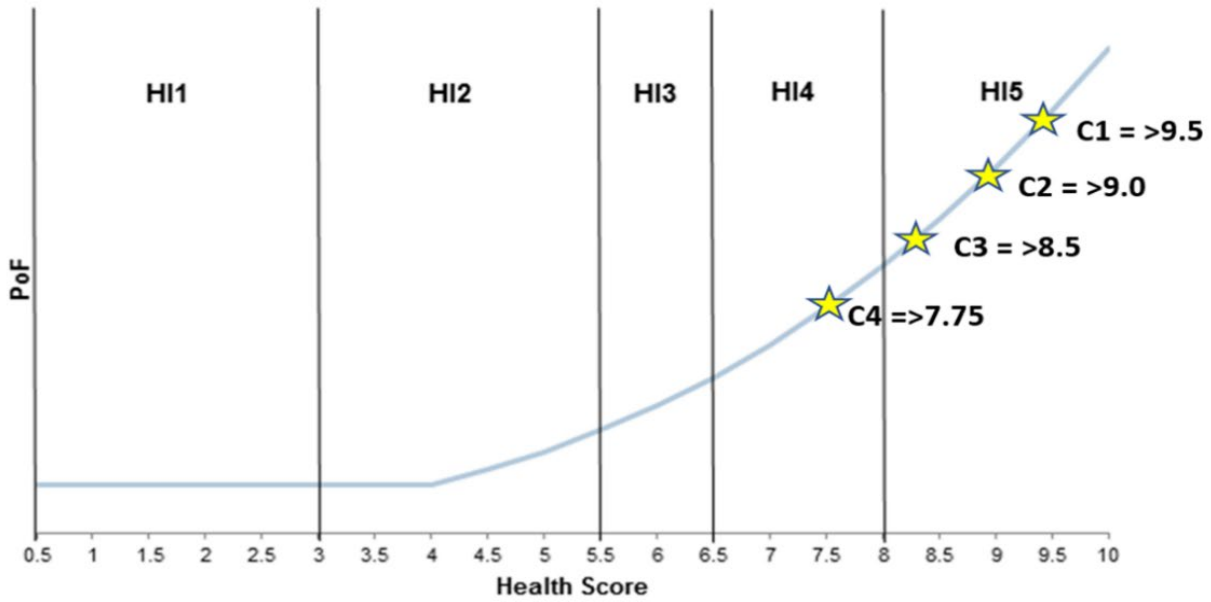


Figure 21: Health Score Investment Criteria for Link Boxes by Criticality (C1-C4)

Our approach has been designed to maximise the useful life our assets whilst managing the risk of failure.

6.2 Sensitivity Analysis

To arrive at the methodology discussed above in Section 5 a sensitivity analysis was carried out. This sensitivity analysis allows us to establish the impact on the volumes of interventions required during RIIO-ED2 when the Health Score investment criteria is adjusted. This risk management exercise explores the impact on the volume of ED2 interventions if we were to accept more or less risk of asset failures within this asset category.

Stakeholder engagement has found that during RIIO-ED2 network customers' first priority is affordability, closely followed by the reliability of the network. As such, when selecting the minimum Health Score for each Criticality banding which justifies the need for ED2 intervention, it is important that both affordability and reliability are taken into consideration.

The higher the minimum Health Score for each Criticality the lower the number of shortlisted ED2 assets will be. A higher score criteria also allows us to maximise the useful lifetime of network assets. However, as the Health Score corresponds to the Probability of Failure (PoF) increasing these minimum values will also increase the number of costly asset failures that we will experience during ED2. As such, a careful balance must be found between maximising the lifetime of our assets and avoiding costly failures.

For this reason, three sensitivities were considered for Link Boxes as shown in Table 6 below. Each sensitivity captures a different volume of assets for intervention during ED2. It is important to note that these minimum values represent the Health Scores that have been calculated for each asset by the end of ED2 as calculated by our CBRM models.

Table 6: LV UGB Sensitivity Analysis Criteria

Criticality	Health Score band		
	Sensitivity 1	**Sensitivity 2**	Sensitivity 3
C1	≥ 9.50	**≥ 9.50**	≥ 9.00
C2	≥ 9.00	**≥ 9.00**	≥ 8.75
C3	≥ 8.50	**≥ 8.50**	≥ 8.25
C4	≥ 8.00	**≥ 7.75**	≥ 7.50

The Sensitivity 1 investment criteria shortlists assets for intervention which will fall within the Health Index 5 band only. However, within this Health Index the more critical C4 assets are shortlisted for intervention at a lower Health Score (and lower PoF) than the C1 assets, due to C4 assets having a more significant Consequence of Failure (CoF).

Sensitivity 2 takes this slightly further by shortlisting those C4 assets which fall within the very end of the HI4 band (7.75) just before these assets are expected to become HI5s. This approach reduces the total risk that network customers are subjected to with these highly critical LV UGB, whilst also attempting to maximise their useful lifetime.

For LV UGBs, the effect over volumes from each sensitivity can be seen in Table 7 below. There are small variances with changing the health band for the different scenarios in both SEPD and SHEPD.

Table 7: LV UGB Sensitivity Analysis Volumes

Asset	ED2 Volume		
	Sensitivity 1	Sensitivity 2	Sensitivity 3
	Vol	Vol	Vol
LV UGB - SEPD	3,737	3,750	4,060
LV UGB - SHEPD	343	347	455

The impact of these volumes on overall Health Profiles at the end of ED2 can be seen in Figure 22 and Figure 23 below.

Figure 22: Health Profiles of Sensitivity Analysis for LV UGB (selected in bold) – SEPD

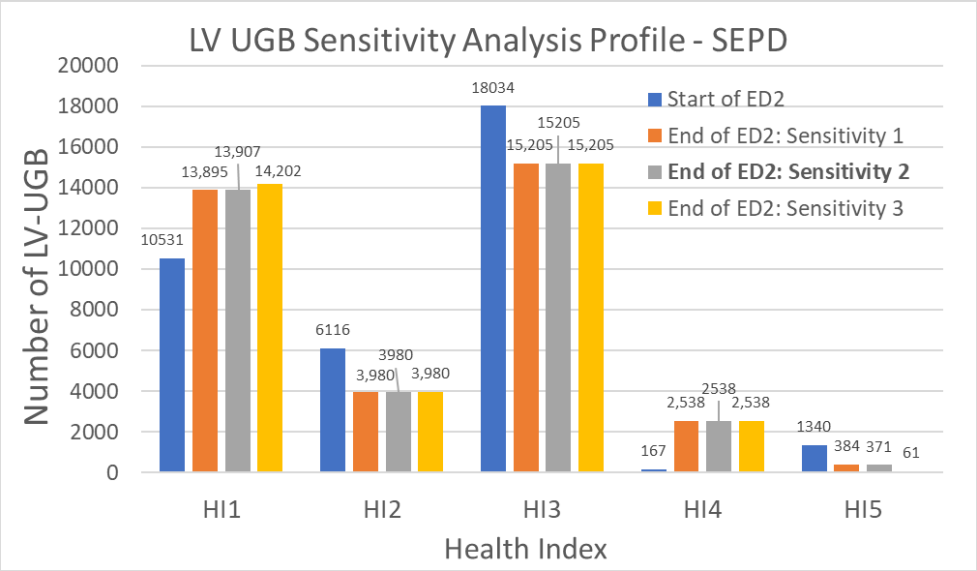
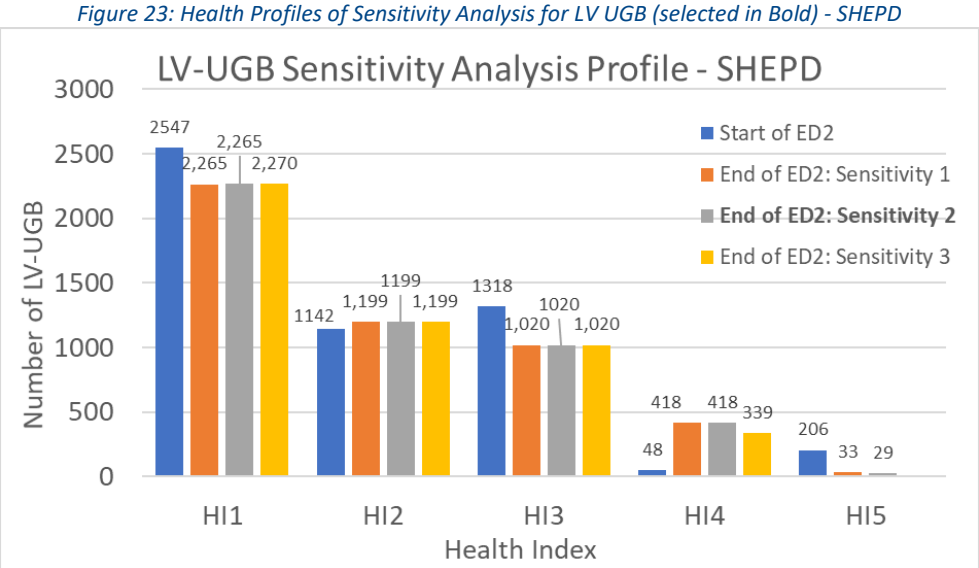


Figure 23: Health Profiles of Sensitivity Analysis for LV UGB (selected in Bold) - SHEPD



Monetised risk points were also calculated to allow comparison as part of the sensitivity analysis process, the points for each intervention scenario for LV UGBs are provided in Table 8 below.

Table 8: Change in Monetised Risk Points (MRP)

Licenced Area	MRP (Nov 2020)	MRP (End of ED2 with proposed sensitivity analysis investment)		
		Sensitivity 1	Sensitivity 2	Sensitivity 3
SEPD	215,728,676	196,195,907	195,907,923	189,040,611
SHEPD	21,610,756	20,063,126	19,983,054	18,447,344

The impact of these scores combined with all assets in the ED2 business plan were reviewed holistically and a decision was made to pursue **Sensitivity 2** as it represents the right balance of risk (affordability vs reliability) for the business and network customers.

6.3 Cost Benefit Analysis

The investment options described in this EJP have not been assessed within a Cost Benefit Analysis (CBA). This is based on the information contained in the CBA guidance document published by Ofgem.

LV UGB condition is based on NARM/CNAIM outputs. Also, these assets are restricted in their feasible options on technical grounds. The sole technically justified option tackles interventions using a replacement strategy. The full replacement is considered BaU which is specified to be considered baseline by Ofgem. This is the limit of feasible options which could be compared as the guidance states we should not reflect a 'do minimum' ('run to failure') approach as this is not a practical option for a DNO to employ as a business strategy.

6.4 Proposed RIIO-ED2 Investment

As previously described, the primary investment driver associated with this EJP is the management of LV UGB assets for non-load related purposes, specifically asset Health and Criticality. This correlates to the CV7 (Asset Replacement) and CV14 (Legal & Safety) tables within Ofgem's BPDTs. The following subsections show the costs and volumes that are proposed for RIIO-ED2 for this CV table. Appendix 4 shows several examples of condition reports that have been undertaken to identify link boxes which are considered candidates for RIIO-ED2 replacement.

6.4.1 CV7 Asset Replacement

Table 9 and Table 10 show the volumes and costs associated with the proactive replacement of Link Boxes for SEPD and SHEPD. These costs and volumes have been determined in line with our ***Safe and Resilient (Annex 7.1)*** for this asset category and the feedback we have gathered from the RIIO-ED2 stakeholder engagement activities.

As discussed in Section 4, the risk scoring indicates certain Link Boxes have reached end of life. Like-for-like replacement is the existing strategy undertaken and is considered as BaU. The replacement in the form of an LV Overground Pillar is considered where practicable, as per our Strategy for Distribution Underground Link Boxes ST-NET-ENG-008. As described in Section 5.5, SHEPD will continue to adopt this approach for 95% of the link boxes replacement during ED2. The Link boxes in the north are prone to snow cover which can make locating difficult and they suffer from the issue of lids freezing during winter months. An advantage in the north is that streets are less congested meaning it's easier to fit a pillar than in the south. In SEPD, the LV networks and footpaths are very congested. We look at each site on its own merits and must consider all risks associated with the project and its location and environment.

Table 9: CV7 LV UGB - Volumes for RIIO-ED2

Asset Category	Unit	2024	2025	2026	2027	2028	Total
LV UGB (SEPD)	#	552	713	766	766	766	3,563
LV UGB (SHEPD)	#	3	3	4	4	3	17
Total	#	555	716	770	770	769	3,580

Table 10: CV7 LV UGB - Cost for RIIO-ED2

Asset Category	Unit	2024	2025	2026	2027	2028	Total
LV UGB (SEPD)	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
LV UGB (SHEPD)	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Note please refer to 314_SSEPD_NLR_LV_SWGR to see the volumes of LV Pillars (OD Not at Substation) installed in replace of a Link Box.

6.4.2 CV14 Legal & Safety

Table 11 and Table 12 show the volumes and costs associated with the addition of Link Box blankets for SEPD and SHEPD. This includes a provision for fitting Link Box blankets to high risk link boxes, where a fault is present or if the Link Box is found to have a Condition 4 defect identified upon inspection.

Table 11: CV14 LV UGB - Volumes for RIIO-ED2

Asset Category	Unit	2024	2025	2026	2027	2028	Total
LV UGB (SEPD)	#	293	293	293	293	293	1,465
LV UGB (SHEPD)	#	20	20	20	20	20	100
Total	#	313	313	313	313	313	1,565

Table 12: CV14 LV UGB - Cost for RIIO-ED2

Asset Category	Unit	2024	2025	2026	2027	2028	Total
LV UGB (SEPD)	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
LV UGB (SHEPD)	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	£m	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

6.5 Unit Costs

We have modified costs per activity, capturing and reporting those adjustments in our cost-book. By tying our costs back to reported, outturn, real life data this approach provides multiple data points on which both the Regulator and we can benchmark cost efficiency. It provides a high level of cost confidence in our Business Plan cost forecast for RIIO-ED2.

Through our benchmarking analysis, we recognised that not all Non-Load related RIIO-ED1 actual unit costs sit within the upper quartile efficiency band. Where this is the case, we have applied a catch-up efficiency to those cost categories. Further detail on our unit cost approach, cost efficiency and cost confidence for RIIO-ED2 can be found within our ***Cost Efficiency (Annex 15.1).***

Following on from our draft Business Plan, we have continued to develop project volumes and costs, utilising valuable stakeholder feedback. We have included developments of our Commercial Strategy within the updated project scope and delivery strategy. This analysis has produced RIIO-ED2 CV7a unit costs as follows:

- LV UGB SHEPD – [redacted]

[redacted] LV UGB SEPD – [redacted]

6.6 Change in Network Health & Risk Scores

A recent review of the number of HI5 assets raised during inspections versus the current rate of replacement suggested we need to target a higher number of assets during RIIO-ED2. We are part way through our inspection cycle for link boxes and have therefore made an assessment for RIIO-ED2 based on the data currently available. Extrapolation from our accessible data has enabled us to forecast the number of HI5 LV UGB on the network at the end of ED2 once the full population of link boxes have been inspected.

Given the investment proposed for the chosen investment strategy in CV7, Figure 24 to Figure 27 below show the change in the Health Profiles for link boxes over the course of RIIO-ED2 with the proposed investment set out in the tables above. This demonstrates the approach we have taken when identifying the link boxes that really need intervention based upon their individual Health Score and Criticality.

As per our asset management strategy for RIIO-ED2, we have only shortlisted link boxes for replacement when the Health Score within the Health Index 5 banding becomes so severe that the continued risk for network customers becomes intolerable and the asset must be intervened upon. Any reduction against these volumes will risk the reliability, safety, and environmental impact of the network to the detriment of our network customers.

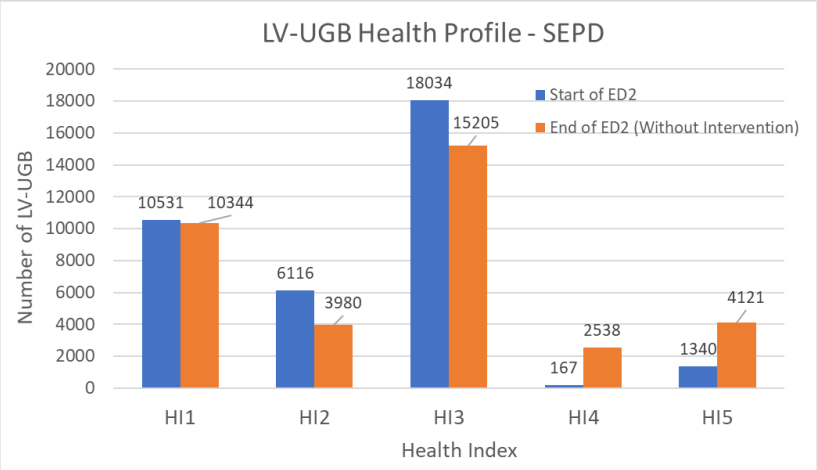


Figure 24: Health Profile (Before Intervention) – SEPD

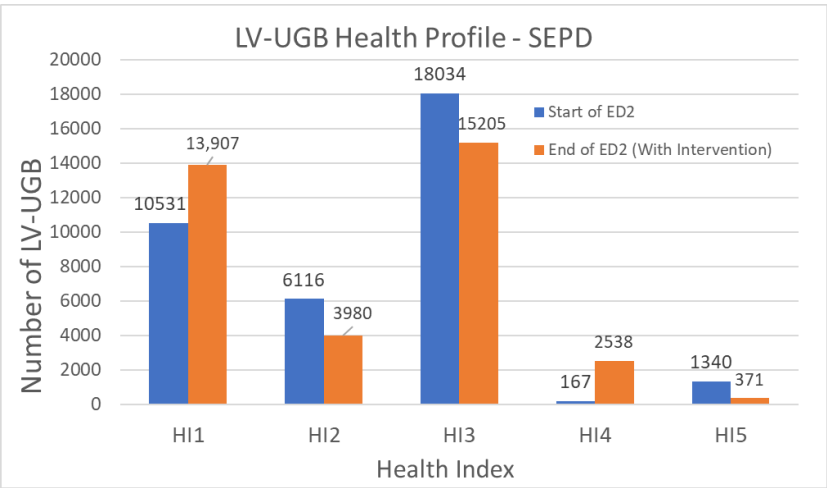


Figure 25: Health Profile (After Intervention) – SEPD

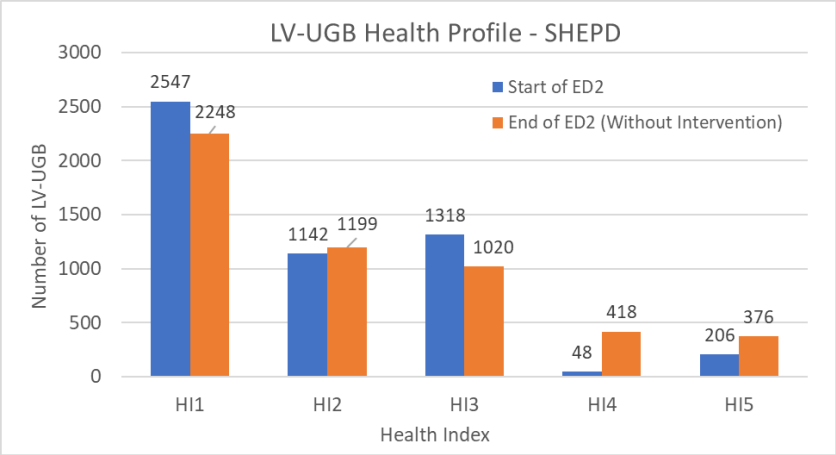


Figure 26: Health Profile (Before Intervention) – SHEPD

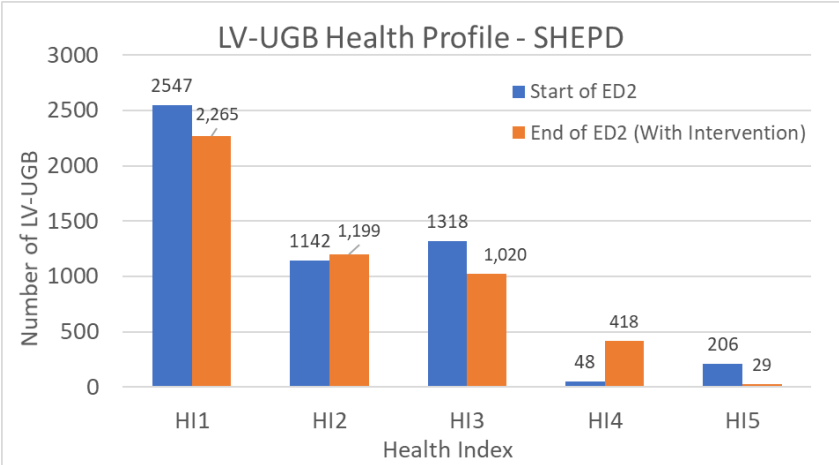


Figure 27: Health Profile (After Intervention) – SHEPD

The majority of Link Boxes will be replaced with a LV Pillar (OD Not at Substation) in SHEPD hence the volume of HI1 assets stay fairly consistent with and without investment. These are captured in the 314_SSEPD_NLR_LV_SWGR EJP. The replacement in the form of an LV Overground Pillar is considered where practicable across both of our networks, as per our Strategy for Distribution Underground Link Boxes ST-NET-ENG-008.

Table 13 shows the change in Monetised Risk Points (MRP) by the end of RIIO-ED2 with and without the investment proposed within this EJP. As below, the total Monetised Risk Points for this asset category increases/decreases in both SEPD and SHEPD. Only link boxes which are truly "end-of-life" within ED2 have been shortlisted for intervention. This is a risk management exercise to only intervene on link boxes where the risk of failure associated with their condition becomes too high for network customers to tolerate.

Table 13: Change in Monetised Risk Points

Licenced Area	MRP (ED2)	MRP (End of ED2 with proposed investment)	MRP (End of ED2 without proposed investment)
SEPD	215,728,767	195,907,923	278,979,785
SHEPD	21,610,756	19,983,054	26,939,052

It should be noted that the Health Profiles shown above, and the updated monetised risk points do not include the assets and additional monetised risk points for the LV Pillar (OD not at substation) assets replacing some LV UGBs. These are brand new assets which replace 'end of life' Link boxes via a risk-based decision and have been included in 314_SSEPD_NLR_LV_SWGR.

6.7 RIIO-ED2 Deployment of Investment Options

Table 14 shows the volumes that have been calculated for each RIIO-ED2 strategy for each of the investment options considered for LV UGBs. The table shows the final volumes associated with each investment option concluded from our strategic review for LV UGB and feedback from our stakeholder engagement exercises.

Table 14: SSEN Final RIIO-ED2 Volumes for Each Investment Option

Option	Options Name	No. of Deployments (#)	RIIO-ED2 TOTEX Spend (£m)
1	Do Minimum	0	0
3	Replacement Like-for-Like	3,580	[redacted]
4	Replacement wit LV Pillar (OD Not at Substation)	517	314_SSEPD_NLR_LV_SWGR

A phased roll-out of replacements for "end-of-life" LV UGB is the preferred approach for the deployment by SSEN. The rollout can be seen in Table 9 above.

6.8 Deliverability and Risk

A recent review of the number of HI5 assets raised during inspections versus the current rate of replacement suggests we need to target a higher number of assets during RIIO-ED2. We are part way through our inspection cycle for link boxes and have therefore made an assessment for RIIO-ED2 based on the data currently available. Extrapolation from our accessible data has enabled us to forecast the number of HI5 LV UGB on the network at the end of ED2 once the full population of link boxes have been inspected. Using the approach descried in Section 5.1 (i.e. HI5C2 >=9 and HI5C4 >=7.75), we will target 4,097 Link Boxes by the end of the period. To ensure the volumes we have proposed within this EJP are deliverable during the five years of RIIO-ED2, we have undertaken a thorough resourcing exercise across the entire portfolio.

To ensure the volumes we have proposed within this EJP are deliverable during the five years of RIIO -ED2, we have undertaken a thorough resourcing exercise across the entire portfolio as per our ***Workforce Resilience Strategy (Annex 16.3).***

The analysis against the outputs of CBRM is used to calculate the number of assets that require additional investment during RIIO-ED2 to prevent unwanted asset failures and to minimise the risk that our network customers are exposed to.

However, the deliverability exercise ensures this volume is achievable during RIIO-ED2 given the internal and external resource that is available to us. If the full volume shortlisted for intervention is not achievable during RIIO-ED2, the network will carry unwanted risk until resource can be ramped up to deliver this volume in RIIO-ED3 and beyond.

Where a shortfall exists, we have created a deliverability plan to show how resource will be ramped up over RIIO-ED2 to allow the required level of interventions to take place from RIIO-ED3 onwards.

Table 15 below shows a comparison of the LV UGB replaced within the first 5 years of RIIO-ED1 compared to our proposal for RIIO-ED2. Overall, our RIIO-ED2 volumes represent a 1149% increase compared to the volumes that have been delivered in the first 5 years of RIIO-ED1.

Table 15: SSEN change in volume comparison for deliverability

SSEN Licenced Area	ED1 (first 5 years) Additions	ED1 (first 5 years) Disposals	ED2 Proposed Volumes (Additions)	ED2 Proposed Volumes (Disposals)	Percentage Change
SEPD	283	212	3,563	3,750	+1669%
SHEPD	135	116	17	347	+199%
Total	**418**	**328**	**3,580**	**4,097**	**+1149%**

7 Conclusion

The purpose of this Engineering Justification Paper (EJP) has been to describe the overarching investment strategy that we intend to take during RIIO-ED2 for the non-load related management of LV UGB assets.

A background into the asset category under consideration has been provided including the Age Profiles for SHEPD and SEPD as well as the Health, Criticality, and Risk profiles prior to the start of ED2 and at the end of ED2 without investment.

As described in this EJP, a holistic approach is taken when selecting the most viable option for each LV UGB project. This includes future network trend analysis and careful consideration of the financial, safety, and environmental implications of each investment option. In relation to LV UGB, the only options to have been considered are in bold below:

- Option 1: Do Minimum
- Option 2: Enhanced Inspection, Maintenance, and Monitoring
- **Option 3: Replacement Like-for-Like**
- **Option 4: Replacement with LV Pillar (OD not at Substation)**
- Option 5: Replacement with advanced functionality

The replacement in the form of an LV Overground Pillar is considered where practicable, as per our Strategy for Distribution Underground Link Boxes ST-NET-ENG-008. This replacement is required following a risk-based decision. Of the total replacements identified **517** will be replaced with an LV Pillar (OD Not at Substation) which are included in the LV Switchgear EJP (314_SSEPD_NLR_LV_SWGR).

This investment represents a total spend of **£19.1m** throughout RIIO-ED2, which is approximately 9% of the asset category estimated Modern Equivalent Asset Valuation (MEAV) of £211m.

Appendix 1: Acronym Glossary

Acronym	Description
BPDT	Business Plan Data Table
CBRM	Condition Based Risk Management
CNAIM	Common Network Asset Indices Methodology
CoF	Consequence of Failure
CV7	Asset Replacement Cost and Volume Table
CV14	Legal & Safety Cost and Volume Table
DNO	Distribution Network Operator
DPCR5	Distribution Price Control Review 5 (2010-15)
EJP	Engineering Justification Paper
ENA	Energy Networks Association
ESQCR	Electricity Safety, Quality and Continuity Regulations
EV	Electric Vehicle
HS	Health Score
HSE	Health and Safety Executive
IDP	Investment Decision Pack
IIS	Interruptions Incentive Scheme
LV	Low Voltage
LV UGB	LV Link Box
NAIM	Network Asset Intervention Methodology
MRP	Monetised Risk Points
NEDWG	NARMs Electricity Distribution Working Group
PoF	Probability of Failure
RIIO-ED1	Distribution Price Control Review (Electricity Distribution 1) 2015-23
RIIO-ED2	Distribution Price Control Review (Electricity Distribution 2) 2023-28
SEPD	Southern Electric Power Distribution
SHEPD	Scottish Hydro Electric Power Distribution
SSEN	Scottish and Southern Electricity Networks

Appendix 2: Relevant Policy, Standards, and Operational Restrictions

The policies, manuals and standards and operational restrictions which govern the management of Link Boxes are listed below in Table 16.

Table 16: Link Box Relevant Documents

Policy Number	Policy Name / Description
ST-NET-ENG-008	Undergrounding Disconnecting Link Boxes Strategy
TG-NET-ENG-026	Network Asset Intervention Methodology
ENA Paper	Management of Link Boxes and Cable Pits on LV Distribution Networks 2017

Appendix 3: Examples of Poor Condition Link Boxes

Example of Water Ingress / Flooding	Example of Water Ingress

Example of High Compound	Example of Gravel/dirt covering links