nationalgrid

North West London

Needs Case Summary



National Grid Electricity Transmission
Needs Case

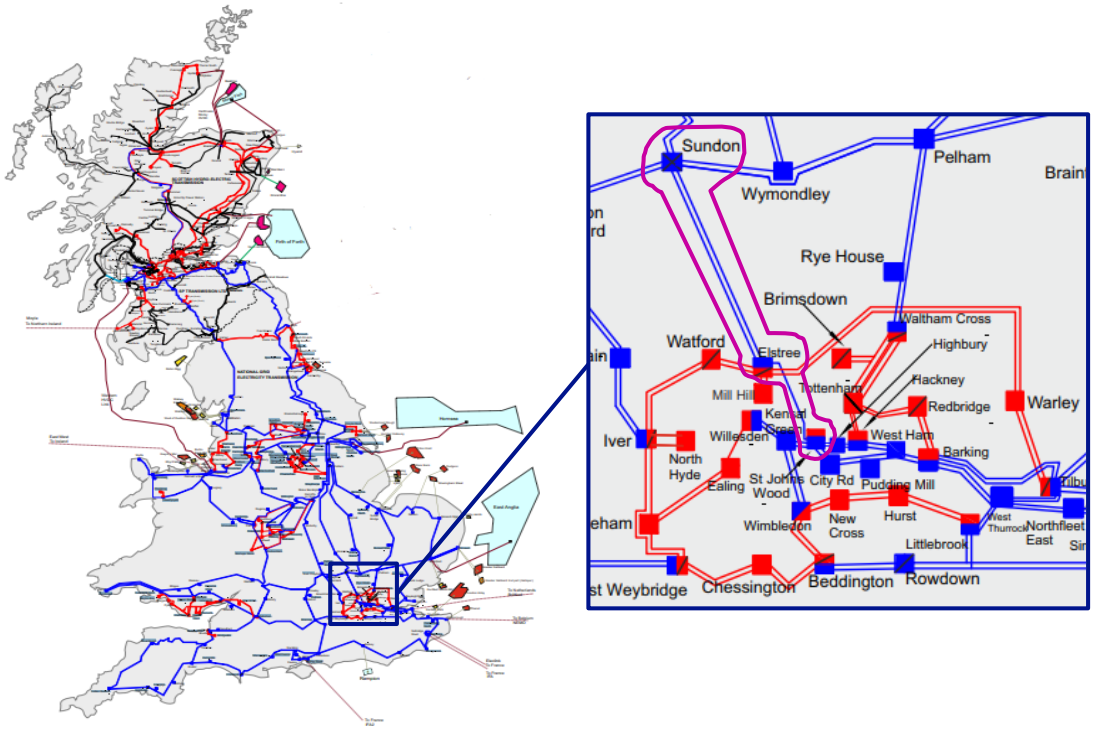
October 2026

1. Background

North West London (NWL) is a network reinforcement project that will increase the capability to import power into London. It brings together two schemes identified by the National Energy System Operator (NESO): a second 400 kV circuit between Elstree and St John's Wood substations, routed through an existing cable tunnel (ESC1), and reconductoring of the Sundon – Elstree second overhead line circuit (SER4).

The Sundon – Elstree – St John's Wood corridor is a key import route into central London. It currently relies on a single 400 kV circuit into St John's Wood, which creates a bottleneck that limits import capability. Power flows into the capital are forecast to increase significantly, with demand in Greater London forecast to rise by more than 170% by 2050.[1] Without reinforcement, consumers would face rising constraint costs and reduced system operability and security.

Figure 1: Proposed location of investment on our network



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

This Needs Case is being submitted as part of the RIIO-ET3 Load Re-opener (LR) mechanism under Special Condition 3.18 (Load Re-opener and Price Control Deliverable) of the Electricity Transmission Licence Conditions. This submission is requesting Ofgem's approval of the continuing investment need against the Load Re-opener criteria and seeks approval of the project's needs case and preferred solution. The project has been directed to Track 3.

2. Investment Drivers

The primary driver is NESO's identified need for additional network capacity. ESC1 and SER4 (formerly SER2) were confirmed by the former Electricity System Operator (ESO) as Holistic Network Design (HND) Essential Options in its Network Options Assessment 2021/22 Refresh, meaning they are needed for the delivery of 50 GW of offshore wind. The project is also designated as a Clean Power 2030 project. It will improve the balance of power flows on the Sundon – Elstree circuits,

[1] NESO, 2024. Electricity Ten Year Statement (ETYS)

increase the network's capability to import power into London and support a significant boundary upgrade across the LE1 and B14 boundaries, reducing constraint costs to consumers.

3. Options

We undertook a structured, multi-factor optioneering process to identify a proportionate and deliverable solution in the interests of consumers. As NWL combines two schemes, we optioneered each element in turn across four stages:

- increasing capacity on the Sundon – Elstree second circuit (SER4);
- adding a second Elstree – St John's Wood circuit (ESC1);
- connecting the new ESC1 circuit at Elstree substation;
- connecting the new ESC1 circuit at St John's Wood substation.

We identified longlist options within each of these four optioneering stages, covering do nothing, market-based, non-transmission whole-system, and alternative intervention options.

In optioneering both SER4 and ESC1, single options were taken forward as preferred options (see table, below). For SER4, reconductoring with Conductor A (**Option Y-2**) was assessed independently by the former ESO as the most cost-effective option for delivering the driver. For ESC1, using the existing tunnel (**Option X-1**), which was future-proofed to accommodate a second circuit, avoids the cost and impacts of building new infrastructure.

In optioneering the connection of the ESC1 new cable at Elstree and St John's Wood substations, we **shortlisted options E-1 to E-3 at Elstree and S-1, S-3 and S-6 at St John's Wood**. This was based on a high-level assessment against balanced scorecard criteria. Options were discounted where they could not deliver the investment driver, were less cost-effective, lacked space within the existing site, or introduced unacceptable planning, consenting or technical risks.

Table 1: Summary of longlist options assessment

Option	Details	Shortlist?	Preferred?
Increasing capacity on the Sundon – Elstree second circuit (SER4)			
A	Do nothing counterfactual option	No – cannot deliver the investment driver	
B	Market-based solution	No – cannot deliver the investment driver	
C	Non-transmission, whole systems solutions (DNO)	No – distribution-level flexibility cannot meet the scale and firmness of London demand	
Y-1	Hotwiring	No – cannot deliver the investment driver	
Y-2	Reconductor the existing OHL route with Conductor A	✓	✓
Y-3	Reconductor the existing OHL route with Conductor B	No – cannot deliver the investment driver	
Y-4	Reconductor the existing OHL route with Conductor C	No – cannot deliver the investment driver	
Y-5	Reconductor the existing OHL route with Conductor D	No – less cost-effective, and insufficient performance evidence at the required operating temperature	
Y-6	Reconductor the existing OHL route with Conductor E	No – less cost-effective than other conductor options	
Increasing capacity on the Elstree – St John's Wood circuit (ESC1)			
A	Do nothing counterfactual option	No – cannot deliver the investment driver	

Option	Details	Shortlist?	Preferred?
B	Market-based solution	No – cannot deliver the investment driver	
C	Non-transmission, whole systems solutions (DNO)	No – distribution-level flexibility cannot meet the scale and firmness of London demand	
X-1	Use the existing cable tunnel	✓	✓
X-2	Surface line route	No – multiple land agreements and highway closures, and unacceptable disruption in a constrained urban area	
X-3	OHL route	No – multiple land agreements and highway closures, and unacceptable disruption in a constrained urban area	
X-4	Construct a new tunnel	No – significant land, consenting, programme and cost risk with no added benefit over the existing tunnel	
Connecting the new ESC1 circuit at Elstree substation			
E-1	400 kV SF_6-free GIS extension of existing building	✓	
E-2	400 kV SF_6-free GIS extension in the 132 kV AIS area	✓	✓
E-3	400 kV SF_6-free GIS extension in greenfield northeast of site	✓	
E-4	400 kV SF_6-free GIS extension in the 275 kV AIS compound	No – insufficient space while the 275 kV AIS remains in service	
E-5	New 400 kV AIS substation	No – would require works on green belt land not owned by NGET, where planning consent is unlikely	
Connecting the new ESC1 circuit at St John's Wood substation			
S-1	400 kV GIS busbar extension	✓	
S-2	400 kV GIS busbar extension into SVC area	No – not feasible due to additional outages and difficult busbar extension	
S-3	Tee-off into 400 kV Shunt Reactor 1	✓	
S-4	Tee-off into 400 kV Super Grid Transformer (SGT) 7A	No – unacceptable risk of high switching overvoltages	
S-5	New 400 kV GIS into the 275 kV AIS building	No – would itself depend on one of the other options, making it redundant	
S-6	Elstree 2 connection into ex-Shunt Reactor 1 bay	✓	✓
S-7	New 400 kV AIS substation	No – insufficient space for AIS in a dense urban environment	

4. Qualitative Trade-offs Between the Shortlisted Options

The table below sets out how the shortlisted options for connecting the new circuit at Elstree and St John's Wood substations compare against the balanced scorecard criteria used in our qualitative assessment.

Table 2: Qualitative trade-offs between the shortlisted options

Criteria	Option E-1	Option E-2	Option E-3
Connecting the new ESC1 circuit at Elstree substation			
Engineering	**Detractor.** Keeps all 400 kV equipment in one building, but limits future extension and places new reactors close to a public road and the M1, raising fire-safety concerns.	**Benefit.** Uses a disused brownfield area of the substation and leaves more space for future GIS expansion than E-1 or E-3, although 400 kV GIS is split across two buildings.	**Detractor.** Fewer existing cables in the area, but splits 400 kV GIS across two buildings and limits future extension.
Environmental	**Detractor.** Uses SF_6-free equipment and the shortest busbar run, but requires felling a wooded area, with habitat loss and possible protected species surveys.	**Neutral.** Uses SF_6-free equipment and avoids greenfield land. Its busbar run is longer than E-1 but shorter than E-3, so uses more insulating gas than E-1.	**Detractor.** Uses SF_6-free equipment, but places new equipment on greenfield land with known dormice habitat and needs the longest busbar run.
Deliverability	**Neutral.** No material difference identified; the delivery date is the same for each option.	**Strong benefit.** Works sit within the existing substation boundary, lowering consenting and planning risk to delivery.	**Neutral.** No material difference identified; the delivery date is the same for each option.
Economic / consumer value	**Benefit.** Short cable and busbar runs make this a relatively cost-effective solution, although land constraints at tunnel headhouses would need costly resolution.	**Neutral.** Longer busbar run than E-1 adds capital cost, but this is shorter than E-3. Timely connection avoids constraint costs.	**Detractor.** Needs the longest cable and busbar run back to the existing GIS hall.
Consenting / stakeholder	**Strong detractor.** Tree clearance outside the site boundary risks losing permitted development rights, requiring a full planning application and carrying reputational risk. New reactors near a public road could cause noise.	**Strong benefit.** Uses existing land inside the substation with no greenfield works, reducing visual impact on the public.	**Detractor.** Sits within a designated Local Wildlife Site, carrying reputational risk and requiring council engagement. New reactors near a new battery storage development could cause noise.

Criteria	Option S-1	Option S-3	Option S-6
Connecting the new ESC1 circuit at St John's Wood substation			
Engineering	**Detractor.** Creates space for a future bay, but requires structural building modifications and room relocations, and reduces access to existing equipment.	**Benefit.** Simpler cable route and fewer building modifications than S-1, with no busbar outages needed. Maintenance access behind Bus Coupler 1 would be tight.	**Detractor.** Fewest GIS modifications and easier maintenance access than S-3, with no busbar outages needed. A fault would disconnect two circuits that share one circuit breaker.
Environmental	**Detractor.** New equipment must be insulated with SF_6, as there is not enough space for SF_6-free equipment.	**Neutral.** Requires less SF_6-insulated equipment than S-1.	**Detractor.** Requires the least SF_6-insulated equipment of the shortlisted options.

Criteria	Option S-1	Option S-3	Option S-6
Deliverability	**Neutral.** More complex programme, and the outages needed may be difficult to secure.	**Strong benefit.** Faster to implement than S-1, needing outages of Shunt Reactor 1 only.	**Neutral.** Faster to implement than S-1, needing outages of Shunt Reactor 1 and SGT 10A only.
Economic / consumer value	**Benefit.** The extent of building modifications makes this likely to be more expensive than S-3 and S-6.	**Neutral.** Lower cost than S-1. Timely connection avoids constraint costs.	**Detractor.** Lower cost than S-1. Timely connection avoids constraint costs.
Consenting / stakeholder	**Neutral.** Within existing NGET land, but new buildings would need a prior approval application. Construction noise and vibration could disturb neighbours.	**Benefit.** Within existing NGET land under permitted development rights, with less construction disturbance to neighbours than S-1.	**Benefit.** Within existing NGET land under permitted development rights, with less construction disturbance to neighbours than S-1.

5. Quantitative Trade-offs Between the Shortlisted Options

As a single option was taken forward for each of SER4 and ESC1, the table below compares the shortlisted substation connection options. It expresses each option relative to the preferred option at each site (Option E-2 at Elstree and Option S-6 at St John's Wood). The cost-book estimates reflect our view at the time of optioneering and allow a like-for-like comparison of the shortlisted options. To ensure we can maintain a competitive tender process and in turn protect consumer value, we have only provided cost ratios.

Table 3: Quantitative trade-offs between the shortlisted options

Measure	Option E-1	Option E-2	Option E-3
Connecting the new circuit at Elstree substation			
Cost-book estimate	0.97	1	1.09
Total capital cost over the 50-year appraisal period, including replacement	0.97	1	1.09
Net present value (cost)*	0.97	1	1.09
Undiscounted carbon, gas leakage and losses costs	0.89	1	1.02
Useful economic life	1	1	1

Measure	Option S-1	Option S-3	Option S-6
Connecting the new circuit at St John's Wood substation			
Cost-book estimate	1.70	1.54	1
Total capital cost over the 50-year appraisal period, including replacement	1.70	1.54	1
Net present value (cost)*	1.70	1.54	1
Undiscounted carbon, gas leakage and losses costs	1.90	1.55	1
Useful economic life	1	1	1

**Lower is better*

For the connection of the ESC1 cable at Elstree, Option E-1 is around 3% cheaper than E-2 on the initial cost-book estimate and has a marginally better NPV, by a similar margin. However, E-1 has lower future-proofing potential and a significantly larger environmental impact, as it requires felling a large section of trees. Option E-3 is the most expensive Elstree option across the cost measures.

For the connection of the ESC1 cable at St John's Wood, Option S-6 has the lowest cost by a large margin, with S-1 and S-3 at around 1.7 and 1.5 times its cost-book estimate and NPV respectively. All shortlisted options assume the same 40-year replacement cycle, so useful economic life does not differ between them.

6. Preferred Solution

Based on a qualitative and quantitative assessment of the options, our preferred overall 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 Conductor A
- For ESC1, our preferred option is X-1, which is to route a cable through the existing futureproofed tunnel between Elstree and St John's Wood
- 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 S6, which is an Elstree 2 connection into ex-Shunt Reactor 1 bay

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.