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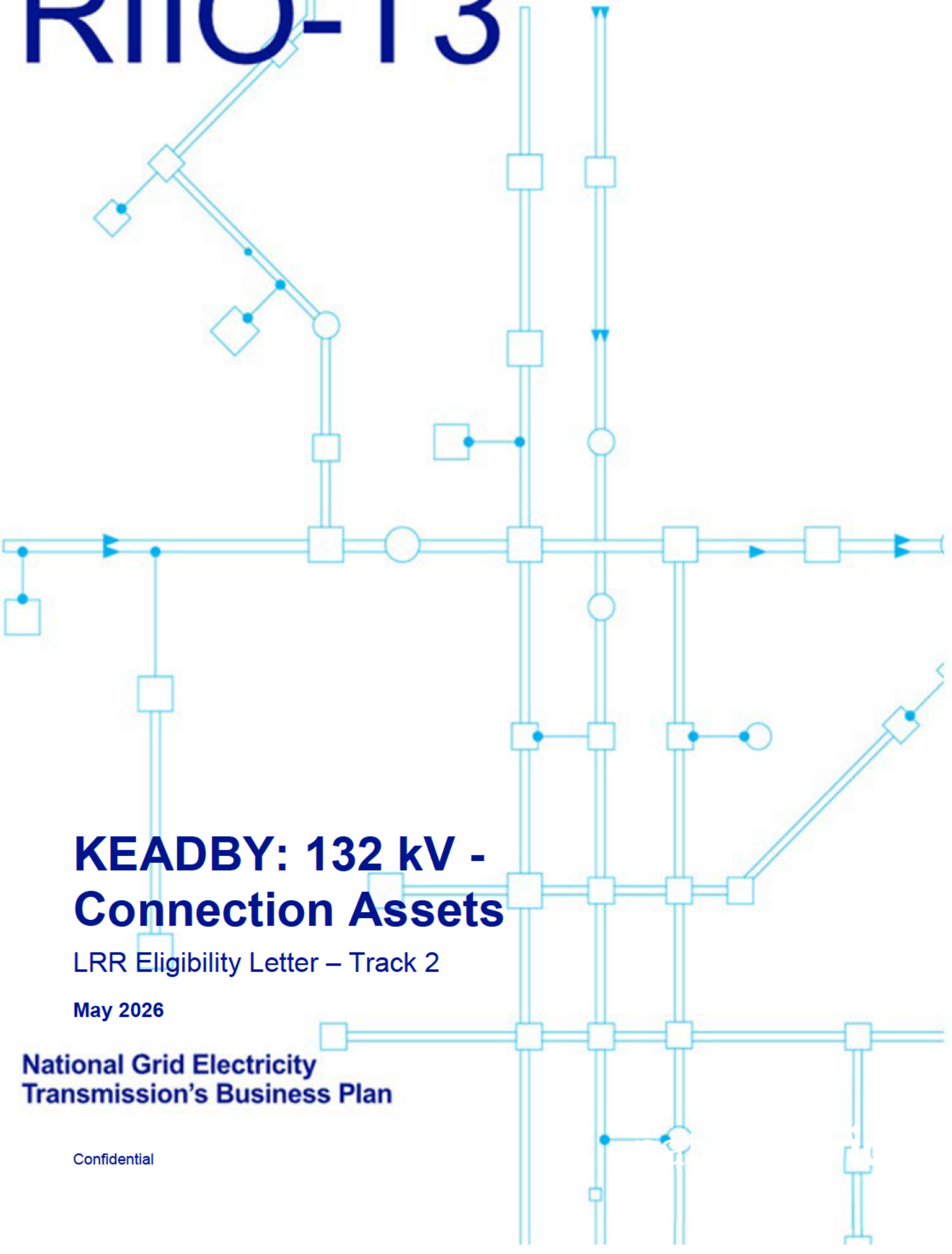
RIIO-T3



KEADBY: 132 kV - Connection Assets

LRR Eligibility Letter – Track 2

May 2026

National Grid Electricity Transmission's Business Plan

Confidential

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Reference and summary table

Field	Description
Name of Project	KEADBY: 132 kV – Connection Assets
TO's preferred re-opener track	**Track 2 Eligibility Letter (EL):** We are submitting this project under Track 2 EL, as the preferred solution is aligned to PASE as a variant option
RRP References	[redacted]
BPDT / Project Reference Number	[redacted]
Load Board Reference	[redacted]
Investment Driver	**Cable replacement to facilitate DNO customer connection:** The Keadby project is driven by the need to replace the TO–DNO cable connection so [redacted] can connect growing generation and demand through a rebuilt 132 kV substation replacing its end-of-life existing site.
PASE alignment	The preferred solution is **PASE compliant** as a variant option [redacted]
Outputs	The installation of a new XLPE cable circuit between the 400/132 kV transformers at Keadby 400 kV Substation and the corresponding bays at [redacted] 132 kV GIS substation [redacted]
Short list of strategic options considered	The shortlisted option for Keadby 132 kV cable replacement is: • **Option E: Installation of new XLPE cable** Option E is the preferred and only shortlisted solution for Keadby because it is the only technically compliant, deliverable and proportionate option that meets the required TO–DNO interface need, using new XLPE cables on the shortest feasible route within existing operational land, while all other options or routes were discounted as unable to provide a safe, economic and enduring solution.
Preferred solution and explanatory narrative on the rationale	The preferred solution for this project is **Option E: Installation of new XLPE cable** This option accommodates all the drivers specified in the scope of works: **Cable replacement to facilitate [redacted] customer connection:** This is a load-driven investment needed to enable [redacted] connection of an additional [redacted] of embedded generation at Keadby, as National Grid studies showed that without reinforcement, the resulting increase in generation would create fault level and thermal overloading issues.
Expected Forecast Costs	**Estimated capital cost:** [redacted] (23/24 prices, incl. Risk & contingency)
Delivery Year	The project is currently planned for a staged delivery: [redacted]

Extension cost	N/A
Applicable Reporting Tables	BPDT 10.5 ET Pipeline log and 2024-25 RRP E1.11_ET Pipeline Log
Historic Funding interactions	An overview of historic T1 and T2 asset health interventions for the Keadby 400 kV substation is presented in Appendix B.
Interactive Projects	[redacted]
Spend Apportionment	[redacted]

1. Executive summary

1.1 Project Summary

This project ensures the essential work needed to maintain the connection between transmission and distribution at Keadby. It involves installing new XLPE cables and related infrastructure, linking the low-voltage side of the 400/132 kV transformers at the Keadby 400 kV substation to the matching transformer bays at [redacted] Keadby 132 kV GIS substation. This investment will enable the timely connection of low-carbon generation in the Humber region, supporting decarbonisation and wider net zero objectives and CP2030.

1.2 Need

This investment is load-driven and required to facilitate connection by [redacted] of an additional [redacted] embedded generation into the Keadby [redacted] 132 kV substation increasing the generation at the substation to [redacted]. NGET system studies indicated fault level and thermal overloading issues if no action was taken for these connections.

To meet the connection request for the additional generation, [redacted]

As a result, the existing cables connecting from Keadby 400 kV substation via SGTs 1, 2 and 3 into the existing 132 kV substation must be decommissioned and replaced with new cables that connect into [redacted] including associated protection and control works.

We are seeking Ofgem's confirmation that the Keadby 132 kV Cable Replacement project is eligible for assessment under the Load Re-opener. We are also seeking confirmation that Track 2 EL is the appropriate route for this project, approval of Pre-Construction Funding (PCF) and approval for the needs case and our preferred solution.

1.3 Optioneering

We undertook a structured, multi-factor optioneering process to identify a proportionate and deliverable solution in the interests of consumers. We first considered a range of strategic options, being do-nothing (Option A), market-based (Option B), whole-system (Option C), reuse existing or extension of existing assets (Option D), and new-build (Option E).

Options A to C were ruled out as there were not able to meet the customer driver.

Option D was ruled out due to the environmental impact of re-using oil-filled cables, as well as the insufficient cable rating of the existing cable which would not accommodate the requirements of the new 132 kV GIS substation.

Option E was the only feasible option that would meet the investment driver. This option was the installation of a new XLPE cable from the LV side of 400/132 kV transformers located at the Keadby 400 kV substation to the corresponding transformer bays at the [redacted] Keadby 132 kV GIS substation.

This option delivers the customer connection with the minimum necessary scope and cost, while reducing engineering complexity, outage risk, environmental and visual impacts, and planning and stakeholder acceptance risk.

Deliverability is further improved by aligning the works with the [redacted] helping to minimise flood wall breaches and maintain a safe, secure site. No reasonable alternative cable route has been identified because the proposed route is wholly within the existing operational boundary, provides a short sub-500m direct link between the existing NGET and new [redacted], minimises cable length, cost, programme, environmental and stakeholder impacts, and presents no fatal flaws that would justify a less direct option.

A detailed justification for why alternative cable routes were not included in the longlist for Option E is provided in section 4.2.

Table 1: Summary of optioneering longlist

Option	Details	Drivers met?	New site?	AIS/ GIS?	Short List?
Option A	Do nothing counterfactual option	No	No	NA	X
Option B	Market-based solution	No	No	NA	X
Option C	Non-transmission, whole systems solutions (DNO)	No	No	NA	X
Option D	Re-use of the existing cable	No	No	NA	X
Option E	Installation of new XLPE cable	Yes	No	NA	✓

1.4 Cost Estimates (high level)

Based on the latest Cost Book (2023/24 prices) and early project estimates, the preferred option, Option E, has an estimated total cost of £[redacted] incl. risk and contingency. This consists wholly of connection works and includes no infrastructure works.

1.5 Indicative Delivery Program (high level)

The project is currently planned for a staged delivery, [redacted]

Delivery remains dependent on [redacted] programme which has been shared and is regularly communicated through regular interface calls, providing a strong customer confidence in the delivery of the works. [redacted] and is continuing work with a mature design.

1.6 Project Benefits

The preferred option delivers the minimum scope required to maintain the transmission–distribution interface at Keadby by installing new XLPE cables and associated works between the LV side of the 400/132 kV transformers at Keadby 400 kV substation and the corresponding transformer bays at [redacted].

The investment will enable the timely connection of low-carbon generation in the Humber region, supporting decarbonisation and wider net zero objectives and CP2030.

2. Introduction

2.1 Keadby 132 kV cable replacement

This paper presents our combined Eligibility Letter and Needs Case submission under Special Condition 3.18 (Load Re-opener and Price Control Deliverable) for investment to complete the 132 kV cable replacement between NGET's 400 kV and NPg's 132 kV substations in Keadby.

Through this submission, we are seeking:

- Approval of the investment need and our preferred option (E), which is the installation of new XLPE cable circuits between the low-voltage side of the 400/132 kV transformers at Keadby 400 kV Substation and the corresponding transformer bays at [redacted] new 132 kV GIS substation;
- Confirmation of the proposed Track 2 EL of the re-opener process, because Keadby 132 kV cable replacement is PASE compliant, and
- Pre-Construction Funding (PCF) under Special Condition 3.15 (Pre-Construction Funding Re-opener, Price Control Deliverable).

Keadby is a load-driven investment needed to connect an additional [redacted] of embedded generation at the distribution level, through [redacted] replacement of the existing 132 kV GIS substation and associated cable connections to address fault level and thermal constraints.

Subject to Ofgem confirming eligibility, needs case and PCF applicability, we will continue development and intend to submit a Project Assessment in line with the re-opener process in the October 2026 window.

2.1.1 Eligibility, project track & PASE

The project is load-driven because it is required to accommodate a significant increase in connected generation at Keadby, with reinforcement needed to resolve the resulting fault level and thermal constraints on the existing network. We are submitting this project under Track 2 EL, as the preferred solution is aligned to PASE.

2.1.2 Pre-construction funding request

Under Special Condition 3.15 of the Electricity Transmission licence, this investment qualifies for allowances equal to [redacted]

Based on our current forecast we have provided below breakdown of costs amounting [redacted] as part of this submission. This equates to [redacted] of the "latest total forecast costs project costs.

Table 2 below summarises the activities covered by the application of these PCF allowances based on our current progress of PCF and EEW spend. This position will be updated as we continue to mature this investment and ultimately reconciled at Project Assessment stage of the re-opener

We confirm that no PCF activity included in this submission has been funded through baseline allowances, other re-openers, or alternative licence mechanisms.

[redacted]

2.2 Background

2.2.1 Chronology of investment

The Distribution Network Operator (DNO), [redacted] is unable to facilitate the growing generation and demand requirements with their current 132 kV Gas Insulated Switchgear (GIS) substation.

[redacted]

To maintain the transmission–distribution interface and enable [redacted] new substation to operate, NGET must install replacement 132 kV cable circuits (plus associated protection and control changes) terminating at [redacted] new GIS bays. [redacted] will provide three new SGT GIS bays for NGET under a signed User Self Build (USB) agreement, with the interface point at the cable sealing ends.

Figure 1 provides the summary of chronology to the investment, while Table 4 provides a breakdown of the contracted customers' detail.

[redacted]

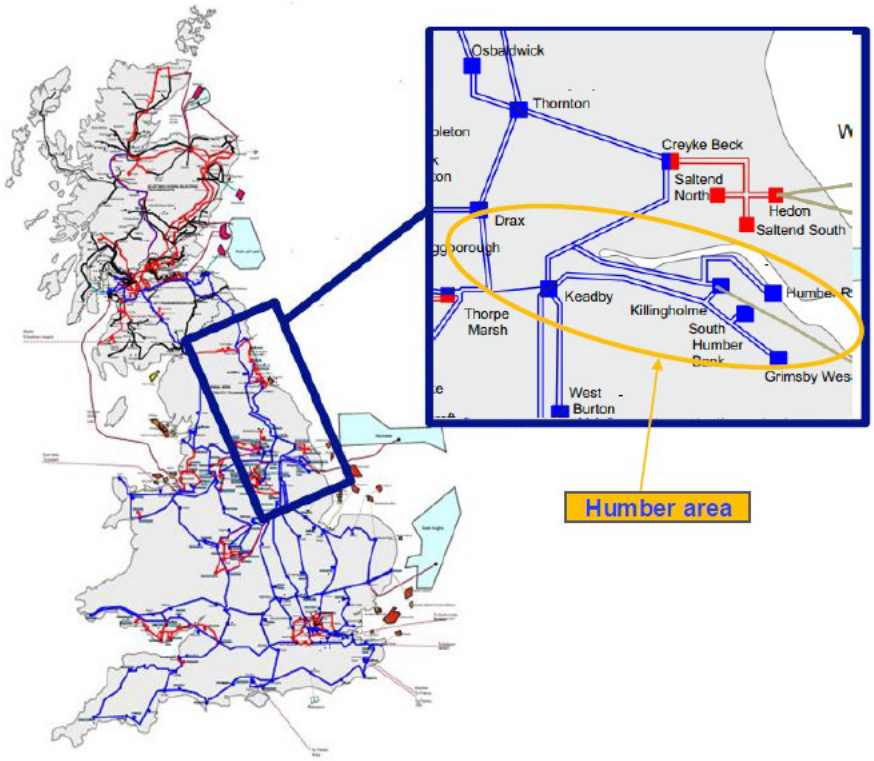
2.2.2 Regional & network context

The Northeast transmission network region is divided into six distinct network clusters, centred around generation and demand groups. Keadby substation resides within the Humber area, which are home to a wide range of industry with a growing demand for clean, reliable and resilient energy infrastructure. There is significant demand for connections in the region due to its coastal geography and availability of land for energy projects. NGET's strategy for this area increases capacity by building new substations to connect and integrate renewables, primarily offshore windfarms and interconnectors. We are also reinforcing and building new overhead line circuits to allow power flow to the south via several strategic infrastructure projects.

DNO networks associated with the Keadby area have been specifically identified by the NESO as an area with strategic demand drivers that need to be considered for proactive investment in the ED3 price control by 2034 (Strategic Energy Need NESO 9Feb 2025).

[redacted] The regional context and network configuration for surrounding sites to Keadby are illustrated in Figure 2 and Figure 3 below.

Figure 2: Location of Keadby substation on NGET's network



[redacted]

2.2.2.1 Interactive projects

[redacted]

2.2.3 Site background

Keadby substation is situated within an industrial and agricultural landscape, with the existing NG Keadby 400 kV substation immediately to the north and further north comprising grassland, scattered trees, an unnamed drain and arable fields. To the east lies land formerly occupied by a demolished substation, beyond which are predominantly arable fields intersected by drainage channels including Glew Drain and Keadby Common Drain, with the River Trent located approximately 690 m away.

The southwest is occupied by Keadby Power Station, while to the south the area includes the existing Keadby Power Station, the new Keadby 2 Power Station, areas of grassland (some animal-grazed), and nearby infrastructure including a railway line (approx. 290 m), the Sheffield and South Yorkshire Navigation Stainforth and Keadby Canal (approx. 335 m), and South Soak Drain (approx. 380 m). To the west, the site is bounded by arable fields containing a number of drainage features.

[redacted]

2.2.4 Historical funding

[redacted]

2.2.4.1 Early Asset Write Off (EAWO)

[redacted]

3. Drivers & needs case

Planned connection of an additional [redacted] of embedded generation to [redacted] existing 132 kV GIS substation is the primary driver for the project. National Grid studies show that the increased generation cannot be accommodated at the existing 132 kV substation without causing fault level exceedances and thermal overloads beyond the capability of the current switchgear, transformers, and circuits. These network constraints, together with [redacted] existing 132 kV substation approaching end-of-life and unable to be selectively uprated to provide a compliant enduring solution, mean the generation can only be facilitated through a rebuilt 132 kV GIS substation and replacement of the associated TO–DNO cable connections, in line with licence obligations to support generation connections.

Table 3: Summary of the drivers

Type	Description	Date
Load	**Cable replacement to facilitate DNO customer connection:** • [redacted] have an increase in embedded generation which the current [redacted] GIS site cannot accommodate without either an extension or a new site • The existing [redacted] site has aging assets so [redacted] decided to build a new site rather than use the existing site • We have to replace the cables which served the old site and connect the new site	[redacted]

3.1 Customers

Table 4 below provides our latest view of the customer [redacted] for this project.

The customer ACL dates presented in this submission reflect the existing P6 programme. The testing and setting of ACL dates for customer contracts within scope of connections reform is ongoing throughout 2026. Confirmation of agreed ACL dates will therefore be presented in the next stage of submission which is Project Assessment.

Table 4: Details of customers with contracted connections

Customer name	Project name	Technology Type	Output (MW/MVA)	Voltage	ACL
DNO					
[redacted]					

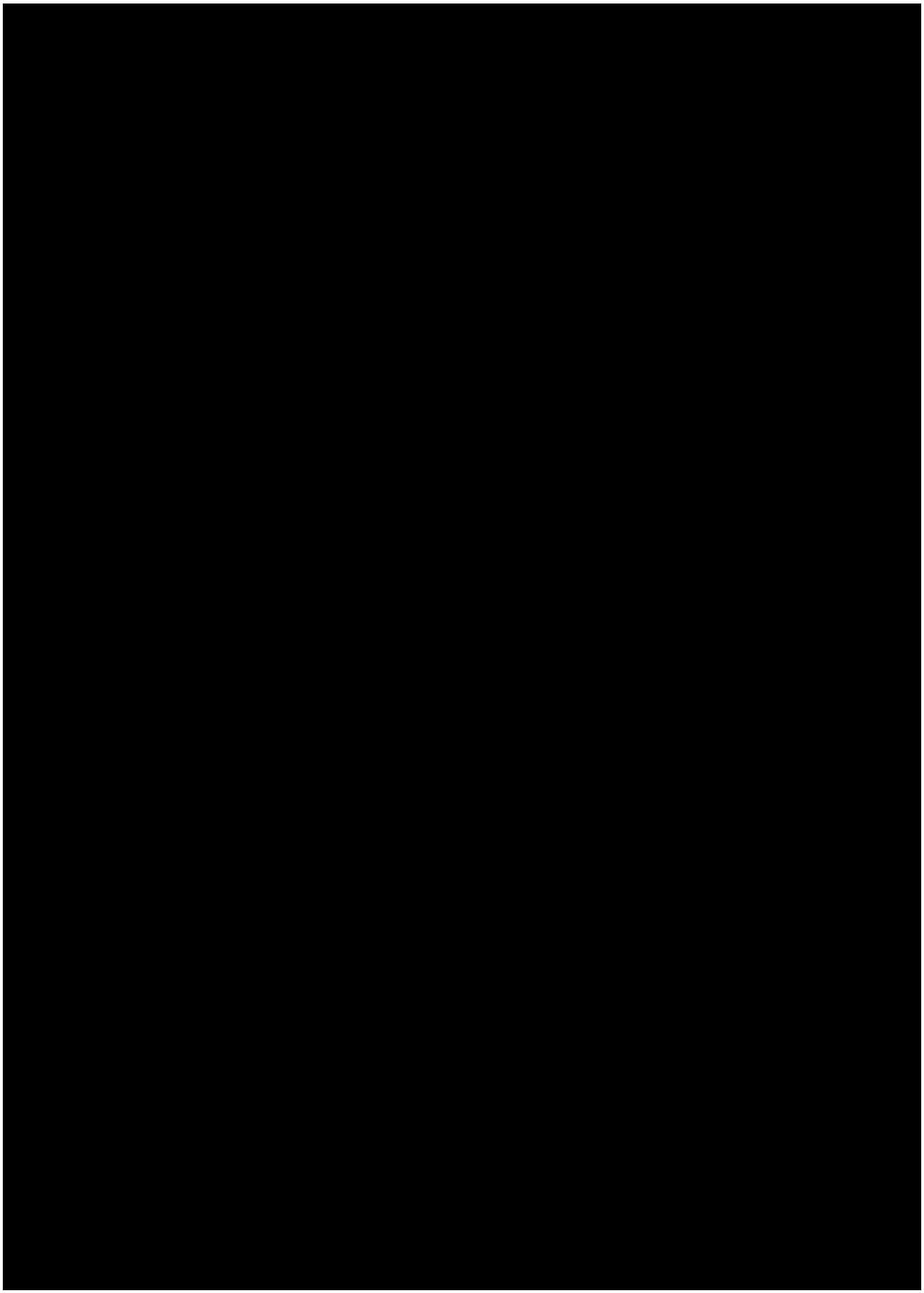
The location of the contracted customer connection [redacted] to the existing Keadby 400 kV substation are shown in Figure 8 below.

[redacted]

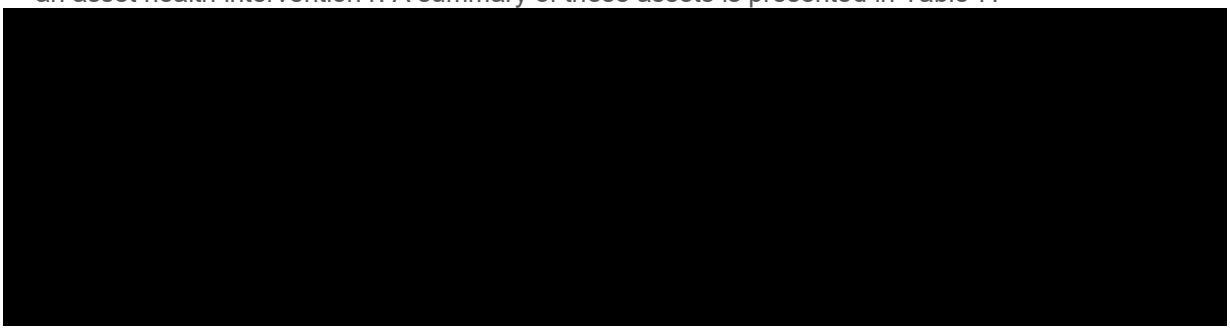
3.2 Asset health summary

Though the selection of the preferred load-driven intervention will affect how we manage the health of the assets at this substation, there is currently no fundamental asset health driver for interventions that is considered likely to affect the scope or timing of this project. The existing cables have low asset health risk classifications and, as such, there is no asset health driver for these works. However, there are asset health/non-load drivers for interventions at the interfacing substations, alongside the predominant load-related scheme.

[redacted]



During the construction of the T3 non-load plan, a selection of assets at Keadby met the criteria for an asset health intervention[1]. A summary of these assets is presented in Table 7.



This submission seeks funding only for the load-related scope described herein. Where load-related scope delivered through reopeners replaces previously allowed non-load-related (NLR) asset funding included within the T3 Final Determination, the corresponding NLR outputs will not be delivered and therefore the NLR PCDs will act as designed to remove associated NLR funding.

Delivery of asset health interventions will be optimised, taking account of outage availability and practical interactions between activities. Where load-related and asset health interventions coincide, delivery may be coordinated to improve efficiency and minimise disruption. Such coordination does not alter the underlying investment drivers, nor the portfolio-level governance or funding treatment of non-load asset health interventions.

Further detail on wider site-level asset health interventions is provided within the RIIO-T3 Asset Health Portfolio EJP and associated supporting documentation, which should be referenced for completeness.

[1] In accordance with the decision-making framework set out in 'NGET_RIIO3_NGETQ10_Asset Health Decision Making', submitted as part of our RIIO-T3 Draft Determination response.

4. Optioneering

We follow a structured, multi-factor optioneering process to select the most economic and efficient solution, in the interest of consumers. In line with the Electricity Transmission Design Principles, our optioneering process takes into account engineering, environmental, deliverability, economic and stakeholder factors. We start by assessing the most suitable strategic options.

4.1 Strategic Options

In line with our standard optioneering process, we considered the following broad strategic options:

Table 8: Strategic options summary table

Option Number	Option Name	Option Description
A	Do nothing	The network is kept in its current state, and no new connections are facilitated.
B	Market based solution	Increased customer demand is accommodated through the procurement and use of ancillary services only.
C	Whole systems solution	The required customer connection is accommodated by a DNO.
D	Make use of existing assets	Facilitating the requested connection by utilising the existing assets
E	New build	Facilitating the requested connection by new cables

We discounted Options A, B and C due to licence and contractual obligations and the inability to facilitate connection requests. A descriptive rationale, including why we later discounted Option D, is explained in Section 4.3, Table 9.

4.2 Siting

There was no siting study conducted as the proposed works are within our existing operational boundary. It is the only reasonable site for these works, namely because it is where the existing cables are so once decommissioned still allows a link between NGET and the [redacted]. The cable route is less than 500m and therefore requires no planning applications, minimal ecology and the site has capacity and minimises cable length and works which leads to the shortest, cheapest and most effective delivery timeline.

The proposed cable route is preferred because it provides the shortest, most direct and proportionate TO–DNO connection between the existing Keadby 400 kV substation and [redacted] 132 kV GIS substation, using existing infrastructure land, minimising environmental, stakeholder, flood-wall and delivery impacts, and presenting no fatal flaws, with remaining risks manageable through further design and construction controls.

4.3 Long list of options considered

Table 9: Longlist table

Options	Technical Description	Relevant Diagrams or Layout References	Consenting Risks & Environmental Impact	Rationale for taking/ or not taking forward the option to shortlisted assessment.
Option A: Do nothing **Rejected**	The network is kept in its current state, and no new connections are facilitated.	N/A	• N/A	• **Contractual and Licence compliance:** Compliant customer connection not delivered, and it would be against our contractual and license obligations. The "do nothing" option would impact a critical customer (NPg) who would not be able to supply their existing and future connections
Option B: Market-based solution **Rejected**	Increased customer demand is accommodated through the procurement and use of ancillary services only.	N/A	• N/A	• **Contractual and Licence compliance:** Compliant customer connection not delivered, and the option does not comply with our licence obligations to provide connections.
Option C: Non-transmission, whole systems solution **Rejected**	The required customer connection is accommodated by a DNO.	N/A	• N/A	• **Contractual and Licence compliance:** Compliant customer connection not delivered. • **Engineering**: The additional generation cannot be accommodated at the [redacted] due to fault level and thermal constraints, requiring replacement of the TO–DNO interface cables to enable connection into the new GIS substation and maintain compliant network operation.
Option D: Re-use existing cables **Rejected**	Re-use of existing cable from LV side of 400/132 kV transformers located at the Keadby 400 kV substation to the corresponding transformer bays at the Keadby 132 kV GIS substation	Not included due to infeasibility of option	• Minimal local and visual impact by minimising cable run	• **Environmental impact**: Existing oil-filled cables present greater environmental risk than modern XLPE alternatives. • **Cable rating:** The existing oil-filled cables are insufficiently rated for the new 132 kV GIS substation and would constrain future DNO flexibility, with replacement likely required before the new equipment reaches end of life. • **Economic/consumer value:** The relocated substation means the existing cable is too short, requiring costly and complex extensions, joints and potential oil/non-oil cable interfaces. • **Asset health**: Re-use would create asset health misalignment due to differences in age, residual life and insulation characteristics between existing and new assets. • **Deliverability:** Retaining the existing cable would require extension works, additional joints and insulation transitions, increasing thermal uncertainty, failure risk and reliability concerns at 132 kV, while the

Options	Technical Description	Relevant Diagrams or Layout References	Consenting Risks & Environmental Impact	Rationale for taking/ or not taking forward the option to shortlisted assessment.
				associated disconnection and reconnection works could result in outages of around six months and create significant risk for the DNO.
Option E: Installation of new XLPE cable **Taken forward**	Installation of new XLPE cable from LV side of 400/132 kV transformers located at the Keadby 400 kV Substation to the corresponding transformer bays at the Keadby 132 kV GIS substation	[redacted]	• Minimal local and visual impact by minimising cable run	• **Deliverability:** meeting connection agreement and ETP partner engaged • **Cable rating:** The rating of a new XLPE cable will accommodate the requirements of the new 132 kV GIS substation • **Consumer/economic value:** delay would mean we do not meet contractual obligation and risks the local DNO being without a supply • **Consenting/stakeholder**: it is the only reasonable site for these works, namely because it is where the existing cables are so once decommissioned still allows a link between us and the DNO. The cable route is sub-500 meters are requires no planning applications, minimal ecology and the site has capacity and minimises cable length and works which leads to the shortest, cheapest and most effective delivery timeline

Options A – C are discounted because they will not allow us to facilitate the connection requests and consequently, we will not meet our contractual and licence obligations.

Option D was not progressed because it would introduce unacceptable technical, environmental, cost and deliverability risks while failing to provide an enduring solution aligned with the new 132 kV GIS substation. By retaining and extending the existing oil-filled cables, this would introduce environmental risk, insufficient capacity and asset-life misalignment, require costly and complex interface joints to reach the relocated substation, create additional reliability and thermal risks, and necessitate prolonged outages of around six months, meaning it would not provide a safe, economic or enduring 132 kV solution.

Option E is the only technical solution and feasible cable route (as discussed in section 4.2) that will meet the investment driver and requirements for this project. The option has minimal local and visual impact and can be delivered within the required timescales with the [redacted]. It represents the only reasonable and proportionate solution to maintain the transmission–distribution interface following decommissioning of the existing cables.

4.3.1 Influence of stakeholders on shortlisting

Preliminary ecological surveys

The Preliminary Ecological Appraisal supports the Keadby option by confirming that works are largely within existing substation land and previously disturbed, low-value habitat, avoiding higher-value habitats and designated sites including the Humber Estuary designations c.560m east. It identifies only localised, manageable ecological sensitivities, with no ecological blockers or need for alternative corridors that would increase land take, ecological risk and consenting complexity. Ecology therefore supports the selected option as the least environmentally disruptive, proportionate and only practicable solution.

4.4 Shortlisted options

The shortlisted option for Keadby-NPg 132 kV Cable replacement is:

- Option E: Installation of new XLPE cable

Other longlist options were screened out prior to shortlist stage because they did not meet the requirements of the investment driver of this project and therefore did not represent credible investable solutions. On that basis, the shortlist contains a single option: not because alternative options were not considered, but because only one option was feasible and proportionate to take forward for detailed assessment and cost justification. Further qualitative analysis of this single option can be found in Appendix C

4.4.1 Option E: Installation of new XLPE cable.

This option is for the installation of new XLPE cable from LV side of 400/132 kV transformers located at the Keadby 400 kV Substation to the corresponding transformer bays at the Keadby 132 kV GIS substation.

The scope of the project comprises:

- Place 3 new existing XLPE cables from the HV bays on NGET 400 kV AIS compound to the NPg 132 kV GIS compound, these cables will go from x3 NGET 400 kV bays to [redacted] 132 kV bays
- Associated civils works with the bays

- 132 kV CSE and 132 kV earth switches steel supporting structures and foundations at SGTs terminations
- Interface of new cable route and existing Flood Defence Wall, including breaching the flood defence wall
- Design, supply, install and commissioning of the protection systems
- Installation of new LV relay panels
- Installation of new multi-core fibres
- Remove redundant cables and panels
- Update interlocking
- All detailed design, procurement and temporary works associated with the above

The proposed route for new 132 kV XLPE insulated cable circuits from SGT1, SGT2, SGT3 to new 132 kV GIS substation is shown on Drawing [redacted] including approximate linear route length for each circuit. Along the proposed 132 kV cables route there are existing services including a public road, ditches and a flood defence wall that must be crossed. The 132 kV cable installation along this route will consist of direct buried or fully ducted cabling with duct banks for crossing of services. Between each of the three SGT's and the Keadby 400 kV substation, the approximate route length of new 132 kV cable circuits are:

- STG1 0.60km
- SGT2 0.54km
- SGT3 0.74km

It is expected the cable for each circuit will be supplied and installed in one continuous length without joint. The existing 132 kV oil filled cables connection from SGT1, SGT2 and SGT3 to existing [redacted]

Figure 9 below shows the layout of the preferred solution. [redacted]

[redacted]

4.4.2 PASE

The preferred solution for the 132 kV [redacted] cable replacement is PASE compliant as a variant option, [redacted]

4.5 Detailed quantitative analysis of shortlisted option

4.5.1 Cost estimates of the shortlisted option

To assess the shortlisted options, cost estimates have been created for quantitative economic comparison. All capex costs are derived from NGET's latest Cost Book (23/24 prices). Estimating Units Lines (EULs) have been used to generate cost estimates based on the scope of work and the new assets to be acquired for each option. For each EUL, we have applied a [redacted] based on historic project analysis, to account for unforeseen circumstances and to mitigate risks during implementation.

4.5.1.1 Cost drivers

The project cost estimate has been developed to reflect current market conditions and the defined scope of works, supported by a high degree of cost confidence given the maturity of the design. The baseline funding request is underpinned by Estimating Units Lines (EULs) derived from NGET's Cost Book.

Using the Cost Book, the principal cost drivers for the shortlisted option relate to:

- Installation of new 132 kV XLPE cable circuits, including materials, laying and termination; and
- Associated civil and enabling works within the substation, including ducting and local cut-and-fill activities.

4.5.2 Cost benefit analysis

4.5.2.1 Purpose and approach

Our Cost Benefit Analysis (CBA) evaluates the economic efficiency and consumer value of the proposed transmission investments. This analysis aligns with Ofgem's Load Re-opener Guidance and Submission Requirements.

The CBA process integrates monetised benefits such as constraint cost savings, system efficiency improvements, and consumer bill impacts, alongside a comprehensive Whole-Life Cost Analysis (WLCA) that captures capital expenditure, operational and maintenance costs, replacement cycles, carbon impacts, and future extendibility. This dual approach ensures a balanced assessment of both short-term economic benefits and long-term cost efficiency, avoiding the risk of asset stranding or future inefficiencies.

Our CBA considers:

- **Robust optioneering and sensitivity testing:** We have evaluated credible alternatives, including 'do nothing' and 'do minimum' scenarios, to confirm that the preferred solution delivers the optimal balance of technical performance, environmental impact, and economic benefit.
- **Quantification of constraint cost reductions:** Using system operator modelling outputs and historical data, we quantify expected savings from reduced system constraints, which translate into direct consumer bill benefits.
- **Assessment of delay impacts:** The financial consequences of potential project delays on constraint costs and consumer bills are modelled through risk-adjusted scenarios, providing a clear understanding of the value of timely delivery.
- **Inclusion of socio-economic benefits:** Where quantification is challenging, qualitative evidence supported by stakeholder engagement and regional development plans highlights the wider economic benefits, including job creation and inward investment.

- **Consideration of non-monetised benefits:** We explicitly identify benefits that are qualitative or not readily monetisable, such as enhanced system operability, resilience, and environmental improvements, ensuring full transparency of the value proposition.
- **Alignment with policy and government targets including Net Zero and AI Growth Zones:** The CBA reflects the influence of national and local policies, including Clean Power 2030, net zero commitments, and economic growth plans demonstrating how the investment supports the broader energy transition.

We have assessed consumer value by comparing the whole-life costs and benefits of five shortlisted connection and substation delivery options using Ofgem's RIIO-ET3 CBA template. The assessment is completed relative to a counterfactual and on a discounted basis over a 50-year appraisal period (2027–2076), consistent with the CBA methodology.

For each option considered, we have quantified:

i) Initial CAPEX investment required

ii) Future end of life replacement costs

The supporting CBA model quantifies the costs and benefits for this project. Using the Ofgem RIIO-ET3 CBA template spreadsheet, the CBA compares the discounted cost and benefits for consumers for the following options.

- Baseline (Option E: Installation of new XLPE Cable)

4.5.2.2 CBA outcome

Lifetime Cost-Benefit Analysis: The lifetime costs and benefits refer to a 50-year period starting from 2027 until 2076.

Table 11: Lifetime cost-benefit analysis (2023/2024 base prices, central carbon pricing, discounted values)

Option	Initial Investment (£m)	PV of Lifetime Costs (£m)	PV of Monetised Benefits (£m)	NPV (£m)
Option E (Baseline - KEAD4: NPg 132kV Cable Replacement)	[redacted]	[redacted]	[redacted]	[redacted]

4.5.2.3 Assumptions of the CBA analysis

Core assumptions and sensitivities. The CBA results are based on the following high-level assumptions (with sensitivities used to test robustness where appropriate):

- Appraisal period of 50 years (2027–2076), with costs and benefits discounted and presented relative to the counterfactual.
- Cost base: 2023/2024 prices, aligned to the Ofgem RIIO-ET3 CBA template inputs (including treatment of replacement CAPEX and maintenance).
- Carbon: central base case carbon price applied for monetising construction carbon, SF6/alternative gas leakage and losses, with scenario testing for alternative carbon price trajectories.
- Benefits scope applied consistently across options; where option-specific benefits exist (e.g. constraints), the basis and evidence are documented and applied consistently.

- Key sensitivities considered (as applicable): timing/phasing, CAPEX uncertainty ranges, delivery/outage risk, and benefit parameter uncertainty (including losses and leakage assumptions).

4.5.2.4 Costs

A summary of all Capex and Opex costs are illustrated in the following table:

[redacted]

As only one credible and proportionate option has been identified to maintain the transmission–distribution interface at Keadby, no comparative cost assessment between multiple options has been undertaken. The baseline option therefore represents the lowest-cost and lowest-risk solution capable of meeting the required interface and contractual obligations.

4.5.2.5 Benefits

The following benefits have been included within the CBA:

- SF6 / Alternative gas leakage reduction
- Carbon cost of construction reduction
- Transmission loss reduction
- Summary of all Benefits

Table 13 presents the summary of all (undiscounted) benefits, including environmental and non-environmental benefits, considering the central base case carbon price.

[redacted]

4.6 Preferred solution

We consider that Option E: Installation of a new XLPE cable is the preferred option for Keadby 132 kV cable replacement, when the CBA and qualitative assessment are read together. The project comprises installation of three new XLPE cables between NGET 400 kV bays and [redacted] 132 kV GIS

bays, associated civil and structural works, integration with the flood defence wall, delivery of protection and control systems (including LV panels, fibres and interlocking updates), removal of redundant assets, and all related design, procurement and temporary works.

Option E is the preferred solution because it is the only technically compliant, deliverable and proportionate option that meets the required transmission–distribution interface need, while providing the best balance of engineering performance, consumer value, stakeholder impact and timely delivery.

It delivers the minimum necessary scope through new XLPE cables sized to the maximum practical rating, replaces the existing oil-filled cables with a lower-risk modern technology, uses the shortest feasible route within existing operational land, and avoids wider planning, land and stakeholder impacts.

All other options were discounted through the longlist assessment because they either failed to meet the connection requirement or did not provide a safe, economic and enduring solution. As such, Option E was the only feasible and investable option to take forward.

In addition, the preferred cable corridor for Option E has been shown to be the shortest and most direct feasible route, with no fatal engineering or ecological flaw identified, meaning there was no credible alternative route or asset-reuse solution that could be taken forward on a comparable basis. On that basis, the shortlist contains a single option not because alternatives were not considered, but because only one option was feasible, proportionate and investable.

4.6.1 Project benefits & outputs

The preferred option for this project is Option E: Installation of new XLPE Cable. The installation of a new XLPE cable circuit between the 400/132 kV transformers at Keadby 400 kV Substation and the corresponding bays at [redacted] new 132 kV GIS substation, ensuring continuity of supply to the local DNO following decommissioning of existing assets. The target completion date for this project is 2030 and will deliver the following outputs and benefits:

- Maintains a secure and compliant transmission–distribution interface at Keadby following replacement of [redacted] 132 kV substation.
- Supports the delivery of [redacted] 132 kV GIS substation, replacing ageing infrastructure with modern, reliable assets.
- Ensures continued operability and reliability of the Keadby site using proven XLPE cable technology.
- Represents the lowest-cost and lowest-risk solution capable of meeting the identified need.
- Minimises local and environmental impacts by confining works to existing operational land and maintaining a short, underground cable route.
- Removes legacy oil-filled cables, reducing environmental risk associated with older asset types.
- Leverages established delivery arrangements, [redacted]
- Aligns transmission and distribution delivery programmes to reduce interface risk and improve overall delivery efficiency.

5. Project delivery

5.1 Proposed deliverability programme

[redacted]

[redacted]

The proposed programme of works has been developed to ensure coordinated delivery of the transmission–distribution interface. [redacted]

5.2 Procurement and contracting strategy

[redacted]

5.3 Risk & risk management

The preferred option presents a limited number of delivery risks, consistent with the relatively contained scope of works. Key risks and associated mitigation measures are summarised in Table 14 below. These risks have been informed by the optioneering process, SWOT analysis and Cost Benefit Analysis. A full quantitative risk assessment will be undertaken as the project progresses and mitigation measures will be refined accordingly.

Table 14: Risk and mitigations table

Category	Risk	Mitigation Measure
Design & Technical Complexities	• **Potential left-over underground assets in cable crossing** - The cable run partially goes through the Keadby decommissioned 275 kV substation land, where all assets above ground are visibly decommissioned but it cannot be confirmed if there are any assets left in the ground (such as cables or foundations). Impact is, after site surveys, the cable route may need to be slightly adjusted, or some excavation works at site to remove any blockages]	• To mitigate, surveys are occurring prior to contract award to confirm any buried services or foundations and this will be priced into the customer scope of work and detailed design phase
Thid Party Impact & Network Co-ordination	• Series reactor scheme (ID&D clash) - Works being carried out as part of a separate scheme at Keadby 400 kV substation. • Programme alignment with NPg	• Early and joint internal engagement between teams. • Ongoing interface management with NPg, clear definition of interface responsibilities, and alignment of programmes through regular coordination.
Timing of Programme & Resources	• Long-lead items, SAP resource and supply chain constraints • Contract Award Delays - The ETP is a new contracting framework, and potential delays whilst this framework is navigated • Lead time for XLPE cable - The lead time for the XLPE cable is approx. 52 weeks, which can impact the programme. However, the cable required is well defined and the order can be placed prior to detailed design being completed	• Procure critical items early and ringfence key delivery resources. • Strong relationship and engagement with resource. • This is being mitigated via close collaboration and clear timelines with the customer • If this risk shows a high probability of materialising, then a ECI contract will be placed to allow the ETP to order the cable in stage 1
Cost	• Cost uncertainty from estimates, contract mechanisms and inflation	• Refine estimates, apply early contractor input and secure cost certainty early.

6. Conclusion

This Load Reopener outlines the investment needs case to install a 132 kV cable replacement between NGET's 400 kV and [redacted] 132 kV substations in Keadby and describes the outputs from the optioneering and CBA process that led to the identification of the preferred solution. The driver for this investment is load-driven, where a cable replacement is required to facilitate future DNO customer connections at [redacted] 132 kV substation.

The proposed solution is Option E: installation of a new XLPE cable. Option E is the preferred option because it is the only technically feasible and proportionate solution that can facilitate the connection requests and maintain the transmission–distribution interface following decommissioning of the existing cables, while also delivering the best overall balance of consumer value, stakeholder and consenting impacts, and timely deliverability.

There are known uncertainties and risks associated with Option E that have been captured in this Load Reopener, such as programme misalignment, long lead time for the XLPE cable and cost uncertainty risks. To ensure our successful delivery of this project, collaboration with all stakeholders involved in the proposed investment and within the Keadby site is critical.

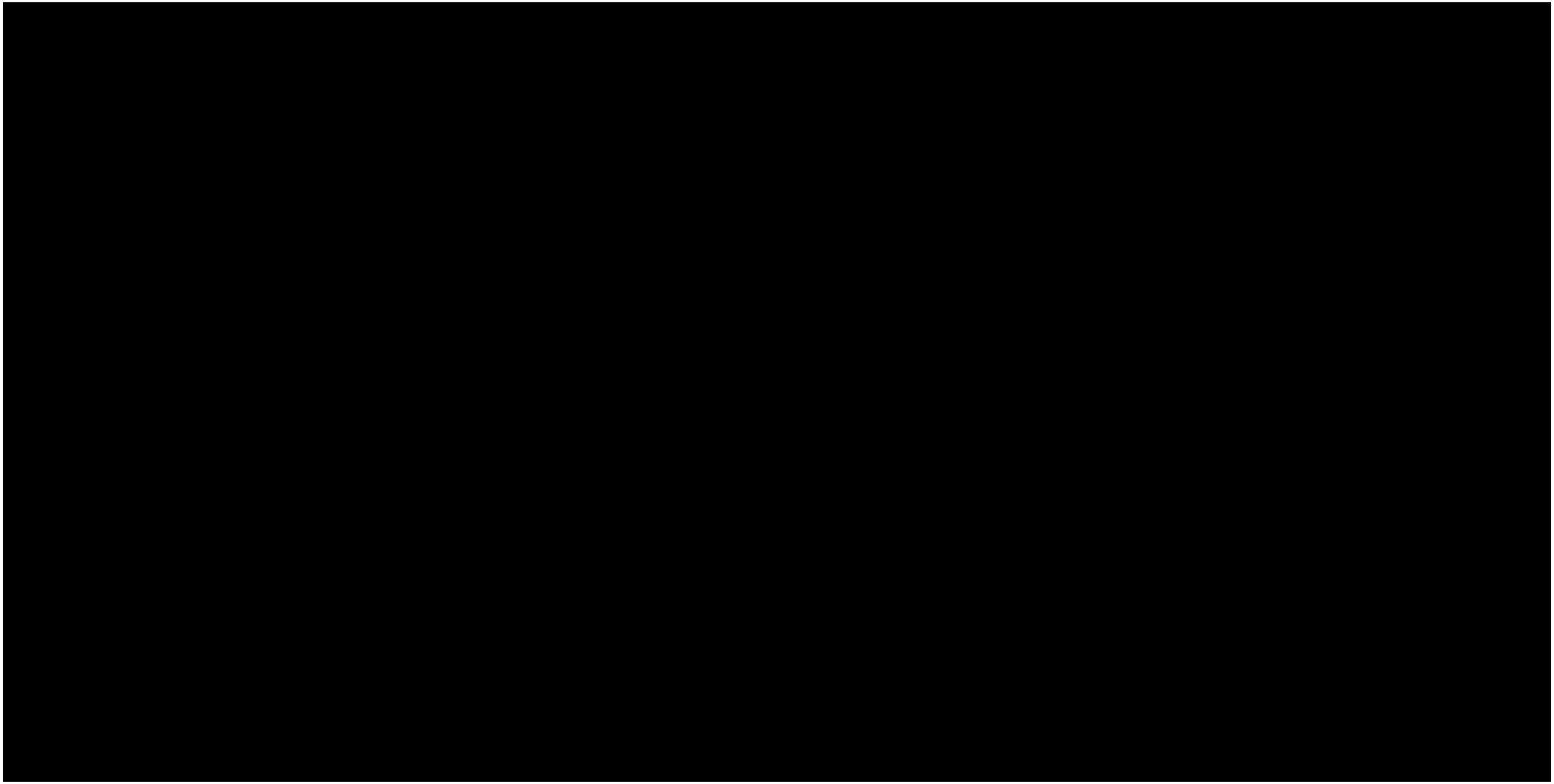
This submission outlines a preferred solution to satisfy the investment drivers. It seeks confirmation of eligibility under Special Condition 3.18, confirmation of eligibility for PCF under Special Condition 3.15, confirmation of re-opener Track 2 EL and formal approval of the preferred option.

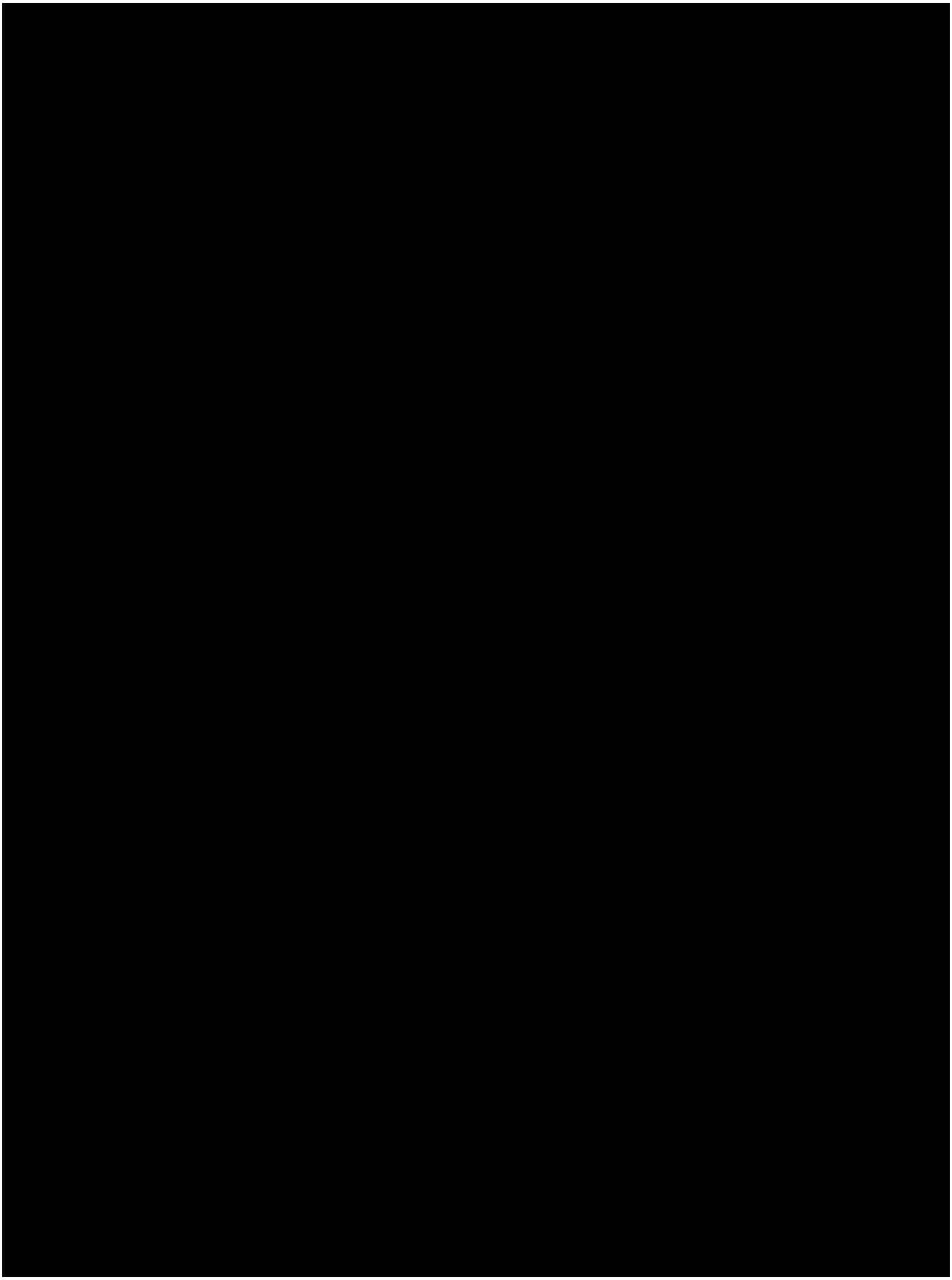
The Price Control Deliverable (£m) associated with this investment proposal is as follows:

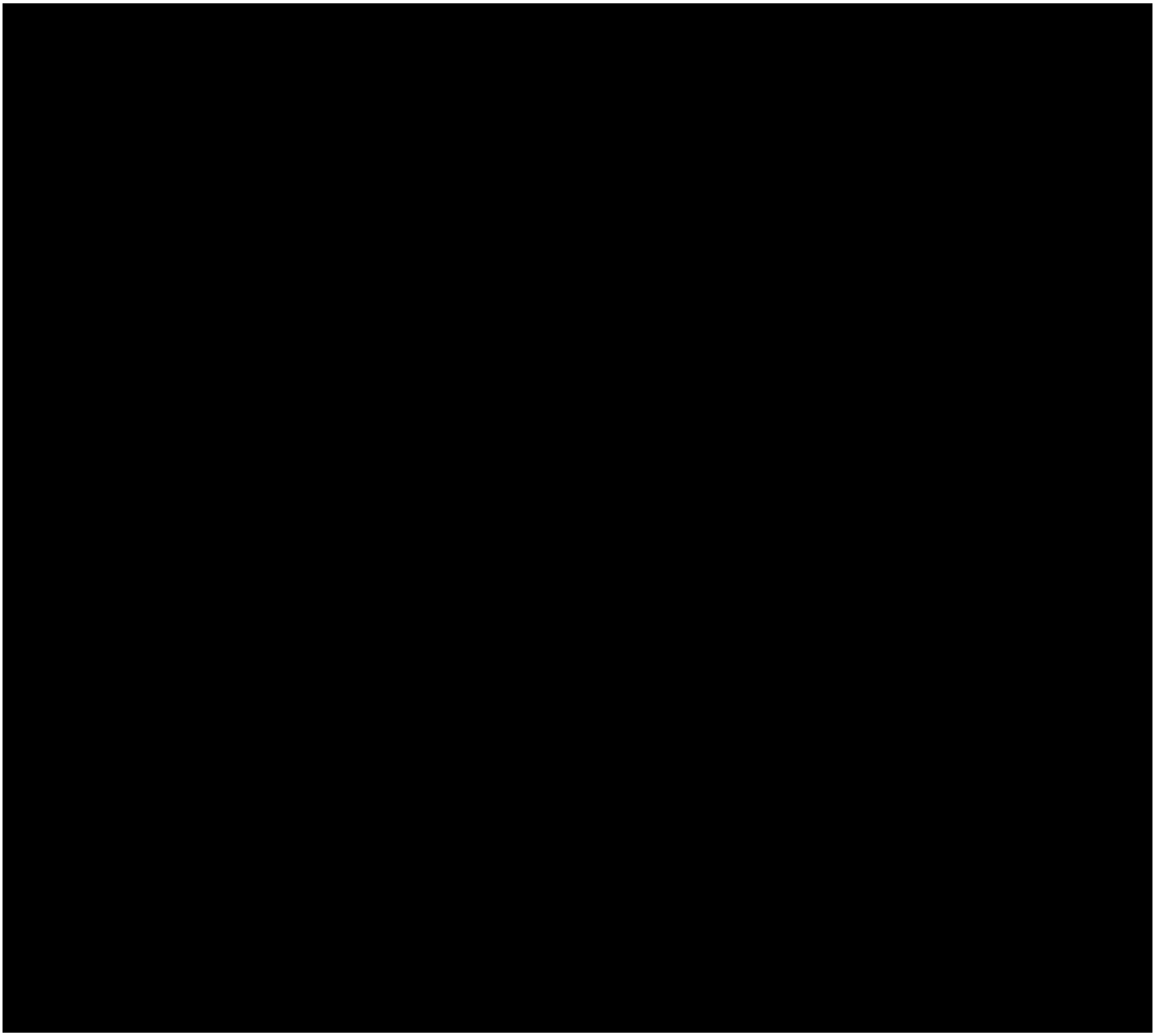
Table 15 – Investment summary

Main Drivers	**Primary investment driver for the cable replacement is to facilitate [redacted] customer connection:** [redacted], with replacement of the TO–DNO interface via approximately 1.9 km of new HV cables to replace aging assets.
Selected Option	The proposed solution is **Option E: Installation of new XLPE cable.**
Estimated Cost & Timing	• **Estimated capital cost cost: £**[redacted] (23/24 prices, incl. Risk & contingency)
Outputs	• **Deliver the grid of tomorrow, today:** helps deliver the capacity needed in the area by the DNO today and builds for the future by supporting a new build 132 kV GIS substation, as opposed to the current ageing substation, whilst maintaining a reliable substation with the latest technology and build standards. • **Do the right thing for consumers, communities and the environment:** protects nature by doing the minimum to facilitate the works (15% net gain target) which also minimises impact to the local community. • **Transform the way we work:** [redacted]

Appendices





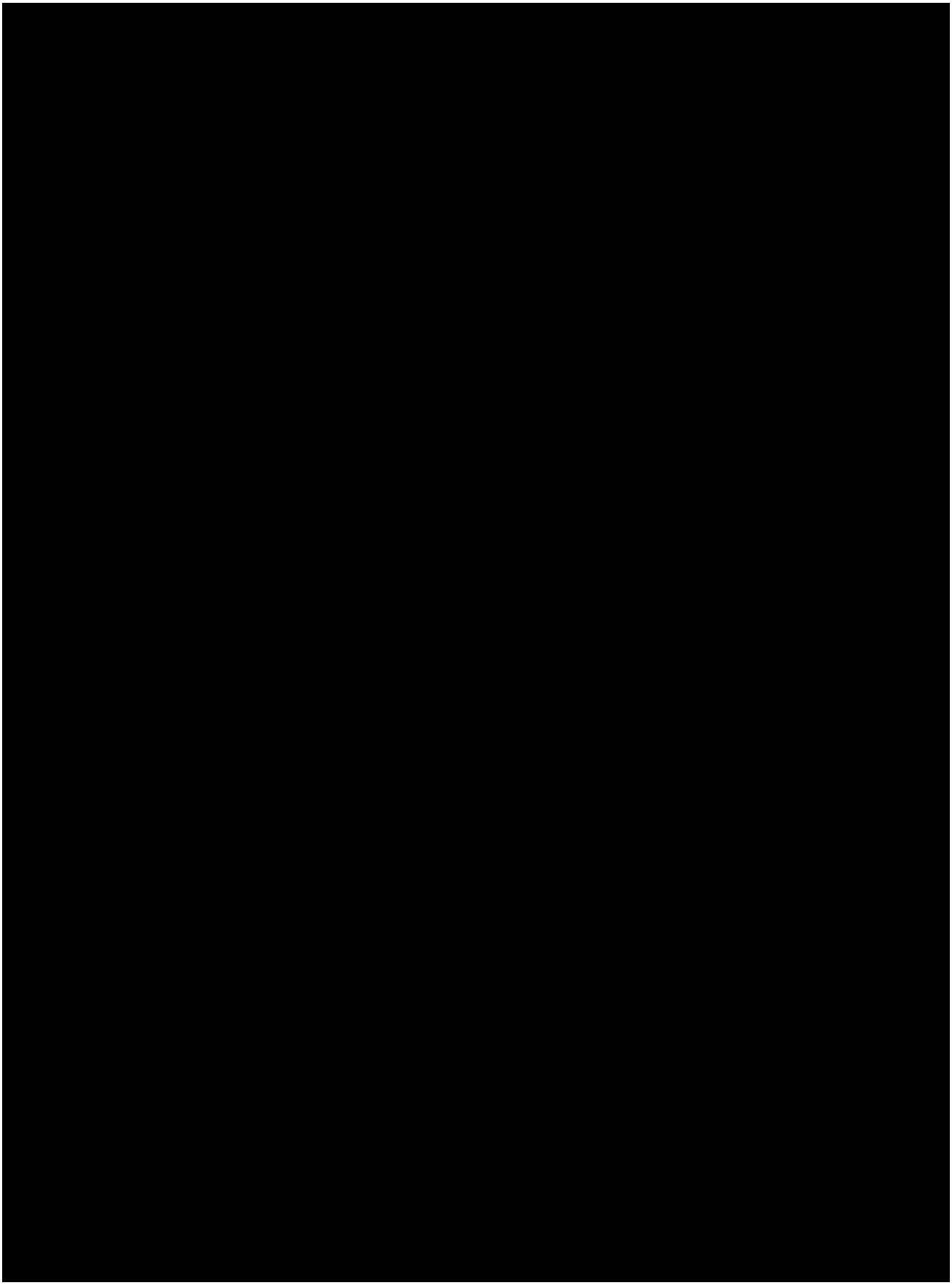


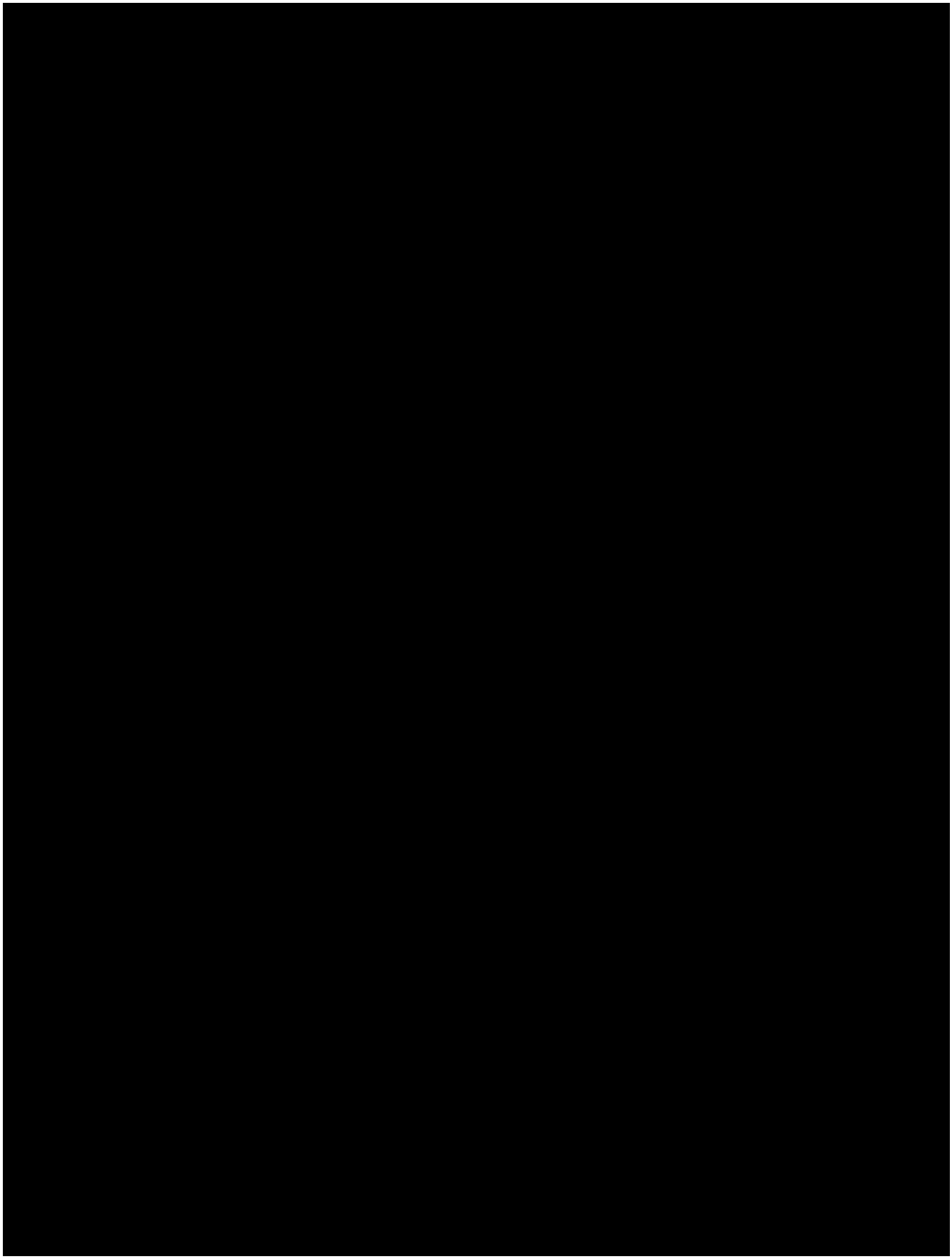
Appendix C: Detailed qualitative analysis of the shortlisted option

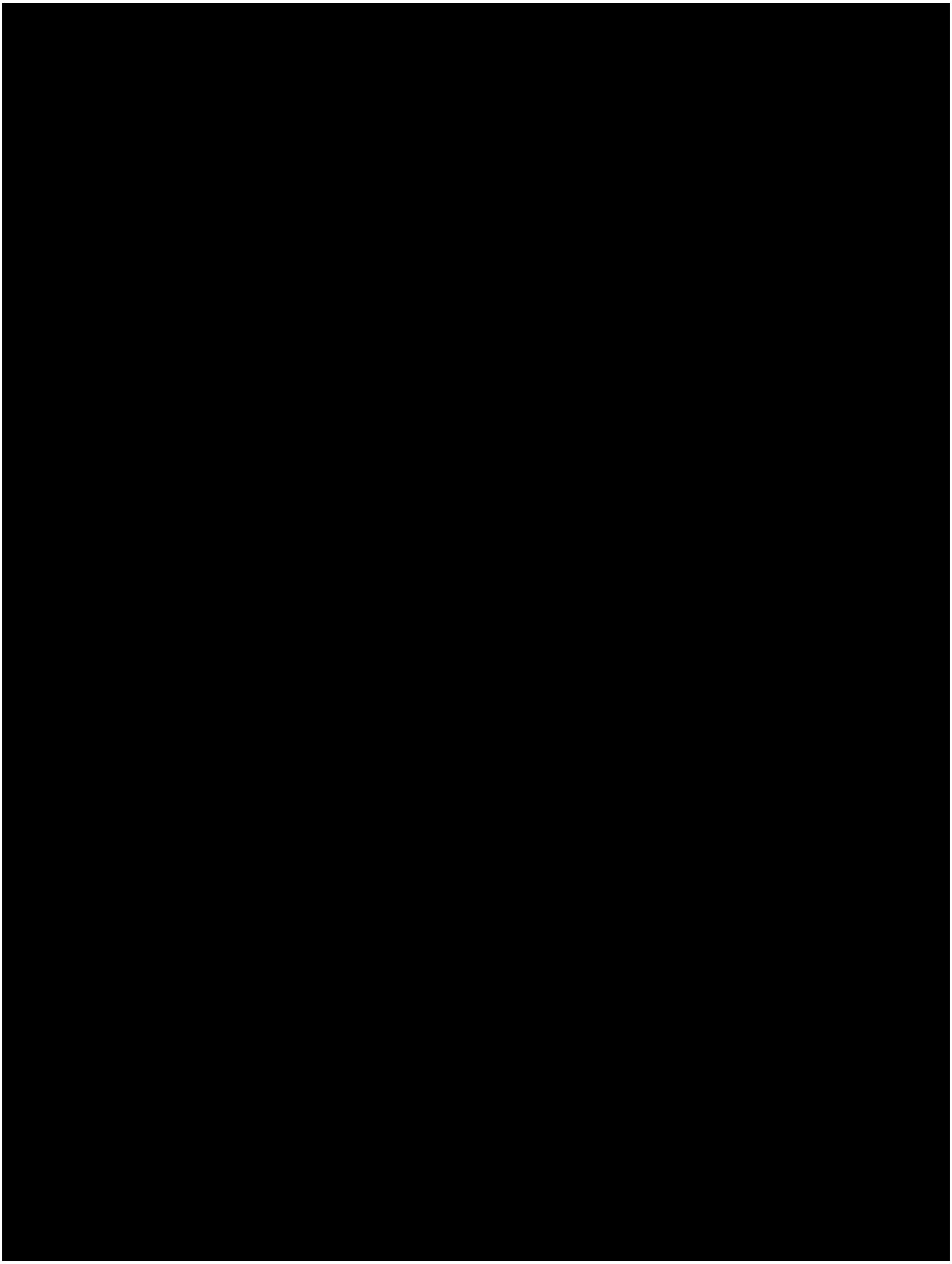
Table 18: Detailed qualitative assessment table

	Optioneering Categories				
Option	**Engineering**	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
Option E: Installation of new XLPE cable	The preferred option meets [redacted] requirements with XLPE cables sized to the maximum practical rating, providing the required interface capacity while minimising additional network complexity, reducing construction and outage impacts through a single flood wall breach, replacing the existing oil-filled cables with a single modern cable technology on site, and ensuring that any future capacity requirement would be driven by separate reinforcement such as additional SGTs.	The preferred option replaces the existing oil-filled underground cables with XLPE cables, removing the risk of oil leakage while avoiding any material additional visual impact; the main environmental drawback is the temporary disturbance associated with installing new buried cables, including potential ecological impacts, although the project seeks to achieve 15% BNG where practicable, recognising that site space constraints are likely to limit on-site delivery.	The preferred solution supports the required delivery date and leverages the appointed [redacted] while coordinating the single flood wall breach with the [redacted] o minimise repeat interventions and maintain site security; the proposed XLPE cables also provide the maximum practical capacity required [redacted] current need and allow efficient future development without precluding any separate reinforcement driven by new requirements.	The preferred option represents the minimum scope and most cost-effective solution needed to facilitate the customer connection within the required timeframe. Any delay would risk failure to meet contractual obligations and could expose the [redacted] to supply risk.	The preferred option requires no land purchase or planning permission and uses the shortest and most direct feasible cable route within existing operational land, avoiding wider third-party and stakeholder impacts, with identified ground and utility constraints considered manageable and no fatal flaw to delivery
	Benefit	**Neutral**	**Strong Benefit**	**Strong Benefit**	**Strong Benefit**

Although there is only one feasible option in our shortlist for this project, the qualitative assessment above justifies our preferred design of Option E. This solution is the preferred option because it is the only solution that provides the required interface capacity in a technically compliant, deliverable and cost-effective manner, while minimising network complexity, avoiding wider consenting and stakeholder impacts, and replacing the existing oil-filled cables with a modern, lower-risk XLPE solution.







Appendix E: Glossary

Abbreviation	Description
ACL	Available For Commercial Load
ACSR	Aluminium Core Steel Reinforced
AIS	Air Insulated Switchgear
APM	Advanced Procurement Mechanism
BESS	Battery Energy Storage System
BP	Business Plan
BPDT	Business Plan Data Template
CAI	Closely Associated Indirect
CBA	Cost Benefit Analysis
CPO	Compulsory Purchase Order
CSNP	Centralised Strategic Network Plan
DC	Direct Current
DCO	Development Consent Order
DC TC	Direct Current Time Constraint
DESNZ	Department for Energy Security and Net Zero
DISC	Disconnector
DLR	Docklands Light Railway
DNO	Distribution Network Operator
ECC	Estimated Cost of Construction
EEW	Early Enabling Works
EJP	Engineering Justification Paper
EoL	End-Of-Life
ESO	Energy System Operator
ET	Electricity Transmission
EU	European Union
EUL	Estimating Units Lines
ESW	Earth Switch
FEED	Front End Engineering Design
FES	Future Energy Scenarios
FY	Financial Year
G3	Green Gas for Grid
GEC	General Electric Company

Abbreviation	Description
GIB	Gas Insulated Busbar
GIS	Gas Insulated Switchgear
GLA	Greater London Authority
GW	Giga Watt
HDD	Horizontal Directional Drilling
HV	High Voltage
HWUP	Hackney Waltham Cross Uprating
IEC	International Electrotechnical Commission
kW	Kilo Watt
LLTI	Long Lead Time Items
LTDS	Long-Term Development Statement
LV	Low Voltage
LVAC	Low Voltage Ac
M&E	Mechanical And Electrical
MITS	Main Interconnected Transmission Systems
MSIP	Medium Sized Investment Project
MVA	Megavolt-Amperes
MW	Mega Watt
NESO	National Energy System Operator
NETS	National Electricity Transmission System
NG	National Grid
NGED	National Grid Electricity Distribution
NGET	National Grid Electricity Transmission
NOA	Network Options Assessment
NOMs	Network Output Measures
NPV	Net Present Value
OHL	Overhead Line
ORPS	Obligatory Reactive Power Service
PCD	Price Control Deliverables
PCF	Pre-Construction Funding
SF6	Sulfur Hexafluoride
SGT	Super Grid Transformer
SLD	Single Line Diagram
SPV	Special Purpose Vehicle

Abbreviation	Description
SSMD	Sector Specific Methodology Document
SSSI	Site of Special Scientific Interest
STC	System Operator Transmission Owner Code
SuDS	Sustainable Drainage Solutions
TBC	To Be Confirmed
tCO2e	Tonnes of Carbon Dioxide Equivalent
TCPA	Town And Country Planning Association
TCSNP	Transitional Centralised Strategic Network Plan
TWB	Through-Wall Bushing
UK	United Kingdom
UKPN	UK Power Networks
UKPN EPN	Eastern Power Networks
UKPN LPN	London Power Networks
UKPNS	UK Power Networks Services
UXO	Unexploded Ordnance
VCA	Voltage Compliance Assessment
XPLE	Cross-Linked Polythene

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom

Registered in England and Wales
No. 4031152
nationalgrid.com