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Aberthaw 275/132 kV Site Strategy

Needs Case Summary

National Grid Electricity Transmission
Needs Case

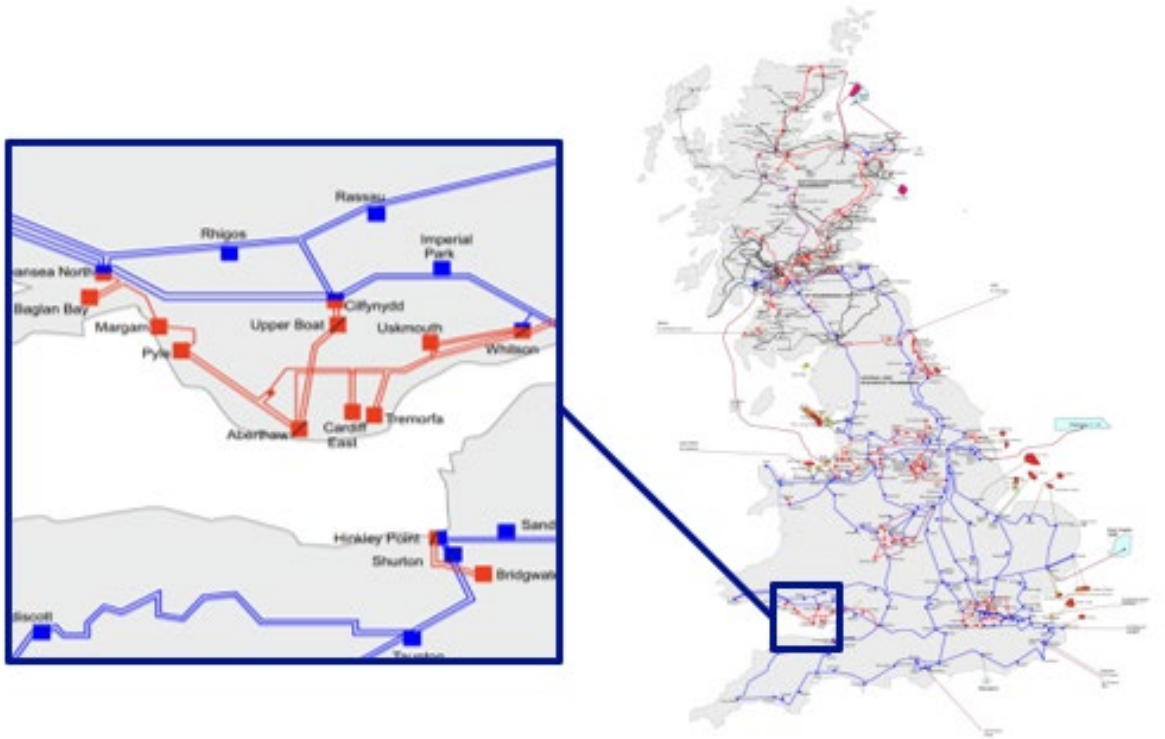
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1. Background

The Aberthaw 275/132 kV Site Strategy is a load-driven reinforcement and asset replacement project in South Wales. It will deliver a new 275 kV gas-insulated switchgear (GIS) substation, feeding a new 132 kV GIS substation and a new 132 kV grid supply point for the local distribution network operator, NGED. All existing circuits will then be transferred from the legacy 1950s and 1960s Aberthaw substations, which will be decommissioned.

Aberthaw is a critical supply point for Cardiff and the Vale of Glamorgan. Our South Wales regional studies show the region can continue to operate at 275 kV, and deliver contracted connections. There is therefore no current driver to uprate Aberthaw to 400 kV, although the design preserves the option to do so if a future need emerges.

Figure 1: Proposed location of investment on our network



*Key: **Red** = 275kV assets, **Blue** = 400kV assets. Investment location shown in **navy** box.*

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 seeks Ofgem's approval of the project's needs case, optioneering assessment and preferred solution. The project's eligibility for the Load Re-opener and associated Pre-Construction Funding was addressed through the Eligibility Letter process, and Ofgem has determined that the project should proceed via Track 3. Subject to approval, we will continue development and submit a Project Assessment.

2. Investment Drivers

The primary driver is customer connections. This includes two strategic demand (data centre) customers requiring a combined 480 MVA at 132 kV, which are designated as Gate 2 connections as

part of Connections Reform.[1] Several battery storage and generation customers were reassigned to Gate 1 through Connections Reform; we have confirmed that our preferred solution remains the most appropriate way to meet the remaining Gate 2 customers.

Asset health is also a key driver. The existing 132 kV and 275 kV indoor substations were built in 1957 and 1965 and much of the equipment is approaching the end of its operational life. Our latest asset health review identifies around 78 assets requiring intervention, including circuit breakers, bushings, instrument transformers and disconnectors. The substation buildings themselves have deteriorating roofs, cladding, floors and flood defences, and our assessments conclude they fall materially short of a modern equivalent. Rather than continue with piecemeal replacements, we are managing these risks on an interim basis so they can be resolved in a single coordinated rebuild.

3. Options

We undertook a structured, multi-factor optioneering process to identify a proportionate and deliverable solution in the interests of consumers. We first identified **13 longlist options** within five strategic option categories: do nothing, market-based, non-transmission whole-system, making use of existing assets, and building a new substation. As a new substation would need a new site, we also completed a siting study of six candidate locations, selecting brownfield land on the former Aberthaw Power Station site, next to the existing substations.

From the longlist, we **shortlisted options D-1, E-2, E-4 and E-6** following a high-level assessment against balanced scorecard criteria (see table, below).

Table 1: Summary of longlist options assessment

Option	Details	Shortlist?	Preferred?
A	Do nothing counterfactual	No – cannot deliver contracted connections	
B	Market-based solution	No – cannot deliver contracted connections	
C	Non-transmission, whole systems solutions	No – cannot deliver contracted connections; no viable distribution network alternative	
D-1	Do minimum works, using spare bays at the existing air-insulated substations	✓	
D-2	Use existing air-insulated substations with a GIS or air-insulated extension for additional bays	No – does not resolve asset health driver	
E-1	New air-insulated substation, cabled to existing overhead line towers	No – air-insulated design not suited to coastal location; greater consenting and programme risk	
E-2	New GIS substation, cabled to existing overhead line towers	✓	
E-3	New air-insulated substation, with overhead line realignment	No – air-insulated design not suited to coastal location; greater consenting and programme risk	
E-4	New GIS substation, with overhead line realignment	✓	✓

[1] The customer connection pipeline has been refined through Connections Reform. As part of this process, projects that did not meet the required progression criteria were reassigned to Gate 1, removing less mature projects from the near-term connection background. The remaining projects (Gate 2, which is split into Phases 1 and 2) therefore represent the current view of the most credible and deliverable customer connections.

Option	Details	Shortlist?	Preferred?
E-5	New GIS substation with minimal land take, phased to demolish the existing 275 kV and rebuild 132 kV in place	No – additional complexity, cost and programme risk	
E-6	New GIS substation, prioritising the 132 kV rebuild with a delayed 275 kV build	✓*	
E-7	New GIS substation built at 400 kV, with local interbus transformers	No – no current need for 400 kV; higher cost and consenting risk	
E-8	New GIS substation built at 275 kV, with 400 kV interbus transformers provided locally or remotely	No – no current need for 400 kV; could be delivered in future if a need emerges	

**Option E-6 was added to the shortlist following Connections Reform, which reduced the 275 kV generation drivers and made a phased solution prioritising the 132 kV rebuild more credible.*

4. Qualitative Trade-offs Between the Shortlisted Options

The table below sets out how the four shortlisted options compare against the balanced scorecard criteria used in our qualitative assessment.

Table 2: Qualitative trade-offs between the shortlisted options

Criteria	Option D-1	Option E-2	Option E-4	Option E-6
Engineering	**Strong detractor.** Uses existing spare bays, but leaves no headroom for future connections. Refurbishing a live site is complex and may not achieve a further 40-year life.	**Benefit.** A new build to modern standards, but the cabled connections add interface complexity, including cable crossings.	**Benefit.** A new build to modern standards. Overhead line connections are simpler to build and operate than cables and easier to futureproof.	**Strong detractor.** The staged approach adds complexity, including transferring circuits twice and continued reliance on the existing site.
Environmental	**Detractor.** Reuses existing buildings, giving the lowest construction carbon, but limited futureproofing could constrain future low-carbon connections.	**Detractor.** Greater civil works and footprint mean higher carbon and ecology impacts than an overhead line connection.	**Neutral.** Uses brownfield land, with scope to place towers sensitively. Some vegetation management may be needed.	**Detractor.** Highest carbon impact of the new-build options, as it combines a new build with additional interface works at the existing site.
Deliverability	**Strong detractor.** Limited scope to build offline means a very high outage burden across multiple outage seasons, delaying full capacity.	**Neutral.** Lower outage needs than D-1, but requires new land and consents, and cable routing adds programme risk.	**Neutral.** Lower outage needs than D-1 and avoids the cable complexity of E-2, although overhead line consents add programme risk.	**Benefit.** Prioritising 132 kV could reduce near-term asset risk and defer some consenting, but extends the overall programme.
Economic / consumer value	**Neutral.** Lowest upfront cost, but a material risk of early write-off and higher future operating costs if the existing site cannot last.	**Detractor.** Higher cost than D-1 and E-4, driven by cable length, with higher whole-life maintenance costs.	**Neutral.** Higher cost than D-1 but lower than E-2 and E-6. Provides spare bays and space for future transformers, reducing future rework.	**Detractor.** Highest cost of the shortlisted options. Could connect strategic demand earlier, but at the expense of generation connection timing.

Consenting / stakeholder	**Benefit.** Largely delivered on the existing site, although new land and consents are still needed for an additional transformer.	**Neutral.** Likely to face a lighter consenting regime than an overhead line realignment, but still needs new land and planning consent.	**Neutral.** Overhead line realignment needs additional consents, but local routing limits visual change and consenting risk.	**Detractor.** Staged delivery could increase consenting risk, and a longer construction programme is likely to have greater local impact.

5. Quantitative Trade-offs Between the Shortlisted Options

The table below expresses the position of the different shortlisted options relative to Option E-4. 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 D-1	Option E-2	Option E-4	Option E-6
Cost-book estimate	0.41	1.03	1	1.13
Total capital cost over the 50-year appraisal period, including replacement	0.71	1.03	1	1.07
Net present value (cost)*	0.60	1.02	1	1.10
Undiscounted carbon and losses costs	0.80	1.00	1	0.95
Useful economic life†	1	1	1	1

**Lower is better*

†All shortlisted options are modelled with a future replacement after 40 years.

Option D-1 has the lowest upfront cost and the best net present value, at around 40% of the upfront cost of Option E-4. However, this assumes the existing buildings can be refurbished to last a further 40 years, which we consider unlikely, and does not capture the outage, safety and early write-off risks of extending reliance on ageing assets.

Of the options that build a new substation, Option E-4 has the lowest upfront cost and the best net present value. Options E-2 and E-6 are around 3% and 13% more expensive upfront respectively. Carbon and losses costs are broadly similar across the three new-build options, with D-1 lowest because it reuses existing buildings.

6. Preferred Solution

Based on a qualitative and quantitative assessment of the shortlisted options, **Option E-4 is the preferred option**. Although Option D-1 has the best net present value, E-4 offers the strongest overall balance of deliverability, resilience, futureproofing and consumer value because:

- It **resolves the asset health challenges** at the site, rather than extending reliance on 1950s and 1960s substations with known safety, outage and maintenance risks.
- It offers **better long-term consumer value**. It avoids further long-life investment in legacy assets that risk early write-off, and has the lowest cost and best net present value of the new-build options.
- It is **more deliverable**, as the new substation is built offline. This avoids the extensive outages needed for D-1, the cable-route complexity of E-2 and the staged circuit transfers of E-6.

- It is **futureproofed**, with spare bays at 132 kV and 275 kV, space for additional transformers and overhead lines designed to be uprated. It more than doubles substation capacity at both voltages.
- It **minimises environmental impact** by using compact GIS on brownfield land at the former power station, and removes SF6 gas from the site.
- It **limits impacts on local stakeholders**, as local overhead line routing keeps visual change limited, and it supports the Welsh Government's enterprise zone and the South Wales AI Growth Zone.
- It is **strategically aligned** with our South Wales regional strategy, which confirms 275 kV is the proportionate choice today, while preserving the option to add 400 kV capacity if a future need emerges.