Killoch 400 kV Substation

Site Strategy EJP
Version: Issue 01
11/12/2024

SP Energy Networks
RIIO-T3 Business Plan

SP Energy Networks

KILLOCH 400kV Substation			
Name of Scheme	Killoch 400kV Substation		
Investment Driver	Accommodation of future new generation and facilitation of development of tCSNP2 WCN2 scheme.		
BPDT / Scheme Reference Number	Part of SPT200469		
Outputs	• 400 kV Platform Creation – 1 unit • 400 kV CB (Gas Insulated Busbar - TBC) – 11 units • 400 kV > 500MVA Wound Plant (Transformer) – 3 units • 400 kV Switch Disconnector – 29 units • 400 kV OHL (Tower Line) Conductor – TBC • 400 kV Overhead Line Fittings – TBC • 400 kV Overhead Tower – TBC		
Cost	£121.87m		
Delivery Year	2037		
Applicable Reporting Tables	BPDT (Section 5.1 – Project Meta Data, Section 6.1 – Scheme C&V Load Actuals, and Section 11.10 Contractor Indirects)		
Historic Funding Interactions	N/A		
Interactive Projects	WCN2 Scheme		
Spend Apportionment	**ET2**	**ET3**	**ET4**
	£0.05m	£9.95m	£111.90m

Table of Contents

1. Introduction

This engineering justification paper describes SP Transmission's plans to establish a new 400 kV/275 kV substation at Killoch to uprate and reinforce transmission capabilities in line with the WCN2 scheme as well as enable a number of connections around the Killoch and South West Scotland area.

This EJP is submitted for Ofgem's assessment of the need case for the project in order to provide sufficient funding for the pre-construction activities. A full optioneering cost submission will be made at the appropriate time, once the project is sufficiently developed to do so.

2. Background and Purpose

SP Transmission plc (SPT), as a transmission license holder, has the responsibility "to develop and maintain an efficient, co-ordinated and economical system of electricity transmission" (Electricity Act 1989).

In the context of both UK and Scottish Government Net Zero targets, now supported fully by National Planning Framework for Scotland 4 (NPF4), development of our transmission infrastructure is key to meeting these targets, with SPT required to deliver significant system reinforcement as well as facilitating the connection of increased renewable energy generation.

The purpose of this document is to set out the broader policy context and needs case for a new 400 kV/275 kV substation at our proposed Killoch substation site.

2.1. Statutory Obligations

SPT is licenced under section 6(1)(b) of the Electricity Act 1989 ("the 1989 Act") to transmit electricity. The licence is granted subject to certain standard and special conditions. Under section 9(2) of the 1989 Act, SPT is required to fulfil the following duty:-

- *To develop and maintain an efficient, co-ordinated and economical system of electricity transmission; and*
- *To facilitate competition in the supply and generation of electricity.*

This statutory duty is reflected in SPT's transmission licence. In addition, SPT has the following obligations pursuant to its licence conditions (LCs):-

- To at all times have in force a System Operator-Transmission Owner Code (STC) which, amongst other things, provides for the co-ordination of the planning of the transmission system (LC B12);
- To at all times plan and develop its transmission system in accordance with the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS) and in so doing take account of National Grid Electricity System Operator's (NESO's) obligations to co-ordinate and direct the flow of electricity on, to and over the GB transmission system (LC D3);
- To make available those parts of its transmission system which are intended for the purposes of conveying, or affecting the flow of, electricity so that such parts are capable of doing so and are fit for those purposes (LC D2); and
- To offer to enter into an agreement with the system operator on notification of receipt of an application for connection, or for modification to an existing connection (LC D4A).

Section 38 and Schedule 9 of the 1989 Act also impose duties on SPT when formulating any relevant proposals. In response to statutory and licence obligations upon it, SPT therefore requires to ensure

that the transmission system is developed and maintained in an economic, co-ordinated and efficient manner, in the interests of existing and future electricity consumers, balancing technical, economic and environmental factors.

2.2. Broader Policy Context

Government Policy

In June 2019, the UK parliament passed legislation introducing a binding target to reach Net Zero greenhouse gas emissions by 2050. In Scotland, the Scottish Parliament has committed Scotland to becoming a Net Zero society by 2045. The timely connection of low carbon generation, such as onshore and offshore wind, will play a vital role in reaching these legislated Net Zero targets.

The UK Government announced in October 2020 its commitment to make the UK a world leader in green energy and boosted the UK Government's previous 30 GW target for offshore wind to 40 GW by 2030. The current Scottish Government ambition is 20 GW of onshore wind and 11 GW of offshore wind in Scotland by 2030. Further commitments, by the UK Government in October 2021, to decarbonise the power system by 2035, as well as the British Energy Security Strategy[1] published April 2022 (which raises the UK Government ambition to 50 GW of offshore wind by 2030), further support the requirement for investment in the existing electricity transmission system to enable the timely connection and integration of the required renewable generation sources.

In December 2022 the Scottish Government published its Onshore Wind Policy Statement[2], setting out its ambition to deploy 20 GW of onshore wind capacity by 2030. This is in addition to the Scottish Government's ambition of 11 GW of offshore wind by 2030.

Furthermore, on the 4th November 2024, NESO published the 'Clean Power 2030' paper, as advice to the government on how to achieve a low-carbon power system; where demand is met by clean sources (primarily renewables) with gas fired generation only to be used to ensure security of supply (primarily during periods of low wind). This publication further enhanced the need for us to continue to invest in our wider transmission network to ensure that targets around 2030 are met.

ScotWind

The results of the ScotWind leasing process, a programme managed by Crown Estate Scotland to lease areas of the seabed around Scotland for offshore wind farm development, were announced throughout 2022 culminating in approximately 28 GW of offshore wind being offered option agreements reserving the rights to specific areas of seabed.

The ScotWind results underline both the scale of development potential off the north and east coasts of Scotland and the commitment from industry to delivering the investments in energy infrastructure necessary to meet Net Zero targets. Off the north and east coasts of Scotland in particular, there is very high potential for offshore wind generation, in areas illustrated by the BEIS/ Ofgem Offshore Transmission Network Review[3] (OTNR) Generation Map[4].

[1] British energy security strategy - GOV.UK (www.gov.uk)
[2] Onshore wind: policy statement 2022 - gov.scot (www.gov.scot)
[3] Offshore Transmission Network Review
[4] OTNR - Generation Map

ScotWind offshore developments are expected to make a significant contribution towards 2045 and 2050 Net Zero targets. It is vital that the onshore transmission system is developed in a timely manner to enable the benefits of ScotWind to be realised and contribute to the legislated Net Zero targets.

2.3. Future Energy Scenarios

Each year, NESO produces a set of Future Energy Scenarios (FES) for use by the Transmission Owners (TOs) as network investment planning backgrounds. Through application of the criteria set out in the NETS SQSS, the FES provide an indication of the capacity requirements of the system based upon the potential future connection of generation and changing demand profiles.

The north to south power transfer requirements on all of the northern transmission system boundaries increase significantly over the coming years due to the connection of new renewable generation throughout Scotland as part of the energy transition to meet legislated Net Zero targets. This trend is clearly demonstrated by the transfer requirements on the boundary between the SPT and National Grid Electricity Transmission (NGET) areas (Boundary B6) (see Figure 1).

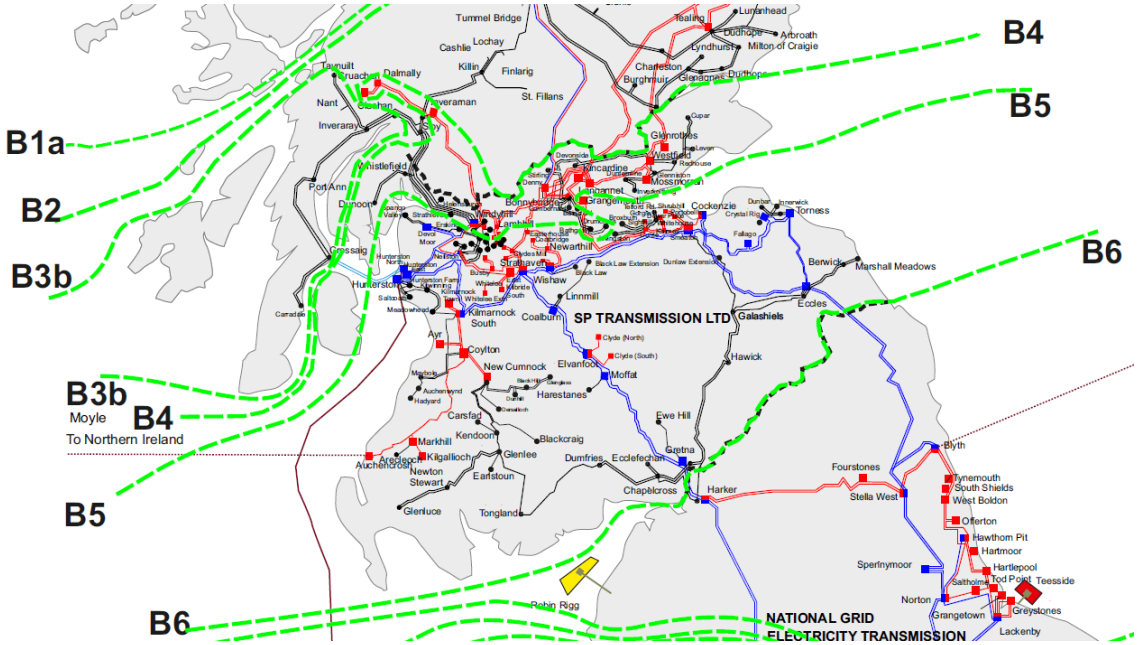

Figure 1: Network boundaries across SPT's network

The figure below indicates the 2023 FES and 2024 FES required transfer capability on the B6 boundary. The existing capability of B6 is already exceeded predominantly due to the connection of onshore and offshore wind across central and northern Scotland.

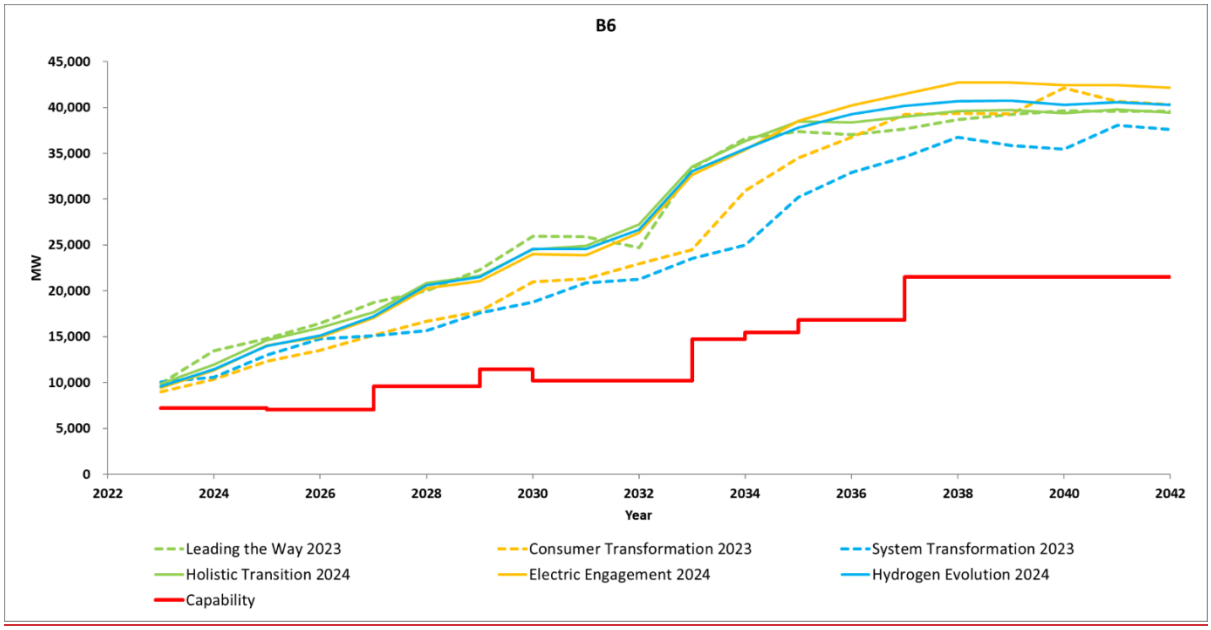

Figure 2: Required transfers and base capability for B6 boundary

The current capability of transmission network boundary B6 is approximately 6,700 MW, dependent upon the geographic disposition of renewable generation output and based on a thermal limitation on the cross border ZV route, south of Elvanfoot. Figure 2 above shows a required transfer of up to 24.9 GW by 2030 and up to approximately 38.5 GW by 2035. In order to maintain an efficient and economic transmission system whilst economically integrating additional renewable generation, significant system reinforcement is required in an unprecedented timeframe.

2.4. Beyond 2030 Publication

Building upon NESO's Network Options Assessment (NOA) 2021/22 Refresh report[5] the recent publication of NESO's "Beyond 2030" report[6] outlines a requirement for further significant network reinforcements to the value of approximately £58 billion across Britain.

The report's recommendations will facilitate the connection of an additional 21 GW of low carbon generation to the UK transmission system as a direct result of the ScotWind leasing round and will help the UK meet its decarbonisation ambitions.

The Beyond 2030 report details the output of a holistic network design exercise undertaken by the NESO and TOs which assessed various permutations of onshore and offshore network reinforcement against an agreed set of design criteria[7]. One of the key areas identified for onshore reinforcement within the report is central and southern Scotland where a coordinated suite of onshore reinforcement has been identified to complement the proposed offshore network and provide a significant increase to the transfer capability of key system boundaries including B6.

A key onshore reinforcement identified is a new 400 kV overhead line between South West Scotland to Northwest England. This project referred to as WCN2 within the Beyond 2030 Report is being jointly

[5] Subject reinforcement recommended to Proceed within NOA 2021/22 Refresh see option ref CMNC within download (nationalgrideso.com)
[6] nationalgrideso.com/document/304756/download
[7] Further detailed provided within NESO's Beyond 2030 Technical Report Final Strategic Options Appraisal (nationalgrideso.com)

developed by SPT and NGET. WCN2 provides further B6 transfer capability as well as integrating onshore generation across central and southern Scotland.

2.5. The WCN2 Project

WCN2 provides an increase to the B6 transfer capability by establishing a new 400 kV double circuit connection from the existing Kilmarnock South 400 kV substation towards Harker substation within NGET's licensed area via new 400 kV substations at Killoch, New Cumnock North, Glenmuckloch and Dumfries North (note that Dumfries North 400kV Substation does not form part of the WCN2 project).

The current proposal is to uprate the existing Kilmarnock South – Coylton – New Cumnock (XY/WA) 275 kV double circuit to 400 kV operation in order to reduce the element of new 400 kV OHL build required whilst minimising need for additional circuits in the Kilmarnock South area. This requires establishment of new 400/275 kV substations at Killoch (near existing Coylton) and New Cumnock North (near existing New Cumnock) in order to maintain supply to the existing 275 kV network in Ayrshire and south west Scotland.

South and east of New Cumnock WCN2 proposes establishment of a new 400 kV double circuit route via Glenmuckloch (being progressed independently of WCN2) and would be coordinated with the development of a new collector substation referred to as Dumfries North.

The majority of the WCN2 scheme when it is considered as its constituent parts is required to enable new onshore connections with ~2.2 GW of active offers across New Cumnock, Coylton, Glenmuckloch and the Dumfries area. The indicative WCN2 400 kV route is shown in Figure 3 with the blue line indicating the proposed 400 kV route (note that only Killoch 400 kV substation is within the scope of this paper).

Figure 3: Planned WCN2 Scheme (Indicative only, subject to project development)

2.6. Existing System

The Killoch area currently has a 275 kV substation (Coylton) connected to Kilmarnock South to the north and New Cumnock, to the south. Coylton 275 kV substation supplies Colyton and Maybole 132 kV substations as well as multiple distribution connections in the area. The 275 kV, and surrounding, circuits are shown in Figure 4 and Figure 5.

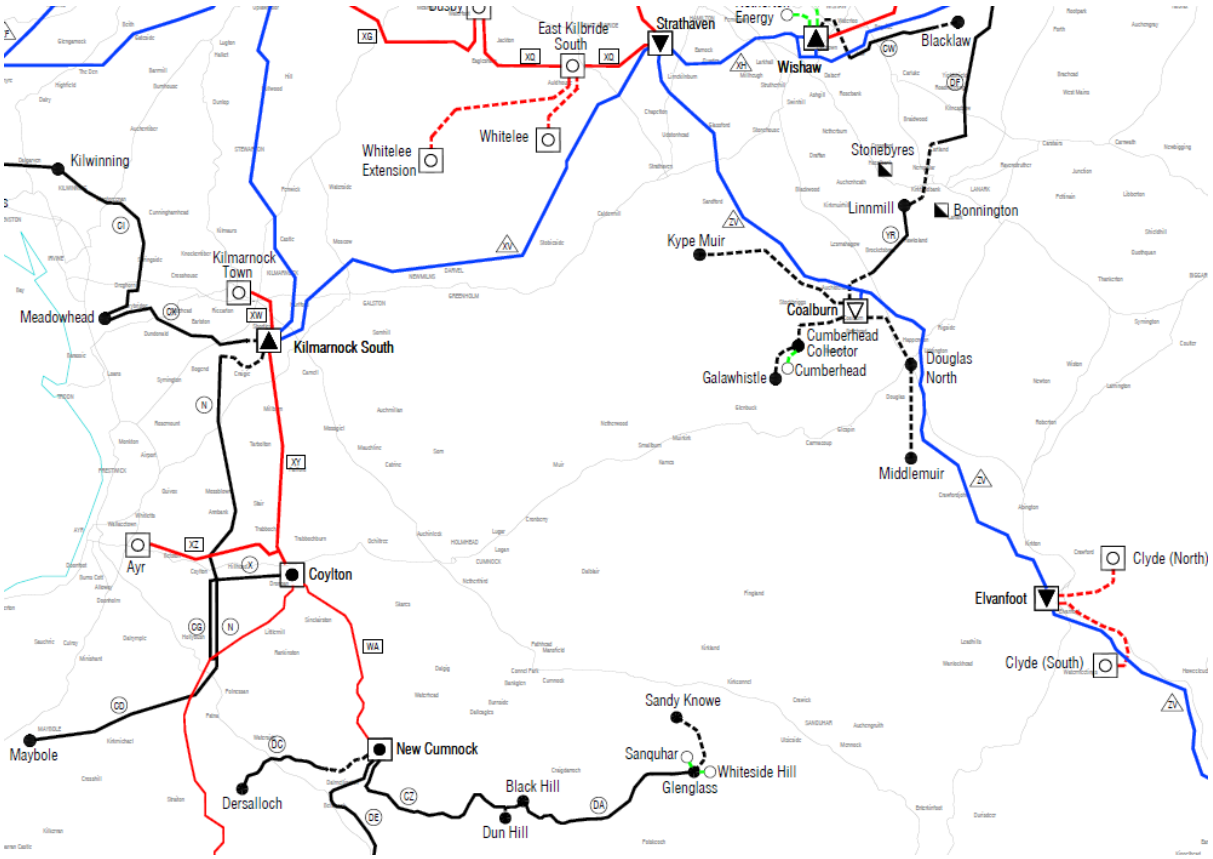

Figure 4: Existing Geographical Transmission Network in Area - Extracted from Networks Diagram Geographical Layout shown in Appendix A (Figure A-1)

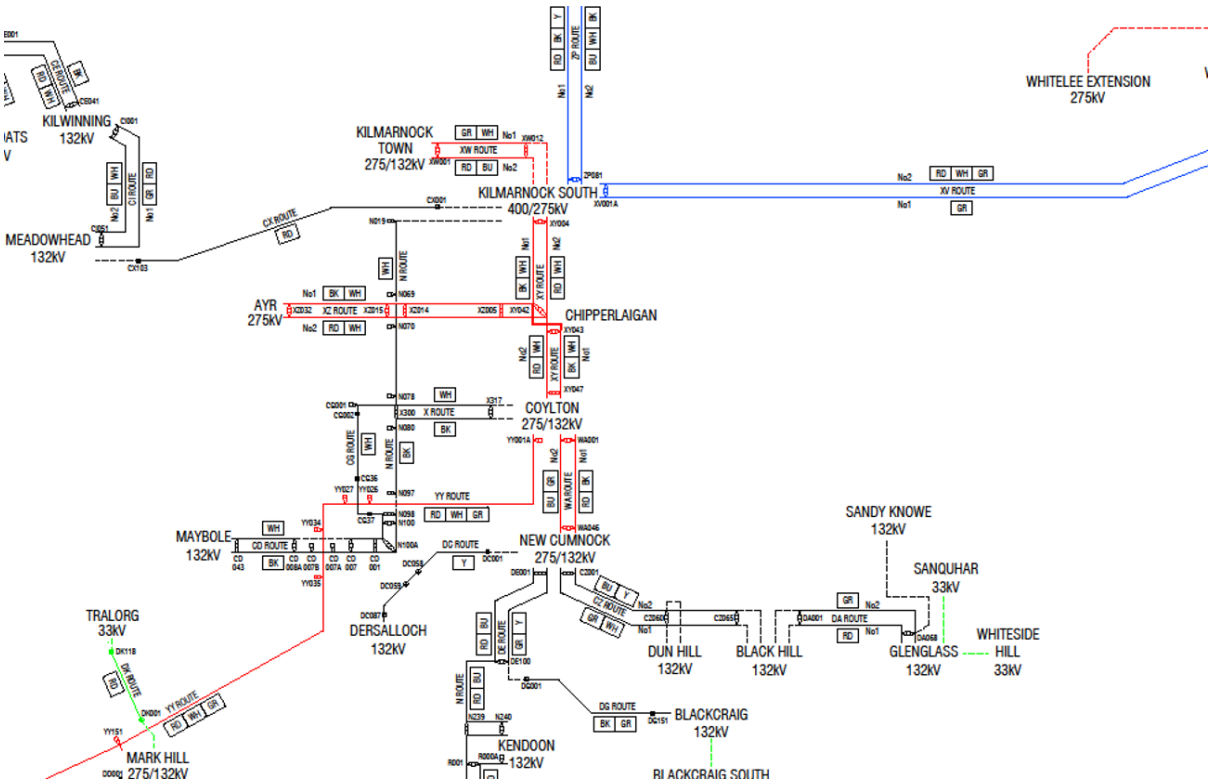

Figure 5: Existing SLD Transmission Network in Area - Extracted from Networks Diagram Geographical Layout shown in Appendix A (Figure A-1)

As shown in Figure 4 and Figure 5, there currently is limited 400 kV infrastructure in the surrounding region. The establishment of the 400 kV route required for the WCN2 scheme (see Figure 3) requires a new 400 kV substation (and associated OHLs) to be constructed at Killoch. The existing 275 kV OHLs north and south of Coylton are of 400kV construction and areto be uprated to 400 kV in order to reduce the element of new 400 kV OHL build required whilst minimising need for additional circuits in the Kilmarnock South area.

2.7. Wider System Upgrades

In order to facilitate new connections and uprate the transmission networks 400 kV capacity within the Southern Scotland region, several transmission works have been proposed of which SPT-RI-2876 (development of Killoch 400 kV/275 kV substation and associated OHLs) is part of. These works are detailed in Figure 6 below:

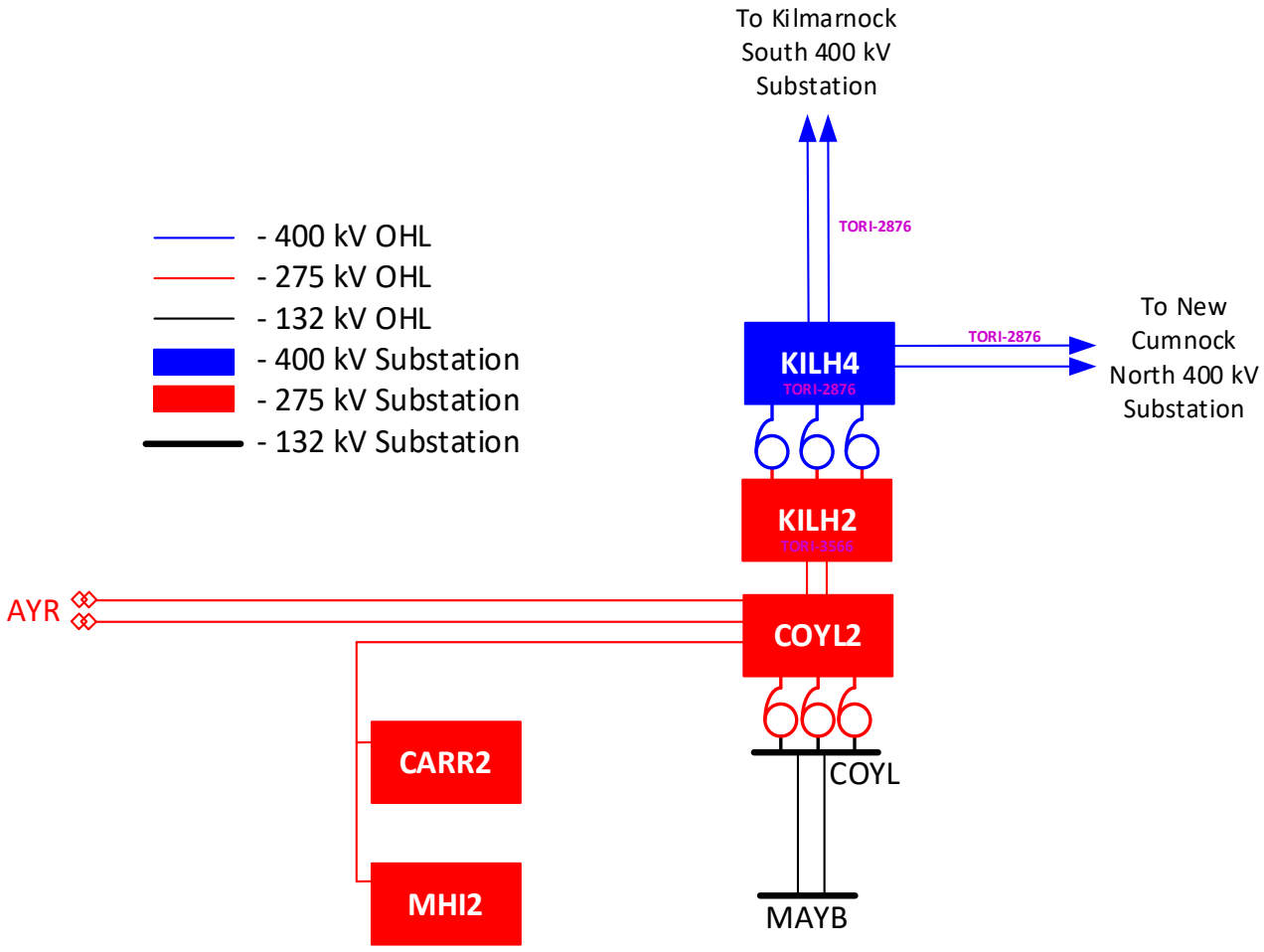

Figure 6: Proposed WCN2 Upgrades in South West Scotland Area - Extracted from WCN2 SLD shown in Appendix A (Figure A-3)

The uprating of the network in the South West Scotland region is shown to be reliant on a package of works being completed including SPT-RI-2876. As shown in Figure 6, the Killoch works are an integral part of the new circuits across the B6 boundary, providing a route for the 400 kV transmission network while alleviating the generation constraints in a congested section of the network.

2.8. New Connections

There is currently 2585 MW of contracted generation to be added to the network around this region, 1094 MW of which features in the SPT best view based on our TECA methodology. These will not be possible without a number of network upgrades, including the development of a new 400 kV/275 kV substation in the Killoch area. The details of the contacted generation projects currently determined to be dependent on the aforementioned works are listed in Table 1.

Table 1: Contracted Generation Dependent Upon SPT-RI-2876 (Development of Killoch 400 kV/275 kV Substation)

Connecting Substation	Contracted Development	Consent Status	TECA Score	Contracted Energisation Date	SPT-RI-2876
[redacted]					

[redacted]				
Total Capacity (MW)	-	-	-	**2585 MW**

During the process of identifying and evaluating options for each connection offer, due regard was given to the development of an efficient, coordinated, and economical system of electricity transmission. As well as determining the most appropriate connection location and connection method (e.g. overhead line, underground cable, wood pole vs steel tower, connection voltage etc).

As a part of the RIIO-T3 load planning strategy, SPT has developed a probability scoring system, in order to score directly connected generation projects based on parameters that will indicate their likelihood to connect to the network by their intended connection date, to inform requirements of network reinforcements. By utilising this tool, a portfolio of generation connections, that have a high probability of connecting to the network in the near future, can be built, enabling SPT to take a proactive approach when considering future reinforcement works on the network. Areas that have a significant number of generation connections scheduled to connect to the network, with a corresponding high probability score, has helped to shape the SPT RIIO-T3 plan.

The methodology of the scoring system splits the overall score into 4 separate categories, each of which carry a different weight regarding the final score and which take into account aspects that are specific to individual projects and the technology as a whole. The four categories are as follows:

- Technology
- Technology Maturity
- Developer Track Record
- Planning Status

The data presented indicates that there is sufficient confidence that a number of the projects that require the works of SPT-RI-2876 will connect to the network, based on those categorised as high and medium probability to progress these works. This would indicate an increase of 1094 MW being added to the network that are affected by the enabling works of SPT-RI-2876. Including the other, low probability connections, this total increases to 2585 MW. In addition to the requirement to accommodate generation growth within the region the establishment of Killoch 400/275kV substation is an essential part of the WCN2 project in order to retain supply to the existing 275Kv network fed from Ayr and Coylton following the uprating of XY and WA routes to 400kV.

Given the targets set by the Scottish government to reach Net Zero by 2045, it is vital that the necessary electrical infrastructure to support the connection of new renewable generation is completed within the upcoming RIIO-T3 period and beyond. The completion of infrastructure projects, such as the proposal outlined in this document, will provide the necessary increase in capacity required to support these projects and will ensure continuity of connectivity through providing a robust and stable infrastructure to support the circuit.

3. Optioneering

This section provides a description of the options that were considered to accommodate connection of renewable generation developments in the South West Scotland area as well as reinforce the B6 connection boundary for future transmission requirements. A summary of each option is described in Table 4. Also, the system requirements and design parameters for the considered options are summarised in Table 5.

Our optioneering approach has identified Whole System interactions with other electricity network / system operators in the development of our proposed solution and has considered the appropriate Whole System outcome.

The options considered are high-level, focussing primarily on the necessary infrastructure required to facilitate the completion of the WCN2 scheme and allow for the connection of contracted generation (see Table 1). Future development will be completed once the scheme has matured to determine additional options (e.g. GIS v AIS, location, number of bays).

3.1. Baseline: Do Nothing / Deferral

A 'Do Nothing' or 'Delay' option is not credible in relation to this project and would be inconsistent with SPT's statutory duties and licence obligations, including Licence Conditions D3 and D4A, which require SPT to comply with the NETS SQSS and to offer to enter into an agreement with the system operator upon receipt of an application for connection. Such offers being in accordance with the System Operator Transmission Owner Code (STC) and associated Construction Planning Assumptions provided by NESO. The proposed works are identified as Enabling Works in the connection agreements relating to the projects in Table 1.

3.2. Option 1 – 'Killoch' 400 / 275 kV Substation

This option is to establish a new 400 kV/275 kV substation at Killoch and deliver associated OHL reinforcements from the new substation to Kilmarnock South and New Cumnock. Note the installation of the 275 kV DBB and associated works are covered under a separate scope of works (SPT-RI-3566), the funding request for which will come once the likelihood of new connections into the substation is better understood. All landtake and layouts developed for this project will ensure space for this to be developed. This option shall require the construction of a double busbar (DBB) 400 kV substation, the installation of 3 x 400 kV/275 kV 1100 MVA SGTs, the uprating of the XY and WA routes, and the installation of new feeder bays at Kilmarnock South and New Cumnock. The works will facilitate the development of the WCN2 scheme (currently being progressed via the tCSNP2 development track). This option requires the following works (see Appendix A – Figure A-3 for SLD):

Overhead Line Works:

- Diversion of 275 kV XZ route to remove the cross-connection setup at Chipperlaggan 275 kV
- Diversion and 400 kV uprating of the XY route between Kilmarnock South 400 kV and the proposed Killoch 400 kV substations.
- 400 kV uprating of the WA route between the proposed Killoch 400 kV and the New Cumnock North 400 kV substations.
- All associated protection and control works.
- All associated environmental and civil works.
- Miscellaneous works.

Substation Works:

At Kilmarnock South 400 kV:

- Install two new 400 kV DBB feeder bays with associated switchgear (circuit breaker and DBB disconnectors)
- All associated protection and control works.
- All associated environmental and civil works.
- Miscellaneous works.

At Killoch 400 kV:

- Establish a new 400 kV substation north of the existing Coylton substation
- Install a 400 kV DBB system with two bus couplers, two bus sections and seven feeder bays
- Install three 400/275 kV 1100MVA SGTs to serve a new Killoch 275 kV substation with interim connections to Coylton 275kV substation.
- All associated protection and control works.
- All associated environmental and civil works.
- Miscellaneous works.

At New Cumnock North:

- Install two new 400 kV DBB feeder bays with associated switchgear (circuit breaker and DBB disconnectors)
- All associated protection and control works.
- All associated environmental and civil works.

The estimated total cost for this option is £121.87m. It would allow for the connection of generation projects detailed in Table 1 as well as providing reinforcement and additional capacity in the Killoch area and at the B6 boundary. This option is currently technology agnostic with regards to the switchgear insulation type due to the ongoing development work that is currently considering substation siting and environmental impacts.

The proposed site layout can be found in Appendix A-5 along with an accompanying geological survey in Appendix A-6.

3.3. Option 2 – Extend/Uprate Coylton 275 kV Substation

This option was unsuitable due to the lack of space remaining at the site due to existing infrastructure and circuits occupying all available space, as shown in Figure 7:

Figure 7: Geographical Site of Coylton 275 kV Substation

This option is also unsuitable due to the requirement for a 400 kV corridor and additional thermal and fault level headroom in the region to satisfy WCN2 requirements and to enable future contracted generation.

Lastly, as shown in Figure 7, there is land adjacent to the site which is suitable for construction (subject to further environmental studies, currently being undertaken via the tCSNP2 development track) and for the completion of a 400 kV substation and transmission corridor, complete with incoming and outgoing overhead lines.

Alternatively, it may be possible to demolish the existing 275 kV substation and replace the site with the 400 kV/ 275kV substation. However, this was deemed unsuitable and ruled out ahead of a costing exercise due to the complications that would be caused such as:

- Decommissioning of assets with significant remaining life.
- Lengthy outages for existing connections while the works are completed.
- Continued development of a now constrained site.

Options	Map	Layout of Substation/ Connection	Layout of all Route Works	Relevant Survey Works	Narrative Consenting Risks	Narrative Preferred Option	Narrative Rejection
Preferred – Option 1: Killoch 400 kV/ 275 kV Substation	Refer to Appendix A-1	Refer to Appendix A-3	Refer to Appendix A-4	Refer to Appendix A-5 & A-6	Early engagement with landowners and environmental bodies to secure necessary site permissions.	Necessary option to facilitate wider WCN2 works and enable local generation works	N/A
Rejected – Baseline: Do Nothing / Delay	N/A	N/A	N/A	N/A	N/A	N/A	Inconsistent with SPT's various statutory duties and licence obligations.
Rejected – Option 2: Extend/ Uprate Existing Coylton 275 kV Substation	Refer to Appendix A-1	N/A	N/A	N/A	N/A	N/A	Does not satisfy requirements for WCN2 Scheme or enabling works

System Design Table	Circuit/Project	**Preferred – Option 1:** Killoch 400 kV Substation	**Rejected – Baseline:** Do Nothing / Delay	**Rejected – Option 2:** Extend/ Uprate Existing Coylton 275 kV Substation
Thermal and Fault Design	Existing Voltage (if applicable)	N/A	N/A	275 kV
	New Voltage	400 kV	N/A	N/A
	Existing Continuous Rating (if applicable)	N/A	N/A	2000A
	New Continuous Rating	5000A	N/A	3150A
	Existing Fault Rating (if applicable)	N/A	N/A	40kA
	New Fault Rating	50/55kA	N/A	40kA
ESO Dispatchable Services	Existing MVAR Rating (if applicable)	N/A	N/A	N/A
	New MVAR Rating (if applicable)	N/A	N/A	N/A
	Existing GVA Rating (if applicable)	N/A	N/A	N/A
	New GVA Rating	N/A	N/A	N/A
System Requirements	Present Demand (if applicable)	N/A	N/A	N/A
	2050 Future Demand	N/A	N/A	N/A
	Present Generation (if applicable)	N/A	N/A	N/A
	Future Generation Count	13	13	13
	Future Generation Capacity	2585 MW	2585 MW	2585 MW
Initial Design Considerations	Limiting Factor	Land availability	N/A	Land availability
	AIS/ GIS	TBC	N/A	N/A
	Busbar Design	Double busbar	N/A	N/A
	Cable/ OHL/ Mixed	OHL	N/A	N/A
	SI	Through further detailed design, two spare bays at each end of the new substation will be included. To be laid out from day 1 for all future known connections, including establishing a new 275kV Killoch substation and WCN2 interaction.		

3.4. Selected Option

The most appropriate option to provide future connection capabilities and transmission reinforcement in the South West is the establishment of a 400 kV/275 kV substation at Killoch (Option 1).

This is planned to be put in place at the chosen site in Killoch (SPT-RI-2876). The construction will consist of a new 400 kV DBB with 11 bays based on the following allowance;

- 2 bays for new double circuit OHL to Kilmarnock South
- 2 bays for new double circuit OHL to New Cumnock
- 3 bays for 400 kV/275 kV SGTs
- 2 bus sections
- 2 bus couplers

The following installations will be carried out at the new Killoch substation as part of SPT-RI-2876:

- Install 3 x 400/275 kV 1100MVA SGTs to serve a new Killoch 275 kV substation with interim connections to Coylton 275kV substation

The works also consist of the following OHL works:

- Diversion of 275 kV XZ route to remove the cross-connection setup at Chipperlaggan 275 kV
- Diversion and 400 kV uprating of the XY route between Kilmarnock South 400 kV and the proposed Killoch 400 kV substations.
- 400 kV uprating of the WA route between the proposed Killoch 400 kV and the New Cumnock North 400 kV substations.
- Installation of 4 new 400 kV DBB feeder bays with associated switchgear (circuit breaker and DBB disconnectors); 2 at Kilmarnock South 400 kV and 2 at New Cumnock North 400 kV.

This option is currently technology agnostic with regards to the switchgear insulation type due to the further development required including environmental and siting studies. As standard, the substation will be laid out with two additional spare bays at either end of the substation. Note that the 275 kV DBB and associated bays will be established under SPT-RI-3566.

It is important to note this option has been chosen due to the wider implications surrounding the WCN2 scheme currently being planned for the South West of Scotland, enabling the connection of increased onshore and offshore generation to the grid while also providing a suitable path to the B6 boundary between Scotland and England. The establishment of the Killoch 400 kV/ 275 kV substation allows for the completion of a new 400 kV route as well as enabling further future works in the South West region.

4. Proposed Works and Associated Costings

4.1. Project Summary

The selected option details the installation of a 400 kV/275 kV substation in Killoch with 11 bays plus two spare bays at either end of the substation. The project is due to be delivered in a safe and timely manner using a single staged approach with future projects expected to utilise the spare bays of the 400 kV DBB.

4.2. Delivery

The Killoch 400 kV/275 kV substation is to be established to provide a connection point for planned connections such as SGTs and the future WCN2 400 kV corridor. The single line diagram for these works is shown in Figure 8: Indicative Works - Single Line Diagram.

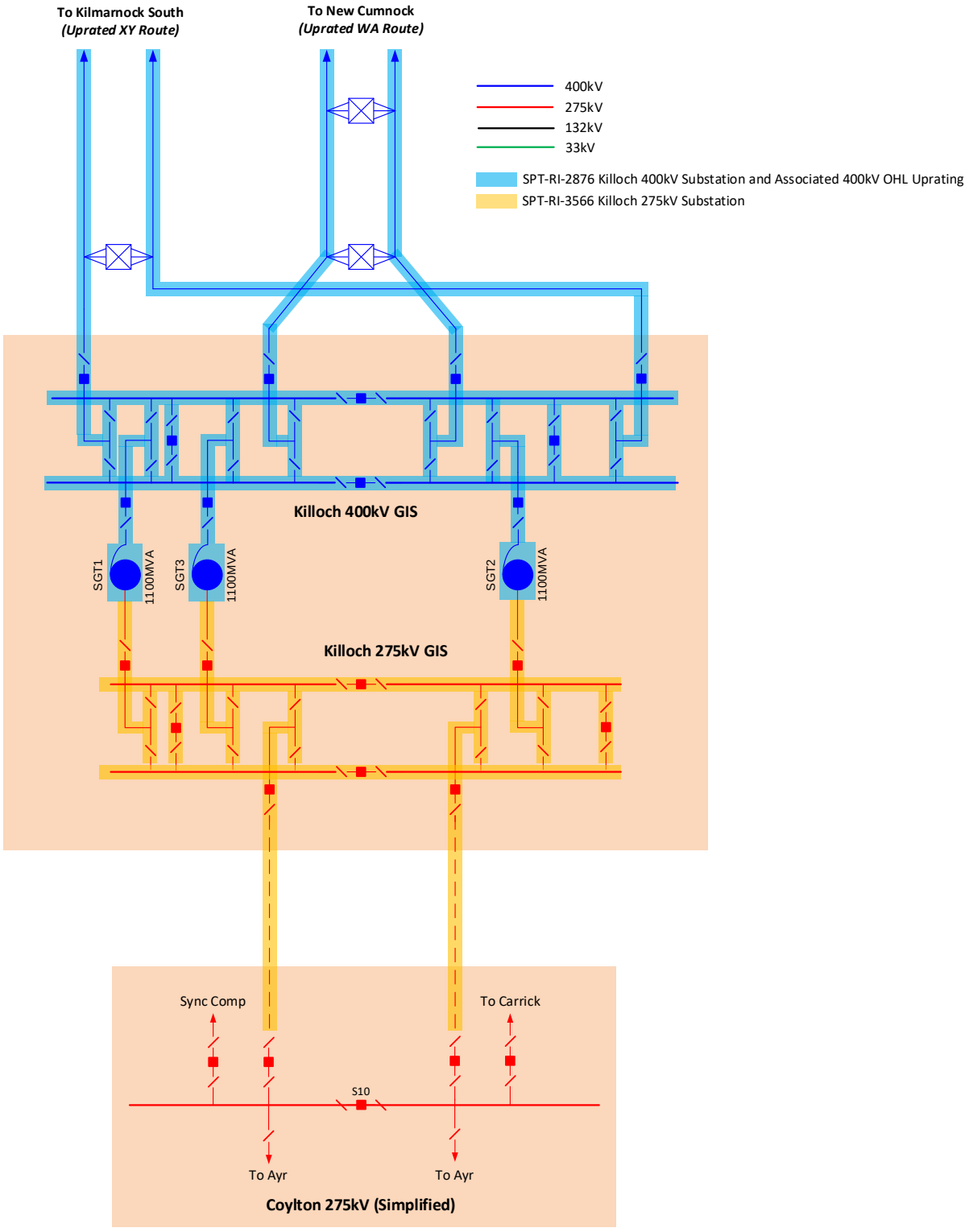

Figure 8: Indicative Works - Single Line Diagram (yellow section not included in this scope of works, part of SPT-RI-3566)

The associated works for selected option are detailed below:

Pre-Engineering Works

The following list is indicative based on previous experience of such sites and as such should not be read as definitive. The following surveys will be carried out:

- Topographical survey of the site
- GPR survey of areas to be excavated to validate approximate locations of buried services.
- Ground bearing capacity checks
- Geo Environmental Investigation to identify the relevant geotechnical parameters to facilitate the civil engineering design works
- Earthing Study
- Insulation Co-ordination Study
- Transport Survey to assess the access of the new Equipment
- Environmental Study.

Killoch 400 kV/275 kV substation

The works at Killoch 400 kV/275 kV substation shall, as indicated in Figure 8, include:

Installing a new 400 kV DBB with 11 bays including space for;

- 2 bays for new double circuit OHL to Kilmarnock South
- 2 bays for new double circuit OHL to New Cumnock
- 3 bays for 400/275 kV SGTs
- 2 bus sections
- 2 bus couplers

Installing 3 x 400 kV/275 kV 1100 MVA SGTs and associated connections to the existing Coylton 275kV substation.

OHL works

The OHL works associated with the option shown in Figure 8 include:

- Diversion of 275 kV XZ route to remove the cross-connection setup at Chipperlaggan 275 kV
- Diversion and 400 kV uprating of the XY route between Kilmarnock South 400 kV and the proposed Killoch 400 kV substations.
- 400 kV uprating of the WA route between the proposed Killoch 400 kV and the New Cumnock North 400 kV substations.
- Installation of 4 new 400 kV DBB feeder bays with associated switchgear (circuit breaker and DBB disconnectors); 2 at Kilmarnock South 400 kV and 2 at New Cumnock North 400 kV

4.3. Further Development at New Substation

Indicators from SP Distribution's Distribution Future Energy Scenarios (DFES) indicate growth in both demand and generation going forward in the area local to this proposed new substation, therefore provision will be made at the site to allow the establishment of a new grid supply point (GSP) which can be interconnected with the existing local distribution system to provide additional capacity.

Engagement with SPD on this will continue as the project develops, to ensure the best solution for the GB consumer, at both Transmission and Distribution levels.

One of the key drivers for this project is to enable a new 400kV corridor over the B6 boundary to increase the bulk power transfer though the system. As this power transfer increases, there will be a requirement to install additional equipment at key locations to ensure the system remains operable. Given this is a new site to be established, layouts will also consider the potential for the connection of this type of device. This will be determined through power system analysis, which will provide the optimal specification and location required.

4.4. Estimated Total Project Cost

A Business Plan provision and estimated cost of the project is indicated in the following table. Costs below are referred as "Direct", so neither risk contingency nor indirect have been included in the project cost. Project costs are summarised in the Cost Breakdown below:

Table 2: Project Cost Breakdown

[redacted]

Expenditure incidence is summarised below (Table 3):

Table 3: Summary of Expenditure Incidence

Energisation Year	Yr. 2024: Direct CAPEX	Yr. 2025: Direct CAPEX	Yr. 2026: Direct CAPEX	Yr. 2027: Direct CAPEX	Yr. 2028: Direct CAPEX	Yr. 2029: Direct CAPEX	Yr. 2030: Direct CAPEX
2037	0.008	0.033	0.730	2.799	3.434	2.502	0.429
	Yr. 2031: Direct CAPEX	**Yr. 2032: Direct CAPEX**	**Yr. 2033: Direct CAPEX**	**Yr. 2034: Direct CAPEX**	**Yr. 2035: Direct CAPEX**	**Yr. 2036: Direct CAPEX**	**Yr. 2037: Direct CAPEX**
	0.428	0.528	5.471	21.825	30.553	34.199	18.957

4.5. Regulatory Outputs

The indicative primary asset outputs are identified in Table 4 below:

Table 4: Indictive Primary Asset Outputs

Asset Category	Asset Sub-Category Primary	Voltage	Forecast Additions[8]	Forecast Disposal

[8] Forecast Additions are indicative pending further detail design.

Circuit Breaker	CB	400 kV	11	-
Substation Platform	Platform Creation	400 kV	TBC (m^2)	-
Wound Plant	Transformer	400 kV>=500MVA (1100MVA)	3 units	-
Switchgear	Disconnector	400 kV	11 units	
Overhead Tower Line	OHL (Tower Line) Conductor	400 kV	TBC	
Overhead Tower Line	Tower	400 kV	TBC	
Overhead Line Fittings	Fittings	400 kV	TBC	

5. Deliverability

We have applied SPT's project management approach to ensure that this project work is delivered safely, and in line with the agreed time, cost and quality commitments. We have a proven track record of delivering essential transmission network upgrade projects and will draw upon this knowledge and experience to effectively manage these works. We have assigned a dedicated Project Manager to the works at every stage who is responsible for overall delivery of the scope and is the primary point of contact for all stakeholders.

5.1. Delivery Schedule

A standard approach has been applied to the planning phase of these works and that will continue for the reporting and the application of processes and controls throughout the lifecycle. The Gantt chart (Figure 9) below summarises the key milestones within the delivery schedule for Stage 1 of this project. Initial development work is underway and being funded via the tCSNP2 development track. The output of this development work will inform the technical solution.

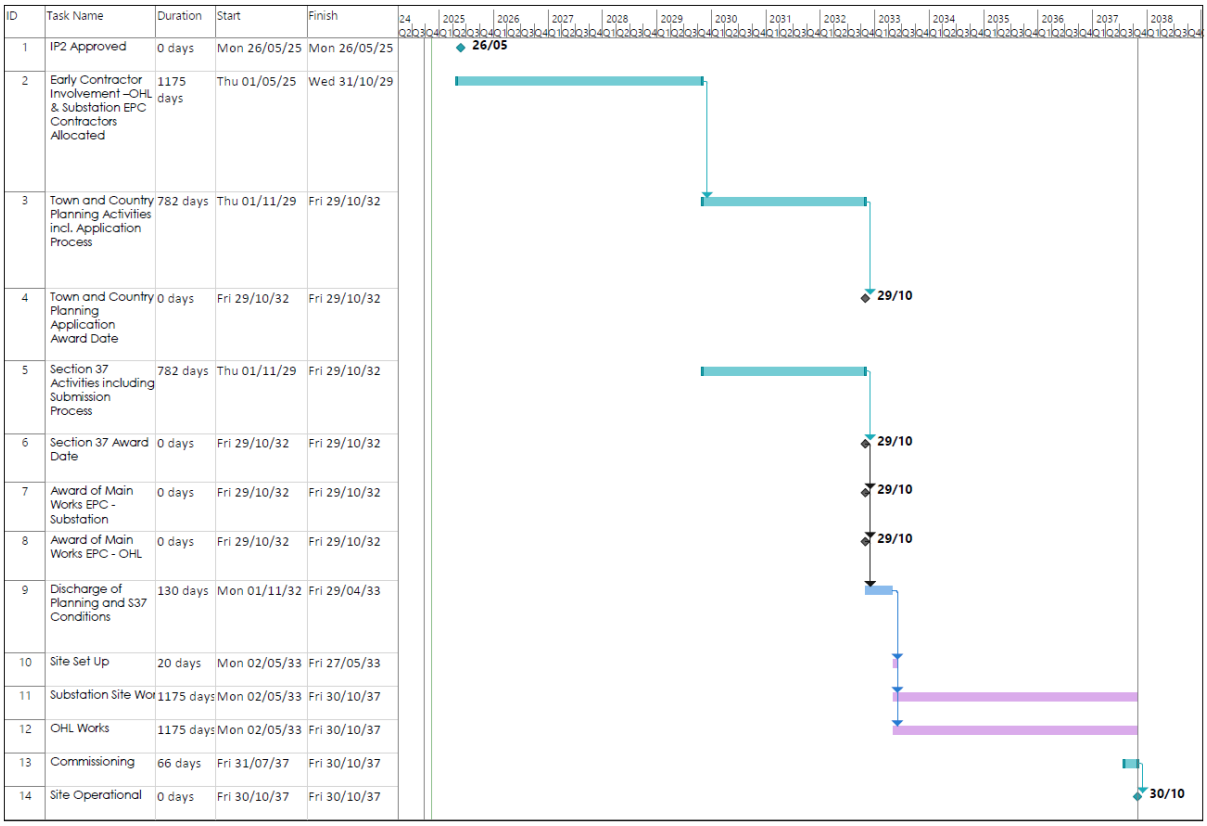

Figure 9: GANTT Chart of Project Progression and Associated Milestones

Regular meetings with the Project and Construction Management Teams shall be undertaken to assess the ongoing effectiveness of the Project Management interfaces.

The Project Manager will facilitate internal Project Team Meetings, in which project progress and deliverables will be reviewed and any arising risks or issues will be discussed and addressed.

5.2. Risk and Mitigation

A Project Risk Register was generated collaboratively during the initial project kick-off meeting to identify any risks, which if realised, could result in deviation from the delivery plan. Mitigation strategies have also been developed to manage the risks identified and these will be implemented by the Project Manager. The risk register shall remain a live document and will be updated regularly by the project team. Currently, the top scheme risks are:

- Planning Consents - Town & Country Planning App. for substation. This could require choosing a different site and delay construction.
- Availability of land at appropriate location to site new substation - Competition with battery developers, ancillary services, etc. could require replanning, delay construction, and/or increase costs.
- Ground Conditions - unknown until site is selected and environmental studies are completed. This could lead to increased construction costs.

5.3. Quality Management

SPT adopts a “life cycle” approach to Quality Management in major project delivery. Our Management Systems are certified to ISO 9001, ISO 14001 and ISO 45001. Various areas applicable to these standards ensure a quality product is delivered. The significant areas detailed below:

5.3.1. Quality Requirements During Project Development

Any risk or opportunity that may affect the quality of the product are detailed in the Project Risk Register. The suppliers of main equipment may also receive a Factory Acceptance Test Inspection when the asset is being built.

5.4. Quality Requirements in Tenders

Each contract that SPT issues has a standard format. Specifically in relation to quality, this will include a Contractors’ Quality Performance Requirement (CQPR). This CQPR represents a specification that details roles and responsibilities for all parties during the works, frequency and format of reporting. It will also specify the document management process to be adhered to during the delivery of the project. In addition to the CQPR, each project has a contract specific Quality Management Plan, detailing the inspection and testing regime for works as well as the records to be maintained.

5.4.1. Monitoring and Measuring During Project Delivery

SPT Projects undertake regular inspections on projects and contractors to monitor and measure compliance with SPT Environmental, Quality and Health and Safety requirements, as detailed in the contract specifications for the work. All inspections are visual, with the person undertaking the inspection ensuring that evidence of the inspection and any actions raised are documented.

The following inspections are completed:

- Quality Inspections (monthly)
- Environmental Inspections (monthly, with weekly review by third party Environmental Clerk of Works)
- Safety Assessments & Contractor Safety Inspection (daily, with full time Site Manager)
- Project Management Tours (monthly)

The scope of audits and Inspections is to determine compliance with:

- Procedures & Guides
- Planned arrangements for ISO 9001, 14001 & 18001
- Legal and other requirements.

5.4.2. Post Energisation

SPT Projects and SPT Operations, within SPEN, carry out a Defect Liability Period Inspection within the Contract Defect Liability Period with the aim of identifying any defects and rectifying them with the contractors.

5.5. Environmental Sustainability

IMS-01-001 encompasses all activities undertaken within and in support of SP Energy Networks three Licences. This includes operational and business support functions concerned with management of SP Transmission, SP Distribution and associated regulatory and commercial interfaces, products, services and their associated environmental, social and economic impacts. The policy makes the following commitments which shall be respected in any works associated with this scheme.

SP Energy Networks will incorporate environmental, social and economic issues into our business decision-making processes, ensuring compliance with or improvement upon legislative, industry, regulatory and other compliance obligations. We will deliver this by being innovative and demonstrating leadership on the issues which are important to us and our stakeholders, and will:

- Ensure the reliability and availability of our Transmission and Distribution network whilst creating value and delivering competitiveness by increasing efficiency and minimising losses.
- Reduce greenhouse gas emissions in line with our Net Zero Science Based GHG target, which is a target of 90% reduction in GHG emissions by 2035 (TBC) from a 2018/19 baseline.
- Integrate climate change adaptation requirements into our asset management and operations processes to support business resilience and reduce the length and time of service interruptions.
- Consider whole life cycle impacts to reduce our use of resources to sustainable levels, improve the efficiency of our use of energy and water and aim for zero waste.
- Improve land, air and watercourse quality by preventing pollution and contamination and protecting and enhancing biodiversity in our network areas.
- Improve our service to local communities, supporting their economic and social development, protecting vulnerable customers, and respecting human rights.

ENV-04-014 gives specific guidance on the management of incidents with environmental consequence, or potential for environmental consequences, over and above the general requirements for the management of incidents.

5.6. Stakeholder Engagement

SPT is committed to delivering optimal solutions in all the projects we undertake. A key part of this is engaging with relevant stakeholders throughout the project development and delivery process.

Stakeholders can include customers, regulatory bodies and other statutory consultees, national and local government, landowners, community groups, and local residents and their representatives (e.g., MPs, MSPs and councillors). Community impacts associated with construction activities are considered at project initiation by completion of a Community Communications Plan, which details the stakeholders relevant to the project, the communication channels that will be used to engage with them, the information that will be provided to and sought from them, and the timescales over which this will happen. It considers any sensitivities that may require increased stakeholder consultation and details specific events that will be held with stakeholders during the development of the project.

As part of this project, SPT will engage with statutory consultees associated with the planning application for these works - the Local Authority, SEPA and Nature Scot - and the third-party landowner.

6. Eligibility for Competition

Under the RIIO-T3 Business Plan Guidance, Ofgem has requested that projects that are above £50m and £100m should be flagged as being eligible for being suitable for early and late competition respectively. This project forms part of the WCN2 project, which has been shortlisted by Ofgem for Early Competition. It should be noted that this substation is also required for contracted new connections which are embedded in both the 400kV and 275kV substations, and requires the uprating in operation of the existing 275kV circuits to 400kV, which makes it inseparable.

7. Conclusions

This EJP establishes the requirement for a new 400 kV/275 kV substation at Killoch in order to enable both the progression of the WCN2 scheme and connection of up to 1094 MW of generation (according to SPT best view methodology) in the surrounding area.

The WCN2 corridor requires the completion of the works at Killoch in order to accommodate the 400 kV double circuit corridor between the west of Scotland and the B6 boundary with NGET. This will allow for future transmission requirements to be satisfied in line with predicted FES requirements in the region.

In summary, the main conclusions of this submission are:

- The completion of works at the Killoch 400 kV/275 kV substation is essential to enable the connection of up to 1094 MW of connections in the local area and to ease constraints on the existing 275 kV network at Coylton.
- The development of the substation and surrounding 400 kV transmission works is required to align with future needs in the South West region and to progress with the WCN2 scheme
- The proposed scheme plays a vital role in reaching legislated Net Zero targets and is aligned with SPT's RIIO-T3 strategic goals.

This EJP is submitted for Ofgem's assessment of the need case for the project and the selection of the preferred option in order to provide sufficient funding for pre-construction and early construction activities.

8. Appendices

8.1. Appendix A: Maps and Diagrams

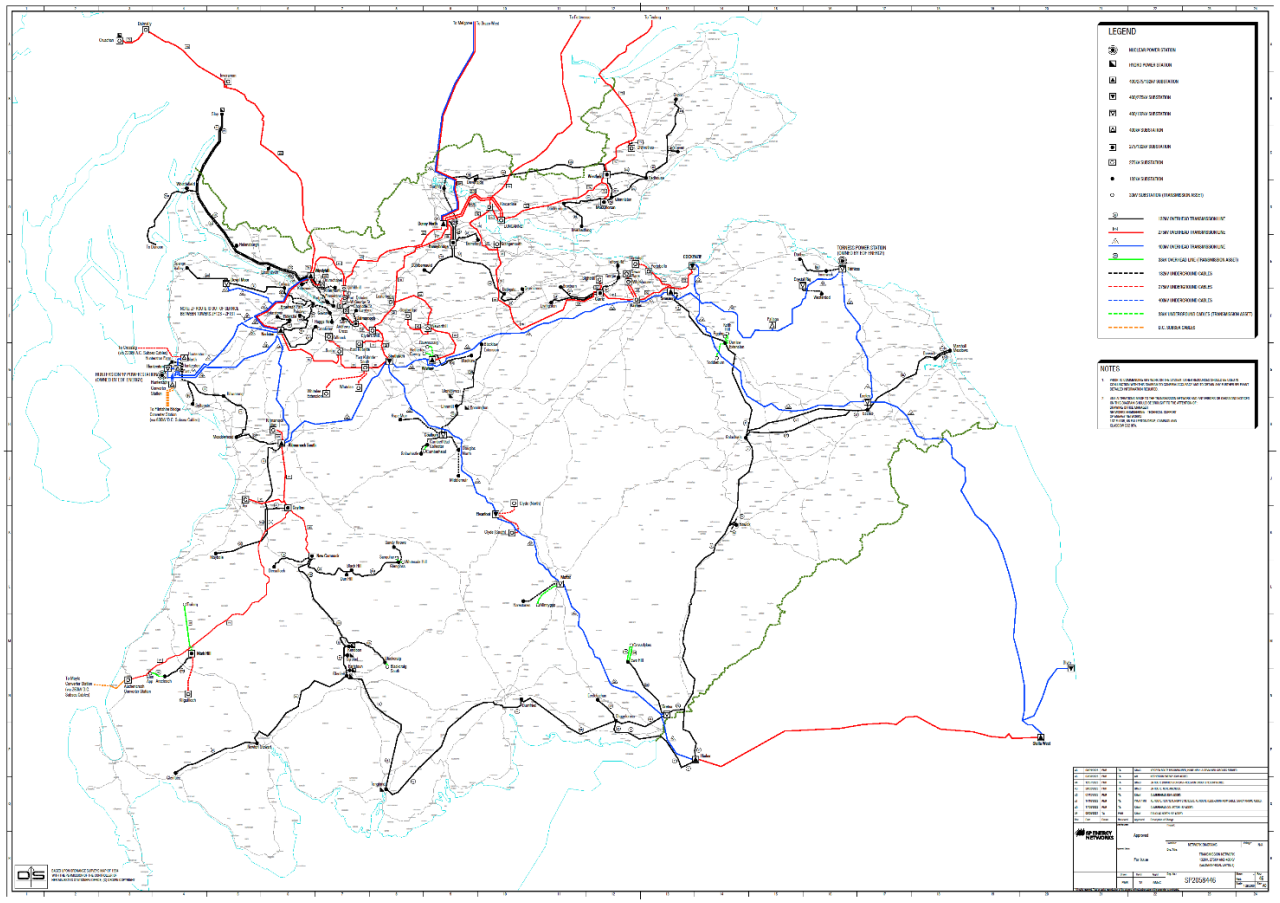

Figure A-1: Networks Diagram of the existing SPT system - Geographical Layout

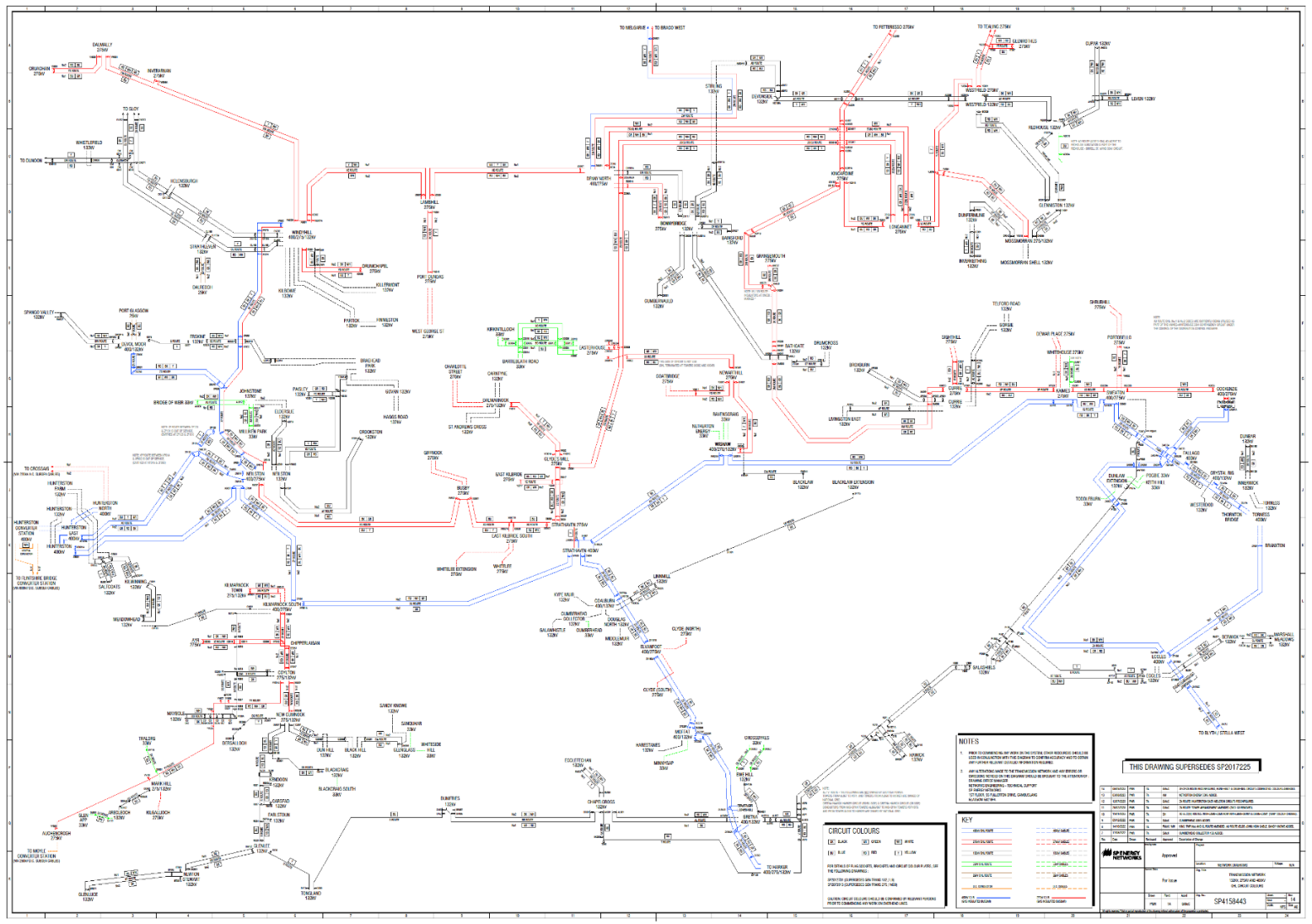

Figure A-2: Networks Diagram of the existing SPT system – Single Line Diagram

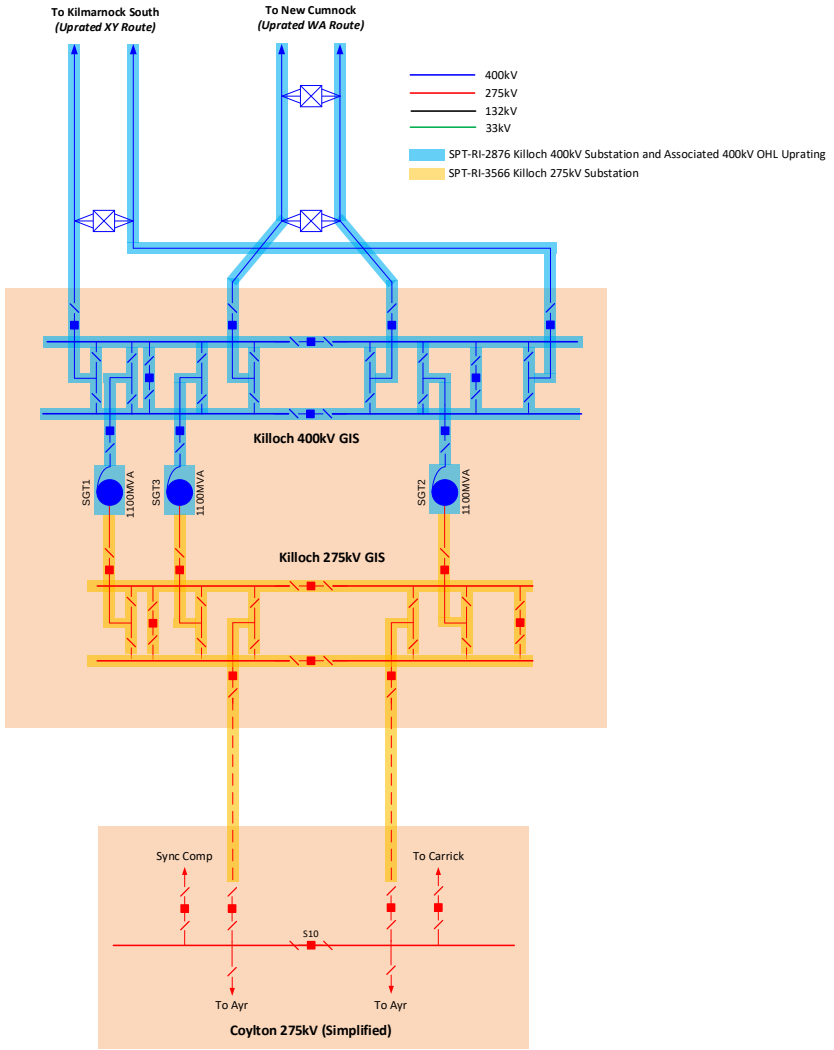

Figure A-3: Proposed Killoch Works – Single Line Diagram (275 kV board is not included in these EJP works)

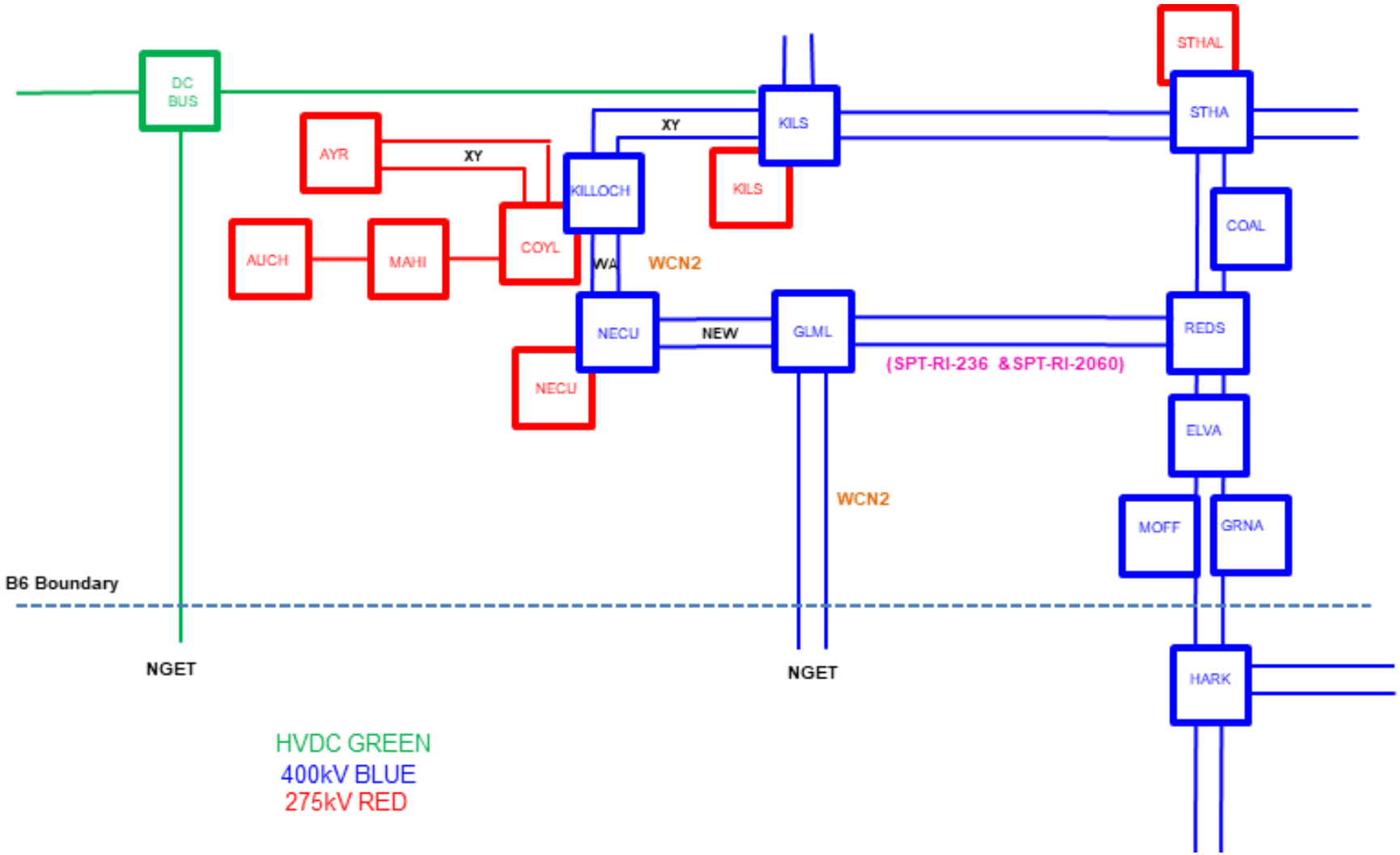

Figure A-4: Proposed WCN2 Works – Network Diagram (WCN2 works indicated)

Figure A-5: Proposed Killoch Site – Geographical Site Layout (GIS Substation detailed for costings but final option to be determined following ongoing development)