



## LV Underground Cables

### ED2 Engineering Justification Paper Addendum

#### ED2-NLR(A)-SPEN-003-UG-EJP-ADD

Issue	Date	Comments
Issue 0.1	Aug 2022	Internal Draft for Review
Issue 0.2	Aug 2022	Internal Draft with Comments Addressed
Issue 1.0	Aug 2022	First Issue - Draft Determination Response

Scheme Name	LV Underground Cable Modernisation			
PCFM Cost Type	Non-Load Related Asset Replacement			
Activity	Cable Condition Modernisation			
Primary Driver	Asset Modernisation			
Reference	ED2-NLR(A)-SPEN-003-UG-EJP-ADD			
Output Type	UG Cable Modernisation			
Cost	SPD	£22.059m	SPM	£23 560m
Delivery Year	2023-2028			
Reporting Table	CV7/8			
Outputs included in ED1	Yes/No			
Business Plan Section	Ensure a Safe and Reliable Electricity Supply			
Primary Annex	Annex 4A.11: Cable Modernisation Strategy			

Spend Apportionment	ED1 £m	ED2 £45.619m	ED3 £m
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	Proposed by	Endorsed by	Approved by
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Signature	<i>Iustin Irimescu</i>	<i>Alex Campbell</i>	<i>David Cupples</i>
Date	23.08.2022	23.08.2022	23.08.2022



## I Purpose

This addendum has been prepared to provide additional information and justification to ED2-NLR(A)-SPEN-003-UG-EJP – LV Underground Cables following receipt of RIIO-ED2 Draft Determination. The content of this addendum is in response to comments and feedback provided by Ofgem as to the “Partial Justification” status of the EJP. The purpose of this document is to support Ofgem’s assessment for Final Determination including supporting any associated impact on engineering adjustments within Ofgem’s financial modelling.

## 2 Ofgem Comments & Feedback

### 2.1 RIIO-ED2 Draft Determinations SPEN Annex

The following comments are taken from Table 27 of “RIIO-ED2 Draft Determination SPEN Annex”.

**Ofgem Comment** - Partially Justified. Whilst we agree with the needs case for continued investment presented by SPEN, they propose to align investment to total EDI volumes. This represents an increase in average annual investment which we consider has not been sufficiently justified. The increase in average annual volumes results in a deliverability risk for the volumes presented within this EJP.

**Ofgem Identified Risks** – The increase in average annual volumes results in a deliverability risk.

### 2.2 Draft Determination SQs

Following the receipt of Draft Determination, SPEN submitted SQs including ‘SPEN\_DD\_016 – EJP Clarification’ which contain detail relevant to this EJP. The relevant content of the SQ has been included below for reference.

#### **SPEN Submitted SQ\_DD 016 (25/07/2022)**

##### ED2-NLR(A)-SPEN-003-UG-EJP – LV Underground Cable Modernisation

*“Whilst we agree with the needs case for continued investment presented by SPEN, they propose to align investment to total EDI volumes. This represents an increase in average annual investment which we consider has not been sufficiently justified. The increase in average annual volumes results in a deliverability risk for the volumes presented within this EJP.”*

**We are seeking to confirm we understand which component of the LV UG Cable programme Ofgem has deliverability concerns, or if there concerns over expenditure?**

SPEN will provide further detail on the changes to LV cable strategy between RIIO-EDI and RIIO-ED2, and provide further evidence that volumes are appropriate and deliverable within the context of the wider LV cable modernisation programme by comparing this with per annum deliverability in EDI. SPEN will also explain interactions with other related programmes in RIIO-ED2.

**Will the above detail (for the relevant component of the programme) ameliorate Ofgem's concern over deliverability for LV underground cable programme?****Ofgem Response to SQ\_DD\_016 (08/08/2022)**

We were not satisfied that SPEN has provided sufficient evidence to support their justification for increased annual volumes / expenditure when compared to the ED1 period. We welcome further detail on the changes to LV cable strategy between RIIO-ED1 and RIIO-ED2, and further evidence that volumes are appropriate and deliverable within the context of the wider LV cable modernisation programme.

### 3 Additional Justification

#### 3.1 Our Response

As evidenced in Section 3 of the EJP, LV underground cable faults have been increasing in SP Manweb, and are forecast to continue to do so throughout RIIO-ED2 without intervention. In SP Distribution, the forecast is also one of increasing faults, albeit less pronounced. In order to counteract this increase, a data-driven model for targeting interventions across the LV underground cable network was created. The model delivers the greatest fault reductions on a circuit-by-circuit basis in the most cost-effective way, thus optimizing the RIIO-ED2 programme of works and delivering reductions in the number of faults across the network. The following circuits in Table 1 and Table 2 will be targeted in SP Manweb and SP Distribution respectively (note that these are partial lists):

**Table I:** SP Manweb LV Underground Circuits Partial List

<b>Circuit Code</b>	<b>Length (m)</b>	<b>Annual Faults per km</b>
	990	1.62
	792	1.52
	9,502	0.38
	10,254	0.35
	10,769	0.33
	764	1.05
	6,580	0.33
	9,727	0.35
	1,509	0.80
	423	1.42
	8,042	0.40
	565	1.06
	1,362	0.73
	1,425	0.70
	1,969	0.91
	1,011	0.79
	2,459	0.57
	333	1.20
	359	1.12
	1,310	0.46
	1,452	0.41
	6,158	0.29
	8,494	0.35
	640	0.63
	13,103	0.34
	675	0.59
	685	0.58
	710	0.56
	727	0.55
	6,450	0.28

**Table 2:** SP Distribution LV Underground Circuits Partial List

<b>Circuit Code</b>	<b>Length (m)</b>	<b>Annual Faults per km</b>
[REDACTED]	1087.43	1.10
[REDACTED]	458.52	1.74
[REDACTED]	1126.86	1.60
[REDACTED]	6133.12	0.33
[REDACTED]	6262.88	0.32
[REDACTED]	6310.13	0.32
[REDACTED]	2245.09	0.62
[REDACTED]	7038.98	0.28
[REDACTED]	1471.70	0.68
[REDACTED]	478.04	0.84
[REDACTED]	8220.73	0.24
[REDACTED]	8283.69	0.24
[REDACTED]	8308.96	0.24
[REDACTED]	19925.27	0.25
[REDACTED]	6151.25	0.29
[REDACTED]	1576.58	0.38
[REDACTED]	1613.07	0.37
[REDACTED]	1640.87	0.37
[REDACTED]	6461.55	0.28
[REDACTED]	8943.05	0.22
[REDACTED]	820.06	0.49
[REDACTED]	862.31	0.46
[REDACTED]	1810.91	0.33
[REDACTED]	1832.15	0.33
[REDACTED]	9344.00	0.21
[REDACTED]	9356.85	0.21
[REDACTED]	973.17	0.41
[REDACTED]	7244.03	0.25
[REDACTED]	152.61	1.31
[REDACTED]	1095.64	0.37

The average annual fault rate per kilometre in SP Manweb is 0.13. The annual fault rate for the top circuits identified for intervention is up to 12 times larger than the average. Similarly, in SP Distribution the average annual fault rate per kilometre is 0.11, whereas the top identified circuits can have up to 15 times more faults. This provides evidence that the forecast increases in faults are correct, since the increases are driven primarily by the circuits proposed for modernisation in RIIO-ED2. This is also evidence that the RIIO-ED2 modelling has successfully identified circuits on which works must be carried out, highlighting the robustness of the proposed programme.

As mentioned in Section 5.1 of the EJP, three interventions have been modelled for each circuit:

- up to 50% overlay,
- up to 25% overlay, and
- up to 10% overlay (only for circuits longer than 6 km).

A new fault rate was modelled as a result of the interventions. The “up to 50%” intervention was assigned a blended fault rate of 75% network average and 25% circuit’s actual fault rates. The other two interventions were both assigned a blended fault rate of 40% network average and 60% circuit’s actual fault rates. These fault rates are conservative estimates, which acknowledge that intervening on an underground cable circuit is unlikely to eliminate all the issues present. The exact location of the intervention on the circuit will be decided based on known condition issues, cable type, and known poor-quality performance. The length of cable to be overlaid on each circuit may also be split across multiple locations. This is a robust targeting methodology, that will deliver reductions in the number of faults and improve the resilience and performance of the LV underground cable network.

Section 7 of the EJP provides a comparison between RIIO-ED1 and RIIO-ED2 performances in terms of delivered volumes. More detail is provided here, in order to clarify the assumptions behind the volumes. Table 3 presents the RIIO-ED1 and RIIO-ED2 data for SP Manweb across all components of the LV cable modernisation programme. Table 4 presents the same information for SP Distribution. The values for the years 2022 and 2023 are left blank because they are forecasts rather than actual values. Note that the Final Submission volumes for SP Distribution include 3.95 km of LV cable installed as part of the HV Underground Transformer Replacement programme and are not reproduced here (for more information see ED2-NLR(A)-SPEN-002-TX-EJP).

**Table 3:** SP Manweb RIIO-EDI and RIIO-ED2 Performance

<b>Asset</b>	<b>Unit</b>	<b>CV</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>EDI Average</b>	<b>ED2 Average</b>
<b>LV Main (UG Plastic)</b>	km	CV7	19.87	20.95	25.27	15.19	23.31	6.45	-	-	9.96	25.29	25.26	25.48	14.64	<b>18.51</b>	<b>20.13</b>
<b>LV Service (UG)</b>	Each	CV7	229.0	624.0	1,166.0	2,272.0	2,391.0	568.0	-	-	598	1,517	1,516	1,529	878	<b>1,208</b>	<b>1,208</b>
<b>LV Service (UG)</b>	Each	CV8	-	-	-	-	-	-	-	-	398	1,012	1,010	1,019	586	-	<b>805</b>

**Table 4:** SP Distribution RIIO-EDI and RIIO-ED2 Performance

<b>Asset</b>	<b>Unit</b>	<b>CV</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>EDI Average</b>	<b>ED2 Average</b>
<b>LV Main (UG Plastic)</b>	km	CV7	14.89	16.72	18.22	15.23	13.85	17.88	-	-	11.02	14.44	23.17	23.33	22.27	<b>16.13</b>	<b>18.84</b>
<b>LV Service (UG)</b>	Each	CV7	412	545	1,489	1,578	1,670	1,578	-	-	661	866	1,391	1,400	1,336	<b>1,212</b>	<b>1,131</b>
<b>LV Service (UG)</b>	Each	CV8	-	-	-	-	-	-	-	-	441	578	925	933	891	-	<b>754</b>

As shown by the tables above, the annual average in RIIO-EDI for SP Manweb is 18.51 km of LV cable overlay, whereas the proposed RIIO-ED2 annual average is 20.13 km. This is an increase of 1.62 km from RIIO-EDI run rates or 8.8% per year. Similarly, for SP Distribution the RIIO-EDI average is 16.13 km and the RIIO-ED2 proposed annual average is 18.84 km. This represents an increase of 2.71 km from RIIO-EDI run rates or 16.8% per year. These marginal increases will deliver an annual average reduction of up to 200 faults in SP Distribution and up to 130 faults in SP Manweb compared to the baseline scenario of replacing LV cables when faulty. This is evidenced in section 5.2 of the EJP and reflected in ED2-NLR(A)-SPEN-003-UG-CBA Issue 2. As there is only a marginal increase in RIIO-ED2 annual volumes in comparison to RIIO-EDI in both licences, SPEN foresee no deliverability risk associated with this programme.

Furthermore, the number of faults is forecast to increase by 2% annually over the course of RIIO-ED2 for both SP Manweb and SP Distribution, should the baseline approach of replacing when faulty (as per the RIIO-EDI approach) be continued. Comparatively, the proposed programme results in a 1% annual reduction in the number of faults in both licence areas. This results in a position at the end of RIIO-ED2 in which the number of faults is 3% lower in SP Manweb and 4% lower in SP Distribution compared to the end of RIIO-EDI. The small increase in volumes in RIIO-ED2 is necessary in order to reverse the trend of increasing faults and ensure the resilience of the LV underground cable network.

The proposed main cable overlay volumes are 100.63 km in SP Manweb and 94.22 km in SP Distribution, as presented in Section 5.2 of the EJP. Given that the LV underground network is located predominantly in urban areas, with high customer densities, it was assumed that there is a service every 10 metres, or 100 services per kilometre of main cable. Therefore, there are 10,063 services in SP Manweb and 9,422 services in SP Distribution that must be connected to the new main cable as part of overlay works.

The analysis in Section 5.2 of the EJP proposes to replace 6,038 services in SP Manweb and 5,654 services in SP Distribution, based on the condition of the service cable as identified during overlay works. These service replacements will be funded through CV7. This results in a remainder of 4,025 services in SP Manweb and 3,768 services in SP Distribution that will not be replaced. The entirety of these services must be transferred to the new main LV cable. These volumes constitute the CV8 works within the submission. Lack of funding for the entire service transfer volumes captured within CV8 would create a deliverability risk that would affect the entire LV underground cable modernisation programme, therefore these volumes are required to ensure this intervention programme can be delivered.