CABLE SEALING END PROACTIVE PROGRAMME	
Name of Scheme/Programme	SPNLT20113
Primary Investment Driver	Asset Health
Scheme reference/ mechanism or category	SPNLT20113/Cable
Output references/type	NLRT2SP20113/Cable
Cost	£7.9M
Delivery Year	2022 – 2026
Reporting Table	C0.7/5.18
Outputs included in RIIO T1 Business Plan	No

Issue Date	Issue No	Amendment Details
July 2019	Issue 1	First issue of document
December 2019	Issue 2	Gross cost and Reporting Table values updated.

Table of contents

1. Introduction and Background

Potential failure of cable terminations is an ongoing consideration for SPT. A number of catastrophic failures from 2016 to 2018 led SPT to define a cable sealing end management strategy driven by this experience. The aim of this strategy is to understand cable sealing end failure mechanisms, monitor and address these failures and ultimately plan replacement of the termination where appropriate.

Monitoring, assessment and maintenance of oil filled cable terminations is essential for the understanding the cable sealing end condition hence non-intrusive techniques such as partial discharge monitoring has been incorporated within the routine inspection practices.

A series of catastrophic failures on porcelain silicone oil filled cable terminations in 2016 led SPT to deploy an asset investment strategy in RIIO-T1 period where targeted porcelain silicone oil filled cable terminations [redacted]132 kV [redacted] porcelain terminations constructed between 1998 and 2003) were replaced. There are multiple causes attributed to the failures namely water ingress due to termination design, poor manufacturing, moisture within the silicone oil, poor jointing and poor assembly.

Figure 1 (Meadowhead): oil contamination March 16.

Figure 2 (Gretna): oil result failure April 16.

Figure 3 (Gretna): failure August 2016.

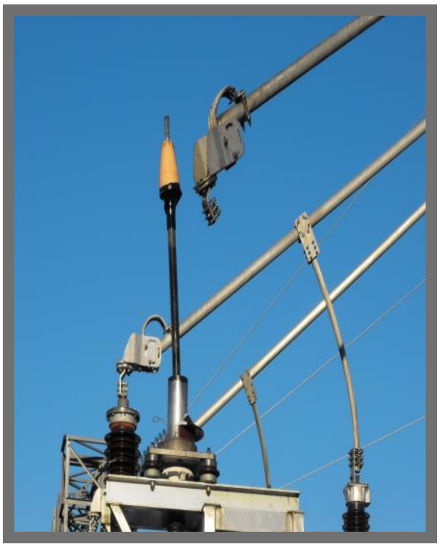

Figure 4 (Tongland): failure February 2016.

In 2018, a series of catastrophic failures in non-aged sealing ends (XLPE cable circuits) raised the need for an investigation and, as a result, an asset investment strategy which could be triggered during the RIIO-T2 period when patterns of degradation are identified in a cable sealing end before failure.

2. Detailed analysis

Four cable sealing end catastrophic failures were recorded in 2018, 3 in SPT and one in our sister company SP Manweb (SPM):

Blackhill 132kV Substation:

Background:

- [redacted] 132kV [redacted] GIS Termination.
- The termination failed a HVAC commissioning test following installation at Blackhill 132kV Substation.

Findings:

[redacted]

Figure 5: post-mortem termination inspection.

Figure 6: post-mortem termination inspection.

Percival lane (SPM) – Salt Union 132kV Circuit:

Background:

- [redacted] 132kV [redacted] joint [redacted].
- During the high voltage commissioning test on the Percival Lane (Runcorn – Salt Union 132kV circuit) a failure was recorded on the yellow phase.
- The high voltage test level applied was 90kV, due to the age of the existing cable. Failure occurred after 1 minute.

Findings:

[redacted]

Figure 7: post-mortem termination inspection.

Figure 8: post-mortem termination inspection.

Harestanes – Moffat 132kV Circuit

Background:

- [redacted] 132kV [redacted].
- A 132 kV outdoor cable sealing end of type [redacted] failed on 03rd of July 2018. The outdoor sealing-end was installed Harestanes – Moffat 132 kV cable circuit. The cable system had been commissioned in August 2013.

Findings:

[redacted]

Figure 9: post-mortem termination inspection.

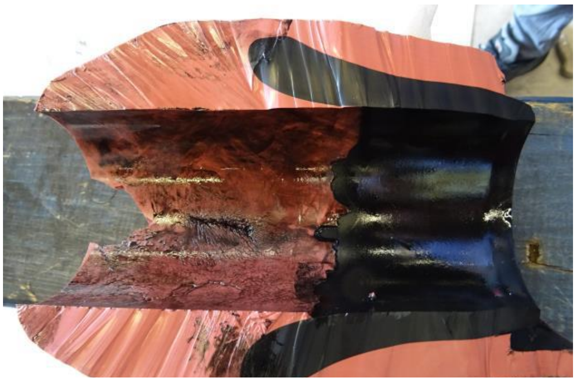

Figure 10: post-mortem termination inspection.

Blackhill 132kV Substation:

Background:

- [redacted] 132kV [redacted].
- On 14/09/2018 a failure occurred during normal operation of an OTC-145 outdoor termination. The failure was identified as Dunhill/New Cumnock circuit 1A yellow phase cable sealing end at the Blackhill 132kV substation.

Findings:

- [redacted]
- [redacted]
- [redacted]

Figure 11: post-mortem termination inspection.

Figure 12: post-mortem termination inspection.

3. Conclusion

[redacted] are the main root cause of cable sealing failures experienced in 2018 as detailed above. Non-intrusive techniques are essential to detect any signs of early degradation on aged and no aged cable sealing ends. It is because of this, and based on the gathered experience in recent years, partial discharge techniques have been incorporated as a routine inspection technique across SPT cable sealing end fleet.

It has been identified the need to survey the whole SPT Network and articulate an asset investment allowance that can be triggered when sign of degradation are identified and early intervention before failure is required.

As a result of all the above, this paper introduces the need for a “Cable Sealing End Proactive Programme” to be captured as a ring fenced Price Control Deliverable.

- Scheme Total Cost: £7.9M
- Timing of investment: 2022 - 2026
- Price control period of outputs: 2022 - 2026

4. FUTURE PATHWAYS – NET ZERO

4.1 Primary Economic Driver

The primary driver for this investment is asset condition and risk. The investment does not have a strong reliance on environmental benefits.

4.2 Payback Periods

The CBA indicates that a positive NPV results in all assessment periods (10, 20, 30 & 45 years) which is consistent with the lifetime of the intervention. Consumers benefit from reduced network risk immediately on completion of the project.

4.3 Pathways and End Points

The network capacity and capability that result from the proposed option has been tested against and has been found to be consistent with the network requirements determined from the ETYS and NOA processes. Additionally, the proposed option is consistent with the route-specific capacity requirements from SPT’s Energy Scenarios.

4.4 Asset Stranding Risks

Electricity generation, demand and system transfers are forecast to increase under all scenarios. The stranding risk is therefore considered to be very low.

4.5 Sensitivity to Carbon Prices

The CBA inputs are not sensitive to carbon prices.

4.6 Future Asset Utilisation

It has been assessed that the preferred option is consistent with the future generation and demand scenarios and that the risk of stranding is very low.

4.7 Whole Systems Benefits

The supergrid voltage proposals do not inhibit whole system solutions but are more remote from the interfaces.

5. OUTPUTS INCLUDED IN RIIO T1 PLANS

N/A