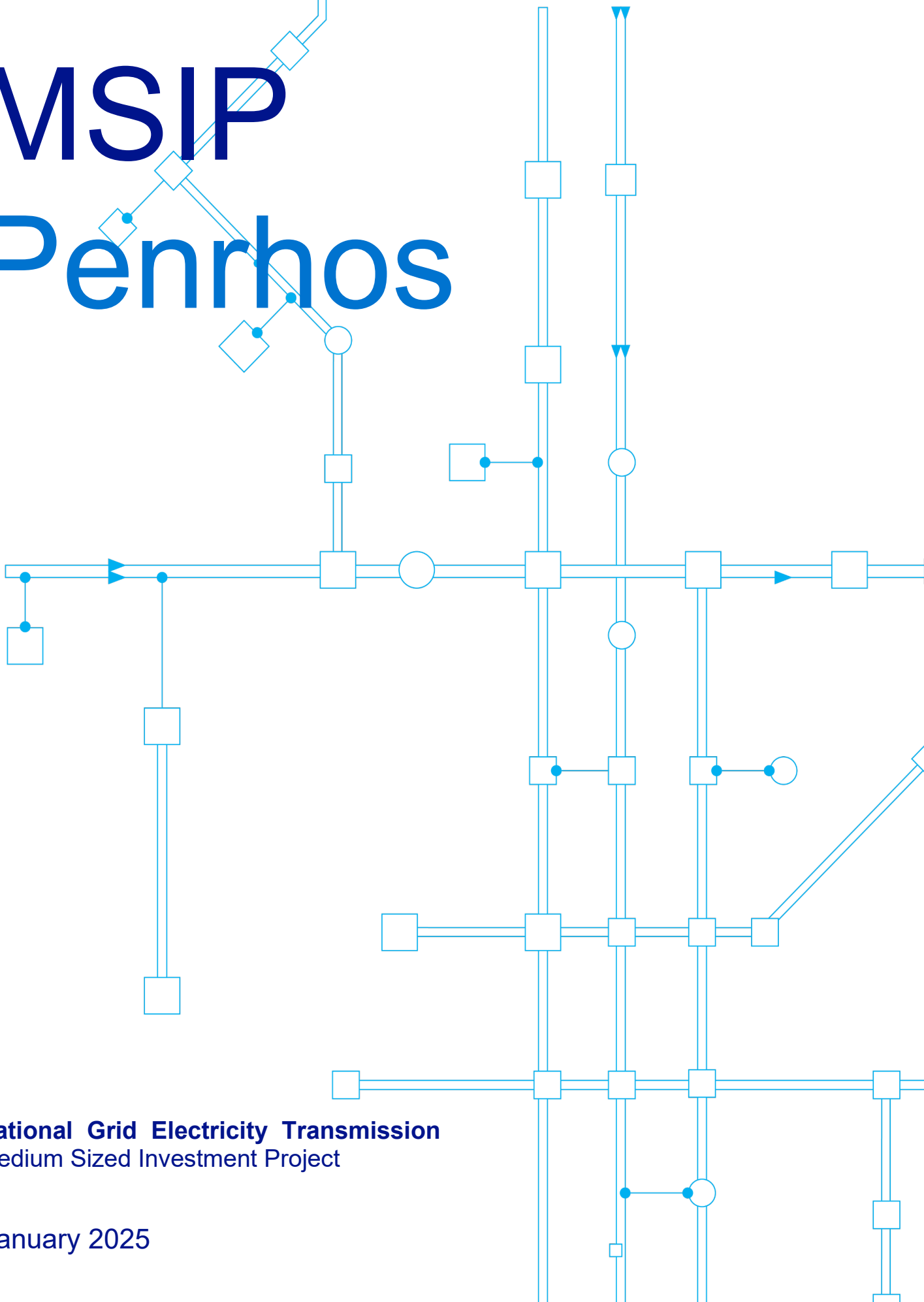
MSIP Penrhos



National Grid Electricity Transmission
Medium Sized Investment Project

January 2025

Contents

Investment Summary

Project Name	Penrhos 132kV Rebuild	**Delivery year**	[redacted]
Drivers for the Investment	**Generation and Demand – to provide connections for two contracted customers (Eclipse and Menter Môn).** [redacted] have requested a 210MW demand and generation connection in 2027 and Menter Môn a 180MW generation connection in 2028. [redacted] connection is for an Independent Distribution Network Operator (iDNO) substation that will enable its extension of the Angelsey Freeport and construction of the adjacent 'Prosperity Parc' innovation campus, containing a data centre and other science and research facilities. The Menter Môn connection is for a new tidal power project located on the west coast of Holyhead Island, the tidal power park is titled Morlais. This initiative is the largest consented tidal project of this type in the world.		
Key considerations & challenges	Key considerations and challenges in delivering the investment include: • **Time:** The requirement to deliver against a contracted connection dates. • **Land & Consents:** The availability of land within a constrained area. • **Existing network assets:** The proximity to existing 132kV circuits. • **Technology options:** NGET's position to prefer Air Insulated Switchgear (AIS) over Gas Insulated Switchgear (GIS) technology where possible, except within 5km of the coast. • **Environment & Sustainability:** the need to minimise impacts on the local biodiversity and protected habitats as far as possible whilst working in SSSI/AONB designated areas.		
Optioneering	NGET considered a total of 7 high level options across 5 categories. These included: • 3 options categories (doing nothing, market and whole system solutions) could not provide a physical connection. • 1 option to utilise an existing substation, at Wylfa 132kV, could not deliver the required connections in an economically viable manner. • 3 options to build a new substation in place of the previously demolished Penrhos substation. Of these, 2 options were taken forward for detailed analysis. The 2 options differed in their use of a containerised unit.		
Proposed Solution	Rebuild the 132kV Penrhos substation as an 8-bay SF6-free GIS substation and replace 3km of cable on the Penrhos-Wylfa circuits between Penrhos and tower EV86, and install 2km of cable between Wylfa and tower EV09.		
Outputs of the Investment	**Network capacity:** This investment will provide a 210MW demand and generation connection for [redacted] to enable additional capacity at the 'Prosperity Parc' development and Angelsey freeport. It will also provide a 180MW generation connection for Menter Môn to enable the connection of new a tidal power 'plug and play' facility. By delivering both connections, this investment goes further in supporting regional economic growth and development of renewable generation sources. To facilitate future connections, this investment also includes two spare bays, facilitates additional headroom on the connected cable for other connections with design variations in the short term (i.e. non-firm), or long term firm connections subject to installation of a third circuit.		
PCD Primary Output	Construct a new 132kV 8-bay substation for installing at Penrhos for connecting both [redacted] and Mentor Mon by [redacted]		
Estimated Cost (price base 2018/19)	The current total cost of the project is [redacted] The current direct cost of the project, and funding allowance being sought is: [redacted]		
Spend profile	**T2 (FY2022 – FY2026):** [redacted]	**T3 (FY 2027 – FY2031):** [redacted]	**T4+ (FY 2032+):** [redacted]
Reporting table	Annual RRP – PCD Table	**PCD Modification Process**	Special Condition 3.14, Appendix 1
Historic funding interactions	No existing funding in RIIO-T1 or RIIO-T2.		

1. Executive summary

1.1 Context

This paper, together with the associated Cost Benefit Analysis (CBA), summarises NGET's proposed investment to build an 8-bay SF_6 free GIS 132kV substation on the site of the former Angelsey Aluminium owned substation at Penrhos, connecting to the existing 132kV 'EV' [1]circuits, between Penrhos and Wylfa, and seeks to demonstrate the consumer interest in the associated investment.

The investment is required in order to facilitate connection of both demand and generation customers, including the largest consented tidal project of this type in the world and the development of an iDNO substation [redacted] that will serve Stena Line's expansion of the Angelsey Freeport and development of a new innovation campus called 'Prosperity Parc', containing strategic facilities like a data centre, business centre and research centre aimed at driving regional and UK growth.

This MSIP paper seeks approval of the need for the investment, as well as approval of the proposed solution and requested funding allowances for efficient spend on the project.

1.2 What is the background to this Investment?

In 2020 and 2022, NGET received applications from Mentor Mon and [redacted] respectively, for new customer connections to the Electricity Transmission network in the region. [redacted] (an iDNO) is facilitating the connection of the nearby Prosperity Parc and Angelsey Freeport developments, and Menter Môn is connecting its 'plug and play' tidal power infrastructure, the development is also known as 'Morlais'.

NGET owns the 132kV circuit in the area (known as EV) which connected onto the former Penrhos 132kV substation. The former substation was owned by the Angelsey Aluminium Metals Limited (AAML) smelting plant. The aluminium smelting plant ceased operation in 2009 and the substation was decommissioned. Following a number of failed attempts to use the site by both AAML and other subsequent land owners, the defunct substation was demolished by the current landowner along with all other buildings in the area in 2024 as its age and condition would no longer meet modern substation standards for operation.

Stena Line purchased all of the derelict land around the previous Penrhos substation site [redacted], which is seeking a demand and generation connection to NGET's network via a new substation at Penrhos connecting to the two 132kV Wylfa-Penrhos circuits.

This connection will support Stena Line's expansion of the existing Angelsey Freeport and investment to develop a new adjacent innovation campus called 'Prosperity Parc'. Freeports are special areas created by government to boost investment in targeted areas of the country, which can benefit from a package of incentives and tax reliefs[2]. The Prosperity Parc innovation campus will complement the freeport and include various facilities such as a [redacted] data centre, a [redacted] Battery Electric Storage System (BESS) and Solar generation connection and research centre.

Menter Môn, a social enterprise, is requesting a 180MW generation connection to facilitate its own onshore substation which will provide the infrastructure for developers of tidal energy converters to deploy their tidal devices on a commercial scale in a 'plug & play' arrangement via a subsea cable

[1] EV is the name of the circuits connected between Wylfa 132kV substation and Penrhos – not to be confused with the common abbreviation for Electric Vehicles.
[2] https://www.gov.uk/guidance/freeports

installed by Menter Môn. Once fully operational it is expected to be the largest tidal project of this type in the world[3].

By supporting regional economic development and enabling the connection of a data centre and renewable generation onto the grid, the outcomes of this investment advance the interest of consumers and directly contribute to a number of Ofgem's duties, such as that for economic growth, and national initiatives, such as the government's advancing AI[4] plan and meeting Clean Power 2030[5].

1.3 What have we considered in developing options for this investment?

NGET assessed a range of solutions to meet the investment drivers in a way that best serves the interests of consumers. In evaluating options, NGET encountered several challenges that necessitated trade-offs to identify a preferred solution driving value for consumers. The primary challenge was ensuring timely delivery of necessary connections to support Available for Commercial Load (ACL) dates balanced with longer term strategy for the region, taking into account the existing network assets in the area (which operates at 132kV), the limited land availability around the existing Penrhos site and NGET's policy on AIS and GIS switchgear.

Whilst further detail regarding the optioneering process is provided in Sections 4 and 5 of this submission, a brief summary of the options considered is explained below.

Following the reopener guidance set out by Ofgem, NGET considered 3 options as standard which were discounted on their inability to provide a compliant and viable connection for both customers. These options included: doing **nothing, market-based**, and **whole system solutions** (**Option A, B and C).**

We assessed one option to provide a connection into the existing 400kV substation at Wylfa **(Option D-1)**. We ruled this out given it would increase costs and would be incompatible with the ACL dates for the customers, which given their role in supporting economic development in the region made it unattractive from a broad view of consumer benefit. It would have involved a high volume of cable (>25km) being prohibitively expensive for both customers, as well has having additional environmental impacts, and also would require the construction of an additional circuit in addition to the significant substation extension works. Overall, it would have significantly increased cost to consumers.

Given the existing 132kV circuit assets connecting to the Penrhos site sitting in close proximity to both customers, we therefore focused on four options for **building a new** substation (**Option E).** This also included the scope for replacing 3km of cable on the Wylfa-Penrhos circuits, addressing end of life condition between Penrhos and tower EV86 and a missing circuit between Wylfa and tower EV09.

- **Option E-1**: Build a new 132kV SF6-free GIS substation at Penrhos and replace cables between Penrhos – tower EV86 and Wylfa – tower EV09
- **Option E-2:** Build a new 132kV SF6-free GIS Containerised Solution at Penrhos and replace cables between Penrhos - tower EV86 and Wylfa – tower EV09
- **Option E-3:** Build a new 132kV AIS substation at Penrhos and replace cables between Penrhos - tower EV86 and Wylfa – tower EV09
- **Option E-4** : Build a new 400kV substation at Penrhos

Of the four options identified for delivery of the new substation, 2 were progressed to detailed options analysis (E-1 and E-2). Key reasons for discounting the other options at this stage included:

[3] https://www.ice.org.uk/events/recorded-lectures/morlais-largest-consented-tidal-energy-project
[4] CP 1241 – AI Opportunities Action Plan – January 2025
[5] https://www.gov.uk/government/publications/clean-power-2030-action-plan

- The site falls within 2km of the coast and in turn requires us to follow our switchgear policy which necessitates use of SF6 free GIS switchgear, over AIS to prevent coastal pollution within 5km of a coastal or saline area[6] (discounting Option E-3).
- The constrained land [redacted] preventing an AIS solution from fitting on the site (discounting Option E-3)
- The additional delivery time and cost to consumers in pursuing a 400kV substation, which would require a new 400kV OHL circuit to be designed, consented and built across Angelsey. This option could not be delivered in time for the customer ACLs and would increase costs to consumers Option E-4)

Table 1 provides a summary of the two shortlisted options against key criteria for the project.

Table 1: Summary of shortlisted options against key criteria

	Option E-1	Option E-2
Time	Enabled a [redacted] connection date	Time increase for the need to type register a novel solution
Technology Choice	SF6-free GIS Within policy for the proximate coastal location	SF6-free GIS Within policy for the proximate coastal location
Land & consents	Sufficient land available for purchase	Sufficient land available for purchase
Futureproofing	Enables space for additional bays, constrained by cable rating	Enables space for additional bays, constrained by cable rating

1.4 What is the preferred option and what outputs does it deliver?

The preferred option is to construct a new 8-bay 132kV SF6-free GIS substation at Penrhos and replace 3km of cable on the Penrhos-Wylfa circuits between Penrhos and tower EV86, and install 2km of cable between Wylfa and tower EV09 (Option E-1). This option aligns with key investment drivers, which include delivering a timely connection considering current contracted ACL dates [redacted] for [redacted] and MML respectively, whilst making efficient use of existing consents, land made available for purchase for a nominal price and in turn reducing the cost to consumers of delivering the two connections.

Funding allowances are sought as part of this MSIP submission. The direct costs for this investment are [redacted] Further details related to the makeup of these requested allowances are detailed within the cost model available alongside this submission.

132kV substation

We considered that the current charging regulations established by the NESO stipulate that given the **new 132kV substation** will be classed as an infrastructure asset, it will be funded by consumers, rather than a connection asset paid for by customers. Based on our analysis, we consider providing a single point of connection through a common 132kV substation represents the most time-efficient and cost-effective solution for consumers, considering the existing Wylfa-Penrhos circuits connecting to the site and the capacity requirements of the contracted connections. Whilst we considered use of an existing 400kV substation (Wylfa) and building a new 400kV substation as part of our optioneering, we recognised that significant escalations in time and cost to deliver both approaches would be unfeasible in meeting timely connections' for both ACL dates.

If NGET were not to build a 132kV substation, each connecting customer would need to establish their own individual connection sites, NGET would then be responsible for delivering the connection

[6] PS(T) 023 Substation Primary Insulation (Air/Gas)

assets from a transmission substation to these locations. This approach would necessitate substantial cable volumes to multiple customer substations across unspecified distances and locations. Overall, it would be a more expensive option for consumers due to the additional assets they would have to fund.

Furthermore, managing these numerous individual connections could significantly increase project delivery risk and consequently impact the timelines for meeting both ACL dates. By investing in a centralised 132kV substation, we mitigate timing and delivery risks linked to managing multiple separate connection assets, and streamline the number of necessary connection assets. In addition, individual connections would also reduce operational flexibility for customers. Specifically, any circuit disconnection due to an SGT intervention would directly affect the operational flexibility of the network —a critical concern for the data centre customer at Prosperity Parc, who prioritises uninterrupted network reliability.

1.5 How has future proofing been considered in the proposed investment?

The proposed solution at Penrhos substation includes space for an additional two bays either side of the substation, which would allow for additional bays to be constructed in the future to support new customer connections. The scope also includes replacing the cable between the Penrhos site and tower EV86 on the Wylfa-Penrhos circuit, and installing a new section of cable between Wylfa 132kV substation tower EV09 – both of which will be uprating simultaneously to 390MVA. This new 390MVA circuit rating will provide enough capacity to facilitate both the [redacted] and Menter Môn connections driving this investment, however, it will not provide sufficient capacity for facilitating additional permanent connections making use of these two spare bays without further uprating.

Looking ahead we have the ability to uprate the Wylfa-Penrhos circuit via installation of a third circuit, should sufficient demand arise. However, we do not believe it is currently cost efficient for consumers to cover the cost of a third circuit upfront and consider instead the investment would be better triggered on the establishment of a firm and necessary connection driver. It is also worth noting that any new circuit would need to connect into one of the two spare bays included in the scope of the submission. [redacted]

Future connections would have the ability to connect to the spare bays at Penrhos 132kV substation, without further circuit uprating works, under a 'non-firm' contract with agreed design variations.

As part of our assessment, we also examined the feasibility and value of combining current connections in the pipeline around the Wylfa substation (4 connections presented in Section 3.2 of this paper) with the two connections driving the new substation at Penrhos. However, as the required 400kV substation to connect all those customers could not be delivered before 2035, well after the customers' ACLs and it would involve the additional costs of new cables to connect to Wylfa, we concluded that it would be in consumers' interests for us to not to combine the customer drivers in a single solution. We recognised the importance of facilitating timely connections for both customers as crucial to supporting the UK's Clean Power 2030 ambitions and stimulating regional economic growth through the Freeport.

[redacted]

1.6 What are the uncertainties and how have they been accounted for?

Several risks and uncertainties have been considered in relation to the option selected:

- [redacted]**Local Opposition to Works -** [redacted]

- **Working Adjacent to Site of Special Scientific Interest (SSSI) -** The construction site and cable route are in close proximity to the Site of Special Scientific Interest (SSSI). Due to this adjacency, there is a risk that the construction methodology may need adaptation to mitigate potential impacts on the SSSI. Such adaptations may be subject to conditions imposed by the local council. The impact could result in halted project development and necessitate re-baselining of the programme, potentially causing adverse reputational impacts and incurring cleanup and rebuilding costs. To address these challenges, we have organised early and ongoing engagement with the local council and other relevant stakeholders to discuss the working methodology and potential legislative changes.
- **System Outages -** Taking parts of the network offline to complete works can only be done if the remainder of the network is operational and can compensate for the removal of capacity during works. To respond to system issues or incidents elsewhere on the transmission network, NESO may need to cancel NG ETs pre-booked outage at any stage up to the commencement of the outage in order to ensure adequate network supply and distribution. Other projects in the region will require outages at the same time. There is a risk that outages may be cancelled/delayed/changed. This could impact in delays to the project due to inability to complete works within scheduled outage. We have ensured early outage requests are planned in and are monitoring requirements within other parts of the system and have monthly coordination meetings with outage planners.

Following investment drivers in North Wales to connect [redacted] new iDNO substation, facilitating development of the Prosperity Parc innovation campus and Angelsey Freeport, as well as Menter Mon's tidal energy park, we have conducted a robust assessment of viable options using a combination of quantitative and qualitative assessment methods. This assessment sought to balance the need to deliver the connections in line with contracted connection dates, making efficient use of available land and existing connection assets in an area hosting minimal transmission network in place, with the selection of the preferred switchgear technology considering the proximity to the coast.

The conclusion of our analysis is the proposal to construct a new 8-bay 132kV SF6-free GIS substation on the site of the former Angelsey Aluminium smelting plant substation, supporting timely connection of these economically and environmentally strategic investments, whilst protecting the interests of current and future consumers.

2. Introduction

2.1 Project background

This paper presents the investment case and associated efficient costs for our preferred solution for a new 8-bay 132kV SF6-free GIS substation at Penrhos, on the site of the former 132kV substation owned by Anglesey Aluminum. The project aims to connect both contracted customers, supporting Stena Line's development of the Prosperity Parc innovation campus and Anglesey Freeport via [redacted] new iDNO substation and Morlais, the Anglesey tidal energy initiative being developed by Menter Môn.

2.1.1. MSIP Eligibility

The Penrhos 132kV substation investment project is eligible as an a-typical MSIP reopener. The project is connecting both generation and demand load to the Electricity Transmission network. However, current total costs for delivering the investment exceed the allowances available via the Generation and Demand Connection Volume Drivers by a variance over £11.84m – the threshold to be eligible for MSIP. The Volume Driver allowances available to NGET under both [redacted] and Mentor Mon's connections would provide [redacted] and [redacted], respectively. Taken together NGET would be eligible for [redacted] in volume driver funding, compared to a total anticipated project cost of [redacted].

The comparative funding to expenditure ratio triggers an a-typical generation connection MSIP (SpC 3.14.6 categories a and b). A breakdown of eligible volume driver allowances is provided in Appendix A.

As agreed with Ofgem in May 2024, NGET is submitting this MSIP in the January 2025 window including total funding allowances for the Penrhos project. This submission is made on the basis of awarded T2 allowances being provided within T2 Final Determinations for the MSIP submission and all relevant T3 allowances being provided within the ET3 Final Determinations. As such, NGET will not provide a further funding submission to Ofgem in respect of the T3 allowances included in this paper.

As communicated to Ofgem in January 2025, NGET acknowledges that the majority of expenditure on the project will now occur [redacted] Although this timeline falls outside the criteria advised by Ofgem for January 2025 MSIP eligibility, the inclusion of the project within the reopener window was planned prior to the anticipated change in the spend profile. Several delays in the procurement process have significantly extended the delivery timeline of the programme, thereby affecting the period when spend is likely to be incurred (further details provided in Section 7). We are grateful for Ofgem's flexibility in supporting NGET's approach to continue with the submission of the project in the January 2025 window.

2.1.2 Chronology to the request

The site has a long and complex history connected to the existence of a previous aluminum smelting plant on the Penrhos site. A brief summary of that history is provided below:

Between 1971 and 2009, the site was owned and used by AAML to operate their smelting plant. The site contained their own 132kV substation which was connected via 2x 132kV circuits coming from Wylfa 132kV substation. Unusually the ownership split at the line disconnectors, AAML owned the busbars and substation bays rather than NGET. These circuits were defined as sole use connection assets.

As their business declined, AAML ceased smelting in 2009 and in the following years the substation was decommissioned and the surrounding land passed hands to a number of owners who unsuccessfully tried to launch new initiatives on the site, all of which wanting to make use of the Wylfa-Penrhos 132kV circuit connections.

Historically, two oil-filled cables comprised these circuits between Wylfa 132kV substation to tower EV09. However, due to the cancellation of the Horizon nuclear project at Wylfa, which initially prompted the plan to replace these cables with XLPE cables, along with the Main Works Contractor, Carillion, entering administration during the cable replacement works, only one of the two circuits remained in place. These factors meant there was no longer a need to complete Circuit 2 and the scheme was suspended.

In 2019 SPEN requested to T-into the remaining circuit between Wylfa 132kV and tower EV09 to connect the Ceagillog substation – this caused the circuit to change from a sole use asset to infrastructure.

In 2023 Stena Line, purchased the land [redacted], from previous owner Orthios, with the intention of expanding its existing Holyhead port into Angelsey Freeport and building Prosperity Parc. [redacted] The decommissioned legacy Penrhos substation was then demolished by the landowner given it was defunct. In facilitating the connection, Stena Line made land available for use by NGET to build a new substation, enabling the existing OHL assets already in place in the area to be used to facilitate a more efficient connection.

The renewed demand for customer connections at Penrhos has prompted the initiative to install the missing second circuit between tower EV09 and the Wylfa 132kV substation.

Furthermore, given the passage of time from AAML's ownership of the site through to the present day, asset health assessments of the cables between tower EV86 and Penrhos have indicated the condition of the cables to be 'end of life' and requiring replacement prior to re-energisation. The cables will also be uprated to provide sufficient capacity to enable both contracted connections.

2.1.3 Importance of the investment

This investment is required to accommodate the contracted demand and generation connections from two customers; [redacted], enabling Stena Line's Prosperity Parc development – an innovation campus intended to compliment and support expansion of the Angelsey freeport, as well as Menter Môn's Morlais Anglesey Tidal energy initiative.

Taking each in turn, Holyhead port is a commercial and ferry port in Anglesey handling more than 2 million passengers each year. The port is the principal link for crossings from north Wales and central and northern England to Ireland. In 2023 UK and Welsh governments granted the port 'freeport' status and the port will now be developed to become the larger Anglesey Freeport. Freeports are special areas where simplified customs and trade rules apply, providing greater incentives for investment and trade particularly in areas which have traditionally missed out on economic support and development. When established, goods entering the freeport will not be subject to the same tax regimes[7], helping to boost business investment in the region and in turn job opportunities and local economic growth. Current plans for the Prosperity Parc site include connection of an Innovation Zone, data centre, BESS and Solar generation technologies. The site is intended to support and compliment the expansion of the Angelsey freeport Stena Line are also undertaking. An indicative layout of the site is included in Figure 1. The establishment of Prosperity Parc helps to support a number of external directives and initiatives including Ofgem's growth duty, considering the impact on the local North Wales economy and the UK government's recent AI Opportunities Action Plan, via supporting the establishment of new data centres.

[7] Freeports in Wales benefit from business rates relief, stamp duty land tax relief, and enhanced capital allowances for plant and machinery used on site.
https://assets.publishing.service.gov.uk/media/6763f8854e2d5e9c0bde9b99/UK_Freeports_induction_pack.pdf

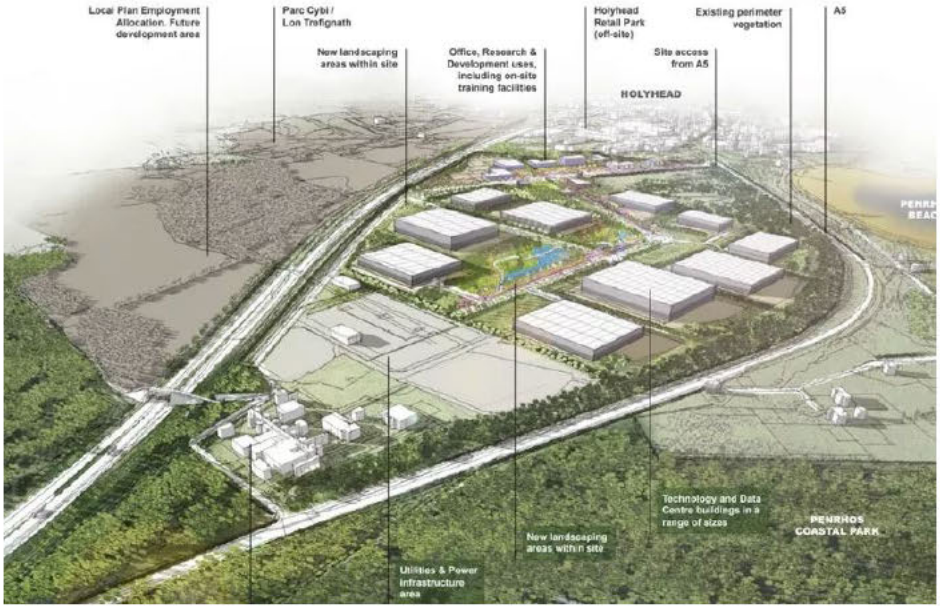


Figure 1 – Aerial image of the planned Prosperity Parc Development

The Morlais tidal energy project, led by Menter Môn, is currently the largest consented tidal energy project of its type in the world. Situated on a 35km² area near the Anglesey seabed , it has the potential to generate up to 240MW of clean electricity, when fully established (although the customer is only seeking a 180MW connection currently). The Crown Estate designated this area as the West Anglesey Demonstration Zone in 2014 to promote growth in the tidal energy sector, recognising it as one of the strongest tidal energy resources in Europe with currents up to 7 knots. Menter Môn, a not for profit social enterprise which supports initiatives across Wales, went on to secure the lease.

This project will install the required infrastructure and enable the connection to the transmission system. When established it will rent berths to turbine developers, allowing a variety of tidal energy technologies to generate electricity at sea and export this generated power onto the grid. By connecting the Morlais project, NGET can further support the UK's ambitions for Clean Power by 2030, encouraging new renewable sources of energy into the mix within the next 5 years. The initiative also has the outcome of further supporting jobs, skills and economic development in the local North Wales economy.

2.2 Regional and strategic context

[redacted] Wales has three national parks and five AONBs which cover almost a quarter of its land mass. The Welsh Government has also outlined its ambitions to reach Net Zero by 2050 and meet 100% of its electricity from renewable sources by 2035. With abundant wind and marine resources, and scope for potential nuclear development at Wylfa, North Wales aims to become a net exporter of low carbon electricity.

Presently North Wales has a diverse generation portfolio of around 4.5GW. However, looking ahead current contracted generation connections for the country out to 2034 sit at 37GW, and demand connections 4.5GW, however not all of this is expected to connect.

Whilst the current Welsh transmission infrastructure is rated for the existing level of import and export requirements, due to the volume of connections in the region, significant infrastructure upgrades are required. New infrastructure is needed to securely transfer power between Wales and England, Wales and Scotland and also across the north to south of Wales. NESO identified the ability to transfer power efficiently and securely between the north and south of the country and across the UK as essential to meet Britain's 2030 offshore wind targets. As such, looking to the future, the

strategic PSNC[8] project, as part of the Great Grid Upgrade, plans to interconnect north and south Wales via a 400kV double circuit.

Other known works in the region include plans to rebuild the existing Aberthaw 132kV and 275kV substations, as well as construct new sites at Chirk, Imperial Park B and Llandyfaelog.

As well as connecting the two customers identified in this paper, the proposed substation at Penrhos substation includes space for an additional two bays either side of the substation to facilitate future load. 1 bay would enable additional capacity via installation of a third circuit and the other space for an additional customer. NGET will also be ensuring the cable replaced between Penrhos and tower EV86 is uprated to facilitate the electrical capacity for both customers connecting on site. [redacted]

2.3 T3 interventions

Although this MSIP is being submitted under the RIIO-T2 price control, it interacts with and forms part of the same regional strategy outline in NGET's RIIO-T3 Business Plan. Penrhos is located in the North Wales region.

By executing the works at Penrhos, NGET ensures that this investment achieves its primary goal of connecting 180MW of renewable electricity to the grid as part of the Morlais Tidal energy project. It also supports economic growth by facilitating the development of the Prosperity Parc and expansion of Angelsey freeport. This investment aligns with the Future Network Blueprint for the region as detailed in our T3 Business Plan. This investment also aligns with Consumer Outcomes embedded across our T3 plan, a summary of these is detailed in Table 2 below.

Table 2 - Alignment with Ofgem T3 consumer outcomes

Infrastructure fit for a low-cost transition to net zero	Enabling connection of the tidal energy park, Angelsey Freeport and Prosperity Parc at Penrhos will facilitate renewable energy onto the grid and support regional economic growth in North Wales. In turn supporting the UK's transition to net zero and Ofgem's growth duty.
System efficiency and long-term value for money.	Making use of the existing 132kV circuits to connect both customers represents a cost efficient approach to delivering these customer connections in the interest of consumer spend.

Looking ahead, NGET is planning eight major substation interventions across the Wales region. We included a number of EJPs within our T3 submission related to these upgrades; these include Major Project EJPs for Llandyfaelog, Pembroke and reconductoring works on a number of Welsh OHL circuits including Cilfynydd-Imperial Park and Cilfynydd-Seabank.

Within T3, NGET will also deliver the Pentir to Trawsfynydd project (PTC1/PTC2), part of the Great Grid Upgrade, which will enhance the existing network in North Wales. Additionally, the PTNO/PTN2 project will develop a second circuit in North Wales along an existing route.

Beyond T3, as part of agreed ASTI investments, NGET will also develop and design a new circuit between North and South Wales (PSNC) and between North Wales and Scotland (AC6), as recommended in NESO's Holistic Network Design (HND). Investment in the Wales region during T3 will support both existing and new infrastructure, enhancing the transmission system's capacity to eventually export power from the country.

Our T3 submission included plans for several Asset Health interventions across our network. Although this investment is for a new substation, we are aware of asset conditions at the nearby Wylfa substation (details in Appendix B). The Wylfa 132kV and 400kV substations have some

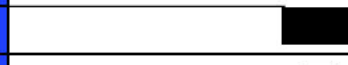
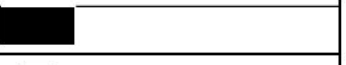
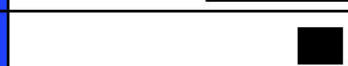
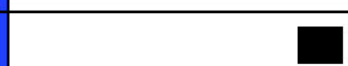
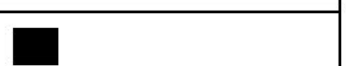
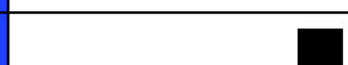
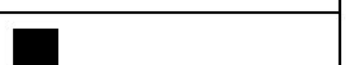
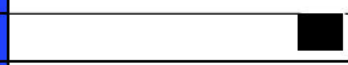
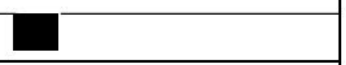
[8] A project to construct a new circuit between North and South Wales.

high-risk assets to be addressed through targeted T3 interventions. However, as discussed in Section 4, Wylfa was ruled out as a viable connection solution for the identified customer connections due to timing and cost efficiency concerns.

2.4 System Design Table

NGET has identified 2 credible system design options to respond to the drivers at Penrhos, as presented in Table 3 below.

Table 3: System Design Table

System Design Table	Circuit/Project	Option E-1: Construct a new 8-bay 132kV SF_6-free GIS substation, replace cables between Penrhos - tower EV86 and Wylfa – tower EV09	Option E-2: Construct a new 8-bay 132kV SF_6-free GIS substation in a containerised unit, replace cables between Penrhos - tower EV86 and Wylfa – tower EV09
Thermal and Fault Design	Existing Voltage (if applicable)		
	New Voltage		
	Existing Continuous Rating (if applicable)		
	New Continuous Rating		
	Existing Fault Rating (if applicable)		
	New Fault Rating		
ESO Dispatchable Services	Existing MVAr Rating (if applicable)		
	New MVAr Rating (if applicable)		
	Existing GVA Rating (if applicable)		
	New GVA Rating		
System Requirements	Present Demand (if applicable)		
	2050 Future Demand		
	Present Generation (if applicable)		
	Future Generation Count		

		[redacted]
	Future Generation Capacity	[redacted]
Initial Design Considerations	Limiting Factor	[redacted]
	AIS/ GIS	[redacted]
	Busbar Design	[redacted]
	Cable/ OHL/ Mixed	[redacted]
	SI Strategic Investment	

3. Establishing Need

3.1 Overview

Table 4: Summary of Investment Driver

Summary of Primary Driver		Date
Customer Connection	**Generation and Demand – to provide new connections for two contracted customers (and Menter Môn).** • has requested a 210MW connection in • Menter Mon has requested a 180MW connection in	

3.2 Load related drivers

Table 5: Details of Load drivers

Customer Name	Project Name	Project Type	MVA Demand	ACL Date	Customer Status
	iDNO Substation	Demand/Generation connection	210MW		
Menter Môn Morlais	Tidal Power	Generation connection	180MW		

There are currently no other planned connections for NGET's proposed Penrhos 132kV substation site. That said, there is a pipeline of four future connections known in the Angelsey area which NGET is currently considering as part of its wider strategy for the region.

These include:

- Two Connections for solar generation –
- One generation connection for the Carrog BESS –
- One 120MW connection for – Solar and BESS

3.3 Customer Drivers

Our contracted connections pipeline is growing at an unprecedented rate. To help develop the network in a way which delivers value for consumers, we have developed a consistent and repeatable methodology for assessing our confidence in each contracted customer connection project proceeding to connect. This methodology is outlined in our T3 Business Plan submission. This methodology results in a score and associated RAG rating that demonstrates the relative likelihood that a contracted project will proceed to connect to our network based on its technology, characteristics, and progress against key milestones. Projects scoring:

- ≥7 are rated green and are most likely to connect.
- ≥ 5 but < 7 are rated amber and have some chance of proceeding.
- <5 are rated red and are less likely to proceed.

It is important to recognise that because the scores are relative, a customer assessed as 'most likely to connect' is not guaranteed to connect and a customer that is 'less likely' to proceed could proceed to connect. We also recognise that the implementation of Connections Reform, in tandem with the Government's Clean Power 2030 Action plan, will have a significant impact on the connections landscape at both a national and regional level.

The contracted projects at Penrhos as part of this site strategy are shown below in Table 6. The contracted connections that trigger the need for this investment demonstrate an average confidence score of 5.9 (amber, 'medium' confidence).

Despite this scoring, NGET has confidence in these customers continuing with development of these projects. Both customers have achieved Final Investment Decisions (FID) and have primary consents granted. Moreover, the backing both connections have from the Crown Estate and UK government, in realising the environmental and economic benefits of tidal energy sources and the Freeport, respectively, provide us with further confidence that these connections will continue to develop at pace.

Table 6: Customer confidence assessment

Customer Name	Project Name	Project Type	MW	ACL Date[9]	RAG confidence
Mentor Mon	Morlais Marine Energy Project	Tidal Generation	180	Mar 27	6.5
[redacted]	iDNO – Angelsey Freeport & Prosperity Parc Connection	Generation & Demand Connection	210	Jun 2028	5.3

3.4 Existing and planned future network

There are limited existing network assets in the region. Sat within the NW1 boundary, the only existing transmission substation in the area is at Wylfa, as shown below in Figures 2 and 3. Previously serving the legacy Wylfa power station, the substation was set to connect the Horizon nuclear power station before it was withdrawn in 2020. A single radial spur connects the Wylfa 400kV and 132kV substations to Pentir substation and also across to the Penrhos site.

Two bays initially designated for the nuclear power station at Wylfa 400kV have been repurposed to support solar and BESS connections being developed by [redacted] and [redacted]

Approximately [redacted] south of Wylfa lies the former Penrhos 132kV substation site. A map of both sites on Angelsey is presented in Figure X. The nearest NGET network assets to Prosperity Parc and Morlais tidal energy sites are the 132kV circuits at this location. Though the original substation, once part of Anglesey Aluminium, was demolished in 2024 after closing in 2009, NGET still owns two 132kV circuits connected between Penrhos and Wylfa, although the cables are cut, capped and fully decommissioned. The potential use of these circuits offers an efficient solution for delivering the two customer connections outlined in this investment.

Looking ahead, the proposed investment includes the construction of a new 8-bay 132kV SF_6-free GIS substation on the former Penrhos site. This development will facilitate connections for [redacted] iDNO substation to connect Prosperity Parc and Angelsey Freeport and the new Morlais tidal energy park, while also providing space for additional future connections via two spare bays. The investment also includes replacement of the circuit between Wylfa 132kV and tower EV09, as well as uprating of the cable between Penrhos and tower EV86 to 2x 390MVA cables – providing enough capacity to facilitate the load from both customer connections. That said it is worth noting that to enable long term firm connections to the site via the spare bay provided, would require an additional third circuit to be installed making use of one of the spare bays. NGET also has the possibility of seeking extra space for additional future bays, should demand arise, through discussion with the current landowner.

We have also assessed the condition of assets on the substation in developing this investment. Given the relative age of the substation, a minimal number of assets require intervention during the T3 period - a brief summary of the asset health of the substation is included in Appendix B of this

[9] The Available for Commercial Load (ACL) date refers to the date that a customer requests in its connection request to NGET.

submission. Whilst these interventions are not in the scope of the MSIP funding submission presented here, they were included in our T3 business plan submission shared in December.

Although this investment is for a new substation, we are also aware of asset conditions at the nearby Wylfa substation (details in Appendix B). The Wylfa 132kV and 400kV substations have some high-risk assets to be addressed through targeted T3 interventions. However, as discussed in Section 4, Wylfa was ruled out as a viable connection solution for the identified customer connections due to timing and cost efficiency concerns and as such these asset health interventions are not relevant to the scope of this investment.

[redacted]

[redacted] it is important to note that considering a new substation was not a feasible solution for connecting both the [redacted] site and the Morlais tidal energy park. The timeline to connect both customers by their agreed [redacted] ACL dates would not be possible, given the considerable time required to develop, plan, consent, and construct a new transmission voltage substation, as well as facilitate consideration of a whole network solution strategy which needs to incorporate the outputs of CP2030 and connections reform, once available. NGET was fully aware of the importance of facilitating these connections as close to agreed timescales to support the UK's environmental and economic goals.

[redacted]

Figure 2 – outline of substations on Angelsey

4. Optioneering

This section summarises the options we considered to address the needs case established in the previous section, in a way that best serves the interest of current and future consumers.

In line with our optioneering process, we identified the following high-level options:

A. A do nothing option as the counterfactual option;
B. A market-based solution;
C. Non-transmission, whole system solutions;
D. Making use of existing NGET substations;
E. A new substation.

In summary, details provided below:

- Options A-C were discounted because they would not deliver a compliant connection.
- One variation of Option D (use of an existing substation) was considered due to the proximity of the existing Wylfa substation, however this was discounted given the increased timing required to deliver the solution and increased cost to consumers.
- Three variations of Option E (building a new substation) were considered, proposing to construct a new 132kV substation on the Penrhos site. These options differed in their use of technology solution, between AIS, SF_6-free GIS and SF_6-free GIS containerised units. The two SF_6-free GIS options were taken forward for detailed analysis, based on their ability to facilitate the connections within the constrained land available.

4.1 Assessment of high-level options

As above, a summary of our assessment of the high-level options identified to meet the customer need is set out below. Each of these is assessed against the following criteria:

- Capacity and future development potential
- Design and technical complexities
- Operation and maintenance
- Safety, health and security
- Planning, land and consent
- Third party impact and network coordination
- Environment and Sustainability
- Timing of programme and resources
- Cost

A summary of our initial options assessment is in Table 7 below:

Table 7: Summary of initial options assessment

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
A	Do nothing	NGET does not undertake any action to enable connection of the iDNO or Tidal power sources.	**Not taken forward** – the option does not comply with NGET licence obligations to provide connections.	Compliant customer connections not delivered.
B	Market-based solution	Increased customer demand and generation is accommodated through the procurement and use of ancillary services only.	**Not taken forward** – the option does not comply with NGET licence obligations to provide connections.	Compliant customer connections not delivered.
C	Whole systems solution	The required customer connection is accommodated by a Distribution Network	**Not taken forward** – the option does not comply with NGET licence obligations to provide connections.	**Capacity and future development potential** There is no available local DNO infrastructure with capacity to facilitate the load required by the two connections. Prosperity Parc is connecting via [redacted], an iDNO, who require a connection from the transmission network to facilitate the load.

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
		Operator (DNO) instead of NGET.		Although Morlais is making initial use of a connection at the nearby SPEN 33kV DNO substation, only [redacted] of capacity remains, which cannot facilitate either customer's demand in the long term.
D-1	Use existing assets	Connect at existing Wylfa 400kV substation	**Not taken forward** – the option disproportionately increases delivery timescales and costs to consumers.	**Timing of programme and Cost to Consumers** Connecting at the existing Wylfa 400kV substation would not be a feasible connection solution for both consumers. In its current state, the substation could only facilitate the connection of one of the two customers. To enable both customers to connect at the existing substation would require a significant substation extension. This would disproportionately increase the time , adding approximately 5 years to the programme to deliver the investment, jeopardising the [redacted] ACL dates, as well as significantly increasing cost to consumers . At a distance of 25km from the customers sites, cable costs would be over £100m and likely render the connection unviable for both customers.
E-1	Build new	Build a new 132kV SF6-free GIS substation at Penrhos and replace cables between Penrhos – tower EV86 and Wylfa – tower EV09	**Taken forward to detailed assessment**	Enables compliant and timely connections for both customers. Makes use of use of existing consents, land made available, a type-registered solution and existing 132kV bays on the previous Penrhos substation. Creates additional space to facilitate additional bays for future connections.
E-2	Build new	Build a new 132kV SF6-free GIS Containerised Solution at Penrhos and replace cables between Penrhos - tower EV86 and Wylfa – tower EV09	**Taken forward to detailed assessment**	A containerised substation is a solution designed to address substation applications in challenging environmental and spatial conditions, such as areas with high pollution, high humidity, extreme temperatures, or limited land space. These containerised solutions are customisable, can be constructed offline and remotely, and contain all necessary switchgear, transformers, power, and control equipment. Although NGET has not implemented this application in its own network, the concept is available on the market and is a viable option for installing a full 132kV substation in areas with limited land.

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
				This option enables compliant connections for both customers. Makes use of use of existing consents, land made available and existing 132kV bays on the previous Penrhos substation. Creates additional space to facilitate additional bays for future connections.
E-3	Build new	Build a new 132kV AIS substation at Penrhos and replace cables between Penrhos - tower EV86 and Wylfa – tower EV09	**Not taken forward** – the option was not feasible due to prohibitively expensive and constrained land surrounding the site.	**Planning, land and consent** The Penrhos site is located within 2km of the coast. NGET's policy indicates that GIS switchgear is the preferred technology in coastal areas to reduce potential detrimental impact and pollution that can affect AIS switchgear in these locations. [redacted] Since changing hands, the landowner is willing to sell land [redacted] but is still constrained in offering NGET sufficient land to enable an AIS solution, only a GIS solution is compact enough to fit within the land available on the Penrhos site. Land availability is generally limited on the former Penrhos site, with the area constrained to the south and west by the A55 North Wales Expressway and North Wales Coast Line, and to the north and east the A5, Penrhos Beach and the Penrhos Coastal Park.
E-4	Build new	Build a new 400kV substation at Penrhos	**Not taken forward** – the option was not feasible due to prohibitively expensive and constrained land surrounding the site.	**Planning, land and consent and Environmental Impacts** The option of constructing a new 400kV transmission voltage level substation on the Penrhos site was quickly ruled out due to such a scope incurring excessive costs and necessitating additional circuits and approvals through an Area of Outstanding Natural Beauty (AONB). There is almost no likelihood that NGET would obtain consent for installing a new 400kV circuit in the Angelsey area, when the current

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
				connection requirements driving this investment can be met by the existing 132kV circuits. Furthermore, there is currently no confirmed need to upgrade the 132kV network to 400kV in this area. Although this would improve resilience and futureproof for further connection demand, the required upgrades cannot be completed within the needed timeframe for the connections. Without a customer driver NGET is cautious about over-investing in equipment that may not be utilised. [redacted]

Following the high-level options assessment, two options for building a new 132kV substation on the former Penrhos site were taken forward for detailed assessment, which is set out in Section 5. The shortlisted options were:

- Option E-1: Build a new SF6-free GIS substation at Penrhos. Replace cables between Penrhos - tower EV86 and Wylfa – tower EV09
- Option E-2: Build a new SF6-free GIS substation in a novel containerised unit at Penrhos. Replace cables between Penrhos - tower EV86 and Wylfa – tower EV09

Considering the available land and existing assets within current consenting rights, along with the lack of other known connections seeking to connect directly at Holyhead island, NGET determined that utilising the existing 132kV circuits and bays represented a more time-efficient and cost-effective solution for ensuring the required connections could be facilitated as close to their respect ACL dates as possible.

5. Detailed options analysis

This section provides a detailed qualitative and quantitative assessment of the two shortlisted options in section 4. The section concludes by setting out our preferred option.

5.1 Description of the options

The two shortlisted options differ from each other in terms of technology configuration. All drawings provided are also included at larger scale within the Appendix C.

5.1.1 Option E-1: Construct new 8-bay 132kV SF6-free GIS substation and replace 3km cables between Penrhos and tower EV86 and install 2km of cable between Wylfa and tower EV09

Option E-1 considers building a new 8-bay 132kV indoor SF_6 free Gas Insulated Switchgear (GIS) on the land made available by [redacted] on the Penrhos site. This new substation would be a double busbar configuration on the former Anglesey Aluminum site, located approximately in the same location where the old Penrhos Substation used to be situated.

This new 132kV SF6-free GIS substation would serve as the infrastructure for the installation of new circuits to Wylfa and Caergeiliog-Wylfa; the customers [redacted] and Menter Môn, as well as spare capacity for future 132kV connections via 2 spare bays (one being required for an additional circuit). The substation would also house one 132kV Bus Coupler bay and two 132kV Bus sections.

Figure 4 – Single line diagram of Option E-1

Under this option NGET would also replace existing oil filled cable between tower EV86 and the new Penrhos substation with new XLPE cables. These cables would be uprated from 330MVA to 390MVA, increasing capacity on site to facilitate the new connections. New cables would also be installed between Wylfa 132kV substation and Tower EV09.

5.1.2 Option E-2: Construct a new 8-bay 132kV SF6-free GIS substation in a containerised unit and replace 3km cables replace cables between Penrhos and tower EV86 and install 2km of cable between Wylfa and tower EV09

Figure 5 – Single line diagram of Option E-2

[10]This option is largely similar to Option E-1. The only key difference related to the option is its choice to site the substation via a novel containerised unit, rather than a traditional indoor GIS substation building. Option E-2 therefore includes building a new 132kV indoor SF_6 free GIS containerised substation with a double busbar configuration on the former Anglesey Aluminium site, located approximately in the same location where the old Penrhos AIS used to be situated.

The containerised unit is a novel solution which has not yet been trialled or type registered for use by NGET on the transmission network. The features of the solution enable the substation to be built offline and sited within much smaller spaces. However, NGET would need to pursue the process of type-registration to enable use of this technology within

[10] The drawing provided for Option E-2 still presents a [redacted] arrangement due to being developed prior to receiving the design variation request from [redacted] for an additional [redacted].

the investment. Current internal estimates suggest type-registration can take in the region of 12-18 months.

NGET explored using a containerised GIS substation [redacted] given the constrained land available. After Stena Line bought the land, they offered NGET a larger area [redacted], influencing the assessment of the options for a containerised and traditional GIS options as the preferred solution.

This new 132kV GIS substation would serve as the infrastructure for the installation of new circuits to Wylfa and Caergeiliog -Wylfa; the customers [redacted] and Menter Môn as well as spare capacity for future 132kV connection via two spare bays (one of which enabling a new circuit if required). The substation would also house [redacted] 132kV Bus Coupler bay and [redacted] 132kV Bus sections.

The drawing provided in Figure 5 and also provided in Appendix C details the layout of a 6-bay substation. [redacted]

Other Works

A set of cable related works are to be covered under both options and do not differentiate between option E-1 or E-2. A summary of these additional cable works is provided below:

[redacted]

5.2 Design Variation: Movement from a 6 to 8-bay substation

It is also worth noting that a design variation in the project has resulted in a customer-driven change to the substation design. [redacted] This modification was requested to allow greater operational flexibility in the event of a network fault in order to meet enhanced reliability requirements [redacted]. Upon reviewing this request, NGET agreed to a revised offer with the customer, modifying the substation to an 8-bay design. As this requirement exceeds the SQSS-compliant connection NGET is obligated to provide, the cost of these additional bays ([redacted]) [redacted]. Moreover, NGET ensured that the space for an additional two bays, initially part of the 6-bay design, remains available in the 8-bay arrangement to offer future connection opportunities for other potential customers at Penrhos.

5.3 Qualitative options analysis

Table 8 below provides a summary of our detailed qualitative assessment of the relevant technical, environmental, planning, and socio-economic considerations pertaining to options E-1 and E-2.

Table 8: Summary of qualitative analysis of shortlisted options

Option #	E-1	E-2
Option title	**Construct a new 8-bay 132kV SF_6 free GIS substation, replace cables between Penrhos - tower EV86 and Wylfa – tower EV09**	**Construct a new 8-bay 132kV SF_6 free GIS substation in a containerised unit, replace cable between Penrhos - tower EV86 and Wylfa – tower EV09**
Capacity & future development potential Preferred option: no overall advantage to either option.	• The design incorporates space for two additional spare bays which can be used to facilitate future connections. • Uprating of the cable between Penrhos and tower EV86 and installation of new cable between Wylfa and tower EV09 would increase the rating of the previous 330MVA circuits to facilitate unlocking an additional 60MW of capacity at the site to be used across the planned and future connections.	• The design incorporates space for two additional spare bays which can be used to facilitate future connections. • Uprating of the cable between Penrhos and tower EV86 and installation of new cable between Wylfa and tower EV09 would increase the rating of the previous 330MVA circuits to facilitate unlocking an additional 60MW of capacity at the site to be used across the planned and future connections.
Design & technical complexities Preferred option: E-1	• NGET prefers AIS switchgear technology, where possible. • In an environment close to the coast, it is NGET's policy that an indoor GIS substation helps to mitigate environmental impacts and corrosion on assets compared to an outdoor AIS substation. • A limited number of suppliers are currently offering SF_6 free GIS technology in the market. • An indoor SF_6 free GIS substation is a technology that NGET is familiar with and is experienced in installing and operating.	• NGET prefers AIS switchgear technology, where possible. • In an environment close to the coast, it is NGET's policy that an indoor GIS substation helps to mitigate environmental impacts and corrosion on assets compared to an outdoor AIS substation. • A limited number of suppliers are currently offering SF_6 free GIS technology in the market. • A containerised solution is a new technology which has not yet been used in an electricity substation– this presents unknown risks. • A containerised solution is a novel technology that has not yet been type registered for use by NGET.
Operations & maintenance Preferred option: E-1	• NGET Asset Operations team has a degree of high familiarity with the new equipment to be installed, apart from the SF6-free element of the GIS, as this is new technology recently added to the market.	• Without experience, it is not possible to know whether the maintenance and operation of a containerised substation may be more challenging or not. • The overall footprint and layout of the containerised substation would be smaller than a standard GIS hall and as a new

Option #	E-1	E-2
Option title	**Construct a new 8-bay 132kV SF_6 free GIS substation, replace cables between Penrhos - tower EV86 and Wylfa – tower EV09**	**Construct a new 8-bay 132kV SF_6 free GIS substation in a containerised unit, replace cable between Penrhos - tower EV86 and Wylfa – tower EV09**
		technology to NGET is something the Asset Operations team would not be familiar with and would therefore require additional training in how to operate and maintain a substation of this configuration.
Safety, health & security Preferred option: E-1	• Any new NGET substation would be compliant with National Grid security technical specifications to ensure the site has the appropriate security fence and secure access arrangements in place. • As the site would be a new substation build, the works can be built 'offline' without requiring safety from the system which removes significant risk during the construction phase. The substation would be designed and built to comply with the relevant NGET technical specifications.	• As a new technology solution which has not yet been tested on NGET's transmission network, the containerised substation presents unknown risks.
Planning, land & consent Preferred option: no overall advantage to any option.	• Would make use of available land rights, planning consents and cable easements already available on the land from the existence of the previous substation that served Anglesey Aluminium Smelting plant. • A larger plot of land would be needed compared to a novel containerised unit. The latest customer (landowner) has offered NGET enough land to accommodate construction of a standard SF_6 free GIS substation.	• Would make use of available land rights, planning consents and cable easements already available on the land from the existence of the previous substation that served Anglesey Aluminium Smelting plant. • The containerised unit would require less land. [redacted] making the containerised unit a viable solution for a smaller plot. [redacted]
Third party impact & network coordination Preferred option: no overall advantage to any option.	• Approximately a two week outage would be required to connect the new site to the system. As the site would be an offline build the outage requirements would be less compared to other schemes.	• Approximately a two week outage would be required to connect the new site to the system. As the site would be an offline build the outage requirements would be less compared to other schemes.

Option #	E-1	E-2
Option title	**Construct a new 8-bay 132kV SF_6 free GIS substation, replace cables between Penrhos - tower EV86 and Wylfa – tower EV09**	**Construct a new 8-bay 132kV SF_6 free GIS substation in a containerised unit, replace cable between Penrhos - tower EV86 and Wylfa – tower EV09**
Environment & sustainability Preferred option: no overall advantage to any option.	• SF_6 free GIS solutions exist for 132kV voltage levels. These technologies utilise insulating gases with significantly less carbon equivalent polluting potential compared to traditional SF_6. • This option would make use of land which was already used for the purposes of a substation. This option would prevent the use of additional new land or habitat being encroached on which has not previously been used for the purpose of a network connection.	• SF_6 free GIS solutions exist for 132kV voltage levels. These technologies utilise insulating gases with significantly less carbon equivalent polluting potential compared to traditional SF_6. • This option would make use of land which was already used for the purposes of a substation. This option would prevent the use of additional new land or habitat being encroached on which has not previously been used for the purpose of a network connection.
Timing of programme & resources Preferred option: E-1	• As a standard indoor GIS substation, the technology is familiar to and is already type registered for use across NGET. Additional time for type registration would not need to be allowed for to enable use on the Penrhos project. • During optioneering, this option was identified as being capable of facilitating both customers to be connected by their contracted ACL dates [redacted]	• As a non-type registered novel technology, NGET would need to undertake timely type registration activities to enable use of the containerised substation on offer from Hitachi. Current internal estimates suggest an end to end type registration process can take in the region of 12-18 months. • During optioneering, this option was identified as being capable of facilitating both customers to be connected by their contracted ACL dates [redacted] However, this would be contingent on the type registration process happening smoothly and without delays.

Considering the qualitative analysis above and the chronology of changes relevant to the scheme, we eventually landed on option E-1 as our preferred solution for delivering the demand and generation connections outlined in Section 2 of this paper. This is because the solution meets a number of key criteria fundamental to delivering the scheme:

- **Minimises time:** it reduces the risk of increasing time requirements to the delivery programme by removing the need to type register new asset types, in this case the novel containerised substation unit.
- **Risk:** it reduces unknown technical risks by opting for a technology solution which is well established and NGET has significant experience using in an electricity substation setting.
- **Land, planning & consent:** it makes the best use of land eventually made available from the customer to site a full SF_6 free GIS substation, as well as making use of available planning and consenting certifications already available on the land. Again, this also has the benefit of reducing timescales to deliver the overall project which helps to increase efficiency of project delivery spend and meet customer contracted dates.

5.4 Quantitative options analysis

5.4.1 Lifetime Cost-Benefit analysis (CBA)

The CBA was carried out using the NGET CBA/NPV (net present value) tool which is based on Ofgem RIIO-T2 CBA template spreadsheet, assuming a capitalisation rate of 85% and a pre-tax (weighted average cost of capital) WACC of 3.27%, in line with Ofgem's guidelines.

A summary of the lifetime CBA results is presented in the table below. Costs and benefits are discounted at a rate of 3.5% for the first thirty years, and at 3% after that, in line with Ofgem guidance. Costs and benefits are presented relative to a 'do minimum' counterfactual.

The results shown in the table below demonstrate that option E-1 has a more favourable NPV in comparison to E-2. Whilst a summary of the CBA analysis is included here, the full CBA is provided in Appendix D alongside this submission.

Table 9: Lifetime Cost-Benefit analysis (2018/19 prices)

Options	Total (£m)			
	Costs (discounted)	Benefits (discounted)	NPV	Difference to baseline
E-1	[redacted]	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]	[redacted]

5.4.2 Costs

5.4.2.1 Capex costs

All CAPEX cost estimates are derived from the NGET Project Development Cost Book (August 2024 with 2018/19 prices), which is based on historical tender returns and project data. The cost estimations are based on pre-tender award estimates and are subject to change based on actual tendered solutions. The illustrated options are assessed against a "do minimum" counterfactual.

We have used Estimating Units Lines (EULs) to generate cost estimates based on the scope of work and the new assets to be constructed for each option, including risk contingency.

Table 10: Summary of costs (undiscounted 2018/19 prices)

Option	Total CAPEX (£m)	Carbon cost of construction (£m)	Total (£m)
E-1	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]

The difference within the CAPEX cost can be accounted for by the difference in scope between the two options. The only key difference is E-2 choice to site the substation via a novel containerised unit, rather than a traditional indoor GIS substation building.

Future replacements cost of new assets

To assess the costs of the investment, future replacement costs of the new assets were included within the CBA. It has been assumed that the assets on average would have a lifespan of 40 years after the first year of construction. With initial construction commencing in 2025, the replacement costs will commence in 2065. It has also been assumed that the replacement cost would mirror the absolute cost and timespan occurred in the initial construction. The replacement costs will also impact the carbon cost of construction. In line with Ofgem guidance, the CBA spans 50 years commencing 2023. As both the construction and replacement occur within the 50-year appraisal, the replacement cost has been considered within the assessment. In line with Ofgem guidance, the CBA spans 50 years commencing 2023. As the construction and replacement occur within the 50-year appraisal, the replacement cost has been considered within the assessment.

Table 11: Summary of replacement costs (undiscounted 2018/19 prices)

Option	Replacement Spend Profile (£m)	Carbon cost of construction (£m)	Total (£m)
E-1	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]

5.4.2.2 OPEX costs

Annual maintenance costs [applies to no option]

Given that the maintenance costs do not differ amongst options, and that estimation of these costs would be heavily assumption-driven, annual maintenance costs have been excluded from the analysis.

Constraint costs [applies to no option]

Given that the estimation of outages is heavily assumption driven and these would not differ between options, constraint costs have not been included in the CBA.

5.4.2.3 Summary of costs

A summary of the costs within the assessment is illustrated within the following table:

Table 12: Cost Summary £m (undiscounted 2018/19 prices)

Option	Initial cost (£m)	Replacement cost (£m)	Total cost (£m)
E-1	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]

5.4.3 Benefits

Avoided carbon cost of generation

During the lifespan of the new connection point, energy will be created that originates from renewable sources. This proposal suggests the connection for a new tidal power project located on west coast of Holyhead Island [redacted].

This new tidal power project has a capacity of 180 MW and assists with the development of utilising renewable energy sources that lead to avoided carbon emission in comparison to other sources. This is estimated using the NGET CBA tool based on cost of carbon for displaced generation (assumes CCGT), for type of connection, year, load factor and annual output.

The table below illustrates the benefit for each option:

Table 13: Avoided carbon cost of generation (undiscounted 2018/19 prices)

Option	Avoided carbon cost of generation (£2018/19m)
E-1	[redacted]
E-2	[redacted]

SF_6 – leakages

Upon operation gas leaks will be unavoidable. The disbenefit of these leaks is accounted for by the monetisation of the economic value of 1kg of CO2 emissions. The disbenefit was quantified by the multiplication of the total SF6 weight by 0.1% which captures the leakage and disbenefit to society. The value was divided by a thousand and multiplied by the 326 which represents the equivalent of G3 weight into CO2. The equivalent CO2 weight is multiplied by the carbon price to calculate the disbenefit. Table 6 illustrates the non-SF6 disbenefits for the analysis.

No G^3 leakage data was identified and therefore not included within the assessment.

Table 14: Gas leak disbenefit (2018/19 prices)

Option	G_3 emissions (kg)	Gas emissions (tCO_2e)	Economic value of the benefit (£m)
E-1	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]

Transmission losses

Transmission losses occur when energy is lost in equipment due to forces such as friction which turn the electricity into heat. Within the assessment the loss of electricity has been accounted for as a disbenefit to society as the lost electricity that could have been utilised.

The disbenefit is calculated utilising the transmission loss estimates from the cost book for each option. The loss is assumed to occur during and after the ACL for 40 years as explained in the template. The total estimation is divided by the 30 years to obtain an annual disbenefit. The value is then divided by the total losses to understand the transmission loss as a proportion of the total loss. The yearly loss is then divided by the electricity GHG conversion factor (tonnes per MWh) to calculate the annual MWh loss per year across the lifespan.

The value is converted into tCO_2 equivalent utilising the electricity GHG conversion factor. The value of the disbenefit is then multiplied by the traded carbon price to obtain a quantified value.

The outputs are illustrated in the table below:

Table 15: Transmission loss (undiscounted 2018/19 prices)

Option	Total MWh loss	Gas emissions (tCO_2e)	Value of loss (£m)
E-1	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]

5.4.3.2 Summary of benefits

A summary of benefits included in the analysis is illustrated in the following table:

Table 16: Benefits summary

Option	Environmental benefits			Total benefits (£m)
	Carbon cost of construction (£m)	Gas leak (£m)	Transmission loss (£m)	
E-1	[redacted]	[redacted]	[redacted]	[redacted]
E-2	[redacted]	[redacted]	[redacted]	[redacted]

5.5 Preferred solution

Based on the qualitative and quantitative analysis, we have recommended Option E-1 as the best solution to deliver the investment driver, in the interests of current and future consumers.

Out of the two shortlisted options, Option E-1 is the solution with the highest NPV. It represents the most efficient option for consumers in the long term whilst meeting the needs of the contracted customers.

The key factors influencing our decision included identifying an option that could deliver the connections in a timely manner against the contracted connection dates and that would make efficient use of planning and consenting rights already in place, whilst also providing provisions for additional connections in the future. The preferred solution will enable the connection of both renewable tidal power generation sources up to a maximum of 180 MW, as well as a new iDNO 132kV substation with embedded generation of 210MW that will also facilitate the expansion of the nearby Anglesey Freeport as well as the new Prosperity Parc development containing strategic facilities like a data centre and research centre aimed at driving regional and UK growth.

The scope of work for the preferred option is:

Build a new 8-bay 132kV indoor SF_6-free GIS substation with a double busbar configuration on the former Anglesey Aluminium site, located approximately in the same location where the old Penrhos substation used to be situated. This new 132kV GIS substation will serve as the infrastructure for the installation of the following new circuits:

[redacted]

The scope of the option also includes:

[redacted]

An approximate 2-week outage will be required to connect the new site to the system. As the site is an offline build the outage requirements are less compared to other schemes.

6. Detailed cost for preferred solution

6.1 Introduction

This section provides a breakdown of the overall costs and funding allowance request for Penrhos, including an expenditure profile for all Regulatory Years of delivery.

The following cost estimate breakdown represents our latest view of costs for the proposed investment and all costs are presented in 2018/19 price base, unless otherwise stated.

Appendix E.1 Penrhos Cost Model submitted alongside this document provides a breakdown of the costs in more detail and should be reviewed alongside this chapter.

This Chapter is broken down into the following sections:

6.2 Total Allowance Request

6.3. Cost Estimate

6.4 Cost Firmness.

6.2 Total Allowance Request

Total project costs are [redacted]. NGET requests [redacted] allowance is provided through the MSIP reopener mechanism to recover the direct portion of costs and deliver works described above. The MSIP reopener mechanism is subject to the Opex escalator and therefore indirect costs will be funded under this route

Table 17 - Allowance request

	2018/19 price base (£)									
	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	Total
Total project costs	[redacted]									
CAI	[redacted]									
Allowance request - Direct only*	[redacted]									

*Remainder to be funded via Opex escalator

6.3 Cost Summary

The total cost to develop and deliver the investment at Penrhos project is [redacted] including indirect costs and costs incurred to date.

Table 18 below shows a summary of total project costs.

Table 18 - Cost Summary

Element	Total (2018/19 price base, £)	CAI/Direct
[redacted]		

6.4 Cost Firmness

Table 19 below shows the assessment of cost firmness using the classification outlined in the Ofgem LOTI reopener guidance document published on 29th March 2021. This shows that [redacted] of the total costs (firmness 1 and 2) are either incurred or have been contracted. Although [redacted] of costs are classified under firmness 3, [redacted] We therefore have confidence in the cost submission.

Table 19 - Cost Firmness

Cost Firmness	Total	Notes
1 - Fixed	[redacted]	
2 - Agreed remeasurable		
3 - Agreed remeasurable future information		
4 - Estimated		
5 - Early Estimate		
Total		

Estimated costs relate to National Grid resource costs, calculated based on forecast days and standard rates, as well as risk for the remainder of the project.

7. Deliverability and risk

7.1 Deliverability

This section sets out a summary of the key activities pertaining to the delivery of the project, including the current high-level programme plan, procurement strategy and anticipated risks.

7.1.1 Delivery Programme

The project programme is illustrated in Table 20.

Table 20: Delivery Programme Milestones for Penrhos

Milestone	Date
Stage 1 Contract Award	[redacted]
Order placed for GIS plant	
Access to site	
Stage 2 Programme & Cost Plan Submitted	
Contractor Mobilisation Complete	
Construction Start	
Substation Commisioning	
Completion Date	

Outages for the project have been requested and are being reviewed by NESO. We have high confidence the outages will be approved as this substation is currently offline and located at the end of the circuit. As such, it is unlikely we will be competing with other schemes and other outage plans in the area.

[redacted]

7.1.2 Stakeholder Engagement

To date NGET have begun engaging with stakeholders regarding the achievement of consents for the project, but also the general investment excluding the topic of achieving consents. A summary of the current stakeholder engagements and planned future strategy for engagement is included in Appendix F.

7.1.3 Procurement and Contracting Strategy

An initial "Best for Task" exercise was conducted to source an MWC from the Engineering Procurement and Construction (EPC) framework [redacted]

However, at the point of signing the contract [redacted] ceased their involvement with the project, rendering the contract signature void. Consequently, NGET had to return to the market to re-tender the scheme.

With tight timelines [redacted] NGET made a strategic decision to award the contract [redacted] to [redacted], [redacted] had recently been appointed to the Enterprise framework under the Great Grid

Upgrade and was also a supplier on the cables framework, [redacted]

Our recent Workforce and Supply Chain Resiliency strategy, shared within our T3 submission, highlighted the challenges we are continuing to face in supplier participation in tender processes and increases in supplier risk aversion. The approach taken to securing supply chain capacity for the Penrhos project reflects a number of the mitigations and approaches outlined in the strategy, including building regional supply chain models and developing long term partnerships with key supply chain players.

[redacted] NGET saw this contracting strategy as an opportunity to enhance regional supply chain capacity and work collaboratively with [redacted] to increase supply chain skills and capabilities.

[redacted]

[redacted]

7.2 Risk and Risk Management

A risk management process has been used for managing reasonably foreseeable risks. The process employed is in line with ISO 31000:2009, Risk Management – Principles and Guidelines.

Table 21 below lists the key risks identified for the project, although the full Risk Register is included within tab 4.1 of the Cost Model appended to this submission.

Table 21: Delivery risks for Penrhos

Risks	Mitigation
Local Opposition to Works [redacted]	Regular and early engagement with affected landowners and businesses. Liaison with the local council. Appoint an External Affairs consultancy to manage communications with the local stakeholders.
Working adjacent to Site of Special Scientific Interest (SSSI) The construction site and cable route are close/adjacent to the Site of Special Scientific Interest (SSSI). The works are adjacent to the SSSI. There is the risk that the construction methodology may need to be adapted to mitigate against impact to the SSSI site. This subject to conditions that may be imposed by the local council. The impact could result in a halt to project development and the need for the programme to be re-baselined. In turn causing adverse reputational impact and costs of clean up and rebuilding	Early and ongoing engagement with the local council and other relevant stakeholders to discuss the working methodology and potential change in legislation.

Risks	Mitigation
System Outages Taking parts of the network offline to complete works can only be done if the remainder of the network is operational and can compensate for the removal of capacity during works. To respond to system issues or incidents elsewhere on the transmission network, NESO may need to cancel NG ETs pre-booked outage at any stage up to the commencement of the outage in order to ensure adequate network supply and distribution. Other projects in the region will require outages at the same time. There is a risk that outages may be cancelled/delayed/changed. This could impact in delays to the project due to inability to complete works within scheduled outage.	Ensure early outage requests are planned in. Monitor requirements within other parts of the system and have monthly coordination meetings with outage planners.
Customer Design Change and Interfaces Technical design changes on the customer's project that requires a change to the scope of works at Penrhos. There is a risk that customers the customer's design changes may impact the contractor's design. This could impact in additional re-design costs resulting in the contractor raising a compensation event notice, and potential for programme delay.	We continue to host regular design review meetings with customers and NG contractor.
[redacted]	[redacted]

8. Conclusion

This document is NGET's MSIP re-opener submission to Ofgem for construction of a new 8-bay 132kV SF6-free GIS substation at Penrhos. It is submitted with reference to Special Condition 3.14 (paragraphs a & b) of NGET's Transmission Licence.

Table 22 below summarises the main investment driver, the selected option, estimated costs and expected outputs.

Table 22: Penrhos Project Investment Summary

Main drivers	**Generation and Demand – to provide connections for two contracted customers (and Menter Môn).** have requested a 210MW demand and generation connection and Menter Môn a 180MW generation connection . connection is for an Independent Distribution Network Operator (iDNO) substation that will enable its extension of the Angelsey Freeport and construction of the adjacent 'Prosperity Parc' innovation campus, containing a data centre and other science and research facilities. The Menter Môn connection is for a new tidal power project located on the west coast of Holyhead Island, the tidal power park is titled Morlais. This initiative is the largest consented tidal project of this type in the world.		
Selected Option	Rebuild the 132kV Penrhos substation as an 8-bay SF_6-free GIS substation and replace 3km of cable on the Penrhos-Wylfa circuits between Penrhos and tower EV86 and 2km of cable between Wylfa and tower EV09		
Estimated Cost	The current total cost of the project is (18/19 prices) The current direct cost of the project, and funding allowance being sought is: .		
	T2 (FY2022 – FY2026):	**T3 (FY 2027 – FY2031):**	**T4 (FY2031+):**
Outputs	**Network capacity:** This investment will provide a 210MW demand and generation connection for to enable additional capacity at the 'Prosperity Parc' development and Angelsey freeport. It will also provide a 180MW generation connection for Menter Môn to enable the connection of new a tidal power 'plug and play' facility. By delivering both connections, this investment goes further in supporting regional economic growth and development of renewable generation sources. To facilitate future connections, this investment also includes two spare bays, facilitates additional headroom on the connected cable for other connections with design variations in the short term (i.e. non-firm), or long term firm connections subject to installation of a third circuit.		
PCD Primary Output	Construct a new 132kV 8-bay substation for installing at Penrhos for connecting both and Mentor Mon		

Following investment drivers in North Wales to connect Eclipse Power Network's new iDNO substation, facilitating development of the Prosperity Parc innovation campus and Angelsey Freeport, as well as Menter Mon's tidal energy park, we have conducted a robust assessment of viable options using a combination of quantitative and qualitative assessment methods. This assessment sought to balance the need to deliver the connections in line with contracted connection dates, making efficient use of available land and existing connection assets in an area hosting minimal transmission network in place, with the selection of the preferred switchgear technology considering the proximity to the coast.

The conclusion of our analysis is the proposal to construct a new 8-bay 132kV SF6-free GIS substation on the site of the former Angelsey Aluminium smelting plant substation, supporting timely connection of these economically and environmentally strategic investments, whilst protecting the interests of current and future consumers.

9. RIIO-T1 and RIIO-T2 allowances

There were no investments proposed for this project during either RIIO-T1 or T2 business plans submissions and so no funding was received. The project does not have funding through any other price control mechanism.

10. Assurance and Point of Contact

Attached to this submission is the assurance statement letter, providing written confirmation in line with the assurance requirements set out in Ofgem's Re-opener Guidance and Application Requirements Document, dated 17th February 2023.

This confirmation is provided by the Head of Future Price Controls, Electricity Transmission. They provide the following statements below regarding how this MSIP application has been prepared and submitted in relation to each of the three assurance points requested by Ofgem:

a. It is accurate and robust, and that the proposed outcomes of the MSIP submission are financeable and represent best value for consumers.

b. There are quality assurance processes in place to ensure the licensee has provided high-quality information to enable Ofgem to make decisions which are in the interests of consumers.

c. The application has been subject to internal governance arrangements and received sign off at an appropriate level within the licensee.

NGET's designated point of contact for this MSIP application is [redacted], Strategic Upgrade Regulatory Manager ([redacted]

Appendix A: Volume Driver Allowance Calculator

Two excel files demonstrating the difference between total volume driver allowances the investment is eligible for, compared to total efficient costs is provided alongside this submission attached with titles “Appendix A.1 – Volume Driver Allowance Calculator – Penrhos: EPN – Jan 25 MSIP.xslm” and “Appendix A.2 – Volume Driver Allowance Calculator – Penrhos: Mentor Mon – Jan 25 MSIP.xslm”

Appendix B: Asset Health Summary of Wylfa 132kV & 400kV

Wylfa 132kV

Substation	Asset/ No of Assets	Asset Group	Present Health	Future health (8 years)	Future health (20 years)	Present Risk	Main Health Drivers
Wylfa 132kV	[redacted]						

Asset Types which have a Low/Medium risk

Where an asset type appears in more than one category, numbers in brackets indicate the number of assets under that group:

[redacted]

Wylfa 400kV

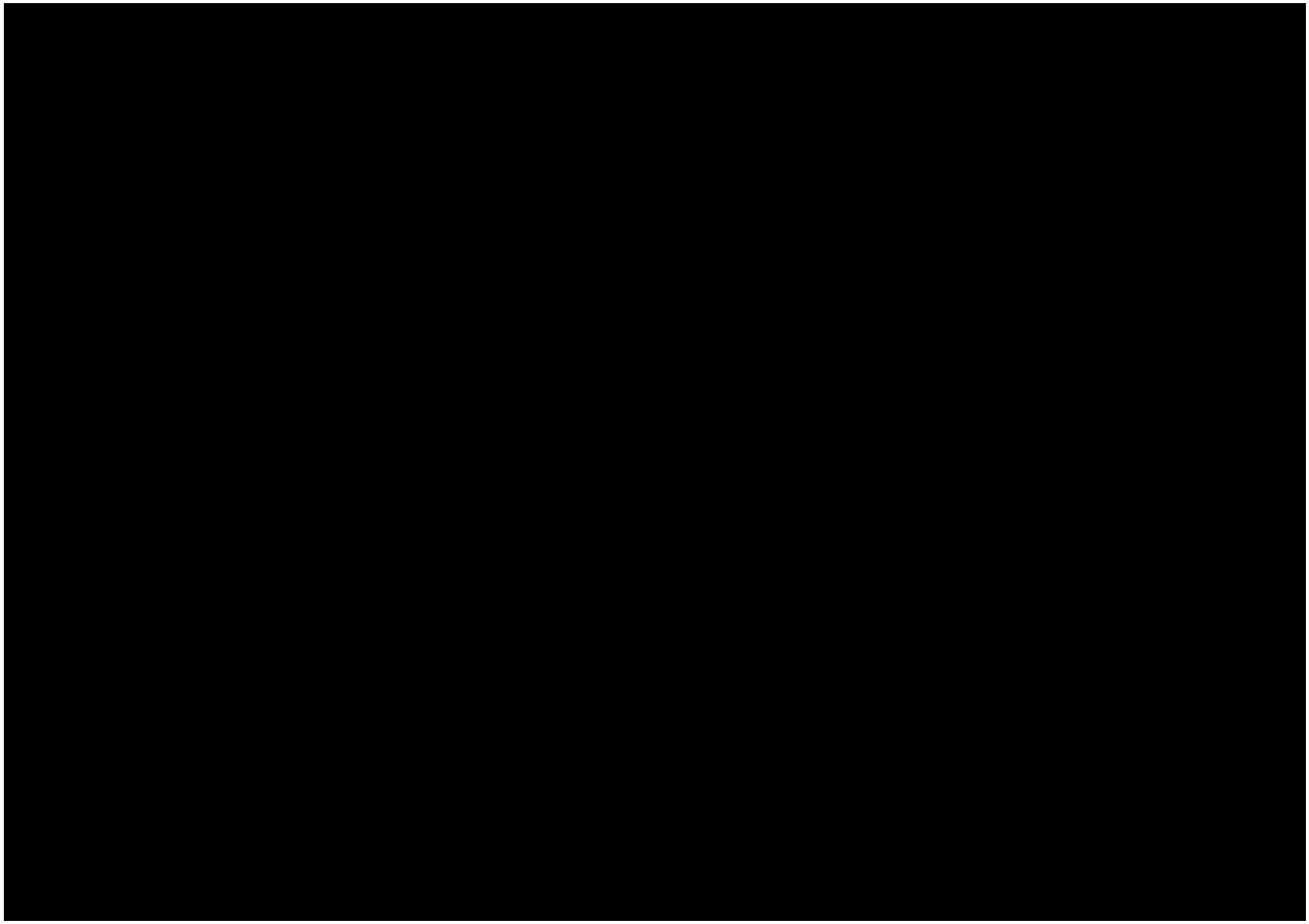
Substation	Asset/ No of Assets	Asset Group	Present Health	Future health (8 years)	Future health (20 years)	Present Risk	Main Health Drivers
Wylfa 400kV	[redacted]						
Wylfa 400kV							
Wylfa 400kV							

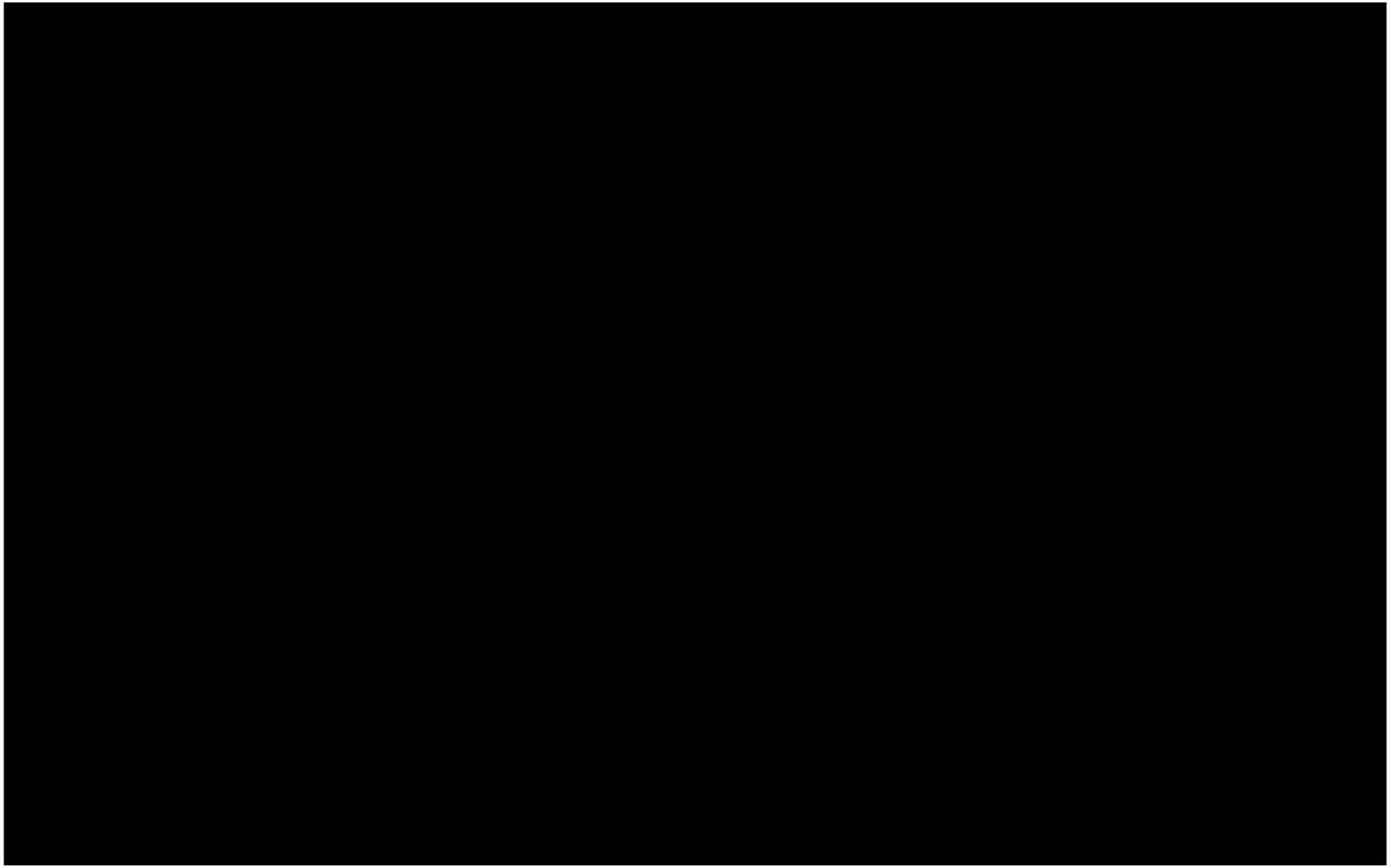
Asset Types which have a Low/Medium risk

Where an asset type appears in more than one category, numbers in brackets indicate the number of assets under that group:

[redacted]

Appendix C: Enlarged drawings of shortlisted options





Appendix D: CBA

An excel files demonstrating the CBA for the investment is provided alongside this submission attached with title “Appendix D – Penrhos CBA - Jan 25 MSIP.xslm”.

Appendix E: Cost Model

An excel files demonstrating the funding allowance request for the investment is provided alongside this submission attached with titles:

- “Appendix E.1 – Penrhos Cost Model - Jan 25 MSIP.xslm”.
- “Appendix E.2 – Penrhos Estimated Inflation – Jan 25 MSIP.xslm”

Appendix F: Stakeholder Engagement

To date NGET have began engaging with stakeholders regarding the achievement of consents for the project, but also the general investment excluding the topic of achieving consents. A brief summary of engagements to date so far and plans for future engagements are included below:

Non-consents stakeholder engagement

Following confirmation of the scope (Sept 2023), we identified the stakeholders affected by the substation and cable works. Affected stakeholders include [redacted]

Due to the varying types of stakeholders, different approaches were taken for engagement:

[redacted]

To date, meetings have typically been quarterly or introductory as there has been minimal site activity and updates [redacted]

Responses from stakeholders have been positive, and they have appreciated the early engagement. The sessions have been productive, allowing accommodation of stakeholder requests where possible. Examples include:

[redacted]

Future stakeholder engagement will be more structured including a number of phases including:

1. Pre Engagement – including initial meetings with local political stakeholders,
2. Preliminary engagement - with the Isle of Angelsey County Council, as well as local community and town councils,
3. A full public consultation
4. Ongoing reporting of the outcomes of the consultation.

Consents Stakeholder Engagement

Looking to consents, we have a record of engagement with stakeholders to date includes:

- Liaison with Heneb: Clwyd-Powys Archaeology (July 2024) to provide an archaeological Written Scheme of Investigation and discuss further reports, investigations, and watching briefs.
- Liaison with the Isle of Anglesey County Council to confirm permitted development rights for the new substation (August 2023).
- Liaison with authorities regarding forthcoming ground investigation works, likely involving the Isle of Anglesey Council Highways department and Heneb: Clwyd-Powys Archaeology.

Future engagement in 2025/2026 will include:

- Further liaison with Heneb: Clwyd-Powys Archaeology regarding Scheduled Monument Consent and Listed Building Consent for cable installation.
- Liaison with the Isle of Anglesey County Council to confirm permitted development rights for the cable route.
- Liaison with the Isle of Anglesey County Council to agree on the external details and colours of substation buildings.
- Liaison with the Isle of Anglesey County Council regarding an exemption for S37 consent for tower modifications.
- Liaison with organisations regarding the delivery of Biodiversity Net Gain (e.g., the Isle of Anglesey County Council, Local Wildlife Trusts).
- Principal Contractor's liaison with stakeholders such as NRW and the Isle of Anglesey County Council regarding secondary consents (e.g., environmental permits, highways permits).
- Liaison with the Isle of Anglesey County Council tree officer regarding tree removal.

Appendix G: Glossary

Acronym	Definition
ACL	Available for Commercial Load
AIS	Air Insulated Switchgear
ATF	Automotive Transformation Fund
BESS	Battery Energy Storage System
BNG	Biodiversity Net Gain
CATO	Competitively Appointed Transmission Operator
CBA	Cost-Benefit Analysis
DNO	Distribution Network Operator
EA	Eligibility Assessment
ECI	Early Contractor Involvement
EIA	Environmental Impact Assessment
EMFs	Electromagnetic Fields
EPC	Engineering, Procurement and Construction
ESO	Electricity System Operator
EV	Electric Vehicle
FID	Final Investment Decision
FNC	Final Needs Case
GBA	Green Belt Assessment
GDP	Gross Domestic Product
GIB	Gas Insulated Busbar
GIS	Gas Insulated Switchgear
GSP	Grid Supply Point
GVA	Gross Value Added
iDNO	Independent Distribution Network Operator
kV	Kilovolt
LDO	Local Development Order
LEP	Local Enterprise Partnership
LOTI	Large Onshore Transmission Investment
MVA	Megavolt Amperes
NDP	Network Development Process
NG	National Grid
NGET	National Grid Electricity Transmission
OEM	Original Equipment Manufacturer
OHL	Overhead Lines
SDS	System Design Specification
SF_6	Sulphur Hexafluoride
SGT	Super Grid Transformer
SQSS	Security and Quality of Supply Standard
SWOT	Strengths, Weaknesses, Opportunities and Threats
tCO2e	Carbon Dioxide Equivalent
UG	Underground Cable

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nationalgrid.com

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