RIIO-T3

North West London (NWL)

Track 3 Needs Case Submission

October 2026



Electricity Transmission

nationalgrid

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Reference and summary table

Field	Description
Project Name	North West London
TO's preferred re-opener track	Track 3 Needs Case
RRP Reference	[redacted]
BPDT / Scheme Reference Number	[redacted]
Load Board Reference	[redacted]
Investment driver(s)	This project was first identified as a National Energy System Operator (NESO) driven project under Network Options Assessment (NOA) 7. ESC1 and SER4. received a "essential" signal under Holistic Network Design (HND) and is designated as Clean Power 2030 (CP2030). These projects are required to deliver the following: • to improve the balance of power flows on Sundon – Elstree circuits and increase the network's capability to import power into London; • to support a significant boundary upgrade across LE1 and B14, therefore reducing constraint costs on the system. [redacted] As such, this investment supports the delivery of key UK government energy policy objectives and the regulatory framework set through RIIO-3 and the CP2030 pathway, by enabling a secure, affordable and resilient electricity system capable of accommodating sustained growth in demand and generation.

Field	Description
Project outputs	• Additional 400 kV network capacity along the Sundon-Elstree-St John's Wood route • Second 400 kV cable circuit from Elstree–St John's Wood substations via an existing tunnel • Reconductoring of the Sundon–Elstree No. 2 overhead line (OHL) Circuit
Short list of strategic options considered	To deliver SER4, the circuit between Sundon and Elstree will be reconductored using [redacted]. To deliver ESC1, a second cable will be routed through the existing Elstree – St John's Wood tunnel. To connect the ESC1 cable at Elstree, the short list of options include: • **E-1:** 400 kV SF_6-free Gas Insulated Switchgear (GIS) extension of existing building • **E-2:** 400 kV SF_6-free GIS extension in the 132 kV Air Insulated Switchgear (AIS) area • **E-3:** 400 kV SF_6-free GIS extension in Greenfield northeast of site To connect the ESC1 cable at St John's Wood, the short list of options include: • **S-1:** 400 kV GIS busbar extension **S-3:** Tee-off into [redacted] **S-6:** Elstree 2 connection [redacted]
Preferred solution and explanatory narrative on the rationale	To deliver HND Essential Options ESC1 and SER4, the circuit between Sundon and Elstree will be reconductored using a [redacted] and a cable will be routed through the existing Elstree – St John's Wood tunnel. For the connection of the ESC1 cable at Elstree substation, our preference is Option E-2. Option E-2 ensures timely delivery of the programme. [redacted] For the connection of the ESC1 cable at St John's Wood substation, our preference is Option S-6. [redacted]
PASE alignment	[redacted]

Field	Description
	• ESC1 is a new circuit intervention between Elstree and St John's Wood, which is designed to be operated at 400 kV. SER4 is a reconductoring intervention between Sundon and Elstree [redacted]
Cost (23/24 prices)	[redacted]
Delivery year	[redacted]
Applicable Reporting Tables	BPDT 10.5 ET Pipeline Log includes ESC1 and 6.1 Scheme C&V Load for SER4. Regulatory Reporting Pack (RRP) 24-25 forecasts are also found in E1.11_ET Pipeline for ESC1 and in the Scheme_C&V_Calc_Load_Actuals table for SER4.
Interactive projects	The Letchmore Heath project, which is a T2 Large Onshore Transmission Investment (LOTI) with OSR number NGT500540 within the ET3 BPDT, [redacted] While ESC1 and SER4 rely on the bays provided by the Letchmore Heath investment, both feeders (SJOW–ELST2 and ELST–SUND2) are needed to achieve SQSS compliance for all customers connecting into Letchmore Heath. The Final Needs Case (FNC) report for that investment was submitted to Ofgem in January 2026. The St Johns Wood (SJW) 275 kV Rationalisation project to remove aging 275 kV assets and reconnect UKPN to the 400 kV network is running in parallel to the North West London Reinforcement (NWL) scheme. We have optioneered the two schemes together as referred to later in this document. This was done to minimise interfaces and provide an efficient design. The contracting arrangements for the SJW Rationalisation scheme are at an earlier stage than NWL; there may be some benefits for delivery in combining elements of the two schemes. This is to be determined during development.

Field	Description
Historical funding interaction	In RIIO-T2: • [redacted] In RIIO-T3, no funding was requested in the Business Plan.
Spend Apportionment	**T2** **T3** **T4+** [redacted]

Executive summary

Project summary

The investment will reinforce the North West London network by delivering the ESC1 and SER4 schemes: a second 400 kV circuit between Elstree and St John's Wood and reconductoring of the Sundon–Elstree route, increasing import capability into London. It was identified by the former Energy System Operator (ESO) as a Holistic Network Design (HND) Essential Option in the Network Options Assessment (NOA) 2021/22 Refresh, supports delivery of Clean Power 2030 (CP2030), and helps enable reinforcement across the LE1 and B14 boundaries.

Submission purpose

This Needs Case and associated CBA are submitted as part of the RIIO-ET3 Load Reopener (LR) mechanism under Special Condition 3.18 (Load Re-opener and Price Control Deliverable) of the Electricity Transmission Licence Conditions.

[redacted]

[redacted]. In January 2026, the Final Needs Case (FNC) report for Letchmore Heath was submitted to Ofgem under the Large Onshore Transmission Investment (LOTI) mechanism, which was Special Condition 3.13 in our T2 licence. That report should be read in parallel with the information set out in this document for NWL. [redacted]

The NWL scheme is complex and is multidisciplinary in nature, requiring all the typical technologies associated with High Voltage (HV) transmission asset construction: power cables, overhead lines, substations, tunnel installation and third-party connections in both urban and rural environments.

Need

NWL is a single investment that delivers two National Energy System Operator (NESO) schemes: ESC1 and SER4. These are the Elstree to St John's Wood Cable (ESC1) project and the Sundon to Elstree Reconductoring (SER4) project. ESC1 and SER2 (which later became SER4) were recognised by the former ESO as HND Essential Options in its NOA 2021/22 Refresh meaning they are needed for the delivery of 50 GW of offshore wind (OSW) and is classified as a CP2030 project. The [redacted]

[redacted]

These investments, shown on the below map, are required to deliver the following:

- to improve the balance of power flows on Sundon – Elstree circuits and increase the network's capability to import power into London;
- [redacted]

[redacted]

Optioneering to date

SER4 Optioneering

To arrive at the scope of work defined for SER4, we coordinated with the former ESO on how best to deliver a capacity increase on the Sundon-Elstree second circuit. We undertook a multi-factor optioneering process to identify a proportionate and deliverable solution in the interests of consumers. We first considered nine strategic options, including non-build options (do-minimum, market-based, whole-system), hotwiring, and reconductoring options that differed based on the conductor type. We were immediately able to rule out most options on the basis that they could not deliver the driver. Of the remaining options, the use of [redacted] (Option Y-2) was selected as the preferred option, given that this was assessed independently by NESO to be the most cost-effective option for delivering against its identified driver. This aligns with the scope of work for SER4.

Table 1: Summary of SER4 optioneering

Option	Details	Drivers met?	Preferred?
A	Do nothing counterfactual option	No	No
B	Market-based solution	No	No
C	Non-transmission, whole systems solutions (DNO)	No	No
Y-1	[redacted]	No	No
Y-2	[redacted]	Yes	Yes
Y-3	[redacted]	No	No
Y-4	[redacted]	No	No
Y-5	[redacted]	Yes	No
Y-6	[redacted]	Yes	No

Our cost estimates for this option are presented below. All capex costs are derived from National Grid Electricity Transmission's (NGET's) latest Cost Book (23/24 prices). We have applied a [redacted], based on historical project analysis, to account for unforeseen circumstances and mitigate risks during implementation.

Table 2: Upfront capital cost estimate for preferred option for SER4 (£m, 23/24 prices)

Option	Total
[redacted]	[redacted]

ESC1 Circuit Optioneering

A similar approach was used to arrive at the scope of work defined for ESC1. From the seven strategic options, we were able to rule out the non-build options on the basis that they could not deliver the driver. The use of the existing cable tunnel (Option X-1) was selected as the preferred option. The construction of new infrastructure when there is already an existing tunnel that has been future-proofed with the specific intention of providing space for this cable would result in unjustified costs to consumers and environmental impacts. The scope of work also aligns with HND Essential Option ESC1.

Table 3: Summary of ESC1 optioneering

Option	Details	Drivers met?	Preferred?
A	Do nothing counterfactual option	No	No
B	Market-based solution	No	No
C	Non-transmission, whole systems solutions (DNO)	No	No
X-1	Use the existing cable tunnel	Yes	Yes
X-2	Surface line route	Yes	No
X-3	OHL route	Yes	No
X-4	Construct a new tunnel	Yes	No

Our cost estimates for this option are presented below, including a [redacted] These costs are as specified in the cost book, and any updates will be shared with Ofgem in the Project Assessment submission.

Table 4: Upfront capital cost estimate for preferred option for the ESC1 circuit (£m, 23/24 prices)

Option	Total
X-1: Use the existing cable tunnel	[redacted]

ESC1 Connection Optioneering

Once it was determined that a cable would be routed through the existing Elstree – St John's Wood tunnel by delivering ESC1, we optioneered how to connect this cable at each substation. For each substation, we undertook a multifactorial options analysis to identify a solution that would deliver in the interests of consumers. For Elstree, we shortlisted three of the five considered options. For St John's Wood, we shortlisted three of the seven considered options.

Table 5: Summary of optioneering for connecting at Elstree and St John's Wood

Option	Details	Drivers met?	AIS/ GIS?	Short List?
Elstree connection options				
E-1	400 kV SF_6-free Gas Insulated Switchgear (GIS) extension of existing building	Yes	GIS	Yes

Option	Details	Drivers met?	AIS/ GIS?	Short List?
E-2	400 kV SF_6-free GIS extension in the 132 kV AIS area	Yes	GIS	Yes
E-3	400 kV SF_6-free GIS extension in Greenfield northeast of site	Yes	GIS	Yes
E-4	400 kV SF_6-free GIS extension in the 275 kV AIS compound	No	GIS	No
E-5	New 400 kV Air Insulated Switchgear (AIS) substation	No	AIS	No
St John's Wood connection options				
S-1	400 kV GIS busbar extension	Yes	GIS	Yes
S-2	400 KV GIS Busbar extension [redacted]	No	GIS	No
S-3	Tee-off into 400 [redacted]	Yes	GIS	Yes
S-4	Tee-off into 400 [redacted]	No	GIS	No
S-5	New 400 kV GIS into the 275 kV AIS Building	No	GIS	No
S-6	Elstree 2 connection [redacted]	Yes	GIS	Yes
S-7	New 400 kV AIS substation	No	AIS	No

Our cost estimates for the shortlisted options are presented below, including a [redacted]

Table 6: Upfront capital cost estimate for the shortlisted options for connecting ESC1 (£m, 23/24 prices)

[redacted]

Our preferred options for these connections at Elstree and St John's Wood are options E-2 and S-6, respectively. Option E-2 ensures timely delivery of the programme [redacted] lower future-proofing

potential and has a significantly larger environmental impact due to the need to fell a large section of trees [redacted]

Preferred overall option

In summary, our overall preferred option for the NWL investment is as follows:

- For SER4, our preferred option is Y-2, which is to reconductor the existing OHL route between Sundon and Elstree with a [redacted]
- For ESC1, our preferred option is X-1, which is to route a [redacted]
- For the connection of the ESC1 cable at Elstree substation, our preferred option is E-2, which is a 400 kV New GIS Extension in the 132 kV AIS area
- For the connection of the ESC1 cable at St John's Wood substation, our preferred option is S-6, which is an Elstree 2 connection [redacted]

Taken together, the preferred solution enables the investment drivers and avoids constraint costs to consumers that would otherwise be incurred. It also supports the Pathway to 2030 strategy and enables increased power transfer into London, aligned with decarbonisation and offshore wind growth. The total cost of the investment is £400.5m (23/24 prices).

Indicative delivery programme

The ACL is in [redacted] which ensures timely delivery of the investment need and prevents expensive constraint costs (see programme of works, below). Key milestones in the programme include:

[redacted]



1. Introduction

1.1 North West London

This Needs Case and associated CBA are submitted as part of the RIIO-ET3 Load Reopener (LR) mechanism under Special Condition 3.18 (Load Re-opener and Price Control Deliverable) of the Electricity Transmission Licence Conditions.

Subject to Ofgem's approval of the continuing need and preferred solution, we will continue development and submit a Project Assessment in line with the re-opener process.

[redacted] Condition 3.13 in our T2 licence. That report should be read in parallel with the information set out in this document [redacted]

The NWL scheme is complex and is multidisciplinary in nature, requiring all the typical technologies associated with High Voltage (HV) transmission asset construction: power cables, overhead lines, substations, tunnel installation and third-party connections in both urban and rural environments.

Track and PASE

The project is being submitted through the Track 3 Needs Case pathway. The two key underlying components of our preferred option are [redacted] in total cost and are primary options within the Pre-Approval of Solution Engineering (PASE) framework:

- the new circuit intervention between Elstree and St John's Wood is designed to be operated at 400 kV (a primary option in the PASE framework);
- [redacted]

1.2 Background

Chronology

The Elstree to St John's Wood Cable 1 (ESC1) project and the Sundon-Elstree 2 circuit Reconductoring (SER2) projects were confirmed as Holistic Network Design (HND) Essential

Options in the former Energy System Operator's (ESO's) Network Options Assessment (NOA) 2021/22 Refresh.[2] These projects are designated as Clean Power 2030 enabling transmission investments, reinforcing the need case established under the Beyond 2030 framework. This was in response to the coordinated offshore network proposed in the HND to connect Round 4 windfarms, which resulted in increased reinforcement requirements across boundaries in the Midlands, South and East of England due to the location of the onshore connection points.

[redacted]

Given shared drivers, constraints and outage dependencies, ESC1 and SER4 were combined into a single integrated scheme in 2025, now referred to as the NWL project. Following strategic confirmation, NWL progressed through structured optioneering to identify credible options to progress.

[redacted]

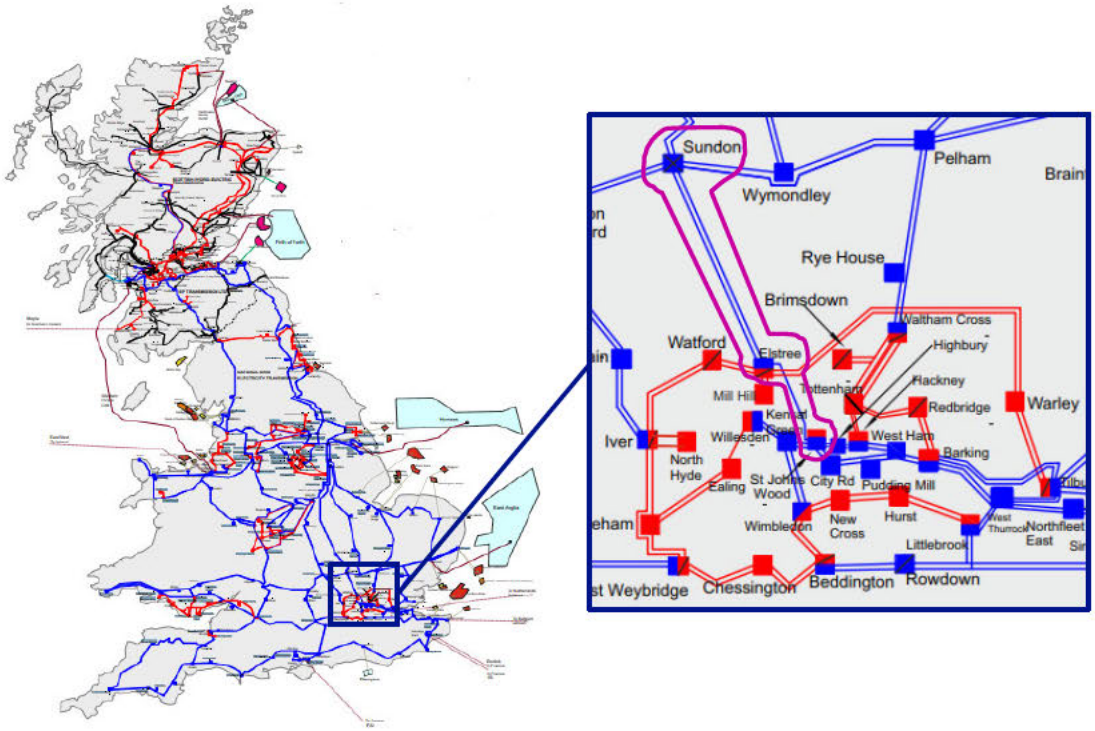
[2] National Grid ESO, 2022, Network Options Assessment 2021/22 Refresh : https://www.neso.energy/document/262981/download

[redacted]

Regional and network context

The proposed investment sites are within North West London, Bedfordshire and Hertfordshire (see Figure 4 and Figure 5). The London and Southeast 275 kV and 400 kV transmission networks are designed to meet London's electricity needs and support the coastal interconnector power exchange capability. There are multiple interconnectors in this region which create dynamic network challenges that affect the infrastructure needed to manage large power flow in either direction.

Figure 4: NGET network map highlighting the NWL project within the London region



*Key: **Red** = 275 kV assets, **Blue** = 400 kV assets. Investment location shown in the **purple** area*



The region is predominantly a net importer, with future power flows into the capital forecast to increase significantly. As a net importer, excess power on the transmission network flows into this region and heads to the interconnectors for export in times of high wind and solar generation in the UK. In Greater London, demand is forecast to increase by more than 170% by 2050, against a backdrop of the UK's transition towards net zero and a significant increase in the number of data centres needed to support the growing telecommunications industry.[4]



[4] NESO, 2024 Electricity Ten Year Statement (ETYS): neso.energy/document/352001/download

- To address the single circuit dependency into St John's Wood; increasing system flexibility and operability by having a second circuit.
- To provide adequate thermal and transfer capability to support forecast peak demand.
- [redacted]
- To ensure the network can accommodate planned renewable generation in line with national decarbonisation policy.
- Central London is highly sensitive to single-circuit outages and heatwave-driven peak demands. The reinforcement enables system balancing and diversity of infeed and not just incremental MW, reducing reliance on eastern corridors.

National Energy System Operator (NESO) has identified the need for network reinforcement. In response to the identified need to increase capacity on key import routes into the capital, ESC1 and SER2 were confirmed as HND Essential Options in the ESO's NOA 2021/22 Refresh.[5] [redacted][6] Their need is to address critical constraints on the network in light of the demand growth described above.

In response to the growing demand in London and the need for reinforcement, our regional blueprints for London and the Southeast include several circuit and substation investments.[7] Examples of our circuit investments include three cable upgrade projects, three reconductoring projects and a new cable project. Two initiatives within that circuit investment portfolio (ESC1 and SER4, which are respectively items 8 and 9 in Figure 6, below) form the NWL investment set out in this document.

[5] National Grid ESO, 2022. Network Options Assessment 2021/22 Refresh https://www.neso.energy/document/262981/download

[6] NESO Strategic Energy Need - Feb 26

[7] NGET, 2024. London: Future Network Blueprint https://www.riiot3.nationalgrid.com/document/30141/download ; NGET, 2024. Southeast: Regional Network Blueprint https://riiot3.nationalgrid.com/document/30126/download



Interactive projects



Site background

The proposed site of the investment includes two major National Grid substations (Elstree and St John's Wood), the existing tunnel route between Elstree and St John's Wood, and the existing OHL between Sundon and Elstree (see Figure 1 in the Executive Summary).

Elstree substation sits within a plot of NGET-owned land in Radlett, Watford (see Figure 7 [redacted]

The substation sits within a plot of NGET-owned land, on which [redacted] Please see Appendix E for a land ownership map. The existing National Grid land and surrounding land is part of the green belt.[8]

[8] Please refer to the Letchmore Heath LOTI FNC submission for further discussion on the green belt surrounding Elstree substation.

Figure 7: Location of Elstree substation outside Watford



St John's Wood Substation (SJOW) is located in inner London (see Figure 8)[redacted]

[redacted]

[9] In our T3 Business Plan submission, we set out the need for site rationalisation to address this asset health driver. In the T3 Final Determination, Ofgem stated that we should request allowances for this through a re-opener submission.

Figure 8: Location of St John's Wood substation on a map of North West London



The existing Elstree to St John's Wood Cable tunnel, built circa 2000, is approximately 21 km in length and has an internal diameter of 3m. It has some localised expansions (circa 20m in length) but is predominantly of the same construction throughout. The tunnel was constructed using pre-cast concrete sections. [redacted]

Historical funding

In RIIO-T2:

- ESC1 received allowances of [redacted] which will be readjusted at the end of RIIO-T2 to reflect the actual T2 spend.

- SER2 received allowances of [redacted]. Allowances were not requested in the initial T2 Business Plan submission but was requested in response to NGET_SQ_ENG_155a received on 21 February 2020, following the publication of the NOA results in January 2020. We shared further information about SER2 in response to NGET_SQ_ENG_195 received on 27 March 2020. However, this was not ultimately delivered because the scope of work changed and the project became SER4, which means the allowances will no longer be used for this investment.

In RIIO-T3, no funding was requested in the Business Plan.

EAWO

There are no Early Asset Write Offs (EAWOs) expected as part of this investment.

2. Drivers and Needs Case

The investment is required to deliver against NESO drivers (see Table 7).

Table 7: Overview of investment drivers

Type	Description	Date
NESO	Deliver ESC1 and SER4, which are HND Essential Options.	2030 - 2031

2.1 NESO

The investment is required to deliver ESC1 and SER4. ESC1 and SER2 (which later became SER4) were recognised by the former ESO as HND Essential Options in its NOA 2021/22 Refresh.10 [redacted]

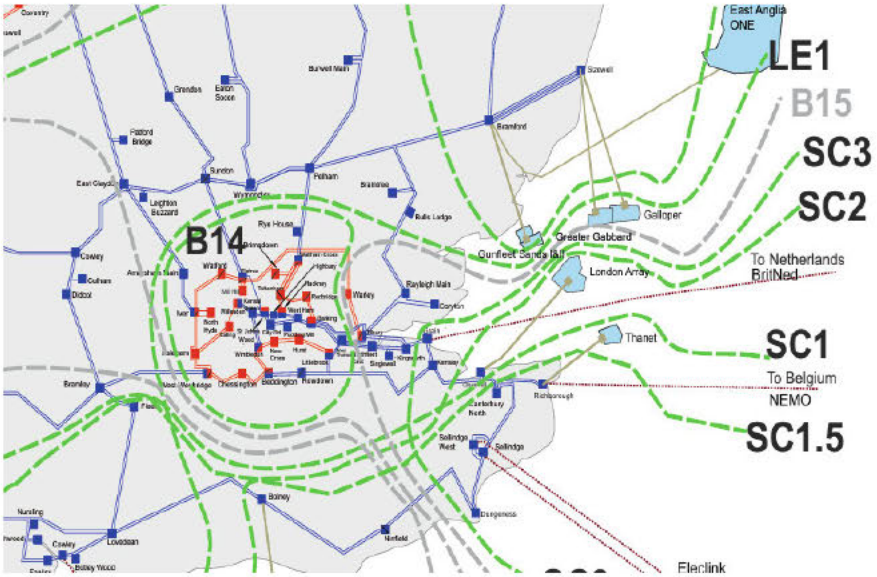
These investments are required to deliver the following:

- to improve the balance of power flows on Sundon – Elstree circuits and increase the network's capability to import power into London;
- to support a significant boundary upgrade across LE1 and B14, therefore reducing constraint costs on the system.

[10] National Grid ESO, 2022. Network Options Assessment 2021/22 Refresh https://www.neso.energy/document/262981/download

[redacted]

Figure 9: LE1 and B14 Boundary Map



2.2 Asset Health

Though the selection of the preferred load-driven intervention will affect how we manage the health of the assets, this scheme is fundamentally network capacity driven and so there is no asset health driver for interventions that is considered likely to affect the scope or timing of this project. There are however asset health/non-load drivers for interventions at the interfacing substations, alongside the predominant load-related scheme.

[redacted]

[redacted]

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 Engineering Justification Paper (EJP) and associated supporting documentation, which should be referenced for completeness.

2.3 Other considerations

Strategic significance of the investment

The investment directly supports the Government's Clean Power 2030 ambition by delivering early reinforcement of corridors that are integral to the Pathway to 2030 network design. It also supports the delivery of the Government's AI Opportunities Action Plan.[12]

The project has also been listed as part of the Greater London Authority's (GLA) London Infrastructure Framework (LIF) as critical energy infrastructure to enable the London Growth Plan.[13] This lays out the long-term vision for London's critical economic infrastructure priorities through to 2050.

Elstree 400 kV substation extension

The two feeder reinforcements are also necessary to connect a 400 kV substation extension at Elstree with Security and Quality of Supply Standard (SQSS) compliance [redacted]

[12] DCMS & Department for Science, Innovation & Technology, 2025. AI Opportunities Action Plan: https://www.gov.uk/government/publications/ai-opportunities-action-plan/ai-opportunities-action-plan

[13] Mayor of London, 2026. London Infrastructure Framework: https://www.london.gov.uk/sites/default/files/2026-03/London%20Infrastructure%20Framework_March%202026.pdf

3. SER4 Optioneering

This section sets out the optioneering for increasing capacity on the Sundon – Elstree second circuit as part of SER4.

3.1 Strategic options

We followed 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 started by assessing the most suitable strategic options (see Table 9).

Table 9: Assessment of the strategic options for increasing capacity on the Sundon – Elstree second circuit

Option	Description	Assessment
A: Do minimum	Maintaining the network its current state and not addressing the investment drivers.	The investment driver would remain unmet, resulting in constraint costs to consumers.
B: Market-based solution	The investment drivers are met through the procurement and use of ancillary services only.	It is not possible to address the investment driver through this means.
C: Non-transmission, whole systems solution	The investment drivers are met through Distribution Network Operator (DNO) flexibility rather than through NGET infrastructure investment.	There are limitations with DNO flexibility. Active Network Management (ANM) or curtailment is not sufficient to meet the need of managing substantial power demands. Whilst DNO flexibility markets are growing, central London demand is largely non-interruptible, with data centres and dense commercial load that have low tolerances for curtailment. Distribution-level flexibility and connection management measures are insufficient substitutes for infrastructure intervention due to the scale, firmness and criticality of London demand.
[redacted]	[redacted]	Rejected because it cannot deliver the investment driver.
Y-2[redacted] **Taken forward as preferred option**	[redacted] by reconductoring the circuit with a [redacted]	[redacted] (see Appendix C).
Y-3[redacted] **Not taken forward**	[redacted] by reconductoring the circuit with a [redacted].	Rejected because it cannot deliver the investment driver.

Option	Description	Assessment
Y-4: [redacted] **Not taken forward**	[redacted] by reconductoring the circuit with a [redacted].	[redacted] (see Appendix C).
Y-5: [redacted] **Not taken forward**	[redacted] by reconductoring the circuit with a [redacted].	While this delivers against the investment driver, this option is less cost-effective than other conductor options considered. In addition, although Curlew is type registered at 210°C and would deliver a 3320 MVA rating, existing Curlew on the network is predominantly operated at 190°C and therefore there is insufficient performance evidence to support adoption at 210°C.
Y-6: [redacted] **Not taken forward**	[redacted] by reconductoring the circuit with a [redacted].	While this delivers against the investment driver, this option is less cost-effective than other conductor options considered.

Shortlisting rationale and influence of stakeholder considerations

- The non-build strategic options (A-C) were ruled out because they would not deliver on the need to intervene on the network that was identified by NESO.
- Of the intervention options, we ruled out hotwiring (option Y-1) on the basis that it would not deliver against the driver.

[redacted] Of the different conductor types, analysis from the SER1 project found that some conductors would not be able to deliver against the same driver on the Sundon – Elstree first circuit. On this basis, given that the findings could equivalently be applied to the second circuit, we ruled out options Y-3 and Y-4 [redacted]

- [redacted] we ruled out options Y-5 and Y-6 [redacted] conductors were furthermore ruled out on the basis that there is insufficient performance evidence to support adoption at 210°C.
- This left option Y-2 as the preferred option [redacted]

3.2 Description of preferred option

[redacted]

How it meets the driver: Increases capacity on the corridor.

3.3 Quantitative analysis of preferred option

Cost estimates of preferred option

Cost estimates have been created for quantitative economic comparison. All capital expenditure (CAPEX) is derived from NGET's latest Cost Book ([redacted]). 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 historical project analysis, to account for unforeseen circumstances and mitigate risks during implementation.

[redacted]

Cost drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements.

Using the cost book, the main factors driving the costs for the shortlisted options are:

- Unit costs of SGTs
- Operational cut and fill works for substation area

Cost-benefit analysis

This subsection sets out the cost-benefit analysis (CBA) for the preferred option and a breakdown of the costs and benefits underpinning that analysis. This analysis is based on the latest cost book estimates.

Purpose and Approach

Our 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:

- Initial CAPEX investment required
- 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 four shortlisted options.

[redacted]

CBA Outcome

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

[redacted]

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.
- Price [redacted]
- 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).

Costs

[redacted]

Benefits

The following benefits have been included within the CBA:

- SF6 / Alternative gas leakage reduction
- Carbon cost of construction 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.

Table 13: Summary of all benefits

Option	Environmental Benefits		Non-Environmental Benefits	Total Benefits (£m)
	Carbon costs of construction (£m)	Gas leakage (£m)	Transmission loss (£m)	
[redacted]				

4. ESC1 Circuit Optioneering

This section sets out the optioneering for increasing capacity on the Elstree – St John's Wood circuit as part of ESC1.

4.1 Strategic options

Replicating the approach adopted for SER4, explained in Section 3.1 Strategic options, we started by assessing the most suitable strategic options for increasing capacity on the circuit (see Table 14).

Table 14: Assessment of the strategic options for increasing capacity on the Elstree – SJOW circuit

Option	Description	Assessment
A: Do minimum	Maintaining the network its current state and not addressing the investment drivers.	The investment driver would remain unmet, resulting in constraint costs to consumers.
B: Market-based solution	The investment drivers are met through the procurement and use of ancillary services only.	It is not possible to address the investment driver through this means.
C: Non-transmission, whole systems solution	The investment drivers are met through DNO flexibility rather than through NGET infrastructure investment.	There are limitations with DNO flexibility. ANM or curtailment is not sufficient to meet the need of managing substantial power demands. Whilst DNO flexibility markets are growing, central London demand is largely non-interruptible, with data centres and dense commercial load that have low tolerances for curtailment. Distribution-level flexibility and connection management measures are insufficient substitutes for infrastructure intervention due to the scale, firmness and criticality of London demand.
X-1: Use the existing cable tunnel **Taken forward as preferred option**	Feed the cable through the existing tunnel, which has been future proofed to accommodate this.	Avoids the need for a new tunnel or surface cable route. This provides significant benefits, including: reducing capital costs; drawing on permitted development rights; reducing environmental impacts of new tunnelling; reducing construction risk; reducing disruption to third parties and local communities; and reducing programme duration, in turn ensuring future constraint costs can be avoided by delivering the scope of work on time.
X-2: Surface line route **Not taken forward**	Construct a new surface line route between Elstree and St John's Wood substations.	Surface line routes would require multiple land agreements, highway closures and environmental mitigation, and would create unacceptable disruption within a constrained urban environment. These options would also present a higher risk of planning refusal and third-party objection.
X-3: OHL route	Construct a new OHL route between Elstree and St John's Wood substations.	OHL routes would require multiple land agreements, highway closures and environmental mitigation, and would create

Option	Description	Assessment
Not taken forward		unacceptable disruption within a constrained urban environment. These options would also present a higher risk of planning refusal and third-party objection.
X-4: Construct a new tunnel Not taken forward	Build a new tunnel underground between Elstree and St Johns Wood. Feed the cable through this new tunnel. Would also require new headhouses along the route.	Construction of a new bored tunnel would require extensive third-party land rights, complex planning consent, introducing significant programme and cost risk without delivering any additional benefit over reuse of the existing tunnel.

Shortlisting rationale and influence of stakeholder considerations

- The non-build strategic options (A-C) were ruled out because they wouldn't deliver on the need to intervene on the network that was identified by NESO.
- Of the infrastructure options, the preferred option is to use the existing future-proofed tunnel (Option X-1). The construction of new infrastructure when there is already an existing tunnel that has been future-proofed with the specific intention of providing space for this cable would lead to unjustified costs to consumers. It also has a significantly lower environmental impact than the other infrastructure interventions among our strategic options. The scope of work also aligns with HND Essential Option ESC1.

The tunnel therefore provides a proven, operational corridor that avoids the need for new surface or underground routes through densely developed urban areas. Using that available space would minimise additional interaction with third-party infrastructure and reduce the impact on the live transmission network during construction.

4.2 Description of preferred option

Proposed works: Re-use of the existing Elstree–St John's Wood cable tunnel to add second circuit within the purpose-built, strategic corridor that was built into the original design of the tunnel as part of future proofing.

How it meets the driver: Provides a second cable in the tunnel, increasing capacity.

Uncertainties and assumptions: Further surveys were undertaken during the optioneering phase to assess whether the existing tunnel is still fit for purpose, given that the existing Elstree-St John's Wood was originally designed to accommodate a second circuit. We have assessed the capacity of the existing forced ventilation (cable rating) system during optioneering but its compatibility and condition for usage for the life span of both circuits will be assessed further during development including the need for any modifications.

Drawing: Please see a profile of the option in Figure 10.

[redacted]

4.3 Quantitative analysis of preferred option

Cost estimates of preferred 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 ([redacted]). 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.

Table 15: Cost Estimate Breakdown

Option	OHL (£m)	Cables (£m)	Substation (£m)	Total (exc. risk) (£m)	Biodiversity (5%)	Total (incl. 13.8% risk) (£m)
[redacted]						

Cost drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements.

Using the cost book, the main factors driving the costs for the shortlisted options are:

- Unit costs of SGTs;
- Operational cut and fill works for substation area.

Cost-benefit analysis

This subsection sets out the CBA for the preferred option and a breakdown of the costs and benefits underpinning that analysis. This analysis is based on the latest cost book estimates.

Purpose and Approach

Our 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 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:

- Initial CAPEX investment required
- 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 four shortlisted options.

- Option X-1: Use the existing cable tunnel

CBA outcome

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

Table 16: Lifetime Cost-Benefit Analysis (2023/24 base prices, central carbon pricing, discounted values)

Option	Initial Investment (£m)	PV of Lifetime Costs (£m)	PV of Monetised Benefits (£m)	NPV (£m)
[redacted]				

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.
- Price base: 2023/24 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).

Costs

Table 17: Summary of all additional Capex costs (2023/24 base prices)

Option	Capex		Total costs (£m)
	Initial works (£m)	Future replacement (40yr) (£m)	
Option X-1: Use the existing cable tunnel	[redacted]		

Benefits

The following benefits have been included within the CBA:

- Carbon cost of construction reduction
- Summary of all Benefits

Table 18 presents the summary of all (undiscounted) benefits, including environmental and non-environmental benefits, considering the central base case carbon price.

Table 18: Summary of all benefits

Option	Environmental Benefits		Non-Environmental Benefits		Total Benefits (£m)
	Carbon costs of construction (£m)	Gas leakage (£m)	Transmission loss (£m)	Other benefits (£m)	
Option X-1: Use the existing cable tunnel	[redacted]				

5. ESC1 Connection Optioneering

This section sets out the optioneering for connecting a new circuit in the existing Elstree – St John's Wood tunnel (selected as the preferred option in Section 4, ESC1 Circuit Optioneering) at Elstree and St John's Wood substations as part of ESC1.

5.1 Elstree connection

Longlist of options considered

For the connection of the cable at Elstree substation, we considered five options and assessed them based on the balanced scorecard categories. An overview of the assessment of our longlist options is provided in Table 19 below.

Table 19: Summary of all identified (Long List) options for connecting at Elstree substation

Option	Technical Description	Relevant Diagrams or Layout References	Consenting and Land Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
[redacted] **Taken forward to detailed optioneering**	Extension of existing GIS to the South-East. [redacted]	[redacted]	**Environment:** [redacted] **Consenting:** Works are within National Grid ownership boundaries, meaning permitted development rights can be used. [redacted]. This would require planning permission. Requires use of greenfield land which requires consenting. **Land:** Works within existing National Grid land.	Technically feasible and delivers scheme requirements, and the option would have close proximity to the access road and M1. [redacted]
[redacted] **Taken forward to detailed optioneering**	Extend the existing 400 kV GIS by installing a new GIS in the ex-132 kV compound. [redacted]	[redacted]	**Environment:** Limited greenfield impact. and reduced ecological impact. **Consenting:** Works are within National Grid ownership boundaries, meaning permitted development rights can be used. **Land:** Works within existing National Grid land.	Provides a new GIS platform within NGET land and connection via GIB, with increased flexibility.
[redacted] **Taken forward to detailed optioneering**	[redacted] A new 400 kV [redacted]	[redacted]	**Environment:** Limited greenfield impact. and reduced ecological impact. **Consenting:** [redacted] **Land:** Due to the above, land would need to be acquired. [redacted]	Technically viable but require greenfield development, longer GIB runs and extensive civils, introducing higher planning, environmental and cost risks.

Option	Technical Description	Relevant Diagrams or Layout References	Consenting and Land Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
	[redacted]		[redacted]	
[redacted] **Not taken forward**	Extend the existing 400 kV [redacted] A new [redacted]	Not produced as option not viable.	**Consenting:** Hypothetically, this would be within the existing substation boundary, meaning planning application would not be needed. However, there is insufficient space. **Land:** [redacted]	[redacted]
E-5: New 400 kV AIS substation **Not taken forward**	Construction of a new 400 kV AIS substation.	Not produced as option not viable.	**Consenting:** A key insight from Letchmore Heath was that AIS options would not be viable at the Elstree site. This is because the use of AIS technology at Elstree to deliver against the investment drivers would require substation works on green belt land not presently owned by NGET, on which we would not hold permitted development rights. This means we would need to gain planning consent, [redacted] **Land:** [redacted]	**Planning, consent and land acquisition:** [redacted] AIS options are not considered to be viable at the Elstree site. Please refer to the Letchmore Heath FNC for more information. **Engineering:** Furthermore, there are technical challenges with using AIS technology at the Elstree site as a result of the need to connect into existing GIS.

Shortlisting rationale and influence of stakeholder considerations

The rational for our identified shortlist includes:

- [redacted]
- Option E-5 was ruled out on planning, consent and land acquisition grounds – please refer to the Letchmore Heath FNC for further information on these constraints at the Elstree site.
- Options E-1 to E-3 were shortlisted because they deliver against the driver and are technically viable.

Shortlisted options

We have shortlisted three options, which are described in the subsections that follow:

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

[redacted]

Proposed works: Extension of the existing GIS to the South-East. A new 400 kV Series reactor and [redacted] will be installed in vicinity along with the [redacted] (please see Figure 12, below).

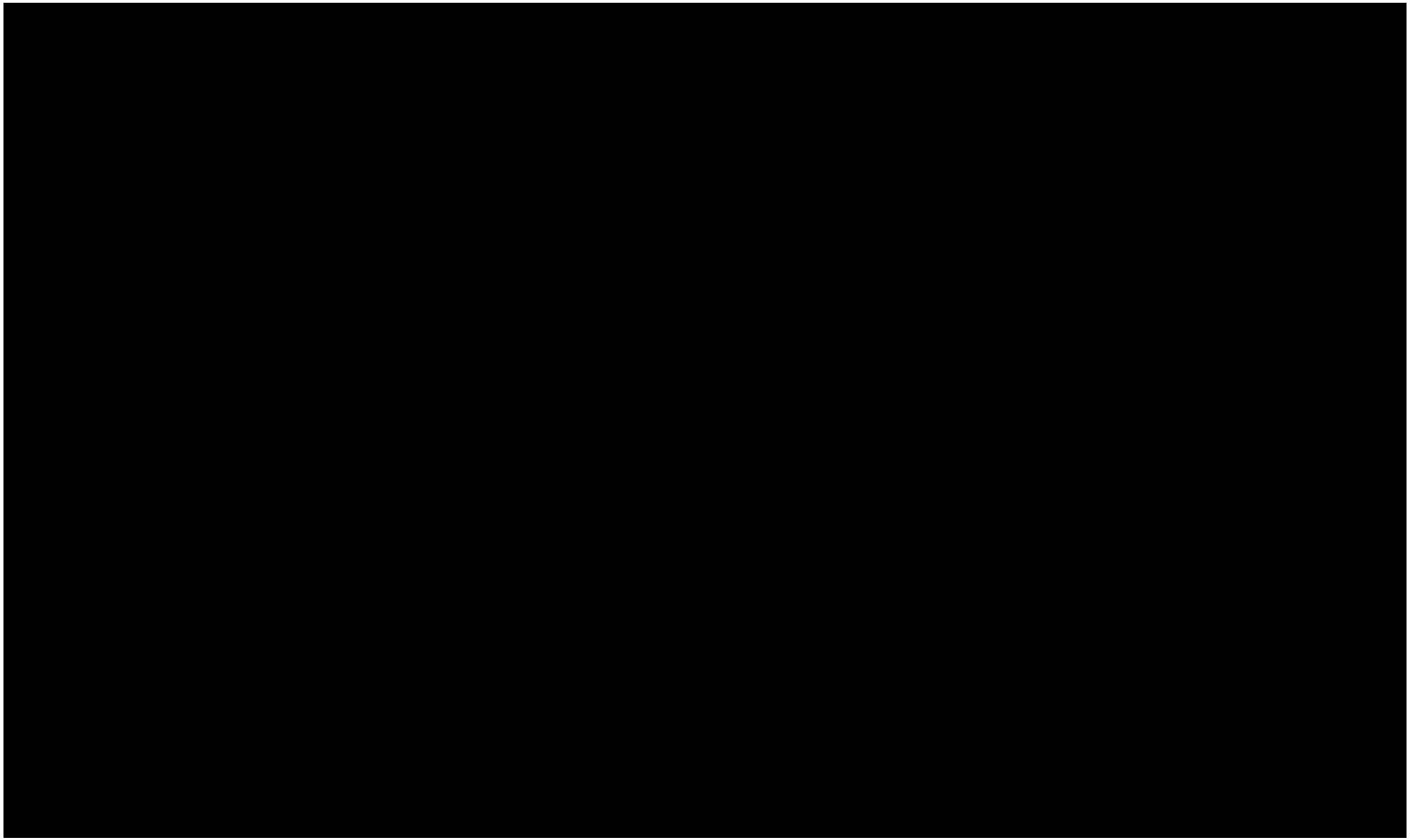
How it meets the driver: Provides a connection at Elstree substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Drawings: Please see the Single Line Diagram (SLD) and layout drawings in Figure 13 and Figure 11 below. These respectively have references PDD-102199-SLD-001 and PDD-102199-LAY-001. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.





*Note: Area of felled trees is indicated in **orange***



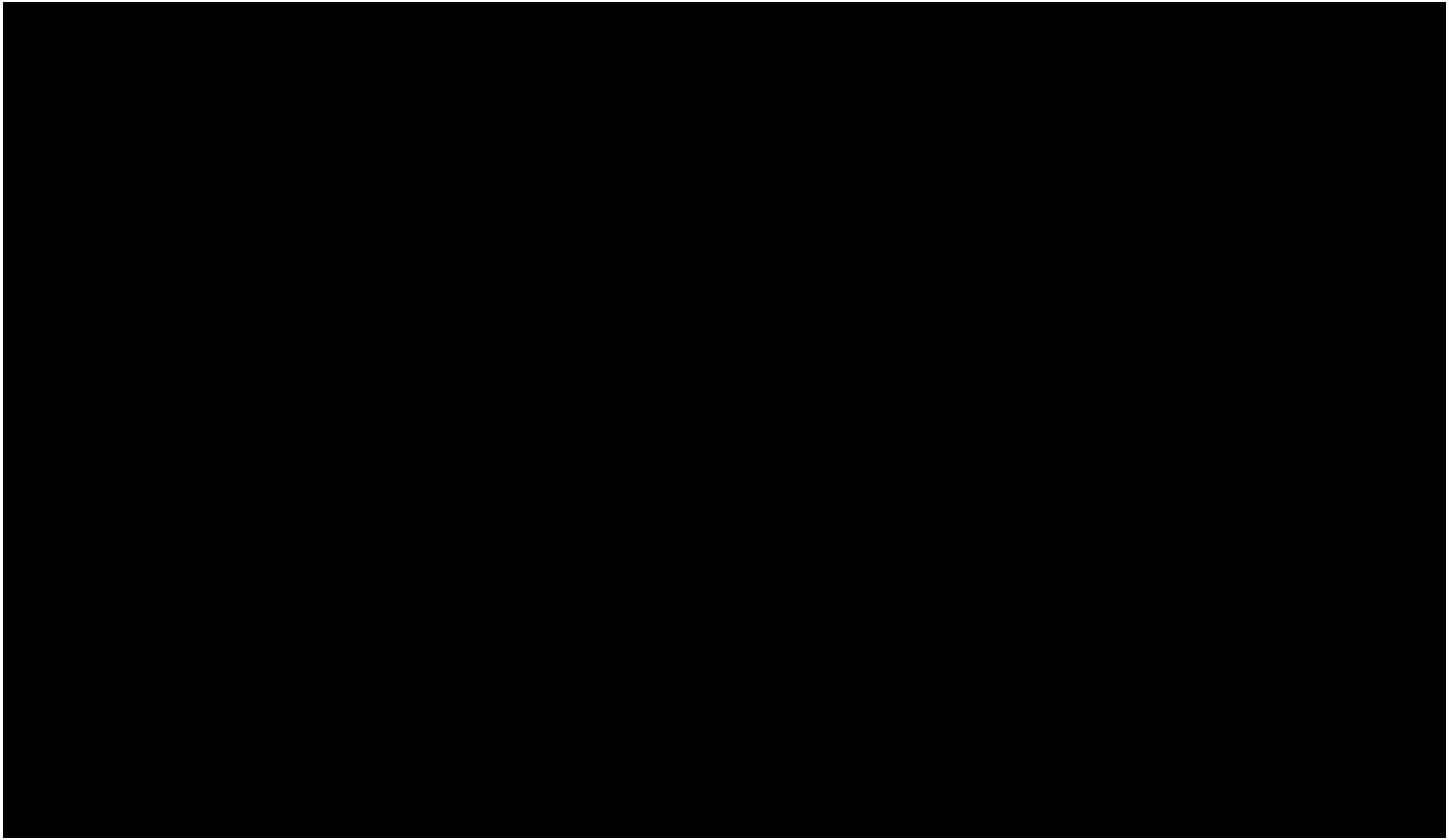
Option E-2: 400 kV New GIS Extension in 132 kV AIS area

Proposed works: Extension of the existing 400 kV GIS by installing a new GIS in the ex-132 kV compound. [redacted]

How it meets the driver: Provides a connection at Elstree substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Drawings: Please see the SLD and layout drawings in Figure 15 and Figure 14 below. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.

[redacted]



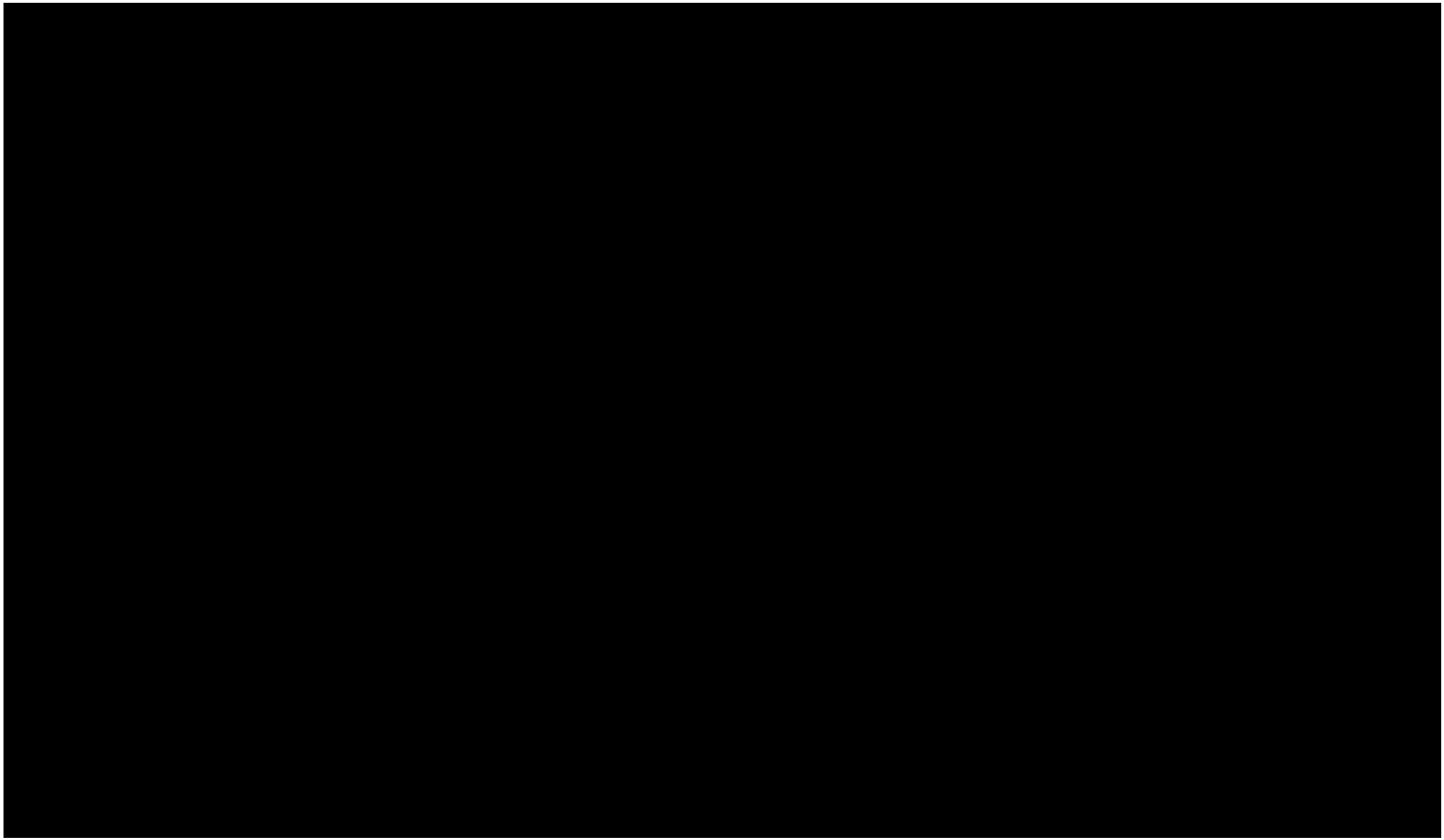
Option E-3: 400 kV New GIS Extension in the Greenfield northeast of site

Proposed works: Proposed works include the extension of the existing 400 kV GIS by installing a new GIS hall east of the substation. This land is within National Grid ownership but outside the site boundary and in an environmentally sensitive area within National Grid land and situated at the opposite corner of the overall site from the existing 400 kV GIS hall. New and existing GIS will be connected via main and reserve busbars via GIB that will run through the site. [redacted].

How it meets the driver: Provides a connection at Elstree substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Drawings: Please see the SLD and layout drawings in Figure 17 and Figure 16 below. These respectively have references PDD-102199-SLD-008 and PDD-102199-LAY-003. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.

[redacted]



Qualitative assessment of shortlisted options

Table 20: Multifactorial analysis

Option	Optioneering Categories				
	Engineering	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
E-1: 400 kV GIS Extension of existing building	✓ **Technical performance:** Keeps all 400 kV infrastructure in a single contained area. All 400 kV equipment will be housed within a single building. × **Future:** [redacted]	✓ **Emissions (SF_6):** GIS extension to use SF_6 free / clean air solution. ✓ **Emissions (other):** Short GIB routes means less gas used. × [redacted] Nature **(2):** Existing dormice in Elstree. Surveys might be required in the greenfield to verify possible protected species, which could affect the project programme.	-	✓ **Capex:** Due to short cable length and GIB run, this will be a relatively cost-effective solution. ✓ Timely connection avoids constraint costs to consumers. × Land constraints would require costly resolution (see next column).	× **Planning and consent (greenfield):** [redacted] × **Planning and consent (trees):** Requires the clearance of trees within National Grid land ownership, but outside the existing site boundary. Tree clearance will be contrary to previous planning conditions and there is a risk that the work would no longer fall under permitted development and would require a full Town and Country Planning Act (TCPA) application. This option carries reputational risk as well. × **Land:** [redacted] × **Stakeholder impact:** New reactors close to public road (Hillfield lane). Possible noise outside the substation. Circuits are crossing the road, so the road will be blocked during construction.

Option	Optioneering Categories				
	Engineering	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
	Supporting Evidence: Front End Engineering Design (FEED) report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	-	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** Record of stakeholder engagement. FEED report. Please also refer to images of trees that would require clearing on the site in Option E-1: 400 kV GIS Extension of existing building
	Detractor	Detractor	Neutral	Benefit	Strong Detractor
E-2: 400 kV New GIS Extension in 132 kV AIS area	✓ **Technical performance:** Operations supportive of proposed design. GIS located in disused area of substation (Brownfield) with inherent minimal impediment to the execution of the works. ✓ [redacted] × **Technical performance:** 400 kV GIS now split across two buildings. × **Safety:** Risk of smoke in M1 in case of fire.	✓ **Emissions (SF_6):** GIS extension to use SF_6 free / clean air solution. • **Emissions (other):** Longer [redacted] from existing GIS hall to new GIS than option E-1, but shorter than E-3. Longer GIB routes use more gas.	✓ **Delivery risk (consenting and planning):** is lower within the boundary favouring this option. It utilises existing internal land within the substations.	• **Capex:** Longer [redacted] existing GIS hall to new GIS than option E-1, but shorter than E-3. Longer GIB routes have greater capex. ✓ Timely connection avoids constraint costs to consumers.	✓ Planning and consent: No interference with greenfield to install GIS and reactors. ✓ Land: The option utilises existing internal land within the substations, so from a visual point of view this reduces the impact on the public unlike E1 tree clearance is a huge visual impact within the highway.
	Supporting Evidence: FEED report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	-	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** FEED report.
	Benefit	Neutral	Strong Benefit	Neutral	Strong Benefit
[redacted]	✓ **Technical performance:** This location has fewer existing cables in the area × **Technical performance:** 400 kV GIS now split across two buildings × **Future:** Limits future extension. Limited space to install more CB and cables. × **Safety:** Risk of smoke in M1 in case of fire.	✓ **Emissions (SF_6):** GIS extension to use SF_6 free / clean air solution. [redacted] × **Nature:** Existing dormice habitat at Elstree. Sundon circuits to be installed in area with dormice. Possible ecological issues with licences and remedial work. Risk of finding other protected species in the area.	-	× **Capex:** Longest cable length and GIB run (~500m) required back to the existing GIS hall. ✓ Timely connection avoids constraint costs to consumers.	[redacted] The site is on NGET land, meaning extension could potentially be permitted development if criteria are met. [redacted]

Option	Optioneering Categories				
	Engineering	Environmental	Deliverability	Economic/Consumer Value	Consenting /Stakeholder
					[redacted]
	Supporting Evidence: FEED report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	-	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** FEED report.
	Detractor	Detractor	Neutral	Detractor	Detractor

Further considerations that apply to all projects on deliverability include:

- **Delivery date:** Due to multiple activities happening on the site at the same time, there is a risk of delays by third party work that could affect the main construction programme. However, delivery date is the same for each option.
- [redacted]

Conclusion from detailed qualitative assessment

Based on the detailed qualitative assessment, Option E-2 is the preferred option because:

- **Environmental:** Avoids the felling of a large number of trees, which is a drawback of E-1
- **Engineering (future proofing):** Allows future expansion of 400 kV GIS
- **Engineering (technical performance):** Utilises brownfield areas to install new GIS [redacted]
- **Consenting and land (planning consent):** No interference with greenfield to install GIS and reactors

Quantitative analysis of shortlisted options

Cost estimates of shortlisted options

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 ([redacted]). 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.

[redacted]

Cost drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements.

Using the cost book, the main factors driving the costs for the shortlisted options are:

- Unit costs of SGTs;
- Operational cut and fill works for substation area.

Cost-benefit analysis

This subsection sets out the CBA for the preferred option and a breakdown of the costs and benefits underpinning that analysis. This analysis is based on the latest cost book estimates.

Purpose and Approach

Our 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 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:

- Initial CAPEX investment required
- 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 four shortlisted options.

[redacted]

CBA outcome

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

[redacted]

On the basis of the discounted lifetime CBA results (Table 22), Option E-1 delivers the highest Net Present Value) (NPV) [redacted]) and therefore represents the preferred option on consumer value grounds. While Options E-2 and E-3 delivers lower NPVs than E-1 [redacted]). This recommendation analysis is subject to confirmation through deliverability, consents/land, outage and risk considerations, and any CBA sensitivities (e.g. carbon price trajectories) set out in the assumptions below.

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.
- Price base: [redacted], 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).

Costs

Table 23: Summary of all additional Capex and Opex costs (2023/24 base prices)

Option	Capex		Opex	Total costs (£m)
	Initial works (£m)	Future replacement (40yr) (£m)	Maintenance costs (£m)	
[redacted]				

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

Table 24: Summary of all benefits

Option	Environmental Benefits		Non-Environmental Benefits		Total Benefits £m)
	Carbon costs of construction (£m)	Gas leakage (£m)	Transmission loss (£m)	Other benefits (£m)	
[redacted]					

Preferred option for Elstree connection

The preferred solution is Option E-2, which is a 400 kV [redacted]

- **Consumer value / economic performance:** The option ensures timely delivery of the programme, avoiding expensive constraint costs.
- **Engineering:** [redacted] has the greatest future-proofing potential among the options considered.
- **Environment:** [redacted] reduces the environmental impact. Alternative Option E-1 requires the felling of a large section of trees.
- **Planning, consent and stakeholder acceptance:** [redacted]

[redacted] Avoids development on green belt land and the associated consenting risk and programme uncertainty present in alternative option E-3.

- **Deliverability:** Avoiding the need for land acquisition or planning consent ensures the programme can be delivered on time.

5.2 St John's Wood connection

Longlist of options considered

For the connection of the cable at St John's Wood substation, we considered seven options and assessed them based on the balanced scorecard categories. An overview of the assessment of our longlist options is provided in Table 25 below.

Table 25: Summary of all identified (Long List) options for connecting at St John's Wood substation

Option	Technical Description	Relevant Diagrams or Layout References	Consenting and Land Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
S-1: 400 kV GIS busbar extension **Taken forward to detailed optioneering**	Extend existing 400 kV GIS by extending middle of busbar	SLD and layout drawing provided in Option S-1: 400 KV GIS Busbar extension in Section 5.2.	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	Feasible but requires major building modifications, live plant interfaces and complex outages
S-2: 400 KV GIS Busbar extension [redacted] **Not taken forward**	Extend existing 400 kV by extending busbars across GIS building,	Not produced as option not viable.	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	Not feasible due to system constraints of additional outages. Difficulty to execute extension of GIB. Involves removal of existing rooms and outages to implement extension.
S-3: Tee-off into 400 [redacted] **Taken forward to detailed optioneering**	[redacted]	SLD and layout drawing [redacted]	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	Feasible but requires basement works and constrained cable routing
S-4: [redacted] **Not taken forward**	[redacted]	Not produced as option not viable.	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	Dismissed due to a tee-off from the SGT 7 circuit to connect Elstree 2 was deemed as unacceptable. [redacted]

Option	Technical Description	Relevant Diagrams or Layout References	Consenting and Land Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
S-5: New 400 kV GIS into the 275 kV AIS Building **Not taken forward**	New 400 kV GIS into the 275 kV AIS Building	Not produced as option not viable.	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	[redacted]
S-6: Elstree 2 connection [redacted] **Taken forward to detailed optioneering**	Relocate 400 kV [redacted]	SLD and [redacted]	**Land and consents:** Work within substation footprint, meaning permitted development and no land take needed. Minimal stakeholder and community impact.	Feasible option. Avoids major building works and provides lowest disruption and outage risks.
S-7: New 400 kV AIS substation **Not taken forward**	Construction of a new 400 kV AIS substation.	Not produced as option not viable.	**Land:** Located in a dense urban environment in central London.	**Land:** [redacted] Site Background in Section 1.2.

Shortlisting rationale and influence of stakeholder considerations

The rational for our identified shortlist includes:

- Options S-2, S-4 and S-5 were ruled out on engineering grounds. S-2 would not be feasible due to system constraints, while S-4 would require [redacted]. S-5 would require the creation of a point of connection at the 400 kV GIS in the 275 kV building
- Option S-7 was ruled out on land acquisition grounds [redacted]
- Options S-1, S-3 and S-6 were shortlisted due to being technically feasible

Shortlisted options

We have shortlisted three options, which are described in the subsections that follow:

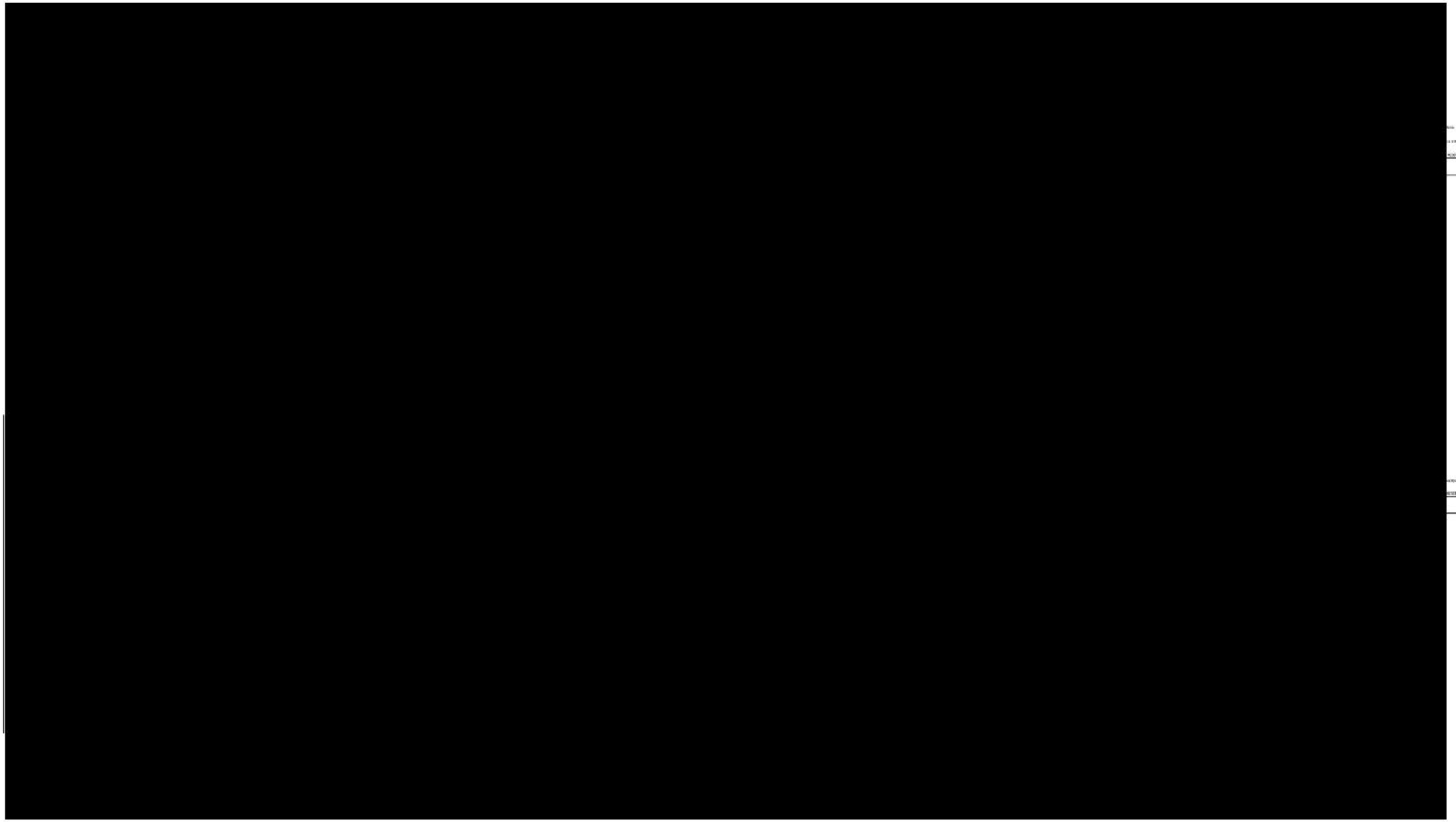
- **S-1:** 400 KV GIS Busbar extension
- [redacted]**S-3:** Tee-off [redacted]
- **S-6:** Elstree 2 connection [redacted]

[redacted]

How it meets the driver: Provides a connection at St John's Wood substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Drawings: Please see the SLD and layout drawings in Figure 19 and Figure 18 below. These respectively have references PDD-102199-SLD-002 and PDD-102199-LAY-005. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.





[redacted]

Proposed works: Proposed works include [redacted] enable the connection of the new Elstree–St John's Wood 400 kV circuit 2. The [redacted]

How it meets the driver: Provides a connection at St John's Wood substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Assumptions and uncertainties: The [redacted]

Drawings: Please see the SLD and layout drawings in Figure 21 and Figure 20 below. These respectively have references PDD-102199-SLD-004 and ,PDD-102199-LAY-007. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.

[redacted]

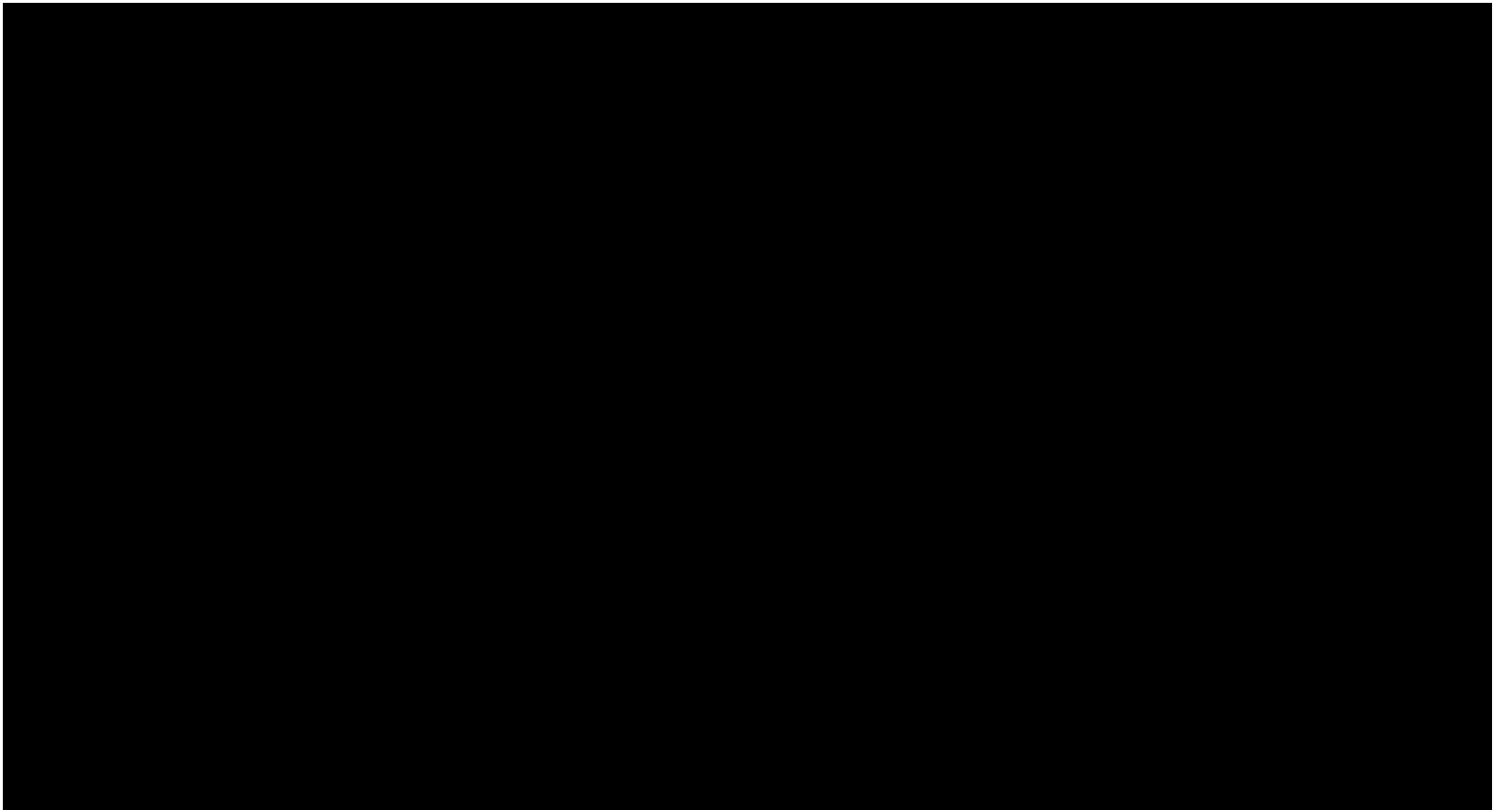


[redacted]

How it meets the driver: Provides a connection at St John's Wood substation for the second circuit in the existing Elstree-St John's Wood tunnel, facilitating an increase in capacity.

Drawings: Please see the SLD and layout drawings in Figure 23 and Figure 22 below. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.





Qualitative assessment of shortlisted options

Table 26: Multifactorial analysis

Option	Optioneering Categories				
	Engineering	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
S-1: 400 KV GIS Busbar extension	✓ **Future (bay extension):** Creates space for [redacted] future extension, this could be used for a future 400 kV GIS hall. ✓ **Technical performance (space for operation and maintenance):** [redacted] × **Technical performance (access):** Design reduces the rear access to Main Bus Section 2. [redacted] × **Technical performance (complexity):** Design requires building modifications. [redacted] This will need to be evaluated by a structural engineer.	× **Emissions (SF_6):** New equipment for GIS extension will be insulated with SF_6. It is not possible to extend the GIS with SF[redacted]	× **Delivery date:** Option is more difficult and risks requiring a longer time to implement with a more complex programme than option S3 × **System access:** Outages required to implement the works could be difficult to be made available	× **Capex:** Due to the extents of the building modifications, this option is likely more expensive than option S-3, 6. ✓ Timely connection avoids constraint costs to consumers.	✓ **Land acquisition:** Solution is within substation's existing boundaries. Using existing NGET land mitigates land acquisition risks. • **Planning and consent:** While permitted development may be possible, the construction of the buildings within the NGET operational boundary would require a prior approval application. × **Stakeholder impact:** Noise and vibration during construction might disrupt neighbours.
	Supporting Evidence: FEED report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	**Supporting Evidence:** Internal delivery planning tools. FEED report.	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** FEED report.
	Detractor	Detractor	Neutral	Benefit	Neutral

Option	Optioneering Categories				
	Engineering	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
S-3: Tee-off into 400 kV [redacted]	[redacted] **Technical performance (complexity):** Easier to implement cable route between headhouse and circuit breaker compared to option S1. Requires fewer modifications in the building than option S1. [redacted] [redacted] **Technical performance (complexity):** However, more GIS modifications than option S9. [redacted] ✓ **Impact to wider electrical system:** Minimal disruption to overall GIS substation. No main or reserve busbar outage required, only circuit outage. × **Technical performance (access):** [redacted] will be very tight at high level. [redacted]	• **Emissions (SF_6):** Requires less equipment with SF_6 compared to option S1, but more than S3.	✓ **Delivery date:** Faster implementation compared to option S1 ✓ **System access:** Only Requires outages [redacted] Minimal disruption compared to option S1	✓ **Capex:** Lower cost than Option S-1. ✓ Timely connection avoids constraint costs to consumers. ✓	✓ **Land acquisition:** Solution is within substation's existing boundaries. Using existing NGET land mitigates land acquisition risks. ✓ **Planning and consent:** Permitted development rights. • **Stakeholder impact:** Noise and vibration during construction might disrupt neighbours, but less than in option S1.
	Supporting Evidence: FEED report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	**Supporting Evidence:** Internal delivery planning tools. FEED report.	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** FEED report.
	Benefit	Neutral	Strong Benefit	Neutral	Benefit

Option	Optioneering Categories				
	Engineering	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting /Stakeholder**
S-6: Elstree 2 connection into [redacted]	✓ [redacted] ✓ **Technical performance (space for operation and maintenance):** It will have easier maintenance of Bus coupler 1 than option S3 ✓ **Technical performance (complexity):** [redacted] ✓ **Impact to wider electrical system:** Minimal disruption to overall GIS substation. No main or reserve busbar outage required, only circuit outage. **Technical performance (complexity):** Requires modifications to the [redacted] × **Technical performance (circuits):** SGT10A [redacted]	× **Emissions (SF_6):** Requires less equipment with SF_6 compared to option S1 and S3.	× **Delivery date:** Faster implementation compared to option S1 × **System access:** [redacted]	✓ **Capex:** Lower cost than Option S-1. ✓ Timely connection avoids constraint costs to consumers.	✓ **Land acquisition:** Solution is within substation's existing boundaries. Using existing NGET land mitigates land acquisition risks. ✓ **Planning and consent:** Permitted development rights. • **Stakeholder impact:** Noise and vibration during construction might disrupt neighbours, but less than in option S1.
	Supporting Evidence: FEED report.	**Supporting Evidence:** Environmental costs calculated as part of our CBA. FEED report.	**Supporting Evidence:** Internal delivery planning tools. FEED report.	**Supporting Evidence:** FEED report. Constraint cost estimates provided to [redacted]	**Supporting Evidence:** FEED report.
	Detractor	Detractor	Neutral	Detractor	Benefit

Conclusion from detailed qualitative assessment

Based on the detailed qualitative assessment, Option S-6 is the preferred option because:

- **Engineering (impact to wider electrical system):** Less disruptive of existing infrastructure
- **Deliverability (system access):** Less onerous outage requirement, more feasible cable entry to the existing headhouse
- **Engineering (technical performance):** Easier cable route through the basement. Fewer constraints in the maintenance of Busbar 1 compared to S-3

Quantitative analysis of shortlisted options

Cost estimates for shortlisted options

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). 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.

Table 27: Cost Estimate Breakdown

Options	OHL (£m)	Cables (£m)	Substation (£m)	Total (exc. risk) (£m)	Biodiversity (5%)	Total (incl. 13.8% risk) (£m)
[redacted]						

Cost drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements.

Using the cost book, the main factors driving the costs for the shortlisted options are:

- Unit costs of SGTs;
- Operational cut and fill works for substation area.

Cost-Benefit Analysis

Purpose and Approach

Our Cost Benefit Analysis 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 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:

- Initial CAPEX investment required
- 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 four shortlisted options.

[redacted]

Option S-3: Tee-off into 400 [redacted]

Option S-6: Elstree 2 connection [redacted]

CBA outcome

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

[redacted]

Option	Initial Investment £m	PV of Lifetime Costs £m	PV of Monetised Benefits £m	NPV £m
[redacted]				

[redacted] is subject to confirmation through deliverability, consents/land, outage and risk considerations, and any CBA sensitivities set out in the assumptions below.

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):

- [redacted]
- Price base: 2023/24 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).

Costs

[redacted]

Benefits

The following benefits have been included within the CBA:

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



Preferred option for St John's Wood connection

The preferred solution is Option S-6, which is an Elstree 2 connection into [redacted]

- **Consumer value / economic performance:** The CBA shows this option to have the highest NPV relative to the baseline among shortlisted options in this category.
- **Engineering:** It provides the lowest level of disruption to the existing GIS building and the most practical and deliverable construction sequence. It requires minimal building modifications and avoids major structural alterations. It also provides the most direct and feasible cable entry route into the existing headhouse and maintains appropriate clearances for long-term operation and maintenance.
- **Planning, consent and stakeholder acceptance:** Avoids main or reserve busbar outages, requiring only short, localised circuit outages.
- **Deliverability:** Presents the lowest overall programme and outage risk of the shortlisted connection options.

6. Preferred overall option

Following the optioneering set out in Section 3, Section 4, and Section 5 our overall preferred option for the NWL investment is as follows:

- For SER4, our preferred option is Y-2, which is to reconductor the existing OHL route between Sundon and Elstree with a [redacted]
- For ESC1, our preferred option is X-1, which is to route a cable through the existing [redacted]
- For the connection of the ESC1 cable at St John's Wood substation, our preferred option is S-6, which is an Elstree 2 connection [redacted]

Taken together, the preferred solution enables the investment drivers and avoids constraint costs to consumers that would otherwise be incurred. It also supports the Pathway to 2030 strategy and enables increased power transfer into London, aligned with decarbonisation and offshore wind growth. The [redacted]

The qualitative and quantitative analysis undertaken as part of the optioneering process demonstrates that the preferred solution provides the most balanced and deliverable outcome when assessed against the balanced scorecard criteria. Information is set out for each option category, below.

6.1 Project benefits and outputs

The key outputs delivered by this option are as follows:

- Additional 400 kV network capacity along the Sundon-Elstree-St John's Wood route to support increased power demands into London. [redacted]
- Second 400 kV circuit Elstree–St John's Wood via existing tunnel
- Reconductoring OHL Sundon–Elstree
- New 400/132 kV transformation via Letchmore Heath
- System capability to enabling wider Pathway to 2030 network objectives

ESC1 materially changes power flow optionality into Central London, which improves NESO's ability to manage constraints and reduces reliance on eastern London corridors during stress events. The reinforcement improves operational flexibility across transmission, distribution and system operation, supporting NESO's future operability requirements for a highly meshed, high-demand urban system.

Additional power capacity enabled by NWL reduces risk of development sterilisation, connection deferrals and supports spatial energy planning certainty for energy stakeholders. Timely

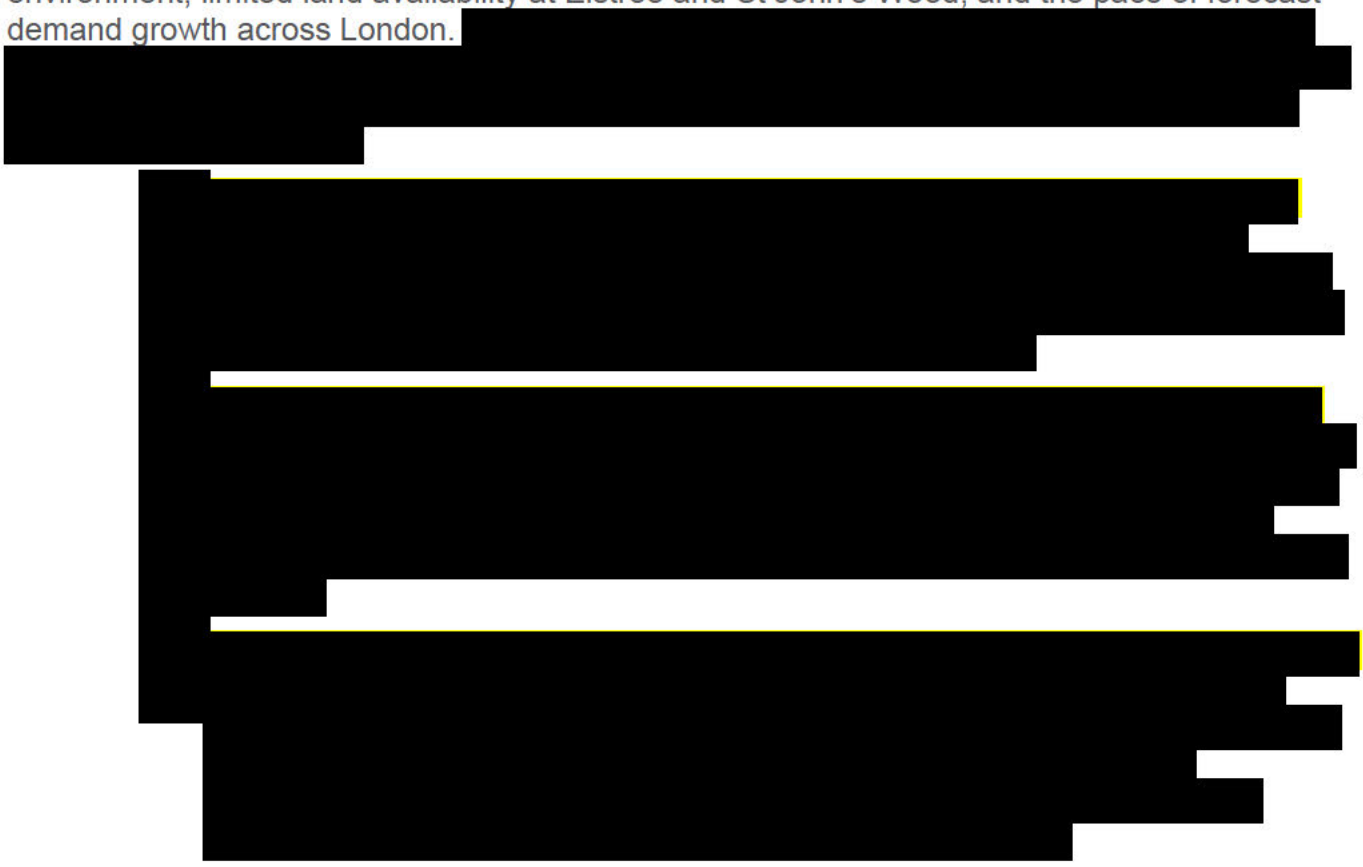
delivery of NWL provides certainty to local authorities and developers, reducing whole-system inefficiency caused by stop-start connection planning.

6.2 Futureproofing

NWL supports the long-term strategy to uprate the network from 275 kV to 400 kV by connecting the Sundon-Elstree circuit directly into the 400 kV substation. The existing 275 kV network increasingly constrains future demand growth and renewable power flows into London.

The preferred option also delivers a single strategic point of connection into London via the Elstree 400 kV GIS extension (which is being delivered within the scope of the Letchmore Heath project). This provides a coordinated interface between the wider system and the London network, enabling power to be distributed efficiently downstream.

More broadly, we have undertaken co-ordinated future-proofing with interfacing projects in the region. There are inherent challenges in future-proofing due to the highly constrained urban environment, limited land availability at Elstree and St John's Wood, and the pace of forecast demand growth across London.



6.3 Influence of stakeholders on optioneering

[redacted] To provide value to consumers, we have therefore sought to prioritise timely delivery in our optioneering.

The minimal additional land and consenting required for the scheme has also influenced our optioneering.

[redacted]

7. Delivery

A programme of works for NWL Scheme is outlined below in Figure 24. The Available For Commercial Load (ACL) is [redacted] ensures timely delivery of the investment need and prevents expensive constraint costs.

[redacted]

7.1 Procurement and contracting strategies

[redacted]

[15] The ICE set up the Infrastructure Client Group (ICG), of which National Grid is a member, for a very specific, policy-driven reason linked to improving how UK infrastructure is planned and delivered.

[redacted]

7.2 Delivery risks

As highlighted in the multifactorial analysis (see Table 20 and Table 26), the preferred option still contains some risks. These are also listed in the CBA risk register. An overview of the high-level risk assessment and associated mitigations is provided in Table 31, below. A full risk assessment is expected to be carried out at a later stage with the output updated accordingly.

Table 31: Risk assessment and proposed mitigations for the preferred option

Risk	Mitigation	Likelihood
Procurement: Lead times for delivery of long lead plant items may lead to a delay in the programme implementation. Procurement timescales for the delivery and manufacturing of long lead items are currently affected by demand in the market, including [redacted] and [redacted]	To mitigate programme delays, the manufacturing slots are being secured to ensure delivery for construction. [redacted]	Medium

Risk	Mitigation	Likelihood
[redacted]	[redacted]	
Technical Risks: There is a risk that the [redacted]	To mitigate this risk, [redacted] perations are also supporting with the work and surveys of the system. We are also [redacted]	High
Third-party: Third-party infrastructure can impact the proposed substation design and lead to late design alterations for the substation.	We have a programme of ongoing stakeholder consultation to understand and mitigate any potential third-party risks.	Low
Internal Interfaces: [redacted]	[redacted]	Medium
Outage: Non-availability of outage and double circuit outage windows could lead to possible delays in programme works.	We have placed and confirmed dates for required outage windows in advance. Interaction with other schemes and prioritisation will be monitored.	Low

8. Conclusion

This paper presents our Track 3 Needs Case submission for the NWL reinforcement scheme.

This submission outlines a preferred solution to satisfy the investment drivers. It seeks approval of the continuing investment need under Special Condition 3.18, and preferred solution and formal approval of the preferred option.

[redacted]

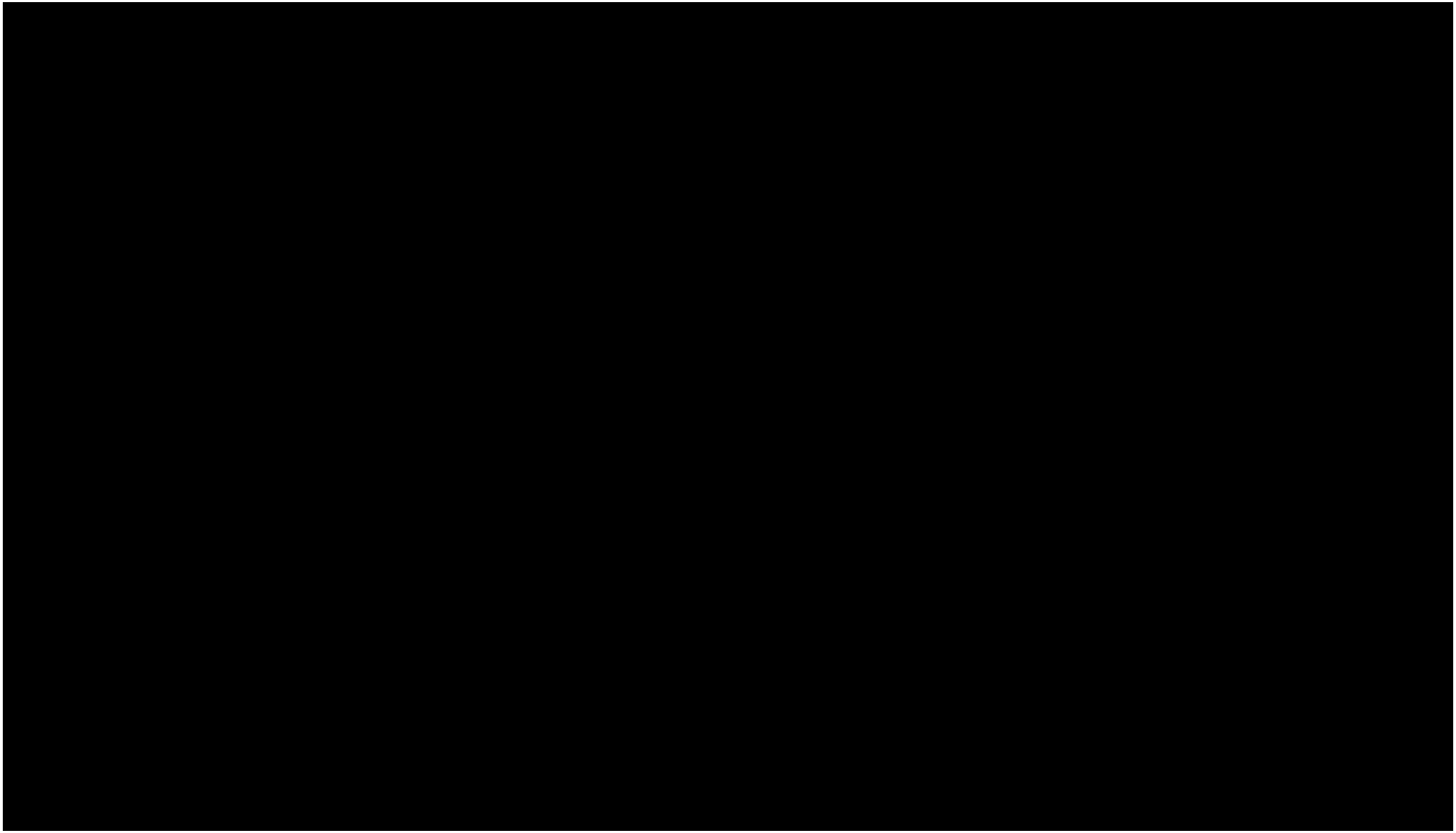
Appendix A
Glossary

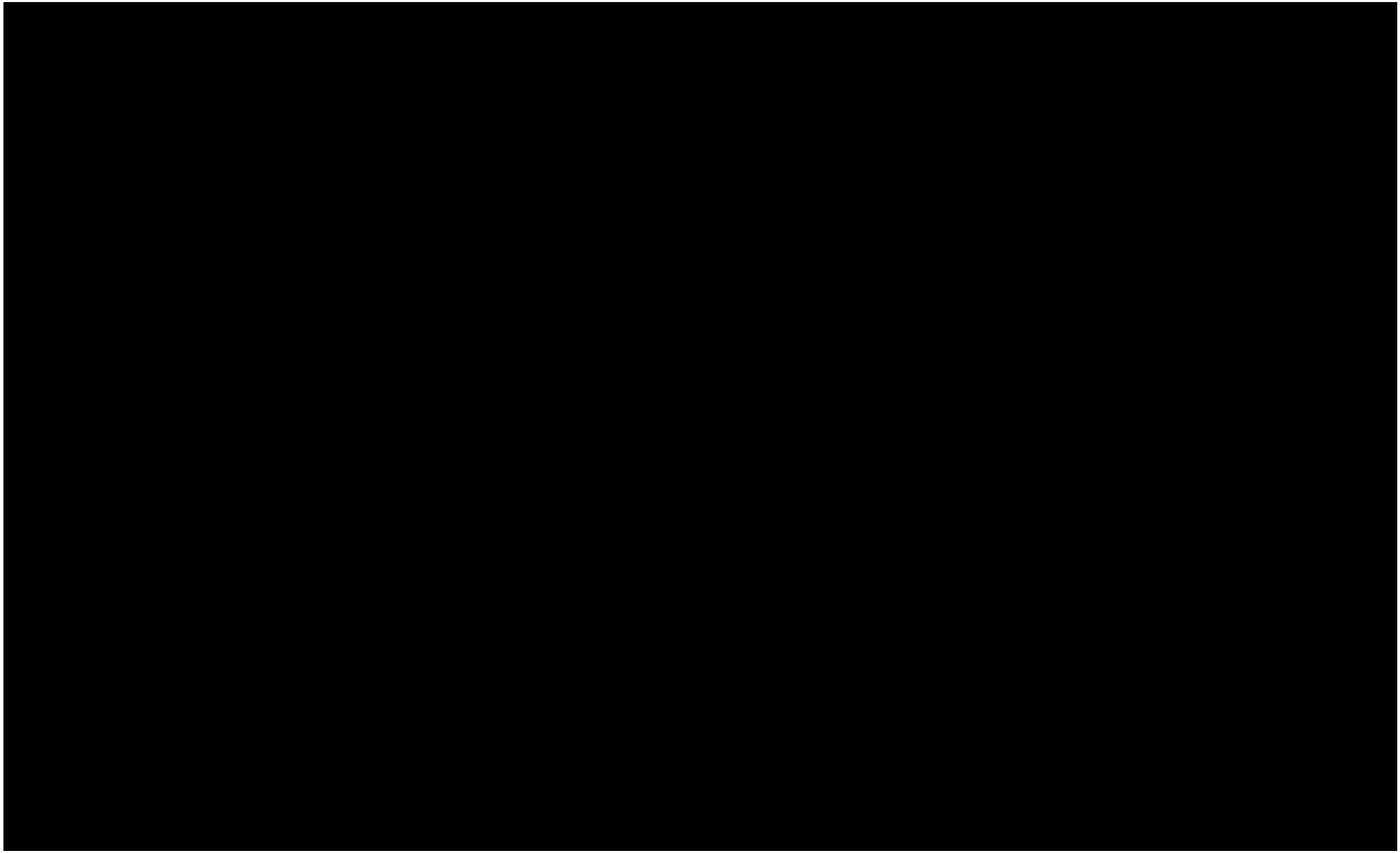
Table 32: Table of abbreviations and definitions

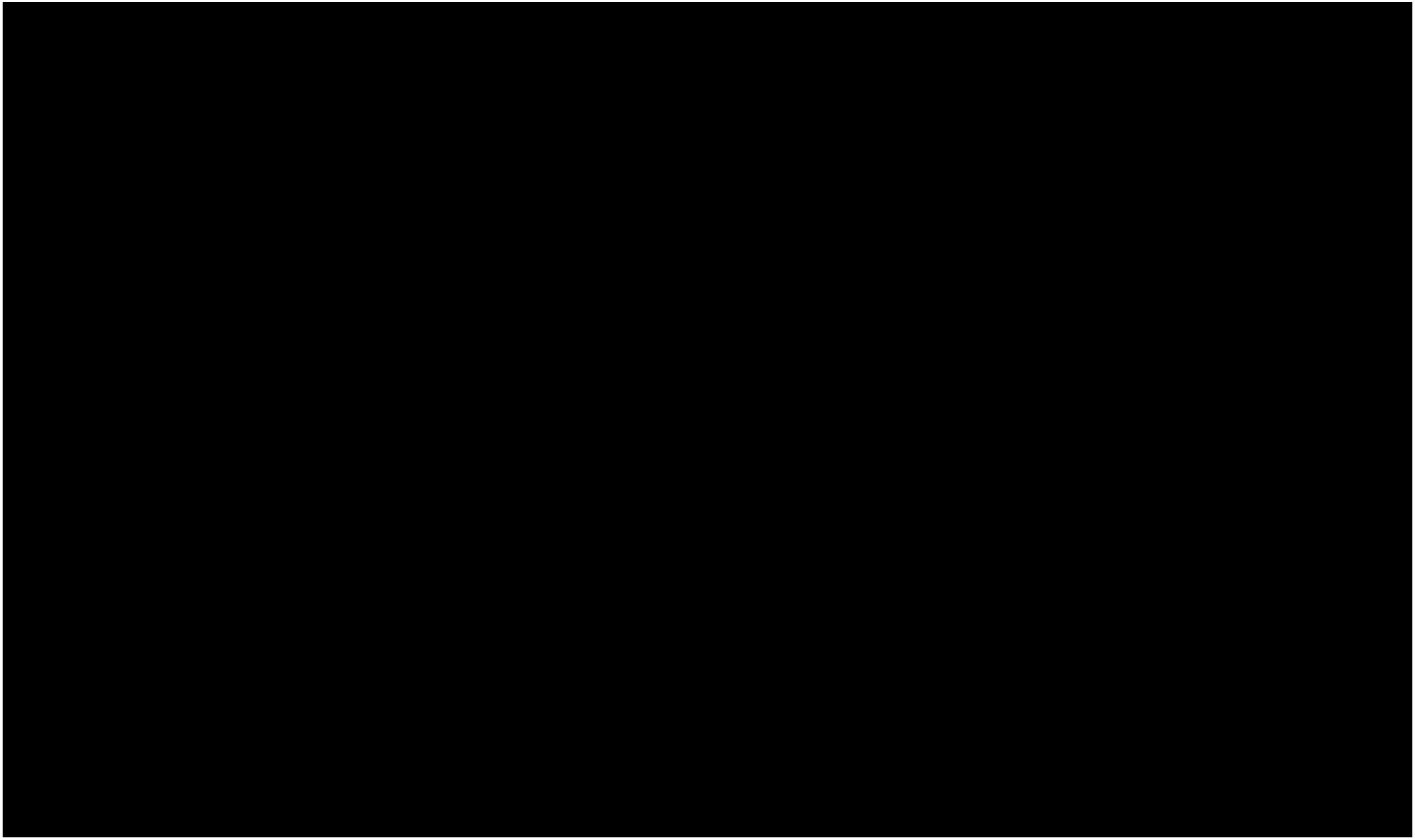
Abbreviation	Description
ACL	Available For Commercial Load
AIS	Air Insulated Switchgear
ANM	Active Network Management
APM	Advanced Procurement Mechanism
ASTI	Accelerated Strategic Transmission Investment
BESS	Battery Energy Storage System
BPDT	Business Plan Data Template
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CP2030	Clean Power 2030
CPO	Compulsory Purchase Order
DC	Direct Current
DNO	Distribution Network Operator
EAWO	Early Asset Write Offs
ECI	Early Contractor Involvement
EEW	Early Enabling Works
EJP	Engineering Justification Paper
EoL	End-Of-Life
ESO	Energy System Operator
ET	Electricity Transmission
EUL	Estimating Units Lines
FEED	Front End Engineering Design
FES	Future Energy Scenarios
FNC	Final Needs Case

Abbreviation	Description
FY	Financial Year
GIB	Gas Insulated Busbar
GIS	Gas Insulated Switchgear
GLA	Greater London Authority
GVA.s	Giga Volt Ampere Seconds
GW	Giga Watt
HDD	Horizontal Directional Drilling
HND	Holistic Network Design
HV	High Voltage
HWUP	Hackney Waltham Cross Uprating
IEC	International Electrotechnical Commission
ISS	Integrated Security System
kW	Kilo Watt
LIF	London Infrastructure Framework
LOTI	Large Onshore Transmission Investment
LV	Low Voltage
MVA	Megavolt-Amperes
MW	Mega Watt
NESO	National Energy System Operator
NG	National Grid
NGET	National Grid Electricity Transmission
NLR	Non Load Related
NOA	Network Options Assessment
NPV	Net Present Value
NWL	NWL Reinforcement Scheme
OHL	Overhead Line
OPEX	Operational Expenditure
OSW	Offshore Wind

Abbreviation	Description
PASE	Pre-Approval of Solution Engineering
PCD	Price Control Deliverables
PCF	Pre-Construction Funding
RESP	Regional Energy Strategic Planning
RRP	Regulatory Reporting Pack
SF_6	Sulfur Hexafluoride
SGT	Super Grid Transformer
SJW	St Johns Wood
SLD	Single Line Diagram
SQSS	Security and Quality of Supply Standard
TCPA	Town And Country Planning Act
TWNC	Tilbury Wymondley New Circuit Project
UK	United Kingdom
UKPN	UK Power Network
VT	Voltage Transformer
WLCA	Whole-Life Cost Analysis

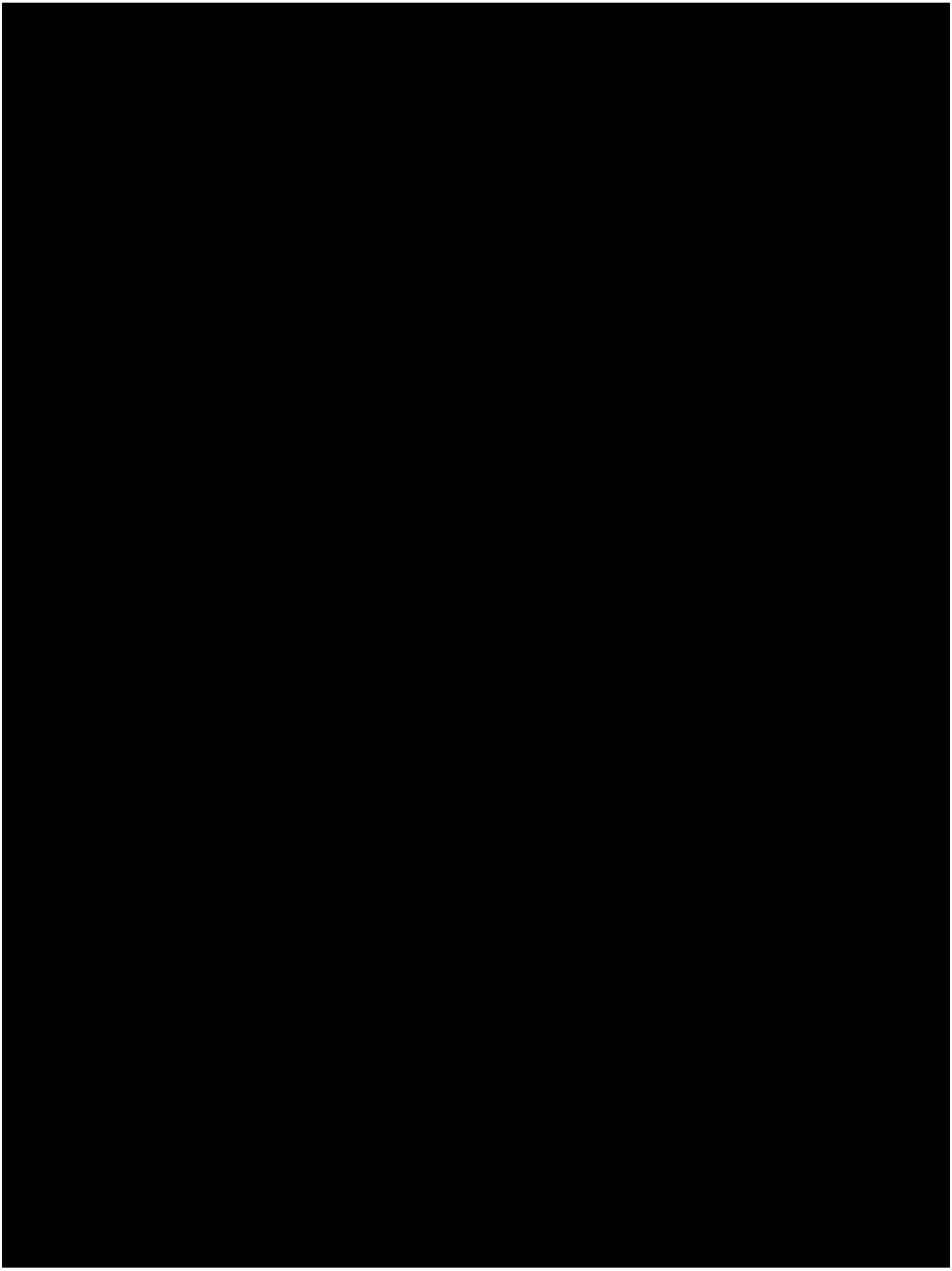




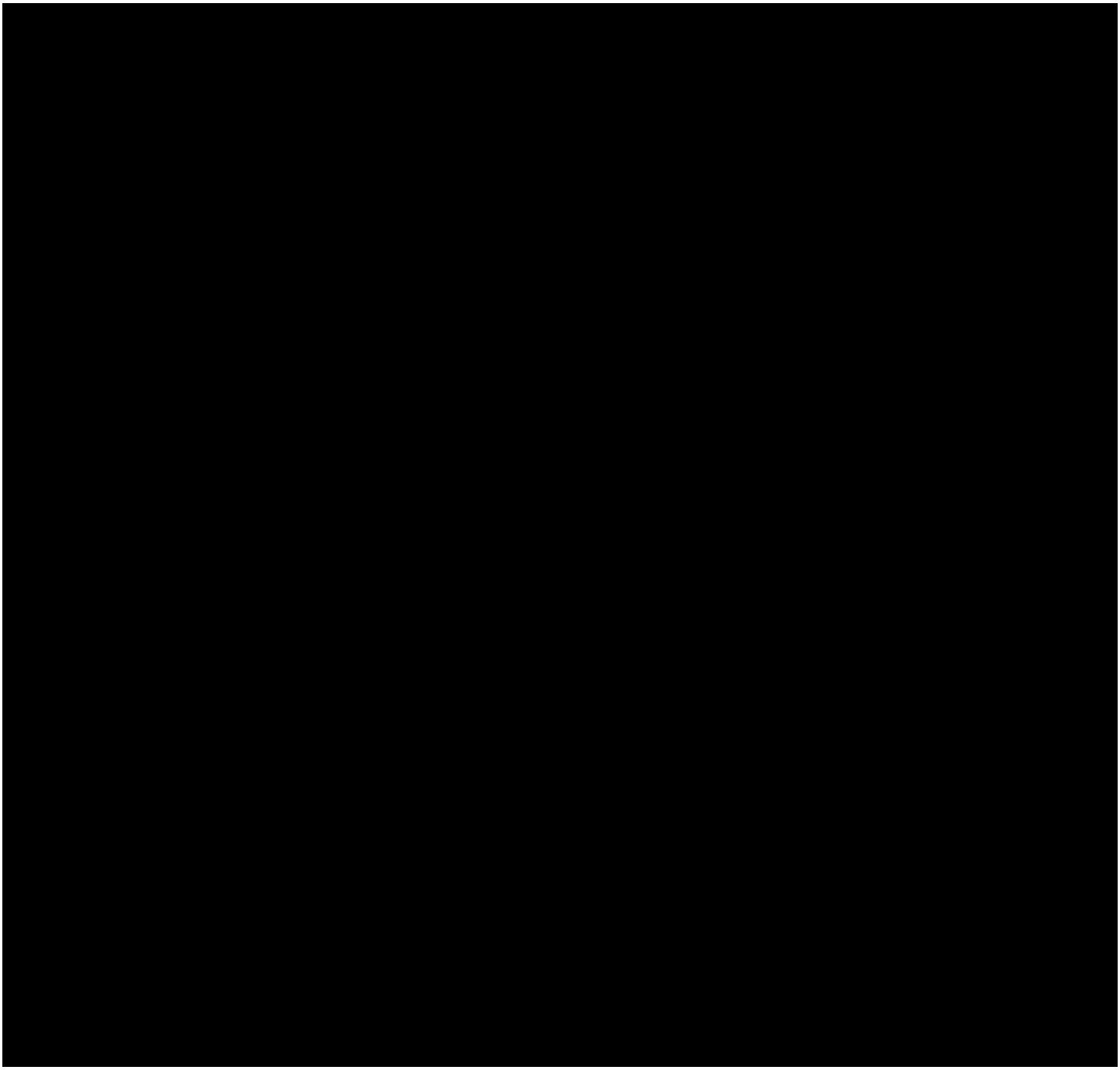














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