RIIO-ED1 NLRE Scheme Summary

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PROJECT DETAILS

NAMP	1.07.07.8401	Region	LPN - London Power Networks
Category	NLRE	Description	132kV Gas cable replacement
Project	Eltham-Sydenham 132kV Gas Cable Replacement		
Route	Eltham-Sydenham Park 132kV	Volume (km)	4
Cost (ED1)	£26,360,098	NAMP version	Table J Less Ind Baseline (S&R Baseline) 19/02/2014

Year	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Spend Profile	0	0	0	0	5,648,592	7,531,457	7,531,457	5,648,592

PROJECT APPROVAL

Approval has been granted as part of the NLRE asset replacement plan.

PROJECT NEED

The Eltham-Sydenham Park gas cables are subject to UKPN's policy to remove all gas cables by end of the ED1 due to their poor performance and the time and cost of repair. Both circuits have had a high number of faults detailed below. These cables are 56 years old and at the end of their life, and for the reasons explained later repairs are no longer cost effective and extremely difficult to schedule. This project will replace 19 km of 132kV gas cable (the entirety of Circuit 1 and 2) with solid cables.

BACKGROUND

Eltham-Sydenham Park Cable Route Details:
The Eltham-Sydenham circuits are part of South London 132kV ring. The circuits are 132kV gas cables running between Eltham Grid to Sydenham substation. The cables are three core 0.6 sq. inch, installed in 1958. Each circuit is approximately 9.5 km in length.

The circuits have a protracted history of gas leakage and in the last few years significant leaks have occurred on these circuits requiring extended outages to effect repair. On average there are two faults on this route per year with an average outage duration of 18 days; outage durations have been increasing in recent years. In one particular event in 2010, the leak was so significant that all gas bottles pressurising the circuit required replacement twice every week. On several occasions even with continuous pumping of gas it has been extremely difficult to hold positive pressure on the cable. Failure to achieve continual positive gas pressure to the cable results in a breakdown of electrical integrity and an electrical fault. This also results in the ingress of water and once this has taken place the extent of the repair or replacement is significant.

Since 2010 the circuits are inspected twice a week in order to ensure positive gas pressure to seek to avoid urgent outages and faults. Feedback from operational staff has also highlighted that the gas pressure monitoring equipment has also failed or provided incorrect information on several occasions which also drives the requirements for very frequent inspections.

The majority of this cable route runs alongside a designated Transport for London (TfL) red route and hence access is severely constrained or even impossible in some circumstances. Any inspection, maintenance or repairs therefore presents significant logistical challenges.

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Gas cable and known issues:
Gas insulated cables are widely accepted in the electricity industry to carry significant operating costs and risk due to the inherent design flaws that are known to exist. The design flaws associated with gas cables include gas leaks, cable faults, control tape fractures, lead sheath distension and thermal instability of the insulating papers. In comparison to other types, the repair of a gas cable takes a considerable amount of time. A typical repair could take many weeks to complete due to the length of time taken to de-gas the cable, locate the fault, obtain spares and depressurise the system. Spare parts for the gas pressurising equipment, sealing ends and joints are now very difficult and expensive to source due to the lack of support offered by current cable manufacturers. Gas cable issues are discussed in further detail in Asset Stewardship Report (ASR) for LPN (Section 4.1). For these reason repairs are extremely difficult to schedule and are not cost-effective.

OPTIONEERING

The development of specific projects will involve revalidating the replacement need nearer the time and will consider applying traditional network asset replacement approaches or 'smart' solutions to deliver programme efficiencies. This may entail the use of solutions which have not been developed yet but are currently being researched.

OPTIONS CONSIDERED

Option 1 – Do Nothing
The known failure mechanisms with gas cables present significant network risk, particularly the outage duration following a fault, the inability to obtain spares and jointers capable of repairing the cable and the fact that the backup circuit is usually of the same design. The cost of repair is usually between £200-250k. Following a fault the backup circuit is usually required to carry increased load. This causes heating and expansion of the cable and increases its likelihood to fault just when it is needed to operate reliably. A do nothing approach puts UK Power Networks at odds with industry best practice and exposes customers to unplanned outages running into months due the difficulty and complexity of the repair of this cable. Once de-energised to repair a fault this cable also has shown to deteriorate rapidly due to the change in load and gas pressure potentially leading to further faults. This option is therefore rejected.

Option 2 – Replacement of faulty cable sections with solid cable
The replacement of specific sections of gas cable with solid cable is not a viable option because the issues associated with this type of cables are not limited to any one particular cable section. As mentioned, issues associated with gas cables include gas leaks, cable faults, control tape fractures, lead sheath distension and thermal instability of the insulating papers. In addition, the repair of a gas cable takes an excessive amount of time in comparison with other cable constructions. Other issues (relating to the long duration of repairs and section replacement in the context of this option) considered were:

- Replacing a cable section could require identifying a new secure re-gassing point and joint location to enable a trifurcating transition joint of approximately 10 x 30m area;
- The re-pressurised cable can fail after pressure testing and commissioning; and
- Purchase of land for new re-gassing points may involve significant planning delays.

Although these challenges can be addressed they require considerable cost and time for a small benefit and will increase the network risk in the event of cable failure. Repairs are extremely difficult to schedule and are no longer cost-effective. This option is therefore rejected.

Option 3 – Replacement of Circuit 1 with cable of similar design
The replacement of the gas cable with a cable of similar design is not possible because the cable is no longer available. This option is therefore rejected.

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Option 4 – Replacement of both circuits with solid cable

The recommended option is to replace both gas circuits with solid cable. As detailed in "Asset Stewardship Report for Underground cables", it is UK Power Networks strategy to replace all gas filled cables before the end of ED1. Replacement of gas filled cables have been phased throughout ED1 in order to make the programme deliverable in a practical sense. This particular circuit has been phased to fit with other asset replacement work taking place in the vicinity at the same time. It is the largest gas cable replacement project in the LPN plan and has been phased mid period. This allows the necessary time for the negotiation of the consents necessary to carry out the work and to allow assessment of risks and potential contingencies to pick up load if the second circuit failed during the replacement works. The total intervention will cost £26,360,098.

RECOMMENDED OPTION
Option 4 – Replacement of both circuits with solid cable

Benefits:

- Removal of gas cable assets with known issues.
- Lower cost to maintain
- Minimise risk of CIs and CMLs caused by prolonged gas cable outage.

Residual Risk:

- New longer cable route may be required to avoid TfL red route.
- Fault on remaining gas circuit during changeover of first circuit to new solid cable.

OUTPUT MEASURES – HEALTH INDICES (HI)

	ED1 Start (2015)					ED1 End (2023) No Investment					End of ED1 (2023) With Investment				
Asset Category	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Circuit-1				4						4	NA*				

*Gas cables are replaced with solid cables. HI's for solid cables are not reported in RIGS.

PROJECT RISK

- Detailed routing of circuits reveals complicating construction conditions, which causes a redesign of concept and/or additional construction costs
- Consents are not provided in the timeframe and manner anticipated
- Detailed project estimating reveals higher costs than anticipated
- Delivery constraints due to Stakeholder/Third Party delays

COST ANALYSIS

The scheme costs are derived from PIMS, and constructed from CUs (Compatible Units) which are derived from historical costs. These costs are refined as and when necessary. The cost of replacing 19km of worst performing gas cable with solid cable is as follows:

Direct Costs £26,360,098

The unit cost for this project is £1,387,373 per km.

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Name	Title	Signature	Date
Andrew Stephen	Senior Asset Engineer		
Name	**Title**	**Signature**	**Date**
Richard Wakelen	Head of Asset Strategy and Performance		
Name	**Title**	**Signature**	**Date**
Barry Hatton	Director of Asset Management		

RIGS Cost Table / Row	Description	Total Direct	Grand Total	Volume	UCI
RIGS Cost Table CV9a	**High Value Projects by Scheme**	**£26,360,098.00**	**£26,360,098.00**		
RIGS Cost Row 92	Cable	£25,833,103.00	£25,833,103.00	19.00	£1,359,637.00
RIGS Cost Row 94	Cable	£526,995.00	£526,995.00	19.00	£27,736.58
Grand Total		**£26,360,098.00**	**£26,360,098.00**		

RIGS cost row 92 includes costs for removing gas cable assets, whereas RIGS cost row 94 includes cost for installing solid cables.

PROJECTSSINGLE LINE DIAGRAM