Project Collette

Concept and Grid Feasibility Study

Green Finance Community Hub CIC

21 Mealbank, Kendal, England, LA8 9DW

Prepared by:

SLR Consulting Limited

3rd Floor, Brew House, Jacob Street, Tower Hill, Bristol, BS2 0EQ

SLR Project No.: 416.065994.00001

11 November 2025

Revision: 3.0

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	22 September 2025	M. Redondo C. Macken I. Najarre	B. Branney	B. Branney
2.0	5 November 2025	M. Redondo C. Macken I. Najarre	B. Branney	B. Branney
3.0	11 November 2025	C. Macken	I. Najarre	B. Branney

Executive Summary

The Green Finance Community Hub (GFCH) has requested SLR to perform a high-level feasibility study for the development of a 1.2 GW offshore wind farm (OWF) off the coast of Cumbria. This feasibility study is separated into 3 different sections: a site and landfall review, an offshore electrical concept and a grid feasibility.

Site Constraints and Landfall Review

The site and landfall review initially assessed the expected constraints for the planned project location. The following constraints were noted for the project site:

- The Cumbrian coast is unique among other parts of the United Kingdom (UK) waters in that it contains 3 jurisdictions, England, Scotland and the Isle of Man.
- The Isle of Man can be considered a hard constraint as it is not considered part of the UK.
- The water depths for the site range between 20m to 50m and are within depths that are generally acceptable for fixed bottom wind, but will require a detailed geotechnical survey to determine the most appropriate foundation.
- There are numerous Special Areas of Conversation (SAC) and Marine Protected Zones (MPZ) in the area, which will further constrain both the landfall and the onshore route. These can be considered hard constraints for the cable route due to the likely delays associated with working within protected areas.
- The topology of Cumbria is characterised by harsh elevations and several large estuaries in the centre and south of the county. The north of Cumbria has a flatter landscape that is mainly agricultural land.
- The closest grid connection points for an OWF of this size are Harker and Hutton, located in the north and the south of the county, east of the Lake District.

Based on the above constraints it was determined that the most appropriate area for the project site is preferably located in the England territorial waters, close to the coast to minimise the length of the export route. Two sites were assessed for landfall, Landfall 1 and 2. Both landfalls were found to have viable locations for an export cable landfall, but the onshore route was only feasible for Landfall 1.

- Landfall 1, north of Workington in Siddock. This allows for the onshore export route, either cable or overhead line (OHL), to be routed through flat agricultural land in the north of Cumbria to connect at Harker.
- Landfall 2, south of Sellafield and north of Barrow in Furness. Landfall 2 was found to have an unfeasible onshore route to Hutton as it required crossing several large estuaries and harsh elevations that are located right up to the coast. However, landfall 2 was found to be viable for a private wire landfall due to its close proximity to Sellafield.

Offshore and Onshore Electrical Concept

The electrical concept design was developed for an OWF of this size based on the current industry standard. This should only be used to provide an indication of the system design and not be used in place of a detailed Pre-FEED (Front End Engineering and Design) or concept design process.

- The wind turbine generators (WTGs) used in the system are estimated to be:
    - 86 x 14 MW WTGs arranged in strings of 6 to 7 WTGs
    - 57–67 x 18–21 MW turbines arranged in strings of 7 to 9 WTGs.
- A 66kV or 132kV collector system, dependent on system requirements.
- 2 offshore substations with 2 transformers each, with a rated capacity of 400 MVA.
    - 140 to 500 MVAr shunt reactor at each offshore substation.

- 4 x 220 or 275 kV circuits of 20km from landfall to offshore substation.
- 4 x 220 or 275 kV circuits of 60km from the onshore substation to the proposed landfall.
- 400 kV onshore substation with 2 x 400/220 kV transformers of 800MVA each.
  - 280 to 1000 MVAr Shunt reactor and a 400MVAr STATCOM at the Project Collete onshore substation.
- The total estimated cost of the idealised electrical system for Project Collette based on the Holistic network Design (HND) costing model is between £780,932,520 and £1,038,601,150.

The inclusion of battery energy storage system (BESS) and a private wire connection to Sellafield were also assessed in this study. The following conclusions were developed from a high-level study

- The colocation of a BESS site at the point of connection could be a viable method of sharing connection headroom and improving the developer's position for developing a Private Purchase Agreement (PPA) for the sites.
- A private wire development to Sellafield is a viable connection option, as shown in the landfall review. The 100 MW power requirement means that a single WTG string can be connected to the site, reducing the system complexity and hence the cost. The Sellafield connection site would likely need upgrades to accommodate the private wire, with the operating voltage of the collector system an important aspect determining reactive compensation and transformer requirements.
- CNF were found to be an unsuitable option for a private wire as they considered the intermittency of offshore generation a critical barrier to meeting their plants requirement for a constant base load to ensure electrolyser operation.

Grid Feasibility

The grid feasibility assessed the two closest 400kV substations to the proposed project location, Harker and Hutton, and found that both substations were suitable for the connection of Project Collette. The following conclusions were drawn from the high-level study:

- The high-level load flow found that the inclusion of Project Collette will likely require approximately 1500 MVAr of reactive compensation capacity, in the form of shunt reactors, to manage the high capacitive effect of the export cables. This was considered when developing the initial reactive compensation requirement.
- The total estimated cost of the enabling works to connect at Harker is estimated to be between £9,350,700 and £21,818,300 based on SLR's internal costing tool.
- It is vital that Green Finance Community Hub (GFCH) begin communicating with National Energy System Operator (NESO) at the earliest opportunity to ensure that the network upgrades planned can be considered the project within the system. In advance of this, GFCH should develop a high-level concept design with a review of planning requirements, CAPEX/OPEX details and project justification from an environmental and community perspective.

Appendices

Appendices

Acronyms and Abbreviations

Abbreviation	Description
AIS	Air-Insulated Switchgear
BESS	Battery Energy Storage System
CAPEX	Capital Expenditure
CSNP	Centralised Strategic Network Plan
DNO	Distribution Network Operator
EHV	Extra High Voltage
ENWL	Electricity North West Limited
ETYS	Electricity Ten Year Statement
GFCH	Green Finance Community Hub CIC
GIS	Gas Insulated Switchgear
GIS	Gas-Insulated Switchgear
GW	Gigawatt
HND	Holistic Network Design
HVAC	High Voltage Alternating current
kV	Kilovolt
LTDS	Long Term Development Statement
MCZ	Marine Conservation Zone
MVAr	Mega Volt-Ampere Reactive
MW	Megawatt
NESO	National Energy System Operator
NGESO	National Grid Electricity System Operator
NGET	National Grid Electricity Transmission
OHL	Overhead Line
OnSS	Onshore Substation
OPEX	Operational Expenditure
OSS	Offshore Substation
OWF	Offshore Wind Farm
PCC	Point of Common Coupling
PPA	Power Purchase Agreement
SAC	Special Area of Conservation
SAC	Special Area of Conservation
TEC	Transmission Entry Capacity
TJB	Transition Joint Bay
TSO	Transmission System Operator
TWR	Transmission Works Register
WTG	Wind Turbine Generator

1.0 Introduction

1.1 General

SLR Consulting has been commissioned by Green Finance Community Hub CIC (GFCH) to provide an early concept and grid feasibility study for Project Collette offshore wind development, a proposed 1.2 GW wind farm located west of the coast of Cumbria. There are several offshore wind farms (OWF) such as the Robin Rigg (174 MW) and Walney (1 GW) in the area already.

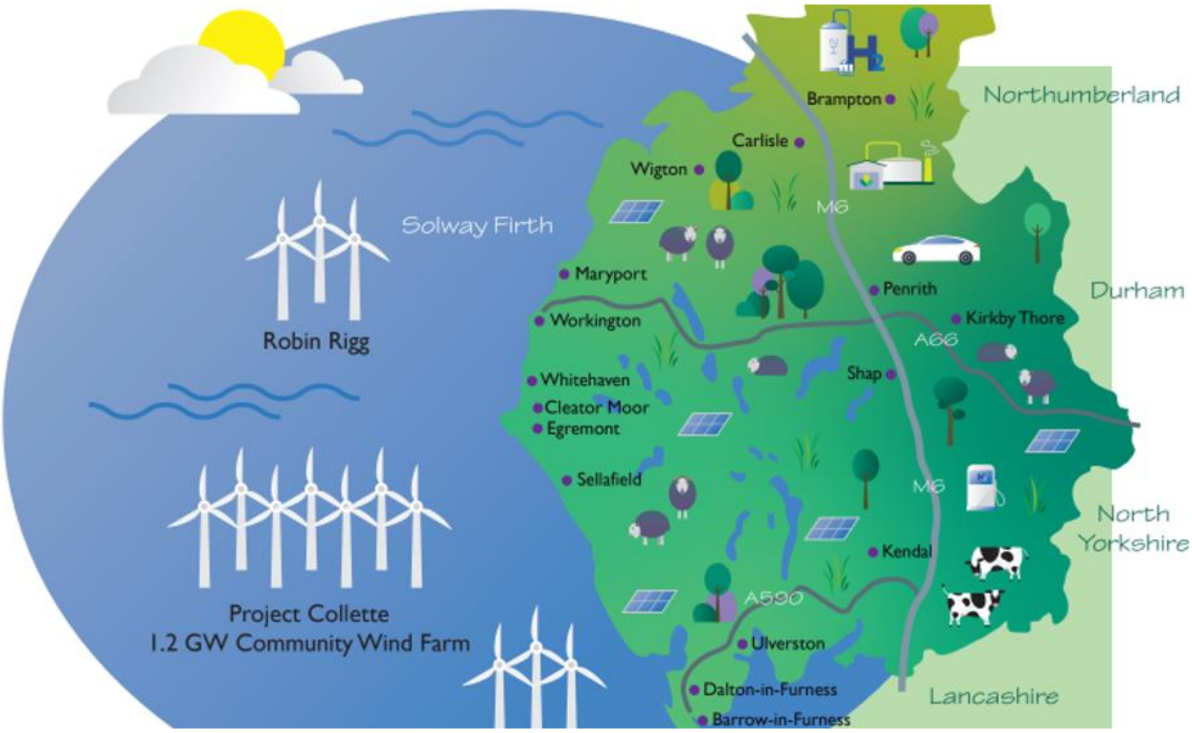

Figure 1.1: Project Collette Concept

This report will assess the following:

- Site Constraints and Routing Review
- Electrical Concept Design
- Grid Feasibility

2.0 Site Constraints and Routing Review

2.1 Introduction

The project location of Project Collette has numerous legislative, natural, and infrastructure constraints. As a result, a review of the expected site constraints in advance of site selection has been carried out. This section is summarised below:

- Site Constraints
  - Marine Boundaries
  - SAC and MCZ areas
  - Site Water Depths
  - Grid Infrastructure and Connection Locations
- Landfall and Routing Review
  - Landfall 1 – Harker Connection
  - Landfall 2 – Hutton Connection
  - Sellafield Private Wire

2.2 Site Constraints

2.2.1 Marine Jurisdictions and Currently OWF Sites

The area in which Project Collette is planned is located in the Scottish, English and Isle of Man territorial waters [1] as shown in Figure 2.1. The Isle of Man is not considered to be part of the United Kingdom and is considered a hard constraint for the site. The Scottish and English Territorial waters are both part of the United Kingdom, and therefore, there is a certain amount of allowance to spread the site between two jurisdictions. This is clearly seen with the Robin Rigg OWF, where the main OWF site is located in the Crown Estate Scotland jurisdiction and the export route corridor (ECC) is located in Crown Estate England jurisdiction. It is advised that the Collette site be kept in a single jurisdiction to reduce the legislative complications of having a site split between two jurisdictions. The ECC generally has different design requirements and can be developed similarly to the Robin Rigg OWF.

There are numerous OWF sites in the area, with the already noted Robin Rigg OWF located in the northeast of Cumbria [2], and several OWFs installed southeast of Cumbria. This includes Walney 1–4 (1 GW), West of Duddon Sands (389 MW), Ormonde (150 MW), and Barrow (90 MW) [3]. Additionally, there are also several planned OWF sites in the area, such as Morgan, shown in Figure 2.1. All planned and currently developed sites southwest of Cumbria are connected in the Moray Firth at Heysham due to its historical 400kV transmission infrastructure developed for the Heysham nuclear station, which is discussed in greater detail in Section 2.2.4.

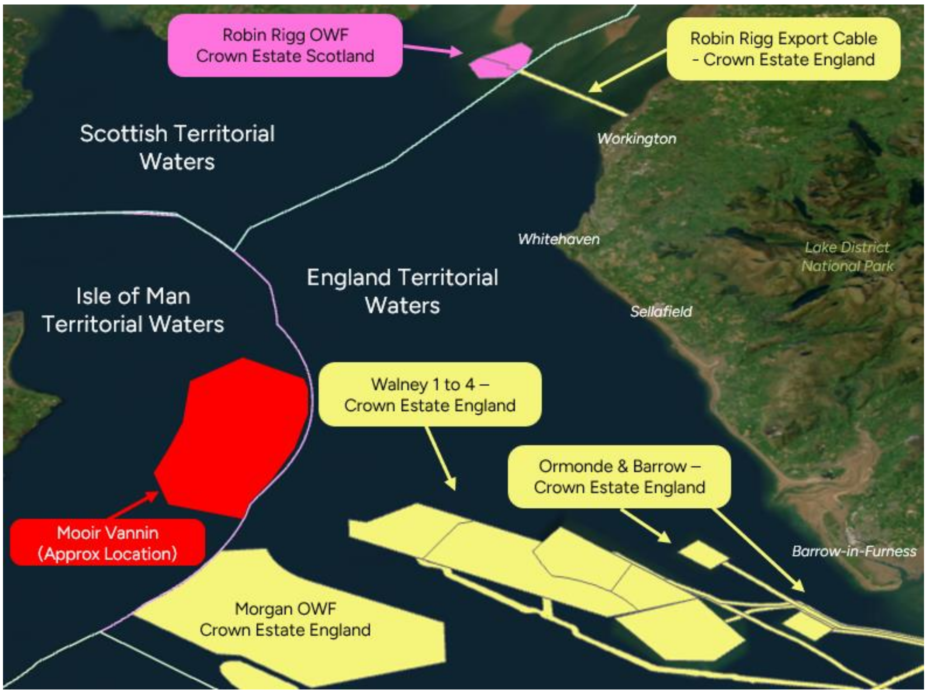

Figure 2.1: Marine Boundaries and OWF areas [1] [2] [3]

2.2.2 Special Areas of Conservation and Marine Protection Zones

The Collette project site will be located in proximity to numerous protected areas in Cumbria, with several Special Areas of Conservation (SAC) onshore and in the Morecambe Bay south of Cumbria [4], as shown in Figure 2.2. There are also marine conservation zones (MCZs) located in the area that will further constrain the landfall options, with the entire coast between Whitehaven and Sellafield designated an MCZ [5], as shown in Figure 2.2.

The offshore wind farm export cables in the area identified in Section 2.2.1 are routed through the SAC identified as the Morecombe Bay, and just north of an MCZ. The routing through SACs and near MCZs is possible, but results in a much greater requirement to prove that the developments will not affect the protected environment and that there are no alternative routing options. The position of the Hunterston grid connection point is located in the SAC, and there is no alternative route available, which likely assisted in the permit to develop within an SAC.

It should be noted, the MCZ areas that overlap with the OWF, identified as Walney 1 to 4 in Figure 2.1, were designated MCZs after the construction of the Walney 1-4. The SACs and MCZs shown in Figure 2.2 should be considered hard constraints and should be routed around unless no alternative route is available.

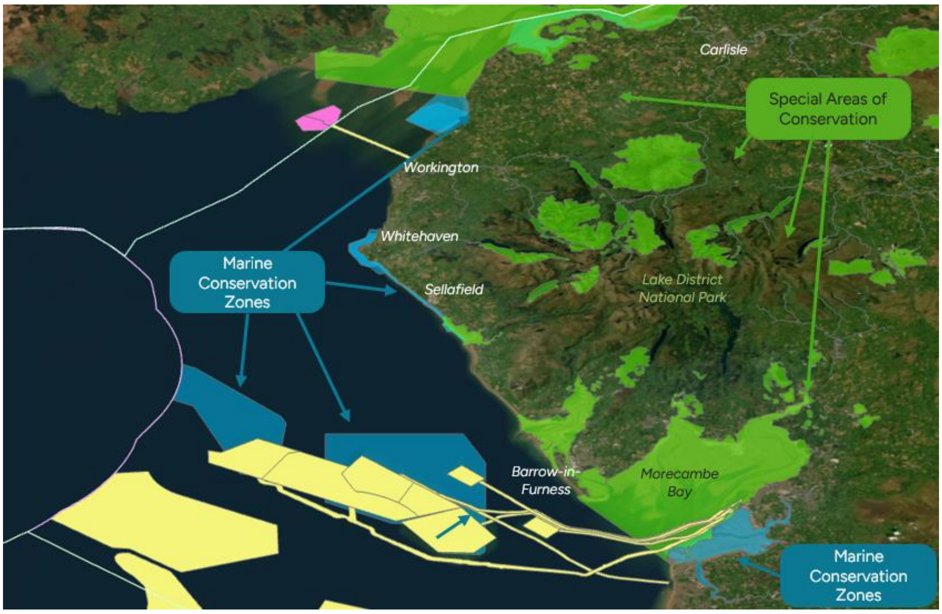

Figure 2.2: SAC and MCZ in Cumbria [5] [4]

2.2.3 Site Water Depths

The water depths offshore of Cumbria are shown in metres in Figure 2.3, with the depths varying between 50m and 20m offshore. These depths are approximately suitable for both fixed and floating foundations, but a geotechnical survey would be required to ascertain the most suitable foundation type. The seabed conditions have resulted in abandoned projects in the region, such as the Celtic Array, which was shelved in 2014 [6]. This displays the importance of a proper geotechnical review to ensure that the most appropriate sites can be selected.

Figure 2.3: Water Depths (Depths displayed in metres) [7]

2.2.4 Grid Connection Locations

As the project is expected to be 1.2 GW in capacity, the grid connection will likely need to have a 400 kV operating voltage to manage the power capacity. There are several extra high voltage (EHV) substations located in Cumbria, but none on the Cumbrian coast. A review of 400kV substations was performed to determine if there was an appropriate connection location nearby [8]. The OWF farms located southwest of Cumbria all connect at the Heysham 400kV substation, but a grid connection to the substation is unlikely due to the amount of capacity already connecting, as shown in Figure 2.4.

The onshore energy infrastructure on the coast of Cumbria consists of several 132kV OHL, which are unlikely to be sufficient to carry the capacity of a 1.2 GW OWF connecting on the Cumbria coast. If a landfall in Cumbria is selected and the current infrastructure is used to connect to the grid, the 132kV OHLs will need to be upgraded, or additional infrastructure will need to be developed to connect to a 400kV substation.

The two most appropriate locations for a grid connection are Harker substation, shown in Figure 2.4, north of Carlisle, and the Hutton substation located northeast of Morecambe Bay. These substations do not have extensive amounts of OWF capacity connected and are located 50 km from the Cumbria coast, where Project Collette is likely to make landfall.

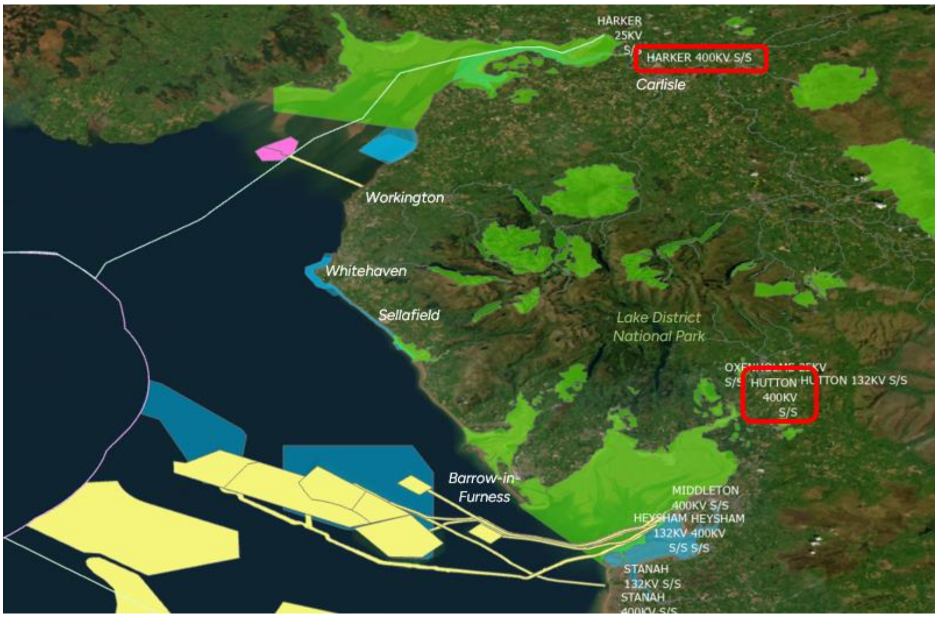

Figure 2.4: Grid Connection Points – 400kV Operating Voltage [8]

2.2.5 Topography

The Cumbrian coast is an area of outstanding natural beauty, with the Lake District National Park located in the county. There are several mountains in the region with heights of up to 978m [9]. This is challenging from an engineering perspective for both OHL and cable routing in the region, as shown by the onerous landscape and harsh elevations [10] displayed in Figure 2.5.

The northern region of Cumbria has notably flatter elevations with gentle elevation changes, which contrasts with the mountainous topography of the centre and south of Cumbria. The south of Cumbria has minimal flat land between the harsh slopes and the coastline. Any infrastructure development will be seriously constrained by the topography of the region, with any landfall on the Cumbria coast likely to need to travel north to avoid the Lake District.

Figure 2.5: Cumbria Topography

2.3 Site and Landfall Selection

This section assesses the most appropriate landfall and routing options for Project Collette to Harker or to Hutton substations while considering the constraints identified in Section 2.2. The most appropriate project site locations, landfalls, and grid connection points are shown in Figure 2.6.

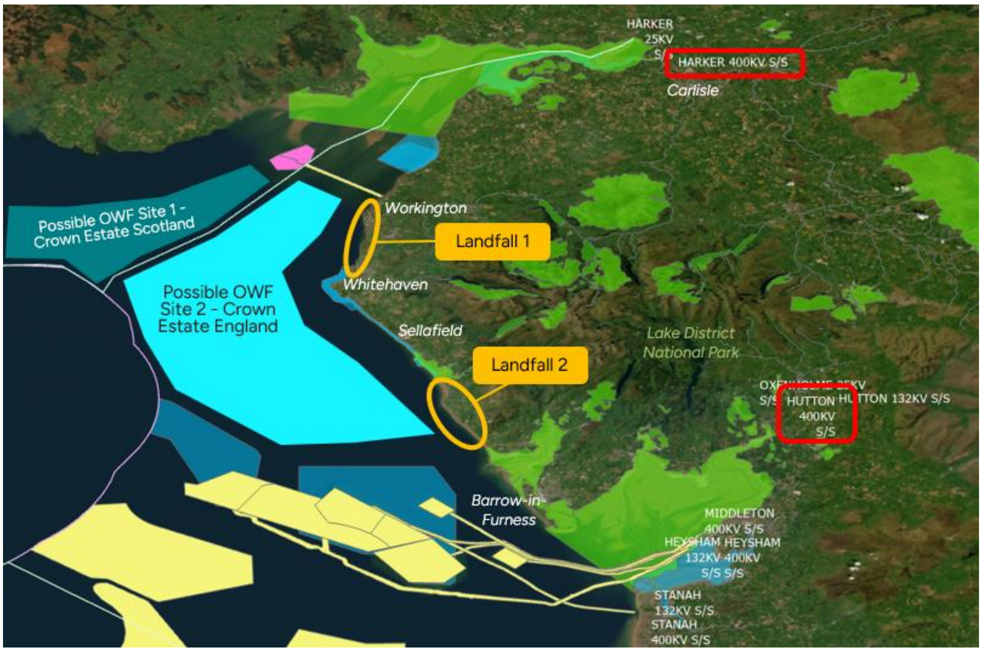

Figure 2.6: Site and Landfall Locations

2.3.1 Site Locations and Landfalls

The most appropriate site for an OWF is located directly west of Cumbria and north of the identified MCZs that overlap the Walney OWFs. The only constraint is that the OWF site should be located entirely in the Crown Estate England or the Crown Estate Scotland jurisdictions. This is to reduce the legislative requirements that will likely be required in the event of working across two jurisdictions. There is scope for the ECC to be in a different jurisdiction, but this would only be applicable if the project is located in Scottish waters. The potential sites are separated between Possible OWF 1 in Scottish waters and Possible OWF 2 in English waters.

Possible OWF Site 1 is a viable location, but would require an export corridor that lands in Cumbria, similar to the Robin Rigg OWF. The distance from the Cumbria coast to landfall from the Scottish jurisdiction will be at least 15km, depending on the OSS locations. This may be approaching the limits of HVAC export systems, as the onshore route will be in the range of 50km.

Possible OWF Site 2 would be the more appropriate location for Project Collette, as it allows the OSS to be located closer to the Cumbria coast and reduces the distance between the OSS and the grid connection.

The only areas suitable for landfalls due to the coastal SACs and MCZs are the area between Workington and Whitehaven, identified as Landfall 1, and between two SACs north of Barrow-in-Furness, identified as Landfall 2. These are shown in Figure 2.6. Due to the distance from landfall to the connection points, Landfall 1 will be assessed for connection to Harker, and Landfall 2 will be assessed for connection to Hutton.

2.3.2 Landfall 1 – Harker Connection Route

Landfall 1 is located near Workington, with two distinct topographical conditions on the coast shown in Figure 2.7 (a) and (b). The southern section, in Figure 2.7 (a), has steep elevation changes at the coastline that would result in burial depths of approximately 50m. Burial of the export cable at this depth increases the risk of thermal failure during operation.

The more appropriate landfall is the northern section of Landfall 1 in Siddock, north of Workington, as shown in Figure 2.7 (b). This area has gentle elevation changes and has been proven to be suitable for landfalls by the Robin Rigg export cable landfall. A constraint to consider is the several onshore wind turbines and factories located at Siddock, but these could be routed around with agreement from the onshore turbine and factory owners. Additionally, the railway shown in the figures below would need to be crossed using trenchless methods, but this is not a notable constraint from a technical perspective.

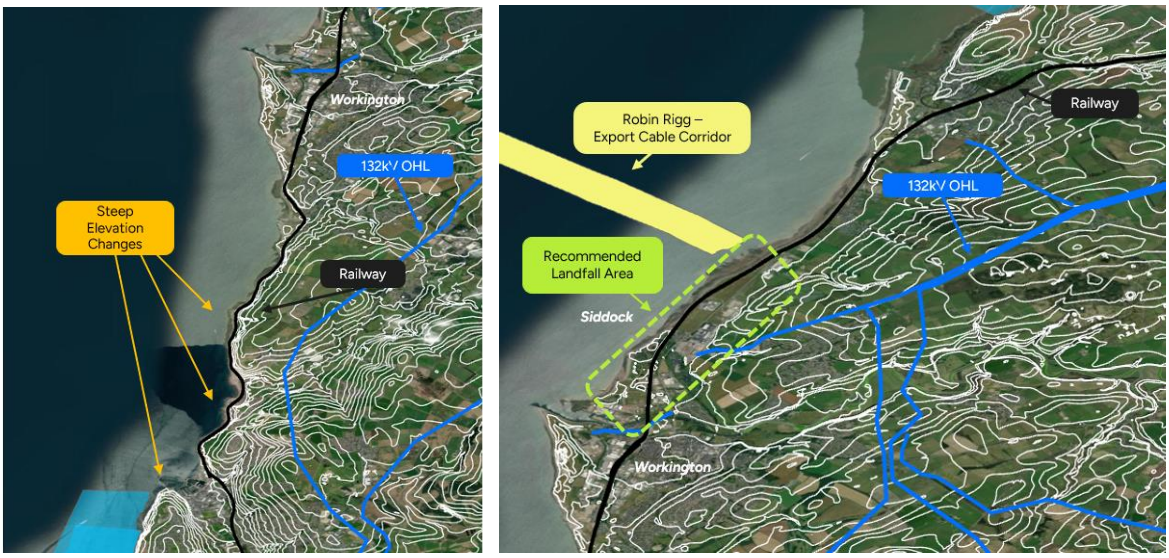

Figure 2.7 (a) & (b): Left – (a) Southern Section of Landfall 1, Right – (b) Northern Section of Landfall 1

The onshore route from landfall to Harker is not a difficult landscape from an engineering perspective, with gentle elevations and minimal infrastructure. The area would be appropriate for a cable route, with the distance estimated to be approximately 40km. The connection upgrades required could be performed with OHL upgrades, but there are risks of planning delays and the lack of energy-intensive industry and consumers in the area. A cable route from landfall to Harker is a more viable option and will be less susceptible to objections and permitting issues, as it will be located underground.

Figure 2.8: Route Constraints to Harker Substation

2.3.3 Landfall 2 – Hutton Connection Route

Landfall 2 is located south of Sellafield between two SACs and north of Barrow-in-Furness. The landfall has similar geometries to Landfall 1, as shown in Figure 2.9. The north section of landfall 2 and the southern tip are characterised by gentle slopes that are suitable for the landfall of a high-capacity subsea export cable. The central section shows steep elevation changes that would likely result in thermal issues at landfall, as stated for Landfall 2.

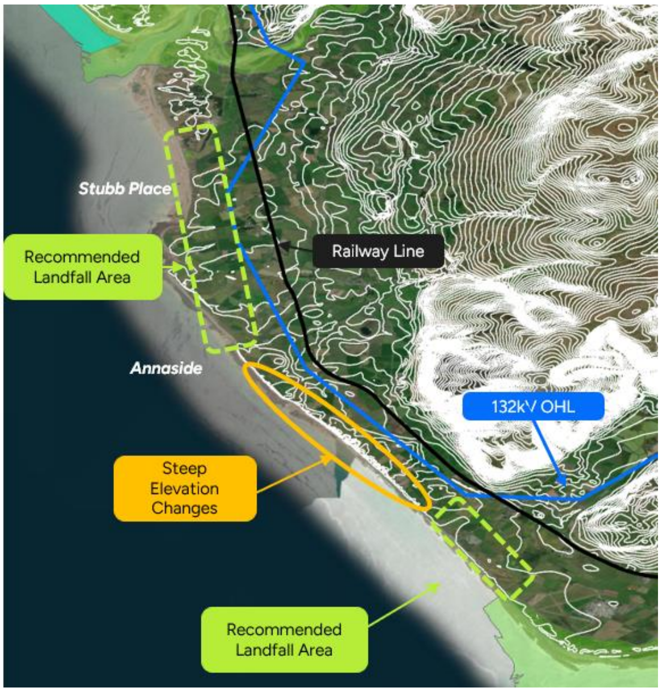

Figure 2.9: Landfall 2 – South of Sellafield, north of Barrow-in-Furness

As noted in Section 2.3.1, the onshore route from Landfall 2 to Harker is unrealistically long, exceeding 90km, resulting in the export system approaching 100km, which would make HVAC economically unviable. A connection to Hutton would be approximately 50km, which is a more realistic onshore length, but it should be noted that this is still approaching the limits of HVAC system distance.

The onshore route from Landfall 2 to Hutton is shown in Figure 2.10. This route is characterised by the SAC of Morecambe to the south and the harsh, steep elevations identified in the south of Cumbria in Section 2.2.5. There is no realistic method of installing an onshore cable route in this area from an engineering perspective, and the only method that would be feasible would be an OHL. The 132kV OHL shown in Figure 2.10 would need to be upgraded to 220kV or 275kV to carry the required capacity, and additional OHL circuits would likely be required due to the size of Project Collette.

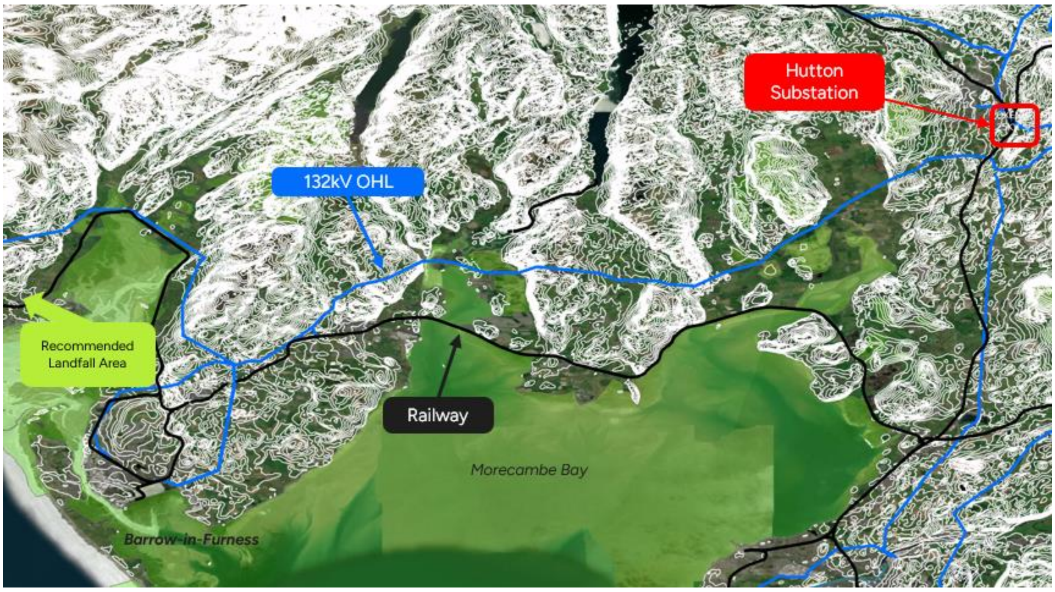

Figure 2.10: Landfall 2 to Hutton Onshore Route

2.3.4 Private Wire to Sellafield – Landfall 1 and 2

A notable off-taker in the region that makes the development of a private wire connection desirable is the Sellafield nuclear processing facility located on the Cumbrian coast beside an MCZ. Sellafield has a large power requirement, with a 2011 report noting an annual consumption of 411000 MWh [11]. This translates to an approximate power requirement of 50 MW. The power requirement compared to the Project Collette's overall size, 1.2GW, means that a private wire from a single turbine string would be appropriate to meet the site's power needs. This means that 5 or 6 offshore WTGs with an approximate total capacity of 50-60 MW would not connect to the offshore substation (OSS) and instead be routed directly to Sellafield. As such, Landfall 1 and Landfall 2 will be assessed for routing to Sellafield.

Landfall 1 to Sellafield is not a technically difficult route, with a distance of 30km onshore and minimal infrastructure and large settlements in the route corridor to Sellafield, as shown in Figure 2.12. The distance would result in increased costs and planning requirements, and minimising cost would be the priority for a private wire development.

Landfall 2 to Sellafield is a shorter onshore route than Landfall 1, approximately 15km in length, but it does route through several harsh elevations and an SAC identified as the Drigg Coast, shown in Figure 2.12. A HDD under the Drigg Coast SAC and following the route of the OHL and railways east of the Drigg Coast SAC would be technically possible if challenging. The proximity to the railway and the OHL would require extensive communication with the grid operator and National Rail.

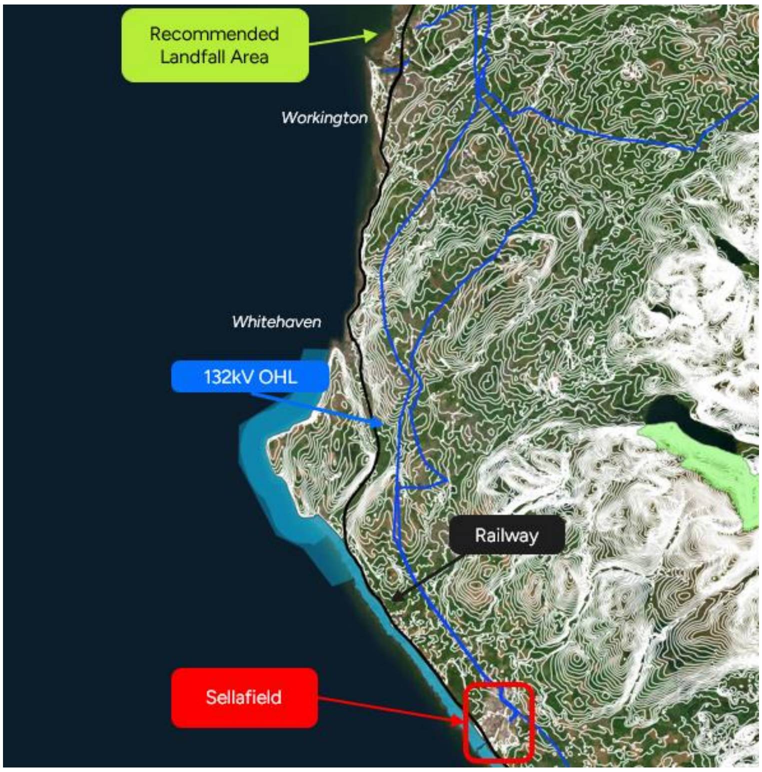

Figure 2.11: Landfall 1 to Sellafield

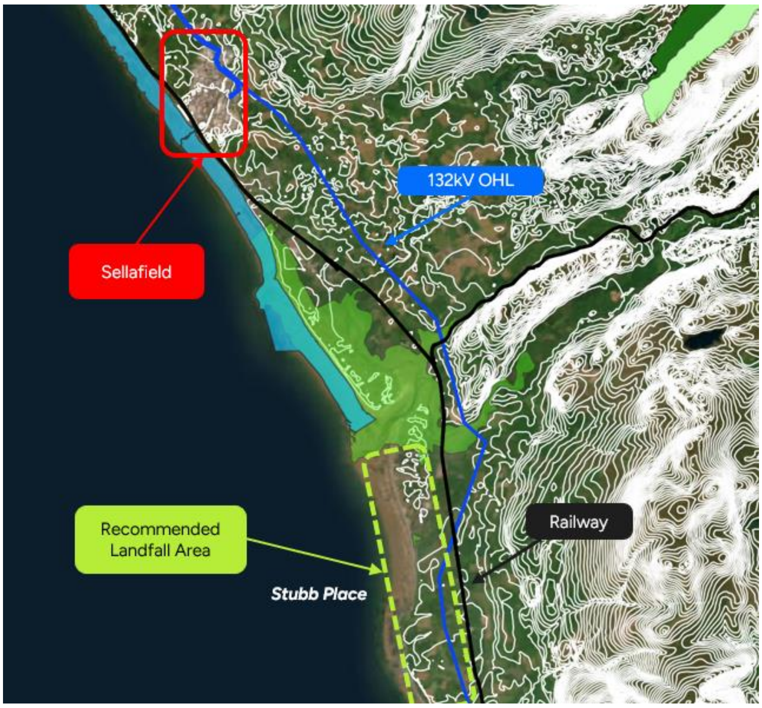

Figure 2.12: Landfall 2 to Sellafield

2.4 Summary of Site and Landfall Review

This section assessed the Cumbria coast for high-level constraints for a large-scale offshore wind farm from a technical perspective. The following conclusions can be drawn from the review:

- The OWF site should be in the Northern part of the English territorial waters, identified as Possible OWF site 2, southwest of Robin Rigg. As landfall 1 is the most appropriate landfall location for the export cables, the OSSs should be located as close to this location as possible to minimise costs. The offshore export cable will have an estimated length of 10-20 km, depending on the location of the OSSs.
- Landfall 1 at Siddock is the most viable landfall location, close to the current Robin Rigg landfall, due to its proven viability for export cable landfalls, its gentle elevation changes and avoidance of SAC/MPZs in the area. The recommended OWF grid connection is the 400kV Harker substation, giving an approximate distance of 50-60km from landfall 1. The area is characterised by gentle slopes and low amounts of large infrastructure, making it ideal for high-capacity cable routing.
- For the private wire connection to Sellafield, Landfall 2 would be the more viable option due to its reduced length requirements. It would be technically difficult to HDD under the Drigg Coast SAC, but it would halve the overall route length when compared to Landfall 1.

3.0 Offshore and Onshore Electrical Concept

3.1 Introduction

Project Collette will be a large-scale offshore wind farm with a capacity of up to 1.2 GW, which will require a large-scale extra high voltage (EHV) electrical system to allow connection to the grid. The electrical system will encapsulate a large portion of the CAPEX for the OWF and will involve large amounts of electrical design work to ensure an appropriate system is developed to meet the OWF system requirements and the TSO requirements at the Point of Connection (PoC).

This high-level description of the project's electrical architecture is intended to provide an early conceptual framework and does not substitute the need for detailed power system studies. Comprehensive analyses remain essential to ensure and demonstrate the safe, reliable, and efficient integration of the generation assets with the national electricity system. Figure 3.1 shows an initial concept for the offshore and onshore electrical systems. This section outlines the expected requirements for each component.

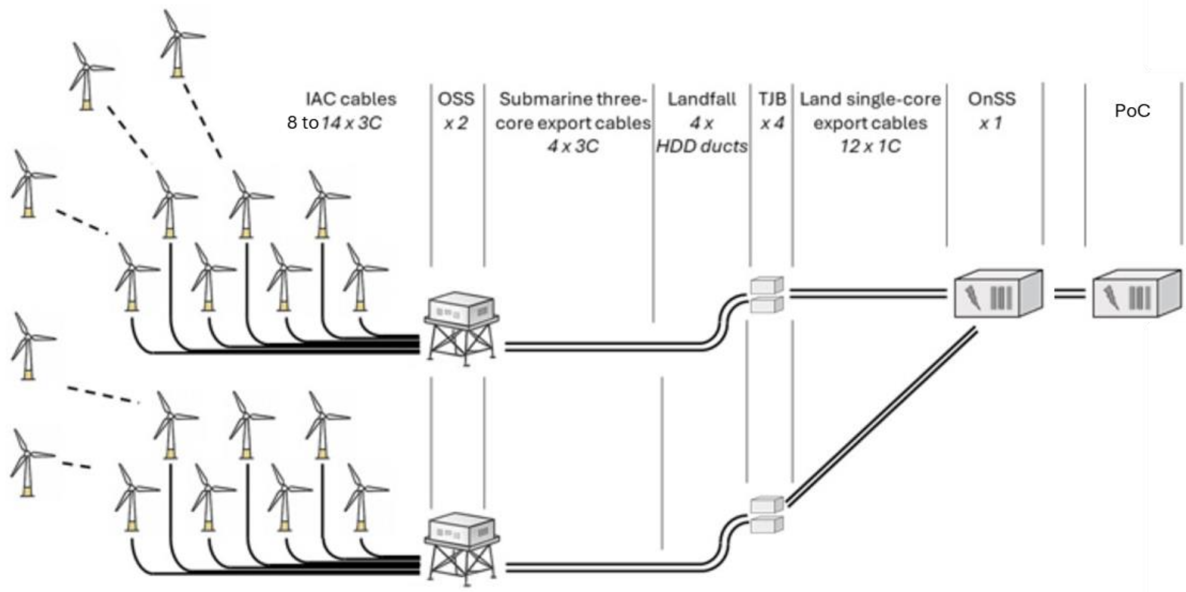

Figure 3.1: Collette Offshore Wind Farm projected overall diagram

3.2 Wind Turbine Generators

The number and specification of Wind Turbine Generators (WTGs) required for the project will depend on several parameters, including site-specific wind resource assessment, technology availability and market offerings and electrical design considerations.

As of 2024, commercially available WTGs have a nominal capacity of 14 MW [12] [13] [14], with market trends indicating an increase to 18–21 MW in the near term [15]. To achieve the target installed capacity of 1.2 GW, the following turbine configurations are anticipated:

- Approximately 86 x 14 MW WTGs arranged in strings of 6 to 7 WTGs
- Approximately 57–67 x 18–21 MW turbines arranged in strings of 7 to 9 WTGs

In terms of electrical characteristics, current 14 MW class offshore WTGs collector systems typically operate at 66 kV. Next-generation WTGs (≥18 MW) are expected to feature an increased collector voltage of 132 kV. These projections will be refined as turbine models are shortlisted and the detailed design progresses.

It should be noted that the increased sizing of WTGs can present a challenge from a foundation perspective, specifically fixed-bottom wind. Turbines in the capacity range of 14 MW to 21 MW may be unsuitable for gravity-based foundation types due to the size requirements of the foundation to maintain a stable structure during operation. This could constrain the design options in the event that the seabed conditions are found unsuitable for monopile or jacket foundations. It is important that a geotechnical survey is carried out to identify the seabed conditions to properly assess foundation constraints in advance of confirming a WTG size.

3.3 Collector System

Based on the current 66 kV state-of-the-art design, preliminary calculations indicate the need for approximately 14 collector strings. If market conditions align with the project timeline, a 132 kV array voltage may be adopted, reducing the number of required collector circuits to around 8 strings, due to the increased power transfer capacity. 132kV array voltage may also need to be considered if the turbines selected have a capacity of 18 MW or greater to ensure the cable loads remain within acceptable limits.

3.4 Offshore Export System

Two offshore export system options are under consideration at this stage. The first one introduces a voltage step-up between the collector system and the export system through the installation of Offshore Substations (OSS). The second one considers a direct connection to shore. This arrangement eliminates offshore substations, directly exporting power from turbines to shore. While technically feasible for smaller projects located near shore, this option is generally unsuitable for large-scale OWFs such as Project Collette, due to losses over distance and practical limitations on the number of export cables required. It is considered for a private-wire connection to the Sellafield Nuclear site – please refer to Sections 2.3.4 and 3.9.

The step-up configuration is the prevailing industry standard, as it reduces current levels, which in turn mitigates losses and reduces the required cable cross-section, lowering capital expenditure. While 220 kV is the current typical export voltage, 275 kV may be considered to reduce the circuit requirement and to comply with the Holistic Network Design recommendations [16] but subject to developments in supply chain capability and component availability.

Based on industry practice and electrical load considerations, two OSS platforms will likely be required to accommodate a 1.2 GW export capacity. Each OSS is expected to include:

- Gas-Insulated Switchgear (GIS) before and after the step-up transformers. While more costly than Air-Insulated Switchgear (AIS), GIS offers superior compactness and environmental sealing—critical in offshore environments.
- Two 400 MVA step-up transformers on each platform, providing partial redundancy. The busbar arrangement should allow rerouting of generation in the event of a downstream failure.
- A Static Reactive Power Compensation system - required to offset the capacitive charging current of the export cables.

  Due to their physical construction, power cables exhibit significant capacitance when operated with alternating current. This capacitive behaviour leads to a reduction in effective power transmission capacity and causes unacceptable voltage drop along the cable length. To mitigate these effects, reactive compensation systems - typically installed at both ends of the cable - are employed to offset the capacitive reactance.

This is typically addressed offshore via shunt reactors placed at the offshore and onshore substations, with each substation containing a portion of the required reactive compensation capacity. The compensation system rating is highly dependent on the export voltage cable characteristics and lengths. Table 3.1 gives indications of the three-phase rating for different scenarios (50% of the cables' reactive power).

- Auxiliary Systems, including low-voltage electrical distribution, control and monitoring systems, communications, crane, helideck, and safety systems.

Table 3.1 - Indicative offshore shunt reactor sizing (*)

220 kV	275 kV
140-320 MVAr	220-500 MVAr

(*) The length of the export cable has been assumed to comprise an estimated 20 km of submarine cable and an additional 60 km of land cables between the landfall and the OnSS located close to the PoC, refer to Section 2.4.

Each OSS is expected to be connected to shore via two three-core submarine export cables, resulting in a total of four export cables, rated for either 220 kV or 275 kV. The number of cable circuits can be optimised during later stages of the project, once thermal ratings are confirmed. This decision will be based on a trade-off between capital expenditure, which favours fewer circuits at higher voltages, and the cost of energy not delivered, which may be reduced through circuit redundancy. Supply chain availability will also be a key factor in this assessment.

These cables will land at the shore and transition to land cables via Transition Joint Bays (TJBs).

Alternatively, the use of an HVDC export system could be considered to mitigate the technical challenges associated with long-distance HVAC transmission, should they be highlighted in the next stages of the project.

3.5 Onshore Export System

From each TJB (four in total), a circuit of three single-core land cables will be routed to the Onshore Substation (OnSS). Current UK best practices recommend locating the OnSS near the Point of Connection (PoC). As a result, the onshore export cable length from the Transition Joint Bays (TJBs) to the substation is assumed to be 60 km. The OnSS will comprise:

- Air-Insulated Switchgear (AIS), unless site constraints require GIS.
- Step-up transformers to 400 kV.
- One Static Reactive Power Compensation System to offset the remaining 50% of the capacitive charging current of the export cables. Its ratings are presented in Table 3.2.
- One Dynamic Reactive Compensation, typically STATCOMs (Static Synchronous Compensators) or SVC (Static VAr Compensators), to maintain voltage stability and meet Grid Code requirements. Considering a power factor ranging between – 0.95 and +0.95 as per the Grid Code requirements, an indicative rating of ± 400 MVAr can be proposed in this early stage.
- Harmonic Filtering, to suppress harmonics arising from wind turbines, long cable runs, and power electronics (e.g., STATCOM).

Table 3.2 - Indicative offshore shunt reactor sizing (*)

220 kV	275 kV
280-640 MVAr	440-1000 MVAr

Power will be transmitted to the PoC from the OnSS via either two underground land cable circuits or overhead lines (OHL) operating at 400kV. The choice of route and method will be subject to detailed feasibility, environmental, economic, and public acceptability assessments.

3.6 Electrical System Summary

A summary of the electrical system described in Sections 3.2 to 3.5 is provided below. This should only be used to provide an indication of the system design and not be used in place of a detailed Pre-FEED or concept design process.

- The WTGs used in the system are estimated to be:
  - 86 x 14 MW WTGs arranged in strings of 6 to 7 WTGs
  - 57–67 x 18–21 MW turbines arranged in strings of 7 to 9 WTGs.
- A 66kV or 132kV collector system, dependent on system requirements.
- 2 offshore substations with 2 transformers each, with a rated capacity of 400 MVA each.
  - 140 to 500 MVAr shunt reactor at each offshore substation.
- 4 x 220 or 275 kV circuits of 20km from landfall to offshore substation.
- 4 x 220 or 275 kV circuits of 60km from the onshore substation to the proposed landfall.
- 400 kV onshore substation with 2 x 400/220 or 275 kV transformers of 800MVA each.
  - 280 to 1000 MVAr Shunt reactor and a 400MVAr STATCOM at the Project Collete onshore substation.

3.7 Electrical System Estimate Cost

The electrical system outlined in Sections 3.2 to 3.5 will be one of the main CAPEX costs when developing an OWF of this size. Developing an appropriate cost estimate for this system is difficult due to the amount of equipment, OEMs and consultants/contractors that will be involved, as well as the previously mentioned market conditions. For an initial costing such as this, SLR use the Holistic Network Design (HND) Costing methodology developed in 2022 [17] which is then adjusted for inflation, assuming a 14.497% increase based on the Consumer Price Index [18]. This adjustment is a simplified method to account for price differences between 2022 and 2025, as the actual inflation value is sector-specific, with supply chain issues, raw material costs and vessel availability all contributing to the cost increases. The reactive compensation requirements are calculated in Section 3.8 and the recommendations from Section 3.6.

Table 3.3: HND Electrical Costing Model – Project Collette

Description	HND Capacity	No.	2025 Prices - Adjusted for Inflation	
			Cost Min	Cost Max
Offshore Export Cables	300 MVA	4 x 20km	£85,341,480	£120,808,070
Platforms	800 MVA	2	£132,839,420	£247,313,520
Offshore Transformers	400 MVA	4	£10,597,840	£11,980,970
Onshore Export Cables	300 MVA	4 x 60km	£492,703,490	£553,157,910
Onshore Transformer	600 MVA	2	£9,223,880	£10,139,850
Offshore Compensation				
Offshore Shunt Reactor	200 MVAr	4	£13,831,240	£18,411,120
Onshore Compensation				
Onshore Shunt Reactor	167 MVAr	3	£11,182,930	£14,274,350
Onshore STATCOM	200 MVAr	2	£25,212,240	£62,515,360
TOTAL SYSTEM COST			£780,932,520	£1,038,601,150

3.8 Battery Energy Storage System Considerations

This section outlines key technical considerations for assessing the feasibility of integrating a Battery Energy Storage System (BESS) with an offshore wind farm (OWF) under the current regulatory and operational framework.

Given the challenging marine environment and the high costs associated with offshore deployment, BESS installations are invariably located onshore. Under the OFTO (Offshore Transmission Owner) regime, the Point of Common Coupling (PCC) for the OWF is located at the Offshore Substation (OSS), whereas the PCC for the BESS is situated at the BESS site, typically onshore at the point of grid export.

This spatial and electrical separation of PCCs necessitates the independent operation of the OWF and BESS. Consequently, the typical co-location use case—where excess renewable generation during periods of curtailment is used to charge the BESS and discharged during periods of low generation—is not directly achievable in this configuration. However, it is noteworthy that the BESS may still influence curtailment dynamics by contributing to overall grid flexibility, potentially reducing curtailment requirements at the OWF level. It should be noted that the colocation of BESS and Project Collette at the same point of connection increases the fault level and power system requirements as both sites must be considered when operating in parallel.

This operational separation leads to decoupled revenue streams: the OWF generates revenue through electricity generation, while the BESS earns income by providing grid services such as balancing mechanisms, ancillary services and wholesale market arbitrage. As such, BESS dispatch will be optimised to provide system services rather than to directly complement OWF output.

Despite their operational independence, co-locating the BESS and OWF at the same Point of Connection (PoC) offers two key advantages:

1. Grid capacity optimisation: both assets can share connection headroom, maximising utilisation and overall revenue.
2. Commercial leverage: owning both assets strengthens the developer's position in negotiating a Power Purchase Agreement (PPA), if applicable.

Alternatively, if Project Collette is configured as a private-wire connection supplying a dedicated Consumer (as opposed to a grid connection), the BESS's primary role would shift to ensuring power availability and mitigating the intermittency of the OWF. This leads to completely different techno-economic trade-offs in BESS sizing, dispatch control and reliability. In this configuration, the developer retains ownership and operational responsibility for the generation assets, the BESS and the private export infrastructure, which is distinct from the OFTO regime where transmission assets are transferred to a licensed third party.

3.8.1 BESS Colocation Summary

The colocation of a BESS site at the point of connection is not a standard method of connection for a OWF that is under the OFTO regime but does offer some potential advantages in improving the grid capacity optimisation and commercial argument for the site. It would increase the design requirements for the site however due to the common PCC for the two developments.

Including BESS in parallel to a private wire connection would be outside the OFTO regime and would improve availability for power generation for the private consumer. The main challenge to this setup is the commercial requirements for a BESS site of the required size.

3.9 Private-Wire Connection Considerations

This alternative system may be configured to supply approximately 50 MW of renewable power directly to Sellafield via a private-wire connection, avoiding grid export and associated transmission charges. This was assessed in Section 2.3.4 for appropriate landfall locations.

The turbines would be located approximately 20 km offshore, with an additional 15 km onshore cable route from landfall to the Sellafield substation if Landfall 2 is selected. Because of the relatively low power and short distances involved, the system may be designed without an offshore substation, simplifying the infrastructure and reducing capital expenditure.

The turbines would be connected via array cables operating at either 66 kV or 132 kV, depending on turbine design. The export cable would transmit power directly to shore at the selected collector voltage. At a collector voltage of 132 kV, the cable system exhibits approximately 30 MVAr of capacitive reactance. If operated at 66 kV, the capacitive reactance reduces to some 15 MVAr. These values influence reactive power compensation requirements and voltage stability, necessitating the use of STATCOMs at the onshore substation at Sellafield.

The choice between 66 kV and 132 kV will influence not only electrical losses and cable sizing but also the complexity of onshore interfacing and protection schemes. Notably, at 66 kV, an additional transformer will need to be supplied.

The Sellafield substation will need to be upgraded to accommodate this new connection while keeping the existing connection to the grid for redundancy purposes, as well as the emergency diesel generators.

SLR also contacted Carbon Neutral Fuels (CNF) to assess a private wire option to the CNF plant that is being developed at Workington. CNF indicated that due to the required base-load for operation of the electrolyser of the plant, a private wire solution was unlikely to be appropriate [19]. This is due to the intermittency of generation associated with offshore wind and CNF state that the current transmission grid capacity at Workington will meet CNFs power requirement and there is no incentive to develop a private wire option.

3.9.1 Private-Wire Summary

The private wire connection to Sellafield is feasible from a technical and engineering perspective. If a private wire connection to Sellafield is selected for further study, SLR would recommend connecting a single string of 5-6 WTGs to Sellafield, with no OSS. The chosen inter-array voltage will determine the required onshore infrastructure for the substation that will connect Project Collette to Sellafield, with 66kV system requiring a transformer for connection to Sellafield and a 132kV system having a larger reactive compensation requirement. The landfall for a private wire is recommended to be located south of Sellafield, identified as Landfall 2 in Section 2.3.4.

CNF were found to be an unsuitable option for a private wire as they considered the intermittency of offshore generation a critical barrier to meeting their plants requirement for a constant base load to ensure electrolyser operation.

4.0 Grid Feasibility

This section outlines the grid feasibility study for Project Collete. The study assessed local electricity infrastructure to identify a technically feasible, economic, and credible grid connection in line with System Operator methodologies.

The transmission network in the area is owned by National Grid Electricity Transmission (NGET) and operated by the National Energy System Operator (NESO) in its role as System Operator. The distribution network is owned and operated by Electricity North West Limited (ENWL).

This analysis formed a key criterion for evaluating the technical feasibility of the project, as it allowed interactions with nearby substations to be considered and the level of reactive power support required to maintain stable and efficient system operation to be identified.

4.1 Methodology

SLR Consulting has modelled the section of the network that determines whether the connection of Project Collete is feasible to the grid while accounting for current and planned grid infrastructure. The modelled section lies between two MITS nodes. A MITS node is one of the principal substations or junctions on the UK's high-voltage transmission backbone, representing key points where the national grid is interconnected and managed—in this case, between Harker and Penwortham.

For this analysis, DIgSILENT PowerFactory was used to model the grid and the connection of Project Collette. PowerFactory is a software tool for modelling and analysing electrical power systems. It supports load flow, fault analysis, stability studies, protection coordination, and renewable integration.

A basic load flow study was undertaken to assess the reactive power compensation requirements for the project. The study was performed considering the specific nature of the project, including an external representation of the connected EHV substations, which was extended to reflect the wider network. A number of assumptions and simplifications were developed to give a high-level representation of Project Collette within the grid, which are summarised in Section 4.2.2.

4.2 Input Data

This section outlines the input data that was used to assess the grid connection of Project Collette, which includes network infrastructure sources, substation and circuit capacities and key study assumptions.

4.2.1 Grid Infrastructure Data

The transmission network in the area is owned by National Grid Electricity Transmission (NGET) and operated by National Energy System Operator (NESO), in its role as System Operator. The distribution network in the area is owned and operated by Electricity North West Limited (ENWL). In undertaking this assessment, SLR have used the most recent available data:

- Electricity North West Limited (ENWL) Long Term Development Statement (LTDS) [20]
- Transmission Entry Capacity (TEC) [21]
- NESO Electricity Ten Year Statement 2024 (ETYS) [22]
- NESO Transmission Works Register (TWR) [23]

As well as in-house data, local knowledge and general understanding of NGET systems and practices to assess the potential options for the connection of the offshore wind farm.

4.2.2 Local Grid Infrastructure

The local transmission infrastructure in Cumbria includes two key 400 kV substations: Harker (400/275/132 kV), located north of Carlisle, and Hutton (400/132 kV), situated east of Kendal. The following sections describe the local grid infrastructure assessed in this study, which covers the area between the MITS nodes at Harker and Penwortham. A visual representation of the local grid is provided in the appendices in Appendix A1 and A2, which should be reviewed in parallel with the input information below.

Harker Substation

Harker is a 400/275/132 kV substation located just north of the Scottish border. It currently contains:

- Four 400/275 kV transformers with a total rated capacity of 2545 MVA.
- Five 275/132 kV transformers with a total rated capacity of 770 MVA.

The substation connects:

- To the south to Hutton via two 400 kV overhead lines (OHLs), each rated at 2771 MVA.
- To the east at 275 kV:
    - To Stella West, rated at 676 MVA
    - To Fourstones, rated at 795 MVA

Hutton Substation

Hutton is equipped with:

- Four 400/132 kV transformers with a total rated capacity of 689 MVA.

The substation connects:

- To the south via two 400 kV circuits to the Quernmoor node, rated 2958 MVA each.
- From Quernmoor, circuits connect:
    - To Middleton substation, rated at 2971 MVA
    - To Heysham substation, rated at 3098 MVA
    - From Heysham to Middleton via 2971MVA

Heysham substation

Heysham substation is equipped with:

- Three 400/132kV transformers with a total rated capacity of 830MVA.

From Heysham, there are two 400kV circuits that connect to Hambelton nodes rated at 3098 MVA and 3152MVA:

- From Hambelton nodes, there are two circuits that connect to Stanah, rated 240MVA each
- From Hambelton nodes, there are two circuits that connect to Penwortham, rated 2189MVA each

Stanah Substation

Stanah Substation is equipped with:

- Four 400/132kV transformers with a total rated capacity of 545MVA.

Penwortham Substation

Penwortham Substation is equipped with:

- Four 400/275kV transformers with a total rated capacity of 7221MVA.
- Two 400/400kV transformers rated 2750MVA each
- Two 275/132kV transformers rated 261MVA each

4.2.3 Planned Network Upgrades

At the time of writing, SLR is aware that NESO is planning to replace all circuits in the area between 2025 and 2035, including the addition of two 400 kV circuits between Harker and Carlisle substations. The programmed changes to the local network system are as follows:

Harker GIS Substation

- The upgrade of the 400/275 kV transformers to increase the total rated capacity to 3300 MVA.
- The upgrade of the 275/132 kV transformers to increase the total rated capacity to 1440 MVA.
- The addition of 2x400kV circuits between Harker and Carlisle substation.

Carlisle Substation

- Two 400/400 kV transformers with a total rated capacity of 5500MVA.

Penwortham Substation

- Removal of two 400/275kV transformers with a total rated capacity of 2268MVA.

Appendix A.2 provides a list of additional information about all the reinforcements planned in the area.

4.2.4 Generation and Demand

The background generation on the system, not including Project Collette, is shown in Table 4.1, with the total generation per substation. Table 4.2 shows the demand per substation described in Section 4.2.2. The generation and demand data are from the LTDS [2], the Transmission Entry Capacity (TEC) register [3], and the Embedded Register [4].

Table 4.1: Background Generation

Substation	Connected [MW]	Contracted [MW]	Total MW Connected and Contracted
Harker	257	2836	3039
Hutton	165	449	614
Middleton	0	440	440
Heysham	2363	600	2963
Penwortham	40	4414	4454

Table 4.2 Demand

Substation	Min Load [MW]	Max Load [MW]
Harker	97.10	388.43
Hutton	61.93	247.75
Middleton	0	0
Heysham	30.40	121.63
Penwortham	149.27	597.10

As SLR cannot determine with certainty which projects may not proceed, the modelling adopts a conservative assumption of a 50% attrition rate and presumes that the remaining projects will be successfully energised in accordance with the connection methodology.

4.2.5 Key Assumptions

The following assumptions and simplifications were applied to this study:

- For the proposed development scale of 1.2GW, the most suitable connection points will be to the 400kV network.
- The connection point identified will be the least cost but technically feasible solution for connection (as the networks' licence obligates the TO to provide). This is based on the proximity to the site and a number of other technical factors, such as available capacity in the network.
- Further discussion will be required with NESO, as there may be further constraints on connections that are not immediately obvious from the data available (for example, space at substations).
- System operators plan for connections under a worst-case scenario, meaning the system will be operating at minimum demand, whilst each project will be exporting full generation. Project Collette will be modelled by the transmission operator as exporting the full capacity of the wind farm at any given time, ignoring intermittency or peaks & troughs in demand. The result of this is that there is more available capacity on the network than modelling would indicate; however, we have created this report following the TO's connecting methodology, which they utilise when creating your grid offer.
- NESO have announced a potential attrition rate as high as 70% for generating projects (as stated in CMP427 [24]), meaning NESO predict that 70% of distribution and transmission projects fail to connect. An attrition rate of 50% has been applied in the model network scenarios to provide a more conservative assumption for the planned generation described in Table 4.1.
- Costs do not include potential network reinforcement costs triggered by the Project Collette connection.
- The fault levels at the connecting Transmission Station have not been considered in determining the project's technical feasibility.
- The estimated connection cost has a potential variance of up to ±40%.

4.3 Network Connection Assessment

In advance of modelling Project Collette, a simplified load flow study had to be carried out to determine the reactive compensation requirements for a project of this size based on the idealised system outlined in Section 3.0. The Single Line Diagram (SLD) for Project Collette is displayed in Figure 4.1, showing all busbars, circuits and reactive compensation.

Figure 4.1 shows the predicted reactive compensation requirement of 800 MVAr for the OSS and 700 MVAr for the OnSS, modelled as shunt reactors in the PowerFactory model. It is expected that the OnSS will require a high level of response to grid voltage variations, and as such, in the proposed design and associated costing in Sections 3.6 and 3.7, respectively, the reactive compensation at the OnSS is split between a 500MVAr shunt reactor and a 200MVAr STATCOM.

It should be noted that this is a high-level, simplified load flow that should be used as an early system requirement indicator only. A detailed load flow, fault study and design process is required to properly size the associated equipment, such as busbars, shunt reactors, STATCOMs, etc.

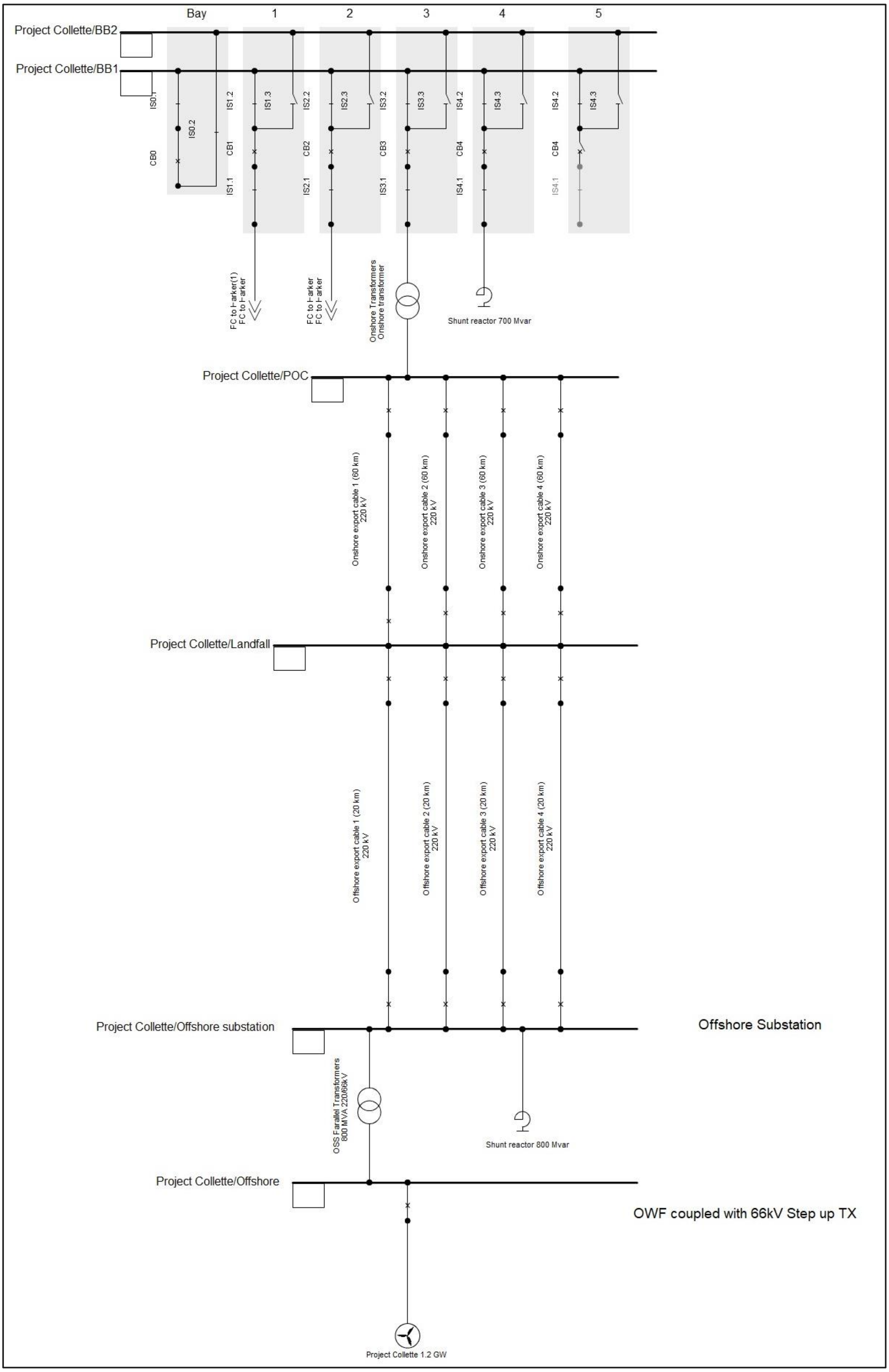

Figure 4.1: Single Line Diagram

To evaluate the available network capacity in the study area, SLR developed six distinct network scenarios to assess the feasibility of connecting Project Collette. Each scenario incorporates a representation of the external transmission network to simulate the behaviour of the wider system beyond the local study area. In all scenarios, the external network is modelled as absorbing any available excess transmission capacity, establishing a consistent boundary condition for the analyses and ensuring realistic power flow representation beyond the local study area. The network diagrams are displayed in Appendices A1 to A6.

The values assessed to determine the feasibility of the connection are circuit capacity and voltage stability. In the diagrams, circuit loading is shown using a colour code:

- Green for 0–80%
- Amber for 80–99%
- Red for 100%

For the substations, voltage stability remains within the grid code limits (0.9–1.1 pu, where pu or *per-unit* is a normalised measure relative to the nominal value) at every node of the grid, achieved through the design of the reactive compensation system. The colour code used to indicate voltage levels is as follows:

Lower Voltage (pu):

- Green: 1.0 pu
- Light Blue: 0.95 pu
- Dark Blue: 0.9 pu

Upper Voltage (pu):

- Green: 1.0 pu
- Yellow: 1.05 pu
- Red: 1.1 pu

Each node is characterised by three parameters: active power (P) in MW, reactive power (Q) in MVAr, and current (I) in kA. The sign convention used is as follows: positive values represent power flowing into the node (input), while negative values represent power flowing out of the node (output).

When evaluating the feasibility of the project through the diagrams, the current loading on all circuits connecting each node should remain below 80-90% of their rated capacity.

The list and description of each scenario are provided below.

- Appendix A1 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected generation.

- Appendix A2 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation.

- Appendix A3 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria, with connected and accepted generation and Project Collette connected to Harker.

- Appendix A4 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette connected to Hutton.

- Appendix A5 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette connected to Harker (attrition rate 50%).

- Appendix A6 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette connected to Hutton. (attrition rate 50%).

Appendix 1 and Appendix 2 examine the future network without Project Collette; Appendix 3 and Appendix 4 assess the impact of Project Collette on Harker and Hutton; and Appendix 5 and Appendix 6 explore the effect of attrition rates of contracted generation projects.

Appendices A3 and A4 incorporated all existing connected and accepted generation, in addition to the proposed Project Collette and can be considered the worst-case operating condition assessed in this study.

The results for connecting to Harker with the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation, refer to Appendix A3, are summarised below. The circuit loading data with connection to Harker is displayed in Table 4.3, and the Harker busbar voltages are displayed in Table 4.4.

The results for connecting to Hutton with the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation, refer to Appendix A4, are summarised below. The circuit loading data with connection to Hutton is displayed in Table 4.5, and the Hutton busbar voltages are displayed in Table 4.6.

Table 4.3 Harker circuit data

Circuits	Loading (%)	P (MW)	Q (MVAr)	I (kA)
Project Collette to Harker	51.8	594.5	55.8	0.799
Harker to Hutton	14.8	383	180	0.567
Harker to Carlisle	20.6	491.6	248.9	0.738

Table 4.4 Harker busbar data

Busbars	Voltage (p.u)
Harker	1.08
Hutton	1.05
Project Collette	1.08
Carlisle	1.07

Table 4.5: Hutton circuit data

Circuits	Loading (%)	P (MW)	Q (MVAr)	I (kA)
Project Collette to Hutton	53.3	594.2	48.4	0.823
Hutton to Harker	7.6	5.4	213.5	0.293

Circuits	Loading (%)	P (MW)	Q (MVAr)	I (kA)
Hutton to Quernmoor	25.3	753.2	245.6	1.087

Table 4.6: Hutton busbar data

Busbars	Voltage (p.u.)
Harker	1.08
Hutton	1.05
Project Collette	1.05

A review of the results shown in Table 4.3 to Table 4.6 indicates that both connections to Harker and Hutton are viable grid connection options. The circuit loadings are within capacity, and the busbar voltages are within the voltage limits of 0.9 pu to 1.1 pu. However, SLR recommends a connection at Harker, as the onshore grid connection route to Hutton faces significant technical and environmental challenges. These include the need to cross two large estuaries, navigate steep terrain that would necessitate the construction of overhead lines (OHL), and manage numerous Special Areas of Conservation (SACs), all of which would substantially complicate permitting and increase project risk as detailed in Section 2.0.

Additionally, a connection at Harker offers advantages in terms of reduced civil works, lower environmental impact, and shorter lead times for construction. It also provides a more robust integration with the existing high-voltage transmission infrastructure, ensuring efficient power evacuation and system reliability.

It should be noted that the status of accepted connections may vary over time, and future adjustments could affect the assessment outcomes.

4.4 Connection to Harker

The estimated connection cost is based on the connection profile required to connect to Harker. To enable the connection of Project Collete at Harker or Hutton, the project developer may be required to pay for a portion of the upgrade works required. This section presents the proposed connection profile for the project and the predicted associated cost of the enabling works.

4.4.1 Enabling Works

Enabling Works are modifications to the existing transmission network needed to accommodate a new project connection. These works may be either solely for the project or shared with others. Based on a 400kV point of supply, the minimum enabling works are expected to involve:

- Installation of 2 Bays at Harker Substation
- 1kA Circuit Breakers at Harker Substation
- Extension of the Protection System to cover additional switchgear Installation.

4.4.2 Connection Cost

The predicted system cost is shown in Section 3.6, based on the described system in Section 3.0 and the high-level review of the required reactive compensation outlined in Section 4.3. The enabling works required at Harker to accommodate the connection of a Project Collette are described in Section 4.4.1, and the predicted costing is displayed in Table 4.7. The costing is based on SLR's internal database and is an initial estimate. The enabling work costing assumes a ±40% price variance, as shown in Table 4.7.

Table 4.7 Enabling works predicted cost

Enabling works	Quantity	Cost Min	Cost Max
Enabling Work Design and PM	-	£5,610,420.00	£13,090,980.00
Misc. Substation Upgrades	-	£342,000.00	£798,000.00
Double Bay AIS Circuit Breaker	1	£1,637,280.00	£3,820,320.00
Double Bay Busbar	1	£1,761,000.00	£4,109,000.00
TOTAL		£9,350,700.00	£21,818,300.00

4.5 Planned Grid Upgrades 2030-2040

England is currently undergoing a major upgrade to the grid to accommodate the planned offshore energy addition to the system, titled “The Great Grid Upgrade”. The development of a large-scale OWF in the North of England will require extensive input from National Grid (NG) and the National Energy System Operator (NESO) to ensure that the generated electricity can be transferred efficiently to the required demand areas. Predicting the development of the grid infrastructure between 2030 and 2040 is a difficult task, as it is based on planned OWF developments and predicted demand. This was carried out by NESO in the Beyond 2030 [25], which assesses the required grid upgrades that would be required for each region of the United Kingdom.

The proximity of the recommended connection points to Scotland would be a notable obstacle to encouraging cooperation and investment from NG and NESO for the required upgrades to the grid infrastructure. This can be seen when looking at the most recent Electricity Ten Year Statement (ETYS) 2024 [26] which assesses the predicted generation/demand relationship from 2024 to 2034. The Scotland demand is predicted to remain below 5 GW in 2030, but is predicted to generate 45 GW 2030 across all FES pathways. This is similarly seen with the North of England. This means that there will be a large amount of electricity transferred south to the high-demand areas, and as such, the addition of 1.2 GW to a low-demand area such as Cumbria will also likely require North to South electricity transfer to an already congested network. This may reduce the NG and NESO’s likelihood to provide the investment and infrastructure required to upgrade the network in Cumbria. It is noted as a low-demand area, and the majority of the power is expected to be exported south; it is unlikely there is a strategic incentive to increase the grid infrastructure along the Cumbrian coast. The Beyond 2030 report [25] and the ETYS 2024 [26] recommend strategic support to encourage the energy demand increases in the north of England, which may reduce the expected grid bottlenecks currently seen between Scotland and England.

The recommended connection into the Harker substation from Section 2.0 is located in an area that in the Beyond 2030 will require extensive upgrades to alleviate the bottlenecks between the Scotland/North of England and the South of England. This is shown in Figure 4.2, which shows the addition of two EHV transmission lines between Scotland and England on the Scottish side and one additional EHV transmission south towards Blackpool and an upgrade of a 275kV transmission line that connects the East and West coast to 400kV operating voltage. Beyond 2030 notes that these grid upgrades are all in the concept phase, and no planning applications or detailed design have been carried out. The development of a 1.2GW OWF connecting close to the nexus point of several recommended transmission upgrades in the north of Cumbria could help justify the required grid upgrades and connection at Harker.

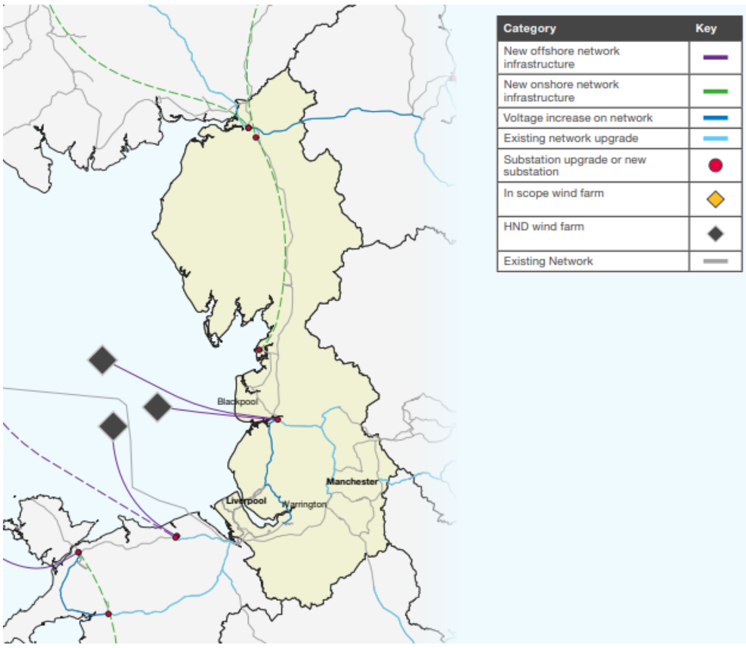

Figure 4.2: Beyond 2030 - North West Recommended Grid Upgrades

SLR do not have high confidence that NESO will recommend upgrading the OHL infrastructure on the Cumbrian coast, and it is likely that Project Collette will have to develop all the infrastructure up to Harker grid connection within the project costs.

It is recommended that GFCH contact NESO as soon as possible to ensure that the addition of 1.2 GW to the grid at the recommended location of Harker in Section 4.3 is appropriately included in grid simulations and can be considered within the recommended grid upgrades.

The ongoing development of the centralised strategic network plan (CSNP), specifically the offshore coordination policy development, is of particular relevance to this development. The CSNP or transitional CSNP (tCSNP) is not a specific approval process used by NESO, but a methodology being developed to inform NESO on the most appropriate investment and infrastructure.

The offshore coordination aspect of the tCSNP and CSNP will be vital in determining the planned upgrades to the grid to accommodate future offshore generation. The goal of the CSNP Offshore coordination is to improve investor value and reduce impact on communities and the environment. As such, it is vital to contact NESO and NG at the earliest point to ensure that Project Collette can be included in grid planning and development. When contacting NESO and NG, it is likely required as a minimum the following information:

- Preferred connection location
- Pre-Planning Level System Design
- Predicted project timeline
- Justification for the system in the area (environmental, local development)
- Initial CAPEX and OPEX Review
- Planning Requirements

4.6 Grid Feasibility Conclusion and Recommendations

Based on the network analysis performed in this study, SLR recommends connecting Project Collette at Harker, as the alternative route to Hutton presents significant technical, environmental, and permitting challenges.

SLR considers that, for the client's requirements of a 1.2GW continuous supply of electricity, Green Finance Hub should consider the following as its next steps:

- SLR strongly recommends that a meeting with the transmission operator in the area, National Grid Electricity Transmission and National Energy System Operator, should be arranged to discuss the connection option in accordance with the details of this report to capture the impact on the systems.
- SLR also recommends additional discussion with the Transmission Operator to identify available fault levels at the nodes of interest, as well as a confirmation of available headroom. A Pre-FEED study can then be initiated as discussions progress to firm up the technical requirements of the project.
- Following the meeting and any further study work, the preferred connection option and the development area should, if possible, be identified by GFCH, which meets their development timescales and investment milestones.
- Once a preferred connection option has been identified, a formal connection application should be submitted, bearing in mind the various costs and timescales and taking into account progress with GFCH’s own consenting for the project and their finances.

5.0 Overall Conclusions

The summarised findings of each section are detailed in Sections 2.4, 3.6, and 4.6. The main conclusions for Project Collette are as follows:

Site and Landfall Review

1. The most appropriate location for Project Collette would likely be in the English territorial waters with a landfall north of Workington in Siddock in Cumbria.
2. The only feasible grid connection point from a technical perspective is Harker, due to the harsh topography and notable amount of SAC and rivers in Cumbria, making a connection to Hutton technically unfeasible.
3. In the event a private wire to Sellafield is required, the most appropriate location is south of Sellafield. The connection requires crossing a SAC and routing close to Ohl and railways, but it is possible, if technically difficult.

Offshore and Onshore Electrical Concept

1. An offshore wind farm of this size will likely require turbines in the capacity range of 14 to 21 MW, with a collector system export voltage of between 66kV and 132kV, depending on power and economic requirements. The larger the turbine, the more likely 66kV collector voltages and certain foundation types such as gravity-based, become unfeasible.
2. The export system will have an estimated route of 80km, which is close to the limits of HVAC systems' viability. Either 220kV or 275kV export voltages are viable, with 220kV more widely available and 275kV having a lower circuit requirement.
3. The associated reactive compensation equipment will be focused on reducing the capacitive effect of the cables, requiring shunt reactors for internal system management and a STATCOM onshore to provide the response time required by the grid code.
4. The total estimated cost of the electrical system for Project Collette based on the HND costing model is between £768,326,400 and £1,007,343,470.
5. The colocation of a BESS site at the point of connection could be a viable method of sharing connection headroom and improving the developer's position for developing a PPA for the sites. Alternatively, a private wire development would make BESS a desirable option to maintain supply during a period of low energy production.
6. A private wire development to Sellafield is a viable connection option, as shown in the landfall review. The 100 MW power requirement means that a single WTG string can be connected to the site, reducing the system complexity and hence the cost. The Sellafield connection site would likely need upgrades to accommodate the private wire, with the operating voltage of the collector system an important aspect determining reactive compensation and transformer requirements.

Grid Feasibility

1. The grid feasibility assessed the two closest 400kV substations to the proposed project location, Harker and Hutton, and found that both substations were suitable for the connection of Project Collette.
2. The high-level load flow found that Project Collette will likely require approximately 1500 MVAr of reactive compensation capacity, in the form of shunt reactors and STATCOMs, to manage the high capacitive effect of the export cables.
3. The total estimated cost of the enabling works to connect at Harker is estimated to be between £9,350,700 and £21,818,300 based on SLR's internal costing tool.

4. It is vital that GFCH begin communicating with NESO at the earliest opportunity to ensure that the network upgrades planned can be considered the project within the system. In advance of this, GFCH should develop a high-level concept design with a review of planning requirements, CAPEX/OPEX details and project justification from an environmental and community perspective.

6.0 References

[1] Admiralty, “Marine Data Portal - UK Hydrographic Office Maritime Limits and Boundaries,” 25 08 08. [Online]. Available: https://datahub.admiralty.co.uk/portal/apps/sites/#/marine-data-portal/datasets/bf77b2ac1b654efc95dc3665c0501e23/about. [Accessed 04 09 25].

[2] Crown Estate Scotland, “Offshore Wind (Crown Estate Scotland),” 03 06 25. [Online]. Available: https://crown-estate-scotland-spatial-hub-coregis.hub.arcgis.com/datasets/b9c7d514362f40ceb3fe299b47aeb8b3_0/explore?location=56.218303%2C-2.971331%2C7.67. [Accessed 04 09 25].

[3] Crown Estate England, “Wind Site Agreements (England, Wales & NI), The Crown Estate,” 26 06 25. [Online]. Available: https://opendata-thecrownestate.opendata.arcgis.com/datasets/22a1be6fb0c5416e9369f97743f387b1/explore. [Accessed 04 09 25].

[4] UK Government, “Special Areas of Conservation (England),” 05 08 25. [Online]. Available: https://www.data.gov.uk/dataset/a85e64d9-d0f1-4500-9080-b0e29b81fbc8/special-areas-of-conservation-england2. [Accessed 04 09 25].

[5] UK Government, “Marine Conservation Zones (England),” 05 08 25. [Online]. Available: https://www.data.gov.uk/dataset/80c075c3-1880-44a0-bffc-69e20f307c21/marine-conservation-zones-england2. [Accessed 04 09 25].

[6] The Guardian, “Centrica withdraws from Irish sea offshore windfarm plan,” 2014. [Online]. Available: https://www.theguardian.com/environment/2014/jul/31/centrica-withdraws-from-irish-sea-offshore-windfarm-plan?utm_source=chatgpt.com. [Accessed 04 09 25].

[7] British Geological Survey, “GeoIndex Offshore - Sample Data - All Equipment: Activity & Scan,” [Online]. Available: https://mapapps2.bgs.ac.uk/geoindex_offshore/home.html?_ga=2.219066896.805881218.1756998182-1940540651.1756998182. [Accessed 04 09 25].

[8] National Grid, “Network route maps,” 10 07 25. [Online]. Available: https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/network-route-maps. [Accessed 04 09 25].

[9] Wikipedia, “Lake District,” [Online]. Available: https://en.wikipedia.org/wiki/Lake_District. [Accessed 04 09 25].

[10] Ordnance Survey, “OS Terrain® 50,” 07 25. [Online]. Available: https://osdatahub.os.uk/downloads/open/Terrain50. [Accessed 04 09 25].

[11] Nuclear Decommissioning Authority, “Strategic Environmental Assessment - Site Specific Baseline Sellafield,” Dec 2012.

[12] Siemens Gamesa, “Scaling up the use of offshore wind turbines,” [Online]. Available: https://www.siemensgamesa.com/global/en/home/products-and-services/offshore.html. [Accessed 30 07 2025].

[13] Vestas, “Offshore wind turbines,” [Online]. Available: https://www.vestas.com/en/energy-solutions/offshore-wind-turbines. [Accessed 30 07 2025].

[14] GE Vernova, “GE Vernova’s Haliade-X offshore turbine,” [Online]. Available: https://www.gevernova.com/wind-power/wind-turbines/offshore-wind-turbines. [Accessed 30 07 2025].

[15] offshoreWIND.biz, “Offshore Wind Turbines in 2024: 20+ MW Prototypes Rolling Out in Europe, China; 16 MW Remains Most Powerful Turbine Installed Offshore,” 01 01 2025. [Online]. Available: https://www.offshorewind.biz/2025/01/01/offshore-wind-turbines-in-2024-20-mw-prototypes-rolling-out-in-europe-china-16-mw-remains-most-powerful-turbine-installed-offshore/. [Accessed 30 07 2025].

[16] NESO, “Pathway to 2030 : A holistic network design to support offshore wind deployment for net zero,” 2022.

[17] NESO, “Offshore Transmission Networks Costs,” 2022.

[18] Bank of England, “Inflation calculator,” 17 09 2025. [Online]. Available: https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator?number.Sections%5B0%5D.Fields%5B0%5D.Value=1000000&current_year=121.7&comparison_year=139.343. [Accessed 17 09 2025].

[19] Eleanor Akers <eleanor@innovative-energy.org>, “Project Collette - CNF Offtaker Meeting,” 21/08/2025.

[20] Electricity North West Limited , “Long Term Development Statement (LTDS),” 2024.

[21] National Energy System Operator, “Transmission Entry Capacity (TEC),” 2025.

[22] National Grid Energy System , “Electricity Ten Year Statement,” 2024.

[23] National Electricity System Operator , “Transmission Works Register,” 2025.

[24] NGESO, “CMP427: Update to the Transmission Connection Application Process for Onshore Applicants,” 2023.

[25] National Energy System Operator (NESO) , “Beyond 2030 - A national blueprint for a decarbonised electricity system in Great Britain,” Mar 2024.

[26] National Energy System Operator (NESO), “Electricity Ten Year Statement 2024,” 2024.

Appendices

Project Collette

Concept and Grid Feasibility Study Study

SLR Consulting Limited

SLR Project No.: 416.065994.00001

11 November 2025

A.1 List of Power Factory Outputs

We have provided attached the following outputs from our modelling of this project:

- Appendix A1 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected generation.
- Appendix A2 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation.
- Appendix A3 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette Connected to Harker
- Appendix A4 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette Connected to Hutton.
- Appendix A5 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette Connected to Harker (attrition rate 50%)
- Appendix A6 – 400kV Network

  This model shows the forecast 400kV transmission network in the region of Cumbria with connected and accepted generation and Project Collette Connected to Hutton. (attrition rate 50%)

A.2 List Reinforcements

Harker

Scheme Name	Scheme Description	MW Effective
101843-203780	Provision of spare 400kV GIS bay in the new build substation inclusive of required Protection and Control to form a compliant connection.	30/05/2031
101268-202511	The scope of this project is the rebuild of Harker substation and rationalisation to leave a new 400kV and 132kV substations with six 400/132kV 240MVA SGTs. The preferred option is to rebuild on a greenfield plot of land adjacent to Harker.	30/05/2031
101268-202511	The scope of this project is the rebuild of Harker substation and rationalisation to leave a new 400kV and 132kV substations with six	30/10/2028

Scheme Name	Scheme Description	MW Effective
	400/132kV 240MVA SGTs. The preferred option is to rebuild on a greenfield plot of land adjacent to Harker.	
101351-202671	Extend the Main and Reserve Busbar 3 to make provision for connection of generator bay (User Works).	30/10/2028
100118-200309	The replacement of the existing four 275/132kV 120MVA SGTs with four 400/132 240MVA SGTs at Harker substation.	30/10/2028
101284-202534	Reconductor the Legacy - Ironbridge and Legacy – Shrewsbury – Ironbridge 400kV circuits with 2x780mm² conductor.	30/10/2028
101474-202196	Uprate the Cellarhead – Drakelow 400kV circuits	30/10/2028
101348-202668	1x225MVAR MSC at Carrington 400kV substation	30/10/2028
032030-032030	Replace the existing Quadrature Boosters at Legacy with a new 2750MVA unit.	30/10/2028
008645-ON0066	The offline build and commissioning of a new Harker 132kV GIS substation. The decommissioning and removal of the existing Harker 132kV AIS substation. Develop and commission a new Harker 132kV Auto Close Scheme and a new Harker 132kV Overload Protection Scheme at the Harker substation.	30/10/2028
101347-202667	2x225MVAR MSC at Penwortham 400kV substation	30/10/2028
101466-202906	Reconductor the existing 2x570mm² conductor on the Cellarhead-Daines 1 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
101468-202908	Reconductor the existing 2x570mm² conductor on the Daines-Macclesfield 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
101278-202528	1. Reconductor the Legacy legs of both Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits with 2x780mm² conductor.	30/10/2028
101279-202529	Reconductor the Connahs Quay legs of both Connahs Quay-Legacy-Trawsfynydd 1 and 2 circuits with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
101285-202535	Establish a system run back scheme for the Western Link to monitor the Circuits between Connahs Quay and Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits and the Cellarhead – Macclesfield and Cellarhead – Daines circuits	30/10/2028
NGET-R1-100247-200628 (Infra)	1.Install earthing transformer on 13kV Tertiary connection 2. Install 72.5kV, 40kA Disconnecting Circuit Breaker (DCB) at the 13kV side connecting Tertiary to Connection Assets for Users connection.	31/10/2029

Middletown

Scheme Name	Scheme Description	MW Effective
101603-203226	N/A	30/10/2028
101474-202196	Uprate the Cellarhead – Drakelow 400kV circuits	30/10/2028
101347-202667	2x225MVAR MSC at Penwortham 400kV substation	30/10/2028
101348-202668	1x225MVAR MSC at Carrington 400kV substation	30/10/2028
101466-202906	Reconductor the existing 2x570mm² conductor on the Cellarhead-Daines 1 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
101468-202908	Reconductor the existing 2x570mm² conductor on the Daines-Macclesfield 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
032030-032030	Replace the existing Quadrature Boosters at Legacy with a new 2750MVA unit.	30/10/2028
101278-202528	1. Reconductor the Legacy legs of both Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits with 2x780mm² conductor.	30/10/2028
101285-202535	Establish a system run back scheme for the Western Link to monitor the Circuits between Connahs Quay and Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits and the Cellarhead – Macclesfield and Cellarhead – Daines circuits	30/10/2028
101279-202529	Reconductor the Connahs Quay legs of both Connahs Quay-Legacy-Trawsfynydd 1 and 2 circuits with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/10/2028
101603-203226 (LSM)	N/A	30/10/2037
102879-206157 (LSM)	N/A	30/10/2037
104039-207941	N/A	30/10/2037
101603-203226	N/A	30/11/2026
101474-202196	Uprate the Cellarhead – Drakelow 400kV circuits	30/11/2026

Scheme Name	Scheme Description	MW Effective
101468-202908	Reconductor the existing 2x570mm² conductor on the Daines-Macclesfield 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/11/2026
032030-032030	Replace the existing Quadrature Boosters at Legacy with a new 2750MVA unit.	30/11/2026
100425-200971	Reconductor the existing 2x500mm² conductor on the Feckenham-Ironbridge 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/11/2026
101603-203226 (LSM)	N/A	30/10/2037
102879-206157 (LSM)	N/A	30/10/2037
104039-207941	N/A	30/10/2037
101603-203226	N/A	30/11/2026
101278-202528	1. Reconductor the Legacy legs of both Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits with 2x780mm² conductor.	30/11/2026
101279-202529	Reconductor the Connahs Quay legs of both Connahs Quay-Legacy-Trawsfynydd 1 and 2 circuits with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/11/2026
101284-202534	Reconductor the Legacy - Ironbridge and Legacy – Shrewsbury – Ironbridge 400kV circuits with 2x780mm² conductor.	30/11/2026
101285-202535	Establish a system run back scheme for the Western Link to monitor the Circuits between Connahs Quay and Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits and the Cellarhead – Macclesfield and Cellarhead – Daines circuits	30/11/2026
101466-202906	Reconductor the existing 2x570mm² conductor on the Cellarhead-Daines 1 400 kV circuit with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/11/2026
101697-203381	Reconductor the Cellarhead – Macclesfield 400kVcircuit with 2x780mm² conductor	30/11/2026
101381-202706	Establish a new substation at the Tee-point on the Legacy – Trawsfynydd - Connah's Quay circuits.	30/11/2026

Scheme Name	Scheme Description	MW Effective
101381-202705	Establish a new 400kV circuit out of North Wales for increased thermal capability.	30/11/2026
101278-202528	1. Reconductor the Legacy legs of both Connahs Quay – Legacy – Trawsfynydd 1 and 2 circuits with 2x780mm² conductor.	30/11/2026
101279-202529	Reconductor the Connahs Quay legs of both Connahs Quay-Legacy-Trawsfynydd 1 and 2 circuits with 2x620mm² conductor to achieve a pre fault summer rating of 2490 MVA.	30/11/2026

Penwortham

Scheme Name	Scheme Description	MW Effective
102450-205004	N/A	30/10/2037
101138-202245	N/A	30/06/2029
101072-202151	Extend the current Wylfa 400kV substation to enable the connection of a new Pentir - Wylfa OHL.	30/06/2029
033708-033708	Pentir - Trawsfynydd 1+2 - Add a second cable per phase to all cable sections and update the OHL sections to achieve required rating	30/06/2029
100974-201953	Construct a second double circuit between Pentir 400kV substation and the Wylfa 400kV substation (circuits No. 3 & 4)	30/06/2029
100975-201954	Convert the current 132kV circuit up to 400kV refurbishing/replacing where necessary	30/06/2029
102712-205484 Morgan AtV	N/A	30/11/2029
102712-205519 Morgan AtV	N/A	30/11/2029
101304-202587	Infrastructure works necessary to connect 1500MW at the Wylfa 400kV substation, for the Project Elizabeth - Yellow One North R4 connection application	30/11/2029
033708-033708	Pentir - Trawsfynydd 1+2 - Add a second cable per phase to all cable sections and update the OHL sections to achieve required rating	30/11/2029
100975-201954	Convert the current 132kV circuit up to 400kV refurbishing/replacing where necessary	30/11/2029

Scheme Name	Scheme Description	MW Effective
101607-203231	Extension Works of the existing fence to provide a 13kV Connection Install Earthing Transformer on 13kV SGT9 Tertiary connection. Install 13kV cable from 13kV SGT9 Tertiary connection to 13 kV Line Disconnector. Install 13 kV Line Disconnector.	30/10/2027
101946-203996	1. Install Earthing Transformer on 13kV Tertiary Connection, 2. Install 13kV Cable from Tertiary connection to 13kV Disconnector, 3. Install 13kV Disconnector at the 13kV side connecting the Tertiary connection to Connection Assets for User's connection, 4. Buy and make good additional land for the tertiary bay.	01/06/2031
101607-205823	N/A	30/10/2027

Making Sustainability Happen