nationalgrid

January 2025 MSIP Reopener

MSIP Wallend

National Grid Electricity Transmission
Medium Sized Investment Project

January 2025

Contents

Investment Summary

Project Name	Wallend 400kV	**Delivery year**	[redacted]
Drivers for the Investment	**Interconnector & Generation - to provide a new 3149MVA connection (to facilitate two interconnectors and a BESS facility) to three customers (Neuconnect, National Grid Interconnect Holdings and Econergy).** Neuconnect have applied for a connection to the grid forn a 1.4GW interconnector to Germany. Construction is well underway for this project, which requires a 400kV substation at Wallend. Two further customers have applied for grid connection at the site. These are National Grid Interconnect Holdings Ltd (NGIL), a part of National Grid Ventures (NGV) who wish to connect a 1.5GW interconnector at the site (known as "SouthernLink[1]" to facilitate a connection to offshore wind assets and to the Belgian grid), as well as Econergy, a 249MW Battery Energy Storage System (BESS).		
Key considerations & challenges	Key considerations and challenges in delivering this investment include: - • **Technology choice**. The proposed site is located less than 1 km from the Kent coastline and therefore the issue of atmospheric pollution requires the use of Gas Insulated Switchgear (GIS). • **Outages**. To facilitate connections of Grain to Kingsnorth and Grain to Tilbury circuits this project will involve outages. Options to reduce the need for additional outages are preferred given they will reduce constraint costs ultimately incurred by consumers. • **Time**. Neuconnect have a contracted connection date [redacted]. NGETs current programme gives a [redacted] first connection date. [redacted] • **Futureproofing and future network requirements**. The proposal will facilitate connection of two interconnectors and a BESS facility, other developers have expressed an interest in connecting at this site; the current site configuration includes spare capacity of 3 bays. • **Consumer value**. Constructing a facility in a single phase capable of enabling multiple connections and where the customer is incurring some of the cost allows us to deliver a cost effective solution for consumers. • **Land and consent**. Planning has already been secured for the preferred option; any amended option should be consistent with the Outline Planning Permission granted by Medway Council.		
Optioneering	National Grid Electricity Transmission (NGET) assessed 11 options. The long list of options included: - • Do nothing & market-based solutions - which fail to provide a physical customer connection. • A whole systems solution. This does not meet the customer's requirement for a 400kV connection and may require additional reinforcements on the distribution network. • 3 options to extend substations close to the Kingsnorth to Grain 4TK line. • 4 options to construct a new substation Three options were shortlisted for detailed analysis, each of which are options to construct a new substation; these include a 5-bay substation, a 10-bay substation in a 10-bay building and a 10-bay substation in a 16-bay building.		
Proposed Solution	The preferred solution is a new 10-bay 400kV SF6-free Gas Insulated Switchgear (GIS) substation close to the 4TK route with provision to expand to 16-bays to accommodate existing and future customer connections, and a double circuit turn-in of the 4TK Overhead Line (OHL) route via two new towers. This solution is in the best interests of consumers as it has a lower construction cost than constructing across multiple phases of works and includes a greater degree of future proofing as additional customers can be connected without the need for a reconfiguration of the substation.		
Outputs of the Investment	**Network capacity:** Outputs are connecting a 1.4GW interconnector between Great Britain and Germany, connecting a proposed 1.5GW interconnector currently in development by NGV and connection of a 249MW BESS facility. The customer connections will provide the grid with greater system resilience, the import of less expensive low-carbon electricity, as well as system balancing benefits.		

[redacted]

PCD Primary Output	Construct a new 10-bay 400kV SF6-free GIS substation and a double circuit turn in off the 4TK OHL route via two new towers to connect two interconnector customers and one BESS facility by [redacted]		
Estimated Cost (2018/19 prices)	The estimated for the cost of the investment is [redacted] (including one off costs) of which we are requesting [redacted] in direct costs for funding as part of this MSIP submission.		
Spend profile	**T2 (FY2022 – FY2026):** [redacted]	**T3 (FY 2027 – FY2031):** [redacted]	**T4+ (FY 2032+):** £0 (0%)
Reporting table	Annual RRP – PCD table	**PCD Modification Process**	Special Condition 3.14 – Appendix 1
Historic funding interactions	A previous iteration of the project (a 5-bay substation) was awarded volume driver funding of around [redacted] However, as the scope of the project has fundamentally changed, these allowances have been returned to Ofgem.		

1. Executive summary

1.1 Context

This paper, together with the associated Cost Benefit Analysis (CBA) , summarises NGET's proposed investment to construct a new 400kV Gas Insulted Switchgear (GIS) substation at Wallend on the Isle of Grain in Kent and seeks to demonstrate the consumer interest in the associated investment The project will facilitate a new 1.4GW HVDC interconnector to Germany (Neuconnect), as well as a 1.5GW HVDC interconnector to Belgium (SouthernLink) and a further connection to a new 249MW Battery Electric Storage System (BESS) (EcoEnergy).

This Medium Size Investment Project (MSIP) 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?

NGET originally received a Connection Application from the Neuconnect HVDC Interconnector project in 2016 for a connection onto the NGET Transmission System with a connection date of [redacted]. Since the original Draft Connection Agreement [redacted] several revisions were made to the Connection Agreement; the final Transmission Owner Construction Agreement (TOCA) includes a connection date of [redacted]. Our current programmed connection date is [redacted] Within this period of time Neuconnect have reached agreement with Ofgem to postpone the regime start date for their HVDC interconnector [redacted].

In response to the connection request, NGET plan to construct a new substation in Wallend. This project will facilitate the connection of a 1.4GW subsea High Voltage Direct Current (HVDC) electricity link between the UK and Germany, a 1.5GW subsea HVDC cable between the UK and Belgium and a 249MW BESS facility.

The new 400kV SF6-free GIS substation is to be constructed by NGET located on land adjacent to Neuconnect's assets. The identified connection location is on the Grain-Kingsnorth / Grain-Tilbury 400kV transmission route (4TK) and will result in a requirement for the new 400kV substation to be fed via a double turn-in connection.

Following the connection offer to Neuconnect, NGET have received further connection requests including a 1.5GW interconnector being developed by NGV (originally due to connect at Grain but a modification request was made to their connection agreement in [redacted] requesting a connection point at Wallend) and a 249MW BESS facility currently being developed by Econergy International Limited, of which the connection request to Wallend was made in [redacted]

Both Neuconnect, the interconnector being developed by NGV and the BESS facility are a key part of the energy mix as the UK transitions to net zero. As we have received additional applications from NGV and Econergy, we have designed a project which will provide a timely connection for all applicants, including the provision of spare connection capacity, in the interest of both current and future consumers.

The increase in interconnector capacity will further help with system balancing and to reduce prices for consumers given that wholesale electricity prices are generally currently lower in Continental Europe than in Great Britain. In the longer term, the proposed interconnector capacity may allow excess energy to be sold to mainland Europe as renewable capacity continues to expand in the UK.

The connection of a further 249 MW of BESS capacity will provide balancing benefits, as well as a reduction in curtailment costs in instances where there is excess generation on the system. It will help to reduce the amount of fossil fuel generation needed to balance the system in times of system stress.

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

NGET assessed a wide range of potential solutions to address the connection requests from Neuconnect, NGV and Econergy in a way that best serves the interest of current and future consumers. There are a number of key trade-offs that have been considered as part of the optioneering process; these trade-offs include the feasibility of implementation (e.g., some options require fewer outages than others), land availability, the cost of each option, technology choices (e.g., the use of AIS versus GIS switchgear) and the ability of each option to address the future connection needs of customers.

Given the landfall site for Neuconnect sits close to the Kingsnorth to Grain 4TK line, we have considered options to connect through extending existing substations in the vicinity of the landfall site (Grain and Kingsnorth 400kV substations), as well as constructing a new substation.

NGET considered three options that did not involve a direct connection: **(Options A, B and C**) doing nothing, market-based solutions, and whole system solutions. However, these were rejected as they did provide a compliant and viable connection. Neuconnect's request for a direct connection to the NGET must be pursued to comply with these obligations.

NGET has therefore considered several options which allow for connections to the transmission system. These include three options to extend or utilise existing substations **(Options D-1 to D-3)** and four options to build a new substation **(Options E-1 to E-4)**:

- **Option D-1** – an extension to the existing substation at Grain using non-SF6 GIS switchgear to connect all customers (Neuconnect, NGV and Econergy).
- **Option D-2** – an extension to the existing substation at Grain using non-SF6 GIS switchgear to connect NGV and Econergy, and the construction of a new substation at Wallend using non-SF6 switchgear to connect Neuconnect.
- **Option D-3** – an extension to the existing substation at Kingsnorth using non-SF6 GIS insulated switchgear to connect all customers (Neuconnect, NGV, and Econergy).
- **Option E-1** – the construction of a new 5-bay substation using AIS switchgear
- **Option E-2** – the construction of a new 5-bay substation with a 5-bay building using non-SF6 GIS switchgear.
- **Option E-3** – the construction of a new 10-bay substation with a 10-bay building using non-SF6 GIS switchgear.
- **Option E-4** – the construction of a new 10-bay substation with a 16-bay building using non-SFT GIS switchgear, allowing for an extension to the number of bays in future, without the need for substantive works.

To allow us to assess the most appropriate options we have conducted both qualitative analysis and a formal CBA, presented in later sections. [redacted]

The options that were shortlisted for further consideration include options E-2, E-3 and E-4. These were shortlisted as they meet the customer's connection needs while offering various degrees of future proofing in meeting future connections requests for other customers.

Option E-2 was originally considered in response to an application for a connection by Neuconnect which was made in 2016. This was a 5-bay substation designed to accommodate a single customer. However, in 2022 NGV requested an amendment to a connection request originally due to connect at Grain 400kV to instead connect at Wallend. In the same year the BESS developer Econergy requested a connection to Wallend, leading to the consideration of two larger substation designs (E-3 and E-4) in addition to the originally smaller design (E-2) in order to accommodate potential customers in addition to Neuconnect.

Of the four options that were identified for the delivery of new build substations, three were progressed to detailed options analysis (E-2, E-3 and E-4). Key reasons for discounting the other option (E-1) at this stage included a combination of the footprint of the facility, the use of AIS in close proximity to the coast, the impact that the choice would have on programme, the need for planning in order to extend in future, and the number of outages required in order to extend the substation.

Table 1 below provides a high-level summary of how the options compare against key criteria for the project.

Table 1: Summary of new build options against key criteria

Option	E-1	E-2	E-3	E-4
Technology choice: Lower maintenance costs from GIS	AIS	GIS	GIS	GIS
Future network requirements: can be extended to future proof for future customers.	Providing additional bays requires major modifications	Providing additional bays requires major modifications	Providing additional bays requires minor modifications	Providing additional bays requires no modifications
Time: enables delivery in time for [redacted] connection date for Neuconnect	No	No	Yes	Yes
Network impact: minimises the number of outages required in delivering the required customer connections	Additional outages required to connect subsequent customers	Additional outages required to connect subsequent customers	Minimises the number of outages required to connect subsequent customers	Minimises the number of outages required to connect subsequent customers
Planning: need for additional planning permission to connect new customers	Additional planning permission required	Additional planning permission required	Planning permission required for building extension (but not OHL towers)	Extension under permitted development rights
Progressed to detailed analysis stage	No	Yes	Yes	Yes

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

Based on our analysis the best performing and hence the preferred option is Option E4, which is the construction of a 10-bay substation within a 16-bay building using non-SF6 GIS switchgear. The preferred option provides for a new 10 bay SQSS-compliant double bus bar 400kV substation with:

- 2 Overhead Line (OHL) towers to facilitate a double turn-in connection on GRAI4 – TILB4 / GRAI4 – KINO4 circuits,
- 4 feeder bays for NGET using modular GIS
- 2 bus coupler bays using modular GIS
- 2 bus section bays using modular GIS
- 2 customer bays for Neuconnect using modular GIS

This option would include a building footprint with sufficient space to accommodate a further 6 bays, with 2 bays used by NGV, 1 bay used by Econergy and a further 3 bays which are designed to accommodate future customers expected this this region.

This option will facilitate the connection of a 1.4GW interconnector between mainland Great Britain and Germany (Neuconnect), as well as a potential further 1.5GW interconnector between Great Britain and Belgium (SouthernLink) and a 249W BESS facility (Econergy). Adding further interconnector capacity to the GB market will allow for import and export of renewable electricity, helping the UK to meet its 2030 decarbonisation goals as set out in the Government's Clean Power 2030 Action Plan[2].

The preferred option is more beneficial to consumers in several ways. Firstly, it is the least expensive of the shortlisted options. Secondly, it is less disruptive to the network; option E-2 would require a higher number of outages which could require curtailment costs which would be incurred by consumers. Furthermore, the preferred option includes spare capacity to connect further customers in future which means that generation or demand capacity can be connected to the grid at a lower cost compared with other options where substantive substation reconfigurations are required.

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

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

The proposed solution considers future connection and system stability. The preferred option includes space for 3 additional bays which could be used by new customers in the future, to take advantage of scale economies and provide consumer value through avoiding the inefficiencies of later works and outages. The building design in the preferred option has been designed explicitly so that additional customers beyond the initial three applicants can connect at least cost and with minimal disruption to the network (for example, the preferred option only requires the construction of new bays and does not require any reconfiguration of the connection between the substation and the transmission network).

The design of the preferred option includes the construction upfront of two new OHL towers, thereby reducing the number of outages required to deliver a 16-bay substation. In future the substation can be extended, allowing for the connection of new customers without the need for further OHL outages.

SF6 emissions are up to 23,500 times more potent than CO_2[3]. Given this, changes in regulation to prohibit the use of SF6 in the UK have been implemented; the UK follows the European Union's F-gas regulation, which aims to phase out SF6 in medium voltage electrical equipment by 2026 and 2030. While high voltage applications are not yet fully prohibited, it is likely that stricter measures and regulations will be considered to reduce SF6 emissions in future. The use of SF6-free GIS equipment will help to future proof the new substation.

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

The following risks and uncertainties to the successful delivery of this project include: -

- **Outage availability:** There remains the risk that outages may not be available to meet the planned project delivery timelines. The planned outages are required to facilitate the diversion of the Grain-Kingsnorth / Grain-Tilbury 400kV transmission route (4TK) needed to construct the 2 new OHL towers and to facilitate connection to the network. This risk has been partly mitigated by the construction of the 2 new OHL towers in 2024.
- **Consents**: Neuconnect have progressed the planning application for the substation, and this was approved in April 2020. [redacted]
- **Ecological and environmental constraints:** There is the potential for delays due to the discovery of protected species including nesting birds, Great Crested Newts or dormice.
- **Procurement:** As the project proceeds to the development and construction phases, the process for procurement will become a further risk to be mitigated through effective contractor management.

[2] https://assets.publishing.service.gov.uk/media/675bfaa4cfbf84c3b2bcf986/clean-power-2030-action-plan.pdf
[3] https://www.siemens-energy.com/global/en/home/stories/alternatives-for-sf6.html

- **Construction:** There are several uncertainties in the construction phase including interactions between the customer and NGET contractors, [redacted]
- **Construction Programme:** NGET moved into contract with a main works contractor to deliver the substation build at Wallend in January 2024. Through the first stage of the contract NGET worked collaboratively with the contractor to refine the substation build programme. [redacted] NGET continue to explore options to improve and de-risk the construction programme.
- [redacted]

Following the receipt of connection requests from Neuconnect, NGV and Econergy, 10 options were considered to facilitate the outputs that the customer connections are expected to achieve. These included 3 non-connection options which were discounted as they do not meet NGET's licence obligations.

Through our optioneering analysis, including both qualitative considerations and more formal CBA we identified a preferred option which met the customer's connection criteria (securing a connection for Neuconnec[redacted] NGV[redacted] and Econergy[redacted] while minimising the impact of the scheme on wider system readiness and providing capacity for future connections in the most efficient and economical way.

The conclusion of the optioneering process was to construct a new 400kV substation at Wallend comprising of 4 feeder bays for NGET, 2 bus coupler bays using modular GIS, 2 bus section bays using modular GIS and 2 customer bays for Neuconnect using modular GIS. The scheme will provide a substation building sufficiently large for the construction of up to 16 bays, of which 13 will be used by NGET and for the connection of the three customers. This will facilitate connections for the NGV interconnector, a BESS facility being developed by Econergy as well as space for an additional 3 bays that can be used by future customers.

2. Introduction

2.1 Project background

This MSIP seeks presents the investment case and associated efficient costs for a new 400kV substation at Wallend on the Isle of Grain in Kent. The project will facilitate the construction of two new interconnectors between the UK and Continental Europe. These interconnectors are the Neuconnect 1.5GW HVDC cable between the UK and Germany and the 1.5GW SouthernLink interconnector between the UK and Belgium being developed by NGV. In addition to the two interconnectors, a 249MW BESS facility currently being developed by Econergy has signed a TOCA to connect at Wallend.

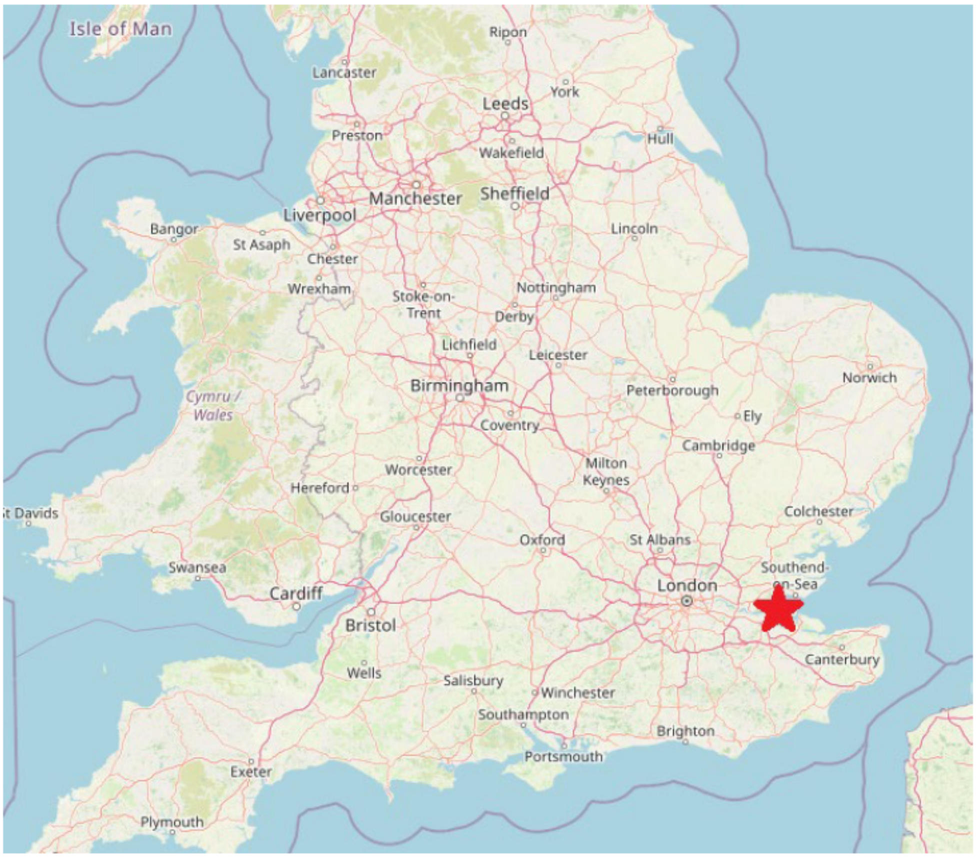

Figure 1: Location of proposed substation on the Isle of Grain, Kent

2.1.1 MSIP eligibility

This MSIP investment request aligns with the requirements of the Special Condition 3.14 (Medium Sized Investment Projects Re-opener and Price Control Deliverable). Section 3.14.6 states that the licensee may apply for a direction from the Authority to amend the outptuts and allowances associated with a General Connection project, (defined as Category a) including all infrastructure related to that project, the costs of which are at least £11.84m more than the level covered by the General Connections volume driver.

2.1.2 Chronology to the request

Neuconnect

[redacted]

NGV

[redacted]

Econergy BESS

[redacted]

2.1.3 Importance of the investment

Supporting the Government's interconnector deployment targets

The UK Government's Clean Power 2030 Action Plan4, published in December 2024, aims to achieve net zero by 2030 by reducing emissions from the power and energy system by 40MtCO2e. The accompanying report on interconnectors suggested that increasing capacity between the British and EU energy markets could reduce emissions, lower electricity prices in Great Britain, reduce thermal generation and reduce the need to curtail renewable electricity generators. The paper also predicted that Great Britain, currently a net importer of electricity, could become a net exporter due to the large-scale deployment of renewable electricity stations.

With the current interconnector capacity in the UK at 9.GW, the Government has committed to increasing this capacity to at least 18GW by 2030 to support the expected growth in renewables. Additionally, the energy white paper[5] that was published in 2020 recommended an offshore transmission network review to enhance the design and delivery of the network. This review suggested using hybrid, multi-purpose interconnectors to maximise the potential of the UK's offshore wind and transmission assets, integrating offshore wind transmission links to neighbouring markets.

The investment covered by this MSIP will contribute towards the Government's ambition to realise at least 18GW of interconnector capacity by 2030, by deploying an additional 2.9GW of interconnector capacity, by connecting both the Neuconnect interconnector (1.4GW) and the SouthernLink (1.5GW) interconnector to the grid. Furthermore, the latter is expected to be deployed as a hybrid interconnector, both providing interconnection capacity between GB and Belgium, as well as connecting renewable generation assets in the North Sea.

Supporting BESS deployment

The deployment of Battery Energy Storage Systems (BESS) is crucial to transitioning the GB energy system away from fossil fuels. BESS allows excess renewable energy to be stored during periods of low demand and sold for a higher price during periods of higher demand, thereby providing financial incentives to encourage the deployment of additional renewables, and providing security of supply benefits. In November 2023, the Government published its first battery strategy[6], outlining steps to develop the battery sector, including strengthening supply chains, supporting innovative financing, reforming the planning system and exploring pro-growth regulations and industry standards.

Although the Government has not set specific targets for battery storage deployment, it expects demand for energy storage to rise to 10GWh by 2030 and 20GWh by 2035. As of 2023, there is around 3.5GW of installed capacity, which is insufficient to meet future demand given the high levels of renewable generation needed to meet net zero targets. The Government's commitment to delivering fully clean electricity by 2030 suggests that much higher levels of battery storage will be deployed in the coming years to bridge this gap.

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[4] https://www.gov.uk/government/publications/clean-power-2030-action-plan

[5] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

[6] https://www.gov.uk/government/publications/uk-battery-strategy

The construction of a new 400kV substation has a key role to play in supporting the further deployment of BESS capacity required to facilitate the level of renewables needed to achieve the Government's ambition to fully decarbonise the electricity sector by 2030.

Further information on each of the projects that the proposed 400kV substation will support is set out in Appendix C.

2.2 Regional and strategic context

To meet future higher levels of demand, the electricity network will need to accommodate a high number of new connections for both generation and demand customers. The proposed intervention is based in the Southeast of England, which is one of the most challenging parts of the network due to high levels of demand due to its proximity to London, high levels of forecast electricity generation in the area and its location as a preferred location for landfall sites for current and proposed interconnector facilities.

These factors mean that the region is a complex landscape of electricity transmission challenges given the need to balance these competing needs.

As of February 2024, there are contracts for new connections that would deliver 54GW of generation capacity in the Southeast[7]. We expect that around 1.7GW of this capacity will be delivered by the end of T3. On the demand side, there have been around 5GW of demand connection applications, with around 1.6GVA expected to connect by the end of T3.

A significant proportion of new generation connections are expected to come from intermittent sources such as solar PV and offshore wind. Large amounts of intermittent generation can cause problems for the effective operation of the grid; it can impact on grid stability, introduce issues around balancing, and requires the need for back-up power to compensate during periods of low electricity generation (for example when it is overcast or during periods of low wind speed).

Battery storage facilities can play a crucial role in addressing the problem of intermittent generation by providing backup storage, grid stability services and balancing services. Installed battery storage is expected to increase to 7.4GW by the end of 2024[8], and the Southeast of England has a key role to play in the deployment of this increase in capacity.

The Southeast Coast's electricity transmission network functions as both a net importer and exporter, depending on interconnector flows. Currently, there is 6GW of interconnector capacity connected to the grid in the Southeast, with interconnectors linking to France, the Netherlands, Belgium, and Germany. These interconnectors are crucial for managing large flows of electricity, especially during periods of high wind and solar generation.

Currently, existing interconnectors in the region are operating close to or at full capacity. During winter months, when demand is at its highest, interconnectors often operate close to their maximum capacity, leading to congestion. For example, in 2021, it was reported that interconnectors operated at around 80-90% of their capacity during peak periods[9]. This limits the UK's ability to import or export electricity efficiently, especially during peak demand periods, and there is a key role for the Southeast region to play in helping to deploy additional interconnector capacity.

Through this proposed investment, NGET can help to address the challenges faced in the region, notably the need for additional substation connection capacity to enable more interconnector, renewables and battery storage deployment.

2.3 T3 Interactions

The RIIO-T3 business plan, published by NGET in December 2024, outlines the strategic investments and initiatives planned for the period from 2026 to 2031. The purpose of the document is to detail how NGET will deliver a transformation of the electricity transmission network to support the UK's transition to a clean, fair, and affordable energy future.

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[7] https://riiot3.nationalgrid.com/sites/g/files/atxybb411/files/documents/2025-01/Southeast%20Regional%20Business%20Plan.pdf
[8] https://eandt.theiet.org/2024/08/19/edf-renewables-uk-build-more-300mw-battery-storage-next-year
[9] https://www.elexon.co.uk/about/interconnectors/elexon-insights-interconnector-flows-in-and-out-of-great-britain/

The proposed substation at Wallend aligns with the RIIO-T3 business plan by addressing the need for increased network capacity and supporting the integration of renewable energy sources; by facilitating additional interconnector capacity the scheme will help to secure additional sources of renewable energy from mainland Europe. Additionally, the scheme will help support the deployment of renewables in Great Britain as the interconnectors will provide renewable generators in Great Britain with alternative sources of revenue, thereby making investment in renewables more attractive.

This substation is part of the strategic infrastructure investments set out in the RIIO-T3 business plan, aimed at enhancing the local network to meet future demands and reduce congestion. By improving the efficiency and reliability of the electricity transmission system, the Wallend substation will contribute to the overall goal of delivering a resilient and efficient network.

The proposed substation is designed to handle the anticipated growth in electricity demand in the Southeast of England and to integrate new technologies that enhance the operational efficiency of the network, such as BESS.

This investment also aligns with Consumer Outcomes embedded across our T3 plan, a summary of these is detailed in the table below.

Table 2 - Alignment with Ofgem T3 consumer outcomes

Infrastructure fit for a low-cost transition to net zero	In the in the interest of efficient spend for current and future consumers, this investment delivers a futureproofed connection solution via construction of a 10-bay substation with capacity to extend up to 16 bays, for a number of strategically important connections, including two interconnectors.
Secure and resilient supplies	Connection of additional interconnector capacity will help to safeguard reliable and secure renewable energy supplies on to the Electricity Transmission Network.

[redacted]

[redacted]

[redacted]

3. Establishing Need

3.1 Overview

This section sets out the key driver for the investment need. This is summarised in Table 4 below.

Table 4: Summary of Investment Drivers

Summary of Primary Driver		Date
Customer connections	This investment is being driven by requests for three customer connections that will require 13 bays at a 400kv substation. The following connections have been requested by customers: • **Neuconnect**. This customer has requested a connection for a 1.4GW interconnector between the UK and Germany. • **SouthernLink**. This customer (NGV) has requested a connection which will facilitate a 1.5 GW Offshore Hybrid Asset interconnector between the UK and Belgium, with an intermediate connection to a new artificial energy island and offshore wind facilities to be located off the coast of Belgium. • **Econergy**. This customer has requested a 249MW connection to a BESS facility.	**Neuconnect** [redacted] **SouthernLink** [redacted] **Econergy** [redacted]

3.2 Load related drivers

The project will facilitate three connections in the near term; these are two interconnectors (Neuconnect at 1.4GW and SouthernLink at 1.5GW), as well as a 249MW battery storage facility. These facilities can act as both load or supply, depending on electricity supply patterns (when supply is high it is expected that the interconnectors and battery storage will be recipients of electricity and therefore act as load operators).

The table below provides details on the proposed customer connections.

Table 5: Details of load drivers

Customer Name	Project Name	Project Type	MVA Demand	ACL Date	Customer Status
Neuconnect Britain Ltd.	Neuconnect	Interconnector	1400MVA	[redacted]	Land – Acquired Planning permission – Secured FID – Taken
National Grid Interconnector Holdings Limited	SouthernLink	Interconnector	1500MVA	[redacted]	Land – Not yet acquired Planning permission – Anticipated for 2026 [redacted]
Econergy International Limited	Econergy	BESS	249MVA	[redacted]	Land – Not yet acquired Planning permission – Anticipated for 2027 [redacted]

Other customer connections

In addition to the connection requests from Neuconnect, NGV and Econergy, NGET is currently aware of a number of other customers seeking connection in the locale. These include: -

- **49.5MW for a Battery Energy Storage System at Cuxton in Kent**. [redacted]
- **1800MW for a combined cycle gas turbine (CCGT) plant** to be built in the Hoo Peninsula in Kent. [redacted]
- **50MW for a Battery Energy Storage System** [redacted]
- **Up to 400MW for either a renewables development (e.g., solar) or a Battery Energy Storage System** [redacted]

3.3 Customer Drivers

FES 2024 Holistic Pathway. Additionally, the NESO is implementing a programme of reforms which aims to reduce the size of the queue and speed up connections. Given the rapid growth of the connections pipeline, NGET had helped to triage potential connections using a connection certainty methodology. NESO continue to work on the connection reforms which will also go further in refining and updating the long and growing list of connections, however outputs of this work are not yet known.

To navigate this uncertainty and 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.

The contracted projects at [redacted] 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 6.6 (amber, 'amber confidence), however two of the tree connections have individually high confidence ratings and none of the three connections considered weak in confidence.

NGET has a high degree of confidence in these connection requests. Neuconnect have acquired land and have secured planning permission for the development. NGET remains in contact about securing planning and permission and land in relation NGIL's interconnector.

Table 6: Customer confidence assessment

Customer Name	Project Type	MW	ACL Date[10]	RAG confidence
EcoGrainWest EIL	BESS	1320	[redacted]	[redacted]

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

Neuconnect Interconnector	Interconnector	1320	[redacted]	[redacted]
SouthernLink NGIH	Interconnector	1320	[redacted]	[redacted]

3.4 Existing and planned future network

This project is located on the Isle of Grain in East Kent connecting to the Southeast transmission network. The current network consists of a 400 kV coastal network starting in the Thames Estuary, through East Kent then tracing the Southeast coast through Sussex to the Solent and connecting into an arterial route that spans Hampshire, Buckinghamshire and Oxfordshire. The region's network is critical in supporting the needs of both London and wider UK power exchange requirements through several coastal interconnectors to mainland Europe. These interconnectors are critical to supporting the UKs energy resilience whilst enabling a commercial trading platform for surplus of renewable energy on the system.

The Southeast Coast electricity transmission network can function as both an importer and exporter of electricity, depending on interconnector flows. With increasing volumes of renewable power connected to the transmission system, large flows of electricity move from Great Britain to Europe during times of high wind and solar generation. Currently, there is 6GW of interconnector capacity operational in the Southeast, with plans to add 6.1GW by 2032.

As of January 2025, there are contracts for circa 54GW of generation connections in the Southeast region, with an estimate of about 1.7 GW of this capacity to be delivered by the end of T3. On the demand side, there are circa 5GW of connection applications with around 1.6GVA expected to be delivered by the end of T3. This need for additional generation and demand connections is being driven by strong growth in the deployment of renewables, battery storage and data centres.

The Southeast of England faces significant strategic challenges due to high levels of forecast demand and generation growth driven by the move to net zero. Balancing higher levels of demand with embedded generation is crucial for the efficient operation of the network. To meet the anticipated increase in electricity demand, the network must accommodate new connections for both generation and demand customers.

Given the level of anticipated growth in the region and the additional connections required to facilitate this level of growth, securing outages to construct a new substation will be a challenge; therefore, options that minimise the number of outages are preferred as they will have less of an impact on system security and the delivery of other projects which may also require outages.

To address the challenges in the region, several investments are planned, including new substations, rebuild of existing substations, significant circuit upgrades, planned improvements within and in the perimeter of London.

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 have identified the following high-level options:

- Option A – identification of a do-nothing option as the counterfactual option
- Option B – identification of a market-based solution
- Option C – identification of a non-transmission, whole systems solution
- Option D – identification of options to make use of existing NGET substations in the locale, including connecting at Kingsnorth and Grain by extending these substations.
- Option E – identification of options for a new substation, exploring different combinations of:
  - The technology configurations, including the use of AIS versus GIS switchgear
  - Different grid connection options (e.g., a double-tee connection versus double circuit turn-ins)
  - Future proofing solutions (e.g., building a substation which would require extending in future to meet new customer connections versus building a substation sufficient to accept future connections without the need to extend the substation)

In summary, the following conclusions were reached: -

- Options A to C were discounted as they did not deliver a compliant connection.
- The different variations of option D (to connect to an existing substation) were discounted as there was insufficient capacity to connect Neuconnect to these substations. We have considered the possibility of extending these substations but there are prohibitive barriers to extending including land access issues.
- Four configurations of Option E (building a new substation) were considered, differing by the choice of technology (AIS or GIS) and the configuration of the site. Our starting point in shortlisting options was to assess whether AIS could be deliverable for the new substation. This was followed by an assessment of the relative merits of building a smaller substation requiring re-configuration or extension to accommodate additional customers beyond Neuconnect versus building a substation which is future proofed by including a sufficient connection to the transmission network, and sufficiently large substation building, to allow for a straightforward connection of additional customers in future. Under all variants of Option E consideration was given to the build of a new substation [redacted] This approach reduced risks associated with planning consent, land purchase and ecology, intending to expedite the first customer ACL at the site. NGET ensured that this approach would allow for future connections from other parties into the site.
- Following a detailed assessment of the different options considered under Option E we shortlisted three options; Option E-1 was discounted on the basis that the use of AIS switchgear would be an inappropriate choice given the proximity of the site to the coast (the location of the new substation is 1.5km from the coast. AIS switchgear suffers from higher levels of corrosion when placed in areas of high atmospheric pollution, thereby incurring higher maintenance costs; the use of AIS switchgear in this location therefore does not offer value for money to the consumer.
- We took forward three options for shortlisting (Options E-2, E-3 and E-4). These options vary by the level of future proofing offered by the investment. Option E-2 provides only for a 5-bay substation using a double-T connection to the OHL network. This means that further connections would require an extension and reconfiguration of the substation, with further substantive work to the OHL circuits to facilitate new connections. Options E-3 and E-4 make use of a double circuit turn-in, meaning that extensions of the substations would require less disruption to the transmission network to facilitate new connections. Option E-3 would only provide for a 10-bay substation building, meaning that new connections would require a substation building extension. Option E-4 includes the highest degree of futureproofing as it already provides for a 16-bay substation, meaning that the only work needed to facilitate a new connection would be the installation of new bays within the existing substation building.

- Option E-4 was the preferred option as it is a more financially cost-effective solution to connect three customers compared with Option E-3 and is less disruptive to the transmission network compared with Option E-2.

4.1 Assessment of high level options

A summary of our assessment of the high-level options identified to meet the customer need is set out below. Each 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 2 below.

Table 2: Summary of initial options assessment

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
A	Do nothing	NGET does not undertake any activity to enable connection of Neuconnect.	**Not taken forward** – the option does not comply with NGET license obligations to provide connections	Customer compliant connection not delivered.
B	Market-based solution	Increased customer demand is accommodated through the procurement and use of ancillary services only.	**Not taken forward** – the option does not comply with NGET license obligations to provide connections.	Customer compliant connection not delivered.
C	Whole systems solution	The required customer connection is accommodated by a Distribution Network Operator (DNO) instead of NGET.	**Not taken forward** – the option does not comply with NGET license obligations to provide connections.	Customer compliant connection not delivered. The distribution network has a licence to operate at 132kV and so this option would require a step-down transformer. A voltage reduction of this size would reduce the connection capacity therefore impacting on the financial viability of the interconnector.

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
D-1	Extension at Grain substation using SF6-free GIS switchgear.	This option would involve extending the existing substation at Grain to allow for Neuconnect, SouthernLink and BESS customers to connect to the grid. This option would use SF6-free GIS switchgear.	**Not taken forward** – this option is not deliverable.	**Land access, future proofing, and technical complexity.** The Connection and Infrastructure Options Note (CION) assessment of connection sites for the Neuconnect interconnector originally identified an option of connecting at Grain. However, the existing spare bay at this site is owned by a third-party who did not agree to a sale of the spare bay. As a result, while this option is technically feasible, it poses a very high deliverability risk due to the need to acquire rights to land owned by a third party. As a result, the CION report found that this option is inferior to building a new substation. The original 2016 connection application considered the possibility of Neuconnect obtaining a spare bay at Grain Substation which was owned, but not currently utilised, [redacted] In August 2017 this option was ruled out when Uniper confirmed they would not sell this bay. This change was captured in the CION process, section 7. In addition, even if the third-party owner of the spare bay were willing to sell it, this would not provide sufficient capacity to meet the connection needs identified in this MSIP (e.g., it would not allow SouthernLink or Econergy to connect to the grid).
D-2	Extension at Grain substation, construction of new substation, both using SF6-free GIS switchgear.	This option would involve the extension of Grain substation to allow for the connection of SouthernLink and the new BESS customers. A new substation would be constructed at Neuconnect to facilitate a connection of Neuconnect's new interconnector. This option	**Not taken forward** – this option is not deliverable.	**Land access, and future proofing.** The Connection and Infrastructure Options Note (CION) assessment of connection sites for the Neuconnect interconnector originally identified an option of connecting at Grain. However, the existing spare bay at this site is owned by a third-party who did not agree to a sale of the spare bay. As a result, while this option is technically feasible, it poses a very high deliverability risk due to the need to acquire rights to land owned by a third party. As a result, the CION report found that this option is inferior to building a new substation.

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
		would use SF6-free GIS switchgear.		The original 2016 connection application considered the possibility of Neuconnect obtaining a spare bay at Grain Substation owned, but not currently utilised, [redacted]. In August 2017 this option was ruled out when [redacted] confirmed they would not sell this bay. This change was captured in the CION process, section 7. In addition, even if the third-party owner of the spare bay were willing to sell it, this would not provide sufficient capacity to meet the connection needs identified in this MSIP (e.g., it would not allow SouthernLink or Econergy to connect to the grid).
D-3	Extension at Kingsnorth substation using SF6-free switchgear.	This option would involve extending the existing sub-station at Kingsnorth to allow for new connections from Neuconnect, the future NGV interconnector and BESS customers. This option would use SF6-free GIS switchgear.	**Not taken forward** – this option is not deliverable.	**Land availability, planning consents, asset health, and programme risk.** This option involves high consents and programme risk, given the findings of the 2016 CION report, which deemed that there would be a requirement for a new circuit between Kingsnorth and Tilbury and that this would require a DCO from the Secretary of State. There are also challenges with re-routing such a new circuit, owing to the proximity of the Medway Towns and Thames Estuary. In the 2016 CION process, the option of connecting to Kingsnorth was eliminated citing consenting issues. Currently at Kingsnorth there are other customers contracted to connect including Damhead Creek 2, Medway Data Centre and embedded generation. This results in insufficient capacity for the connection of Wallend customers into Kingsnorth.
E-1	New 5-bay substation with AIS switchgear	This option would involve the construction of a new 5-bay substation at Wallend using AIS switchgear. This option would deliver 2 feeder network connection	**Not taken forward** – this option is not deliverable.	**Land availability, maintenance costs and programme risk.** The use of AIS would significantly increase the footprint of the facility, beyond the extent of the land [redacted]. The proposed site would be 1.5km from the coast meaning that AIS equipment would be subject to significant atmospheric pollution leading to high maintenance costs. A larger site using AIS would add

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
		bays, 2 customer bays for Neuconnect and a reserve (coupler) bay.		delay to the programme [redacted]
E-2	New 5-bay substation with non-SF6 GIS switchgear, housed in a 5-bay building.	This option would involve the construction of a new 5-bay substation at Wallend using SF6-free GIS switchgear. This option would deliver 2 feeder network connection bays, 2 customer bays for Neuconnect and a reserve (coupler) bay.	**Taken forward to detailed assessment.**	This option provides a 5-bay substation. It includes 2 feeder bays, 2 customer bays and 1 bus coupler bay. This option would include a double tee connection and single OHL tower, meaning that further outages might be required in future to connect additional customers (although the initial construction would provide space for additional bays). The use of a double tee connector would create network management issues as circuit disconnections may be required to facilitate unplanned maintenance at the substation. Further connections of SouthernLink and Econergy would require an extension to the proposed facility.
E-3	New 10-bay substation with a 10-bay building using non-SF6 switchgear.	This option would involve the construction of a new 10-bay substation at Neuconnect using SF6-free GIS switchgear. The options would include 4 grid feeder bays, 2 bus couplers, 2 bus section bays and 2 remaining bays for Neuconnect. This option would include the construction of 2 OHL towers.	**Taken forward to detailed assessment.**	This option provides a 10-bay substation. This option includes two OHL towers. Building two OHL towers in a single phase of works is less expensive than construction across two phases of works, meaning that this option is more cost effective than E-2. The construction of double turn-in reduces the amount of future outages required to facilitate potential extensions to the size of the substation. Further connections of SouthernLink and Econergy would require an extension to the substation building including construction of additional bays. This option delivers a compliant customer connection [redacted], thereby negating the need for further land acquisition and consenting requirements.
E-4	New 10-bay substation with a 16-bay building.	This option would involve the construction of a new 10-bay substation at Neuconnect using SF6-free GIS switchgear. The option would include 4 grid	**Taken forward to detailed assessment.**	This option provides a 10-bay substation, including 4 feeder bays to facilitate additional future connections. However, the extension of this site would be simpler than option E-3 given that the building would have a footprint sufficiently large to allow for the installation of an additional 6 bays; 3 of the additional 6 bays would be used by SouthernLink and the Econergy BESS facility, leaving space for an

Option	Option title	Option description	Taken Forward to Detailed Optioneering?	Rationale
		feeder bays, 2 bus couplers, 2 bus section bays, and 2 remaining bays for Neuconnect. This option would include the construction of 2 OHL towers. However, unlike option E-3, this option would include a larger building to accommodate up to 16 bays in the future.		additional 3 bays for future customers. Further connections of SouthernLink and Econergy would require the construction of three additional bays within the existing 16-bay building. This option delivers a compliant customer connection [redacted] thereby negating the need for further land acquisition and consenting requirements.

Options E-2 (a new 5-bay substation), E-3 (a new 10-bay substation) and E-4 (a new 10-bay substation within a 16-bay building) have been taken forward for detailed assessment.

Option E-2 involves constructing a new 5-bay substation which can only serve Neuconnect, using GIS switchgear. The use of GIS switchgear ensures a smaller footprint and higher reliability than would have been the case under discounted option E-1. However, it is worth noting that future outages might be required to connect additional customers, as the initial construction includes only a single circuit turn-in and a single OHL tower.

Option E-3 provides for a more extensive 10-bay substation. This configuration includes four grid feeder bays, two bus couplers, two bus section bays, and two customer bays for Neuconnect. It has been taken forward for detailed assessment because it provides a robust setup that facilitates future connections without the need for further outages. The inclusion of two OHL towers enhances the reliability and robustness of the network, making it a strong candidate for accommodating future growth and ensuring uninterrupted service. However, it is worth noting that this option still requires an extension to the substation building; while additional connections can be made, this is potentially an inefficient solution from a cost point-of-view compared with building larger substation which can facilitate further connections in future.

Option E-4 is similar to E-3 in terms of the 10-bay configuration but includes a larger building footprint to allow for future expansion up to 16 bays. This option has been shortlisted because it offers the same immediate benefits as E-3, with the added advantage of easier future expansion. The larger building footprint means that additional bays can be installed with minimal disruption, making it a highly flexible and scalable solution. This option is particularly attractive for accommodating future growth and additional customer connections, including specific provisions for SouthernLink and the Econergy BESS facility.

Each of these options has been chosen for their ability to meet current needs while also providing pathways for future expansion and reliability. They offer varying degrees of flexibility and scalability, ensuring that the future substation can adapt to future demands and maintain a robust and reliable network.

5. Detailed options analysis

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

5.1 Description of the options

5.1.1 New 5-bay substation with GIS switchgear (Option E-2)

This option involves constructing a new 5-bay substation at Wallend using non-SF6 GIS switchgear, housed in a 5-bay building. This substation would include: -

- 2 feeder network connection bays,
- 2 customer bays for Neuconnect,
- a reserve (coupler) bay,
- a single OHL tower to facilitate a single circuit turn-in connection to the grid; and,
- a substation building with sufficient space for 5 bays.

This option provides a compact and cost-effective solution that meets immediate needs. However, it does not provide as much flexibility for future expansion as the other options that have been shortlisted. This is because future outages might be required to connect additional customers, as the initial construction includes only a double tee connection and a single OHL tower. Despite this, there is sufficient land available to extend the substation building, meaning that it will be possible to connect additional customers in future, although at a higher cost than the other shortlisted options.

Given the proximity of the proposed location of the substation to the coast, the new substation will be exposed to high levels of atmospheric pollution and therefore it is proposed that this option will use SF6-free GIS switchgear as it offers the best value to consumers; given the proximity of the site to the coast, the operating and maintenance costs of SF6-free GIS will be lower than that of AIS which would suffer from corrosion if installed in this area. The use of SF6-free GIS switchgear also helps to minimise the footprint of the option and keeps the footprint of the new substation [redacted]. The use of AIS would also delay the programme thereby putting at risk the ACL date requested by the customer. This delay would be driven by additional planning approvals [redacted]

Figure 2 below provides the Primary Elevation Drawing for Option E-2.

[redacted]

5.1.2 New 10-bay substation with a 10-bay building (Option E-3)

Option E-3 involves constructing a new 10-bay substation at Wallend using GIS switchgear, housed in a 10-bay building. This substation would include: -

- four grid feeder bays,
- two bus couplers,
- two bus section bays,
- [redacted]
- two OHL towers to facilitate a double circuit turn-in to the grid; and,
- a substation building with sufficient space for 10 bays.

Although this option would require more construction to facilitate further connections in addition to Neuconnect, this option provides a future-proofed setup, in that it facilitates future connections without the need for further outages and therefore disruption to the network. The inclusion of multiple feeder bays and OHL towers reduces the need for outages, making it well-suited for accommodating future growth and ensuring uninterrupted service.

This option is more expensive than option E-2 but provides more flexibility in terms of adding further connections in future, as it does not require outages to the network, which are expensive to implement and reduce network resilience when in place.

The reduction in the number of outages offered by this option, compared with Option E-2, benefits consumers through a reduction in constraint costs, and re-mobilisation costs required in order to facilitate additional circuit connections between the new substation and the OHL circuits.

Figure 3 below provides the Primary Elevation Drawing for Option E-3.

[redacted]

5.1.3 New 10-bay substation with a 16-bay building (Option E-4)

Option E-4 involves constructing a new 10-bay substation at Wallend using GIS switchgear. The new substation would be housed in a 16-bay building providing the maximum amount of future proofing of all the shortlisted options. The substation would include:

- four grid feeder bays,
- two bus couplers,
- two bus section bays,
- two customer bays for Neuconnect,
- two OHL towers to facilitate a double circuit turn-in to the grid; and,
- a substation building with sufficient space for 16 bays.

Figure 4 below provides the Primary Elevation Drawing for Option E-4.

[redacted]

Unlike option E-3, E-4 features a larger building footprint designed to accommodate up to 16 bays in the future. This makes future expansion simpler and more efficient, as the building can easily incorporate an additional six bays. Three of these additional bays are planned for use by SouthernLink and the Econergy BESS facility who have signed TOCO agreements with NGET, leaving space for three more bays for future customers.

5.2 Qualitative options analysis

Table 3 below provides a summary of our detailed qualitative assessment of the relevant technical, environmental, planning, and socio-economic considerations pertaining to the three options.

Table 3: Summary of qualitative analysis of shortlisted options

Option #	Option E-2	Option E-3	Option E-4
Option title	**New 5-bay substation with GIS switchgear, housed in a 5-bay building**	**New 10-bay substation with a 10-bay building**	**New 10-bay substation with a 16-bay building**
Capacity & future development potential Preferred option: E-4	• This option only provides for the connection of Neuconnect in the immediate term. • Further connections e.g. NGV interconnector will require an extension to the substation in the future. • Any extension will require circuit works as this option only includes a double tee connection and a single OHL tower.	• This option allows for an extension of the sub-station as additional bays can easily be added due to the enlarged footprint of the site. • However, the extension will require some disturbance due to the need to extend the footprint of the building. • [redacted]	• This option initially provides sufficient bays for Neuconnect. • As this option provides for a 16-bay building, the addition of a further 3 bays can be made with minimal additional cost and disturbance. • Even after the addition of bays for NGV and Econergy, this option provides space for a further 3 bays. • [redacted]
Design & technical complexities Preferred option: No overall advantage to any option	• No additional design or technical complexities. This option (along with all others, uses SF6-free GIS technology. Although our preferred technology is AIS, we have opted for the use of GIS technology due to the proximity of the site to the coast (where there will be atmospheric pollution) and the amount of land available for construction which limits the footprint of the site.	• No additional design or technical complexities. This option (along with all others, uses SF6-free GIS technology. Although our preferred technology is AIS, we have opted for the use of GIS technology due to the proximity of the site to the coast (where there will be atmospheric pollution) and the amount of land available for construction which limits the footprint of the site.	• No additional design or technical complexities. This option (along with all others, uses SF6-free GIS technology. Although our preferred technology is AIS, we have opted for the use of GIS technology due to the proximity of the site to the coast (where there will be atmospheric pollution) and the amount of land available for construction which limits the footprint of the site.
Operations & maintenance	• A large proportion of maintenance costs are driven by the amount of installed GIS. As this option has the lowest	• This option has greater GIS requirements given its size (10 bays installed), and therefore will have greater O&M needs than option E-2.	• This option has greater GIS requirements given its size (10 bays installed) and therefore will have greater O&M needs than option E-2.

Option #	Option E-2	Option E-3	Option E-4
Option title	**New 5-bay substation with GIS switchgear, housed in a 5-bay building**	**New 10-bay substation with a 10-bay building**	**New 10-bay substation with a 16-bay building**
Preferred option: E-2	amount of installed GIS this has the lowest O&M implications.		
Safety, health & security Preferred option: E-4	• This option includes a double tee connection, which includes cabling from the proposed OHL tower to the substation. This presents a potential H&S risk. While mitigations will be made, this means that there is a hazard risk that could arise if a third-party struck the cable during future earthworks. • This option requires a longer overall construction period resulting from separate phases of construction. • [redacted]	• This option does not include cabling (it includes a double-circuit turn-in) and therefore it is less risky than option E-2. • There are potential health and safety implications from a longer construction period as is required for this option (once the extension of the facility has been considered). • [redacted]	• [redacted] This option will therefore be built to a much higher standard than option E-2 or option E-3.
Planning, land & consent Preferred option: E-4	• This option has the smallest land-take of all three options. While additional planning permission would not be required for this option, extending the substation to connect additional customers would require additional planning consents. • The footprint of this option would sit within the land parcel [redacted]	• This option requires more land than option E-2. However, it is worth noting that additional planning permission would also be required as per option E-2 to extend. • The footprint of this option would sit within the land parcel [redacted]	• Under this option, additional bays can be added to the substation under existing permitted development rights. • The footprint of this option would sit within the land [redacted]

Option #	Option E-2	Option E-3	Option E-4
Option title	**New 5-bay substation with GIS switchgear, housed in a 5-bay building**	**New 10-bay substation with a 10-bay building**	**New 10-bay substation with a 16-bay building**
Third party impact & network coordination Preferred option: either E-3 or E-4	• This option includes single OHL tower with a double tee and therefore requires longer outages in future to facilitate additional connections.	• This option includes two OHL towers with a double-turn in circuit, providing network resilience. Although further connections may require outages, these are not expected to be as long as under option E-2.	• This option includes two OHL towers with a double-turn in circuit, providing network resilience. Although further connections may require outages, these are not expected to be as long as under option E-2.
Environment & sustainability Preferred option: E-4	• This option will involve cabling works which has the potential to negatively impact on local ecology. • Under this option, facilitating additional connections would require a separate extension to the facility. Delivering connections for all customers (Neuconnect, NGV and Econergy) would require two distinct phases of works which would be more disruptive to the environment compared with a single phase of works.	• This option does not include cabling and therefore does not have as large an impact on local ecology as option E-2. • Under this option, facilitating additional connections would require a separate extension to the facility. Delivering connections for all customers (Neuconnect, NGV and Econergy) would require two distinct phases of works which would be more disruptive to the environment compared with a single phase of works.	• This option does not include cabling and therefore does not have as large an impact on local ecology as option E-2. • This option is a less disruptive way of delivering the required customer connections as all major works will be done in a single programme of works. Therefore, this option has the least impact on the environment.
Timing of programme & resources Preferred option: E-4	• The programmatic delivery of the outputs required for all three customer connections will be delivered in an inefficient way due to the provision of additional connections in two phases. • This option would require an extension to facilitate additional connections for SouthernLink and Econergy, which would require a further planning approval. This in turn has the potential to increase the time required to deliver the option.	• The programmatic delivery of the outputs required for all three customer connections will be delivered in an inefficient way due to the provision of additional connections in two phases. • This option would require an extension to facilitate additional connections for SouthernLink and Econergy, which would require a further planning approval. This in turn has the potential to increase the time required to deliver the option.	• This option allows for the most efficient way of delivering connections for customers. The project will be constructed in a single phase (16-bay substation building), with only minor works required to deliver further bays for NGV and Econergy.

Based on our detailed qualitative analysis, our preferred option is Option E-4. This option provides the greatest amount of future proofing, as the number of bays at the facility can easily be extended to 13 to accommodate both NGV and Econergy, driving value for money for future consumers. The substation would also have space for a further 3 bays allowing for additional connections for other customers in the future. Option E-4 is also more beneficial from a health and safety perspective as it does not involve cabling under land to connect the substation to the grid, [redacted]

Option E-4 has fewer adverse impacts on overall system stability. This is because option E-4 includes the provision to construct two OHL towers in a single phase of construction meaning that the number of network outages will be minimised. Option E-4 also has no planning consent challenges; once the 16-bay building has been constructed, up to a further 6 bays can be built within permitted development rights.

5.3 Quantitative options analysis

5.3.1 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 Table 4 below demonstrate that option E-2 has a more favourable NPV in comparison to E-4 (the preferred option) and E-3. This is due to higher discounting of costs for option E-2 as a larger proportion of costs for this project are delayed compared with Options E-3 and E-4 where a higher proportion of the costs are incurred upfront. Option E-2 also has high unquantified costs; for example, Option E-2 involves a higher number of unconfirmed outages which are difficult to secure in such a constrained part of the network, meaning that Option E-2 has higher disruption costs and risks around programme. Whilst a summary of the CBA analysis is included here, the full CBA is provided in Appendix E alongside this submission.

Table 4: Lifetime cost-benefit analysis (discounted 2018/19 prices)

Options	Total (£m)			
	Costs (discounted)	Benefits (discounted)	NPV	Difference to baseline
E-2 (including future extension)	[redacted]			
E-3 (including future extension)	[redacted]			
E-4	[redacted]			

5.3.2 Costs

5.3.2.1 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 5: Summary of costs (undiscounted 2018/19 prices)

Option	Total CAPEX (£m)	Carbon cost of construction (£m)	Total (£m)
E-2 (initial investment)	[redacted]		
E-2.1 (future extension)	[redacted]		
Total E-2	[redacted]		
E-3 (initial investment)	[redacted]		
E-3.1 (future replacement)	[redacted]		
Total E-3	[redacted]		
E-4	[redacted]		

The difference within the CAPEX cost can be accounted for by the difference in scope between the three options. Option E-4 is the least expensive option (once extensions for Options E-2 and E-3 have been accounted for. It is the least expensive option in meeting the customers' connection requirements as the programme of works is most efficient, due to the reconfiguration of transmission connection assets in a single phase of works and the fact that the substation building is built large enough to accommodate the total number of bays required by all customers in a single phase of works.

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. For instance, with initial construction commencing in 2023 for option E-2, the replacement costs will commence in 2063. With works for the extension commencing in 2028 for option E-2.1, the replacement costs will commence in 2070. The same applies to all the other options. The appraisal period goes up to 2072, which means that some replacement costs would fall out of the appraisal period.

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 taken into account within the assessment.

Table 6: Summary of replacement costs (undiscounted 2018/19 prices)

Option	Total CAPEX (£m)	Carbon cost of construction (£m)	Total (£m)
E-2	[redacted]	[redacted]	[redacted]
E-2.1	[redacted]	[redacted]	[redacted]
Total E-2	[redacted]	[redacted]	[redacted]
E-3	[redacted]	[redacted]	[redacted]
E-3.1	[redacted]	[redacted]	[redacted]
Total E-3	[redacted]	[redacted]	[redacted]
E-4	[redacted]	[redacted]	[redacted]

5.3.2.2 OPEX costs

Annual maintenance costs

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 CBA.

Constraint costs

Given that the estimation of outages is heavily assumption driven constraint costs have not been included in the CBA

5.3.2.3 Summary of costs

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

Table 7: Cost summary (undiscounted 2018/19 prices)

Option	Initial cost (£m)	Replacement cost (£m)	Total cost (£m)
E-2	[redacted]	[redacted]	[redacted]
E-3	[redacted]	[redacted]	[redacted]
E-4	[redacted]	[redacted]	[redacted]

5.3.3 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 will facilitate a connection of a Battery Energy Storage System with a capacity of 249MW by 2031. This connection helps support the deployment of renewable energy sources thereby reducing carbon emissions. 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. Table 8 below illustrates the benefit for each option:

Table 8: Avoided carbon cost of generation (undiscounted 2018/19 prices)

Option	Avoided carbon cost of generation (£m)
E-2	[redacted]
E-3	
E-4	

SF_6 – leakages

No SF_6 leakage data was identified and therefore not included within the assessment.

G^3 – leakages

Upon operation gas leaks will be unavoidable. The disbenefit of these leaks is accounted for by the monetisation of the greenhouse gas emissions. The disbenefit was quantified by the multiplication of the total G^3 leakages weight by 0.5% which captures the leakage rate for this gas. The value was divided by a thousand and multiplied by the 326 which represents the equivalent of G^3 weight into CO_2. The equivalent CO_2 weight is multiplied by the carbon price to calculate the disbenefit. Table 9 below illustrates the non-SF6 disbenefits for the analysis. E-2 results in less G^3 leakages because some of the total leakages only begin when the extension of the substation occurs.

Table 9: Gas leak disbenefit (undiscounted 2018/19 prices)

Option	G^3 leakages (kg)	Gas emissions (tCO_2e)	Economic value of the benefit (£m)
E-2	[redacted]		
E-3			
E-4			

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 Table 10 below. E-2 results in lower transmission losses because some of the losses only begin when the extension of the substation occurs

Table 10: Transmission losses (undiscounted 2018/19 prices)

Option	Total MWh loss	Emissions associated with losses (tCO_2e)	Value of loss (£m)
E-2	[redacted]		
E-3			
E-4			

5.3.3.2 Summary of benefits

A summary of benefits included in the analysis is illustrated in Table 11 below.

Table 11: Summary of project benefits (undiscounted 2018/19 prices)

Option	Environmental benefits			Total benefits (£m)
	Carbon cost of construction (£m)	Gas leak (£m)	Transmission loss (£m)	
E-1	[redacted]			
E-2	[redacted]			
E-3	[redacted]			

5.4 Preferred solution

Based on the qualitative and quantitative analysis, we have recommended Option E-4 as the best solution to deliver the investment driver, in the interests of current and future consumers. The project aims to connect 2.9GW of capacity into the Electricity Transmission system though the construction of a new 400kV substation at Wallend. The project will include the construction of four grid feeder bays, two bus couplers, two bus section bays, two customer bays for Neuconnect, two OHL towers to facilitate a double circuit turn-in to the grid and a substation building with sufficient space for 16 bays.

The construction of the project will involve: -

- A new 10-bay 400kV non-SF6 Gas Insulated Switchgear (GIS) substation, constructed to ISS security standards (Category 4 given the substation will ultimately connect more than 3,000 of capacity to the transmission system).
- Associated Air Insulation Switchgear (AIS), amenities, and auxiliary systems.
- Provision to expand to a 16-bay substation.
- Commissioning of 2 bays for the Grain to Tilbury feeder bays
- Commissioning of 8 bays (6 NGET bays and 2 Customer Bays)
- Circuit turn-in of Grain to Kingsnorth into Wallend 400kV.
- Make provision for two additional user bays.
- Circuit turn-in of Grain-Tilbury circuit into Wallend 400kV.
- Commissioning of Grain-Tilbury feeder bays.

6. Detailed cost for preferred solution

6.1 Introduction

This section provides a breakdown of the overall costs for the proposed substation at Wallend (Option E-4) including an expenditure profile for all Regulatory Years of delivery. The costs presented in this section represent our latest view of costs for the proposed investment; all costs are presented in 2018/19 prices, unless otherwise stated.

Appendix D, the Wallend 400kV 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: -

- Total allowance request
- Cost estimate
- Cost firmness

6.2 Total Allowance Request

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

Table 12: Allowance Request (Cost Model Tab Reference 1.0)

£	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/20	Total
Total Project Costs	[redacted]										
CAI	[redacted]										
Direct project costs funded by customer	[redacted]										
Funding request	[redacted]										

6.3 Cost Summary

The total cost to develop and deliver the investment at Wallend project is [redacted] including direct costs, [redacted]

Table 13: Cost Summary (Cost Model Tab Reference 1.1)

Element	Total (£)	CAI/Direct
Contractor Costs		
Main Works Contractor	[redacted]	Direct
Third Party Costs		Direct/CAI
NGET Costs		
Project management		CAI
ET Ops		Direct
Project Services		CAI
Support Functions		CAI
NGET Portfolio Costs		CAI
Other Contracted Costs		
Contract Inflation		Direct
Risk		Direct
Total		N/A

6.4 Cost Firmness

Table 14 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 92% of the total costs (firmness 1 and 2) are either incurred or have been contracted, giving high confidence in our cost submission. Estimated costs relate to National Grid resource costs, calculated based on forecast days and standard rates, remaining third party costs and risk for the remainder of the project.

Table 14: Cost Firmness (Cost Model Tab Reference 1.9)

Cost Firmness	Total (£)	Notes
1 – Fixed	[redacted]	Actual costs
2 - Agreed remeasurable		Contractor costs
3 - Agreed remeasurable future information		N/A
4 – Estimated		Risk, NGET costs, and third party costs
5 - Early Estimate		N/A
Total		

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. These dates are based on NGET's contracted programme.

7.1.1 Delivery Programme

A detailed project delivery timeline has been prepared by NGET.

The project programme is illustrated below in **Error! Reference source not found.**.

Milestone	Date
Contract awarded	[redacted]
Order placed for GIS plant	
Completion of pre-construction surveys	
Stage 2 Construction Start Date	
Commissioning of GIS	
Commissioning of AIS	
Project closure	

7.1.2 Procurement and Contracting Strategy

The procurement and contracting strategy for the Wallend 400kV project adheres to the NGET procurement approvals process, ensuring that all projects meet strategic goals and technical requirements. This comprehensive approach involved a thorough assessment of different procurement options for the project, whereby the project has been procured via an established frameworks [redacted]

Two routes to market have been considered for this project. [redacted] This approach is aimed at minimising procurement risk. [redacted]

The second option, which was ultimately chosen, involved directly allocating the project to a contractor based on the Best for Task criteria assessment. [redacted] he process involves working collaboratively with the appointed contractor (e.g., through weekly catchups), allowing for transparency and quicker decision-making [redacted]

A key component of our procurement strategy has been to use early contractor involvement (ECI). [redacted] By engaging contractors early in the process, we have been able to address emerging issues proactively, compress project timelines, and ensure that all technical and commercial needs of the project are addressed.

7.1.3 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. This process is used to proactively manage foreseeable risks in an efficient way that will not impede delivery of this project. This process is an interactive process and is reviewed on a regular basis to capture any new risks, update any existing risks and remove any risks that have materialised.

Error! Reference source not found. below lists the key risks identified for the Project.

Table 15: Key project delivery risks and proposed mitigations for Wallend 400kV

Cause	Description	Impact	Mitigation
Earthworks	Remedial works required to platform provided by customer.	Delays and reinforcement works	Design Interface Meeting. Provision of further documentation. Additional Surveys.
Design	Undefined customer interface design	Additional time for design and redesign.	Bi-weekly coordination meetings - technical solution agreed.
Commissioning resource	There is limited commissioning resource across the region, there is the risk that commissioning resource may not be available for this project due to other commitments.	Delays to the programme and associated costs.	Early request for resource and ongoing monitoring of commissioning resource requirements elsewhere with NGET Asset Operations Planning team.
Customer Delay	[redacted]	[redacted]	"Bi-Weekly Co-ordination and Interface Meeting - Programme Reviews with Customer Compliance Meetings
System Outages	NESO may need to cancel NGETs 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.	Delays due to inability to complete works within scheduled outage.	Outages already booked. Ongoing engagement with the Network Planners to discuss programme requirements and to understand / monitor outage constraints and interfaces.

8. Conclusion

This document is NGET's MSIP re-opener submission to Ofgem for the Wallend 400kV substation project, to construct a new non-SF6 GIS 10-bay substation on the Isle of Grian in Kent. It is submitted with reference to Special Condition 3.14 (paragraphs a) of NGET's Transmission Licence.

Table 17 below summarises the main investment driver, the selected option, estimated costs and expected outputs.

Table 17: MSIP Project Investment Summary

<table>
<tr><td rowspan="1">Main drivers</td><td colspan="3">This investment is being driven by three customer connections, which will require the construction of a new substation, as there is no spare capacity at neighbouring stations such as Grain or Kingsnorth. The following connections have been requested by customers: -
• Neuconnect. This customer has requested a connection for a 1.4GW interconnector between the UK and Germany. The contracted connection date for this customer is [redacted]
• SouthernLink. This customer (NGV) has requested a connection which will facilitate a 1.5GW Offshore Hybrid Asset interconnector between the UK and Belgium, with an intermediate connection to a new artificial energy island and offshore wind facilities to be located off the coast of Belgium. The connection date for this customer is [redacted]
• Econergy. This customer has requested a 249MW connection to a BESS facility. The connection date for this customer is [redacted]</td></tr>
<tr><td>Selected Option</td><td colspan="3">The selected option is the construction of a 10-bay non-SF6 Gas Insulated Switchgear substation at Wallend. This includes the provision to expand to a 16-bay substation as it will include a 16-bay building and double-circuit tur-in.
The project will include: -
• Associated AIS switchgear, amenities and auxiliary systems
• Commissioning of 2 bays for the Grain to Tilbury feeder bays
• Commissioning of 8 bays for NGET and Neuconnect
• A circuit turn-in on both the Grain to Kingsnorth and Grain to Tilbury lines</td></tr>
<tr><td rowspan="2">Estimated Cost (18/19 prices)</td><td colspan="3">The estimated for the cost of the investment is [redacted] of which we are requesting [redacted] in direct costs for funding as part of this MSIP submission.</td></tr>
<tr><td>T2 (FY2022 – FY2026):
[redacted]</td><td>T3 (FY 2027 – FY2031):
[redacted]</td><td>T4+ (FY 2032+):
£0</td></tr>
<tr><td>Outputs</td><td colspan="3">The outputs from this investment will be a substation with sufficient capacity to ultimately connect two interconnectors (total capacity 2.9GW) and a further BESS facility (249MW). These customer connections will provide the grid with greater system resilience, the import of less expensive low-carbon electricity as well as system balancing benefits.</td></tr>
<tr><td>PCD Primary Output</td><td colspan="3">Construct a new 10-bay 400kV SF6-free GIS substation and a double circuit turn in off the 4TK OHL route via two new towers to connect two interconnector customers and one BESS facility [redacted]</td></tr>
</table>

Following the receipt of connection requests from Neuconnect, NGV and Econergy, 10 options were considered to facilitate the outputs that the customer connections are expected to achieve. These included 3 non-connection options which were discounted as they do not meet NGET's licence obligations.

Through our optioneering analysis, including both qualitative considerations and more formal CBA we identified a preferred option which met the customer's connection criteria [redacted] connection for Neuconnect [redacted] NGV [redacted] Econergy [redacted] while minimising the impact of the scheme on wider system readiness and providing capacity for future connections in the most efficient and economic way.

The conclusion of the optioneering process was to construct a new 400kV substation at Wallend comprising of 4 feeder bays for NGET, 2 bus coupler bays using modular GIS, 2 bus section bays using modular GIS and 2 customer bays for Neuconnect using modular GIS. The scheme will provide a substation building sufficiently large for the construction of up to 16 bays, of which 13 will be used by NGET and for the connection of the three customers. This will facilitate connections for the NGV interconnector, a BESS facility being developed by Econergy as well as space for an additional 3 bays that can be used by future customers.

9. RIIO-T1 and RIIO-T2 allowances

This project was awarded generation connection baseline allowances at in the RIIO-T2 business case which was equal to [redacted] in 2018/19 prices.

However, the scope of the project has changed since the approval of these allowances [redacted] As such, these allowances have been returned to Ofgem (this was confirmed in RRP24). [redacted]

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 Leo Michelmore, Strategic Upgrade Regulatory Manager (leo.michelmore@nationalgrid.com).

[redacted]

Appendix B: Glossary

Acronym	Definition
ACL	Available for Commercial Load
AIS	Air Insulated Switchgear
BESS	Battery Energy Storage System
CAI	Closely Associated Indirects
CBA	Cost Benefit Analysis
CCGT	Combined Cycle Gas Turbine
DNO	Distribution Network Operator
ECI	Early Contractor Involvement
EIB	European Investment Bank
EPC	Engineering, Procurement, Construction
GIS	Gas Insulated Switchgear
HVDC	High Voltage Direct Current
MLWS	Mean Low Water Springs
MSIP	Medium Sized Investment Project
MVA	Megavolt Ampere
NGIL	National Grid Interconnect Holdings Ltd
NGV	National Grid Ventures
NPV	Net Present Value
OHA	Offshore Hybrid Asset
OHL	Overhead Lines
SF6	Sulphur Hexafluoride
SGT	Super Grid Transformer
SpC	Special Condition
SQSS	Security and Quality of Supply Standard
TOCA	Transmission Owner Connection Agreement

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Appendix D: Cost model

An excel file outlining the funding allowance request for the investment is provided alongside this submission.

Appendix E: Cost Benefit Analysis

An excel file outlining the Cost Benefit Analysis for the investment is provided alongside this submission.

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