132kV Optical Transport Network - OFGEM justification paper	
Name of Scheme/Programme	132kV Optical Transport Network Project
Primary Investment Driver	Asset Health
Scheme reference/ mechanism or category	SPNLT2052 Non-Lead Asset – Protection, Control, Telecoms and Metering
Output references/type	NLTR2SP2052 / Non Lead
Cost	£ 13.0m
Delivery Year	RIIO ET2
Reporting Table	C0.7 Non-load Master / C2.2a Scheme Summary
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	Cost updated

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1 Introduction

Telecommunications are essential to provide both protection signalling and SCADA monitoring for the transmission network to ensure safe, reliable and secure electrical network management. The evolution of different telecommunication technologies has has taken place through the last 20 years. This has resulted in a number of technologies in the SPEN network that require rationalisation in order to improve resilience, reliability and remove obsolete equipment. This will also allow technology that can provide additional bandwidth, allowing for additional services to be provided over the network.

The installation of additional fibre network improves the overall reliability and resilience of the telecommunications network. The ability to manage increased volumes of data (for both protection and monitoring) is essential for provision of real time system management and generation load management to ensure the security of the transmission network.

2 Background Information

The 132kV Network is essential for distributing power to the DNO Grid Supply Points and has grown in importance due to the large numbers of renewable generators connected both directly to the 132kV system and to the DNO network.

As the Network has developed, multiple communications mediums have been used to deliver protection, SCADA and Monitoring on this network. Each of these different communication modes has their limitations through obsolescence, bandwidth or resilience.

There is a rapidly growing need to increase SPT operational data speeds (also known as bandwidth) that is being driven by the additional needs associated with technology migration from old circuit based technologies to IP and Ethernet (IEC 61850, IEC 60870) technology. In addition, enhanced security requirements as required by the Network and Information Systems Regulations 2018 together with the impact of distributed generation on the transmission network means that additional services are required over the telecommunications network.

There is a need to rationalise the multiple SPT Telecommunication networks that utilise the different technologies available for the provision of services in the 132kV network into a single all Optical Transport Network to provide for the need of increased bandwidth, resilience, availability and security of the strategic SPT services that will use such a network within RIIO-T2 and beyond.

3 Optioneering

The following is a summary of the options considered for this project.

	Option	Status	Reason for rejection
1	**Do nothing**: Maintain the existing telecoms network as is.	Rejected	Rejected on the basis that system security would be too compromised by this approach in both the short and long term and would not deliver the network resilience or the bandwidth as required to support the transmission network.
2	**Optical Transport Network:** Delivery of a single platform that is capable of supporting the needs of the transmission network now an in the future.	Proposed	-

4 Detailed analysis

4.1 Selected option

The SPT 132kV Telecommunications network uses multiple media for transport at present, the option is to to rationalise these services into a single all Optical Transport Network to provide for the need of increased bandwidth, resilience, availability and security of the strategic SPT services that will use such a network within RIIO-T2 and beyond.

4.2 Telecomms medium currently used

4.2.1 Twisted copper pair 'Pilot cables',

Twisted copper pair 'Pilot cables' can be considered similar to the twisted copper pair cables used by service providers to provide domestic landline telephones and last mile broadband access. These twisted copper pairs are limited in their ability to provide the high speed data services required for modern services. This ageing asset is subject to increasing failures of the joints between the cable sections and subsequent decreasing availability and reliability with increasing levels of repairs. Each repair requires a failed joint to be replaced with a short section of cable plus two joints. Joints represent a significant barrier to the high frequency modem technologies that are used to provide high speed data services over twisted copper pairs and hence each repair further degrades the ability of the pilot cable to support high speed data services.

4.2.2 Microwave Point to Point Radio Links.

The current links were deployed based on obsolete dedicated circuit based technology and are not capable of providing high speed data services.

4.2.3 Fibre Cables.

These include both overground and underground technologies, and the available capacity of these cables is adequate for the foreseeable requirement for high speed data services.

4.2.4 Leased Point to Point Fibre Services.

These are passive between the SPT end points and they do not contain 3rd party equipment within the path.

The above transport media are used to provide connectivity for the following discrete SPT Telecommunications Networks

4.2.5 PDH

A legacy dedicated circuit based technology predominately used to provide teleprotection services between SPT substations that are interconnected via pilot cables. Limitations of the technology prevent automatic restoration of teleprotection services in the event of a single point of failure (such as a pilot cable joint failure), and hence are only capable of providing 99.5% availability of the associated teleprotection services. High capacity data services cannot be provided on these platforms.

4.2.6 MPLS-TP

A technology which is predominately used to provide high availability, highly resilient teleprotection services between SPT substations that are interconnected via fibre cables or leased fibre services. in In the event of a single point of failure, the technology allows for the teleprotection services to be

duplicated and switched transparently hence is capable of providing services with 99.999% availability. The MPLS-TP network is a utility specific technology provided by utility specialist providers and as such has a projected service life until 2030.

4.2.7 ODN

The Operational Data Network (ODN) is predominately used to provide high availability, highly resilient data oriented SPT services such as RTU, SCADA, control telephony, substation security and system monitoring between SPT substations that are interconnected via fibre cables or leased fibre services. The functionality of the technology precludes its use for teleprotection as it will automatically switch in a way that may cause protection mal-operations. The ODN network is provided via an enterprise / telecoms carrier based platform and as such is projected to be unsupported by the provider by 2022.

4.3 Delivery Strategy

It is proposed replace the pilot cables and microwave links that currently provide SPT services with cost effective fibre cables and or leased fibre services. In doing so the entire SPT pilot cable estate and SPT microwave estate will be retired. Implementing an all optical transport layer of fibre cables and leased fibre services enables the existing SPT telecommunications networks of PDH, MPLS-TP and ODN to be collapsed into a single highly available, highly resilient and secure Optical Transport Network that is capable of providing all SPT services.

The following sections detail the scope of work.

4.3.1 Leased Point to Point Fibre Services.

There are 10 SPT existing leased point to point fibre services that will be used in the provision of the 132kV Optical Transport Network. In addition, 25 additional SPT leased point to point fibre services are required to complete the network and to ensure that the network is diverse and reliable.

4.3.2 Fibre Cables

There are 77 SPT existing fibre cables will be used in the provision of the 132kV Optical Transport Network. However, 7 additional fibre cables are required totalling 18.5km will be installed.

The 132kV Optical Transport Network is also dependent on the addditional fibre links as set out in 400kV and 275kV Resilience paper (SPNLT2054).

4.3.3 Pilot Cables

There are 106 obsolete SPT pilot cables that will be 'made safe' such as by pot end termination and the filling and surfacing of obsolete chambers.

4.3.4 Microwave Point to Point Radio Links

The 9 obsolete SPT microwave systems at 12 sites will be removed and made safe including removal of antenna, support structures, feeders and any associated dedicated equipment.

4.3.5 PDH

There are 376 obsolete SPT PDH systems at 125 sites which will be removed. All the 132kV services will be transfered to the new 132kV Optical Transport platform

4.3.6 ODN

There are ODN systems ast 74 sites that become obsolete within the RIIO-T2 period that will be removed. All of the 132kV services will be transfered to the 132kV Optical Transport platform.

4.3.7 MPLS-TP

It is proposed to expand the footprint of the MPLS-TP platform to provide the technology for the rationalised services. The 6 existing SPT MPLS-TP systems at 3 sites will be augmented with an additional 182 systems at 91 sites providing all the communications services for the 132kV sites on one resilient platform.

The phased deployment over the RIIO-T2 period avoids the need for continued repair and replacement of the SPT pilots and reduces the impact on the reliability of the 132kV network.

4.4 Innovation

Innovation is a key component to deliver developments in all aspects of work. While the technology used in the project will be standard with a proven track record and the topology adopted in line with industry standards, SPT will look to use innovate ways of project delivery and installation to deliver the resilient telecoms network required.

5 Conclusion

The current and future technology and data requirements make the telecoms network a critical element of the operation of the transmission system. A network with high levels of availability and resilience is essential to maintain high levels of reliability and enable emerging applications such as wide-area monitoring and active network management.

The SPT Telecoms network has been based on the original 1950s and 1960s copper pilots that have served their purpose well. This network continued to develop to deliver the performance required. In the last decade, as technology and system monitoring requirements have changed the capacity requirements for this telecoms network has increased dramatically. This technology change has been supported with the installation of optical fibres to increase bandwidth.

The proposed solution delivers a resilient telecoms network for the future, with the ability to deliver and support the transition to a low carbon network through a consolidated single platform

- Costs: £ 13.0m
- Timing of investment: RIIO-T2 period
- Declared outputs: N/A

6 Future Pathways – Net Zero

We have reviewed this project against the criteria set out within the business plan guidance and have assessed that it does not prevent achievement of our Net Zero plans or lead to stranded assets.

7 Outputs included in RIIO T1 Plans

N/A