MSIP Re-opener Application – Coalburn SGT4 Installation		
Ofgem Scheme Reference/ Name of Scheme	SPT200200 SPT-RI-263 - Coalburn SGT4	
Investment Category	Local Enabling (Entry)	
Primary Investment Driver	Connection of customer-driven onshore wind generation	
Licence Mechanism/ Activity	Special Condition 3.14 Medium Sized Investment Projects Re-opener and Price Control Deliverable/ Clause 3.14.6 (a)	
Materiality Threshold exceeded (£3.5m)	Yes, as a single project due to the threshold for activity 3.14.6 (a)	
PCD primary Output	Generation: (MW)	
Total Project Cost (£m)	15.46	
Funding Allowance (£m)	To be confirmed	Requested
Delivery Year	2024/25	
Reporting Table	Annual RRP – PCD Table	
PCD Modification Process	Special Condition 3.14, Appendix 1	

Issue Date	Issue No	Amendment Details
31st January 2022	1	First issue of document.

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Table of Contents

1. Abbreviations / Terminology

Table 1: Table of Abbreviations

Abbreviation	Term
ACM	Asbestos Containing Material
AIS	Air Insulated Switchgear
BEIS	Department for Business, Energy & Industrial Strategy
CDM	Construction Design and Management
CEC	Connection Entry Capacity
CION	Connection and Infrastructure Options Note
CT	Current Transformer
ESO	Electricity System Operator
GSP	Grid Supply Point
ITT	Invitation to Tender
Km	Kilometre
kV	Kilovolt
LC	Licence Condition
LSpC	Licence Special Condition
MSIP	Medium Sized Investment Project
MW	Megawatt
NETS SQSS	National Electricity Transmission System Security and Quality of Supply Standard
NGET	National Grid Electricity Transmission
NGESO	National Grid Electricity System Operator
NOA	Network Options Assessment
OHL	Overhead Line
PCD	Price Control Deliverable
RIIO	Revenue = Incentives + Innovation + Outputs
SCADA	Supervisory Control and Data Acquisition
SGT	Supergrid Transformer
SHET	Scottish Hydro Electric Transmission
SPT	SP Transmission
SPEN	SP Energy Networks
STC	System Operator – Transmission Owner Code
VDUM	Volume Driver Uncertainty Mechanism
VT	Voltage Transformer

2. Reference Documents

Table 2: Table of Reference Documents

Document Reference	Title
SPEN-RIIO-T2_Business_Plan	SP Energy Networks RIIO T2 Business Plan 2021 - 2026

3. Introduction

This MSIP Re-opener application sets out SPT's plans to carry out reinforcement work at Coalburn 400/132kV Substation within the RIIO-T2 period (April 2021 – March 2026), comprising reconfiguration works and the installation of a fourth Supergrid Transformer (SGT), increasing the substation capacity and enabling the connection of 274MW of contracted onshore wind generation.

This MSIP Re-opener application is submitted in accordance with Licence Special Condition (LSpC) 3.14.6 and relates specifically to LSpC 3.14.6 activity (a):

"3.14.6 The licensee may apply to the Authority for a direction amending the outputs, delivery dates or associated allowances in Appendix1 in relation to one or more of the following activities:

(a) a Generation Connection project, including all infrastructure related to that project, the forecast costs of which are at least £4.24m more or less than the level that could be provided for under Special Condition 3.11 (Generation Connections volume driver)"

Applying the RIIO-T2 Generation Connections Volume Driver Uncertainty Mechanism (VDUM) to this project results in the £15.46m estimated total project cost being £9.07 higher than the £6.39m allowance provided by the VDUM. An MSIP Re-opener application is therefore required.

Full justification for the preferred investment option is presented within this MSIP Re-opener application document, together with a detailed description of the proposed solution.

The estimated total project cost may be subject to change. As agreed with Ofgem, a further submission will be made at the right time relating to the associated amendments to the outputs, delivery date and allowances to be detailed as a Price Control Deliverable (PCD) in LSpC 3.14 Appendix 1.

3.1 Structure of Document

This MSIP Re-opener application is structured as follows:

Section 4 – Background and Needs Case

This section outlines the background to the proposed works and details the key project drivers.

Section 5 – Assessment of Options

This section sets out the approach taken to considering the distinct options available to address the need identified in Section 4. The results of an evaluation of the alternative options are presented and the reasoning behind the selection of the preferred investment option is summarised.

Section 6 – Proposed Works

This section provides a description of the proposed solution. It sets out the project scope and other key supporting information.

Section 7 – Project Cost Estimate

This section summarises the estimated cost of the selected option.

Section 8 – Project Delivery

This section outlines the approach which will be taken to deliver the project.

3.2 Requirements Mapping Table

Table 3 maps the requirements set out within Chapter 3 of the RIIO-T2 Re-opener Guidance and Application Requirements Document[1] against specific sections within this document.

Table 3: Requirements Mapping Table

Section	Description	Relevant Section(s) in RIIO-T2 Re-opener Guidance and Application Requirements Document
3	Introduction	3.3, 3.4
4	Background and Needs Case	3.8, 3.9, 3.10, 3.11
5	Assessment of Options	3.13, 3.14, 3.21, 3.22
6	Proposed Works	3.14
7	Project Cost Estimate	3.12, 3.19, 3.20
8	Project Delivery	3.15, 3.16, 3.17

[1] RIIO-2 Re-opener Guidance and Application Requirements Document: Version 1

4. Background and Needs Case

4.1 Statutory and Licence Obligations on SP Transmission plc

SP Transmission plc (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 duties:-

- 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.

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

- To always 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 always 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 (NGESO's) obligations to co-ordinate and direct the flow of electricity on, to and over the GB transmission system (LC D3);
- To make its transmission system available for the purpose of conveying, or affecting the flow of, electricity and to ensure that the system is fit for purpose (LC D2); and
- To offer to enter into an agreement with the system operator upon 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 the following 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.

4.2 Key Project Drivers

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 wind, will play a vital role in reaching these legislated net zero targets. Further commitments, by the UK Government in October 2021, to decarbonise the power system by 2035, 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.

On 9th September 2021, the Department for Business, Energy & Industrial Strategy (BEIS) announced the budget for the next Contracts for Difference (CfD) auction, Allocation Round 4, which launched on 13th December 2021. £265m[2] per year will be provided in the fourth round of the scheme, which aims to double the renewable electricity capacity secured in the third round and generate more than the previous three rounds combined. For the first time since 2015, established technologies, including onshore wind and solar, will also be able to bid. Given lowering technology costs and a favourable subsidy regime, we expect this will support a considerable number of renewables projects to successfully transition from project inception and development through to energisation[3].

[2] Biggest ever renewable energy support scheme backed by additional £265 million - GOV.UK (www.gov.uk)
[3] BEIS Electricity Generation Costs (2020) - GOV.UK (www.gov.uk)

4.3 Coalburn 400/132kV Substation – Background

Coalburn 400/132kV Substation forms part of the Main Interconnected Transmission system (MITS) in southern Scotland, situated to the south of Lesmahagow in South Lanarkshire.

A geographic overview of the existing SPT system is provided in Appendix A, and an extract from this geographic overview, indicating existing transmission network connectivity in proximity to Coalburn 400/132kV Substation, is included in Figure 1.

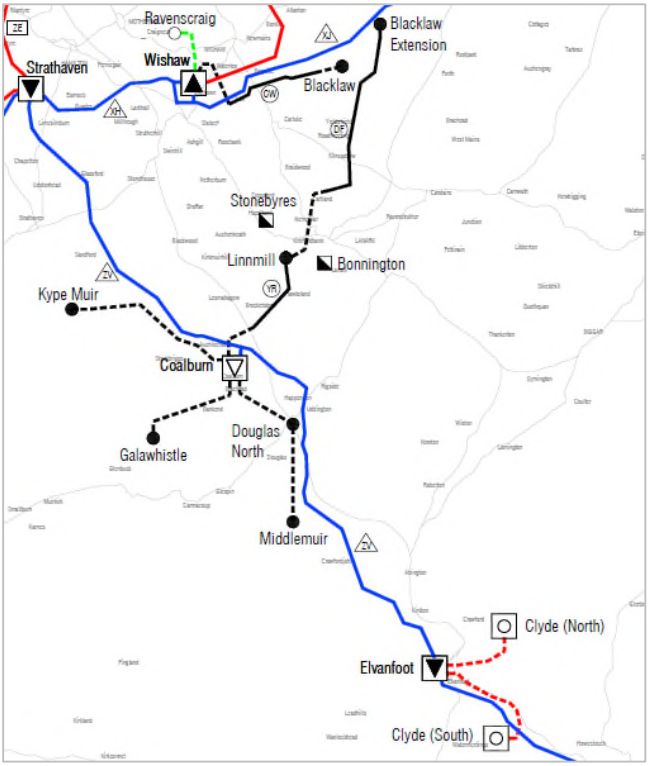

Figure 1: Geographic Indication of Coalburn 400/132kV Substation

Coalburn 400/132kV Substation forms part of the west coast onshore electrical interconnection between Scotland and England and serves Linnmill 132/33kV Grid Supply Point (GSP). It utilises Air Insulated Switchgear (AIS) with 400kV and 132kV equipment in a double busbar configuration. Three 400/132kV SGTs (SGT1, SGT2 and SGT3), with a combined rating of 840MVA, interconnect the 400kV and 132kV busbar systems, with all equipment located within a single compound.

South Lanarkshire is an area rich in wind energy resource. Both Linnmill GSP and Coalburn 400/132kV Substations serve as 'collector' sites for onshore wind energy developments:

- 531MW of renewable generation capacity is today connected to Coalburn 132kV Substation and, in turn, connected to the MITS via the existing three Coalburn 400/132kV SGT's.
- 596MW of additional renewable generation capacity has a connection agreement in place for connection via Coalburn 132kV Substation, of which 566MW has secured planning consent and is scheduled to connect before December 2024.

In order to connect a significant element of this further contracted generation capacity in a manner compliant with the relevant technical standards, it is necessary to reinforce Coalburn 400/132kV Substation through the provision of additional inter-bus transformer capacity.

4.4 Coalburn 400/132kV Substation – Connection of Additional Onshore Wind Capacity

As indicated above, 531MW of renewable generation capacity is currently connected to Coalburn 132kV Substation. This generation is summarised in Table 4 below:

Table 4: Connected Generation

Site	Connection Status	Capacity (MW)
Blacklaw Extension	Connected	60.0
Douglas West	Connected	45.0
Galawhistle	Connected	55.2
Kennoxhead Extension	Connected	60.0
Kype Muir	Connected	88.4
Linnmill GSP (Embedded) [4]	Connected	171.5
Middlemuir	Connected	51.0
Total Capacity (MW)		**531**

Of the 596MW of additional generation capacity noted in Section 4.3 as contracted to connect to Coalburn 132kV Substation, by virtue of the timing of the associated applications for connection, the five consented developments detailed in Table 5, totalling 322MW, can be connected without the requirement for reinforcement of the inter-bus SGT capacity at Coalburn.

A total of 853MW of renewable generation capacity can therefore be connected with the existing 840MVA installed SGT capacity at Coalburn. This follows detailed engagement with National Grid Electricity System Operator (NGESO) as part of the connection offers process and reflects a low degree of diversity across the local generation portfolio, which is largely offset by the need to accommodate off-nominal voltage and power factor conditions. Connected generation capacity at this level is only made possible by the extensive and innovative application of load management and auto-switching scheme, combined with some developments having associated 'non-firm' transmission access rights.

Table 5: Contracted Generation - No Requirement for Additional Inter-bus Transformer Capacity

Site	Connection Status	Consent Status	Capacity (MW)	Contracted Energisation Date
Dalquhandy	Contracted	Consented	45.0	Jul-22
Cumberhead	Contracted	Consented	50.0	Aug-22
Harting Rig	Contracted	Consented	67.2	Sep-22
Broken Cross	Contracted	Consented	48.0	Sep-23
Kennoxhead	Contracted	Consented	112.0	Feb-24
Total Capacity (MW)			**322.2**	

[4] Linnmill GSP has a total of 171.5MW of embedded renewable capacity, together with a maximum demand of approximately 43MW and minimum demand of approximately 13MW. A net position of 158.5MW is therefore considered when assessing capacity on the inter-bus transformers at Coalburn.

Of the 596MW of additional generation capacity noted in Section 4.3 as contracted to connect to Coalburn 132kV Substation, by virtue of the timing of the associated applications for connection, the five developments detailed in Table 6, totalling 274MW, cannot be accommodated without reinforcement of the existing 840MVA inter-bus SGT capacity at Coalburn.

Table 6: Contracted Generation - Additional Inter-bus Transformer Capacity Required

Site	Connection Status	Consent Status	Capacity (MW)	Contracted Energisation Date
Hagshaw Hill Repower Phase 1	Contracted	Consented	30.0	May-24
Hagshaw Hill Repower Phase 2	Contracted	Consented	54.0	May-24
Douglas West Extension	Contracted	Consented	60.0	Jul-24
Cumberhead West	Contracted	Consented	100.0	Nov-24
Little Gala (via new Lesmahagow GSP)	Contracted	In progress	29.9	Oct-27
Total Capacity (MW)			**273.9**	

The works proposed to reinforce the existing 840MVA inter-bus SGT capacity at Coalburn comprise the installation of a new 40/132kV 360MVA SGT4, together with associated reconfiguration works, and are described in Transmission Owner Reinforcement Instruction (TORI) SPT-RI-263.

A Bilateral Connection Agreement is therefore in place between NGESO and the developers of the sites in Table 6 above, with SPT-RI-263 identified as Enabling Works. Corresponding Transmission Owner Construction Agreements are in place between NGESO and SPT.

Reinforcement of Coalburn 400/132kV Substation is necessary to accommodate the full 1,127MW contracted renewable generation capacity (of which 1,097MW is either connected or consented). Discussion of the alternative reinforcement options considered can be found in Sections 5.

In addition to the contracted onshore wind development described above, connection agreements are in place for three further developments (for Battery Energy Storage and Synchronous Compensation), each of which requires the establishment of a new 400kV double busbar bay. It is proposed to connect a fourth additional development (for Battery Energy Storage) into a new 'Coalburn North' 400kV Substation, due to the need to manage loss of infeed risk and challenges in relation to further extending the existing 400kV compound.

4.5 Alignment with RIIO-T2 Strategic Goals

As described in our RIIO-T2 plan[5] for the five-years to the end of March 2026, to mitigate the impacts of climate change and achieve a low-carbon energy system requires a level of focused effort and commitment never seen before. The mass electrification of transport and heat has only started and there is a huge amount required to build on the timely progress already made in the electricity sector.

Energy networks are critical to achieving the wider Net Zero emissions targets and with continued engagement with consumers, network users and our wider stakeholders, we've set a progressive plan in place to facilitate a Net Zero future. Our RIIO-T2 plan sets out four strategic goals – informed by our stakeholder priorities – that will keep us moving towards this sustainable future.

[5] SP Energy Networks RIIO-T2 Business Plan

These goals and their alignment with the Coalburn SGT4 project, are summarised below:

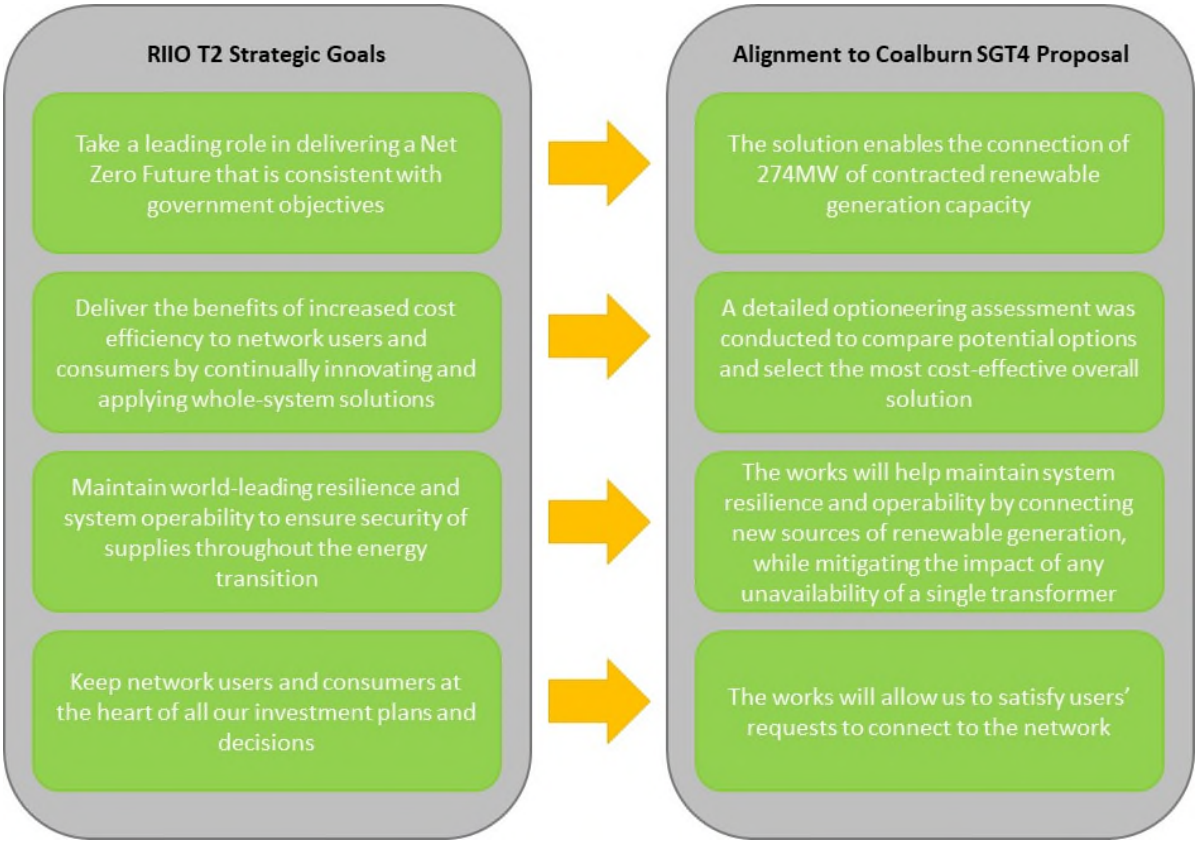

Figure 2: Alignment of the Coalburn SGT4 Proposal with SPT RIIO-T2 Strategic Goals

Further detail regarding how this proposal aligns to our four Strategic Goals is outlined below:

Take a leading role in delivering a Net Zero future that is consistent with government objectives.

By investing in a fourth SGT at Coalburn 400/132kV Substation, transmission capacity will be increased to enable the connection of 274MW of contracted renewable generation capacity in the surrounding area. This will alleviate the need to constrain the renewable generation sources and will contribute towards a reduced reliance on fossil fuel electricity generation sources.

Deliver the benefits of increased cost-efficiency to network users and consumers by continually innovating and applying whole system solutions.

Following receipt of applications for connection, SPT has worked with NGESO throughout the connection offers process to issue connection offers which reflect the most cost-effective connection solutions on a whole systems basis, compliant with the relevant technical standards.

During the Optioneering phase of this project multiple solutions were assessed to establish the most cost-effective engineering solution. More information can be found in Section 5.

This project builds on the extensive and innovative application of Load Management Schemes applied to the transmission connections already served from Coalburn 400/132kV Substation, without which this project would have required to have been significantly advanced from its current programmed completion in 2024.

Maintain world-leading resilience and system operability to ensure security of supplies throughout the energy transition.

The installation of Coalburn SGT4 will help maintain system resilience and operability by enabling the connection of new sources of renewable generation, while mitigating the impact of the unavailability of any single transformer (or associated asset) on the Coalburn site.

Keep network users and consumers at the heart of all our investment plans and decisions.

The completion of Coalburn SGT4 installation will allow SPT to satisfy network users request for connection and is consistent with SPT's statutory and licence responsibilities, including Licence Condition D4A.

Key stakeholders have been consulted during the development of the proposed solution and we will continue to engage with stakeholders throughout the project delivery process. Stakeholder engagement has included statutory consultees associated with the planning application for these works (e.g. Local Authority, SEPA, NatureScot) and the third-party landowner Forestry Land Scotland. More detail on stakeholder engagement can be found in Section 8.5.

The Coalburn SGT4 installation will continue to align with our future strategic ambitions.

5. Assessment of Options

Various alternative options were considered to accommodate the additional contracted generation requiring reinforcement at Coalburn. This included a 'Do Nothing' option, options that involve upgrades to the substation and consideration of other potential alternative infrastructure options.

5.1 Existing System Configuration at Coalburn

Coalburn 400/132kV Substation forms part of the west coast onshore electrical interconnection between Scotland and England and serves Linnmill 132/33kV Grid Supply Point (GSP). It utilises Air Insulated Switchgear (AIS) with 400kV and 132kV equipment in a double busbar configuration.

As detailed Figure 3, Coalburn 400kV Substation connects the following circuits:-

- Elvanfoot 400kV
- Strathaven 400kV
- SGT1 (400/132kV 240 MVA, equipped with 33kV 60MVAr shunt reactor)
- SGT2 (400/132kV 240 MVA)
- SGT3 (400/132kV 360 MVA)

As detailed Figure 4, Coalburn 132kV Substation connects the following circuits:-

- Douglas North (which serves Douglas West, Middlemuir and Kennoxhead Ext. Wind Farms)
- Galawhistle
- Kype Muir
- Linnmill No.1
- Linnmill No.2
- SGT1 (400/132kV 240 MVA, equipped with 33kV 60MVAr shunt reactor)
- SGT2 (400/132kV 240 MVA)
- SGT3 (400/132kV 360 MVA)

The connected and contracted generation position, together with minimum demand level at Linnmill GSP, are detailed in Section 4.

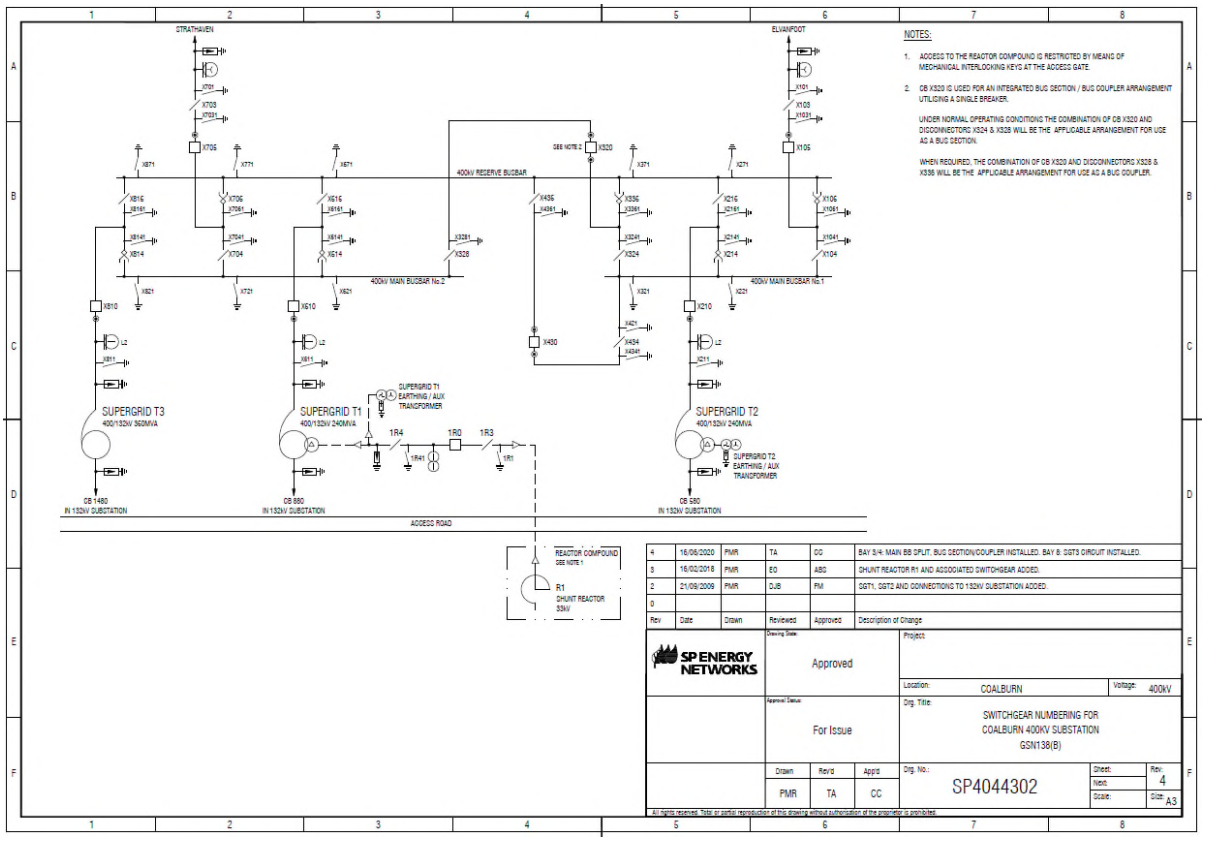

Figure 3 Existing Configuration – Coalburn 400kV Substation

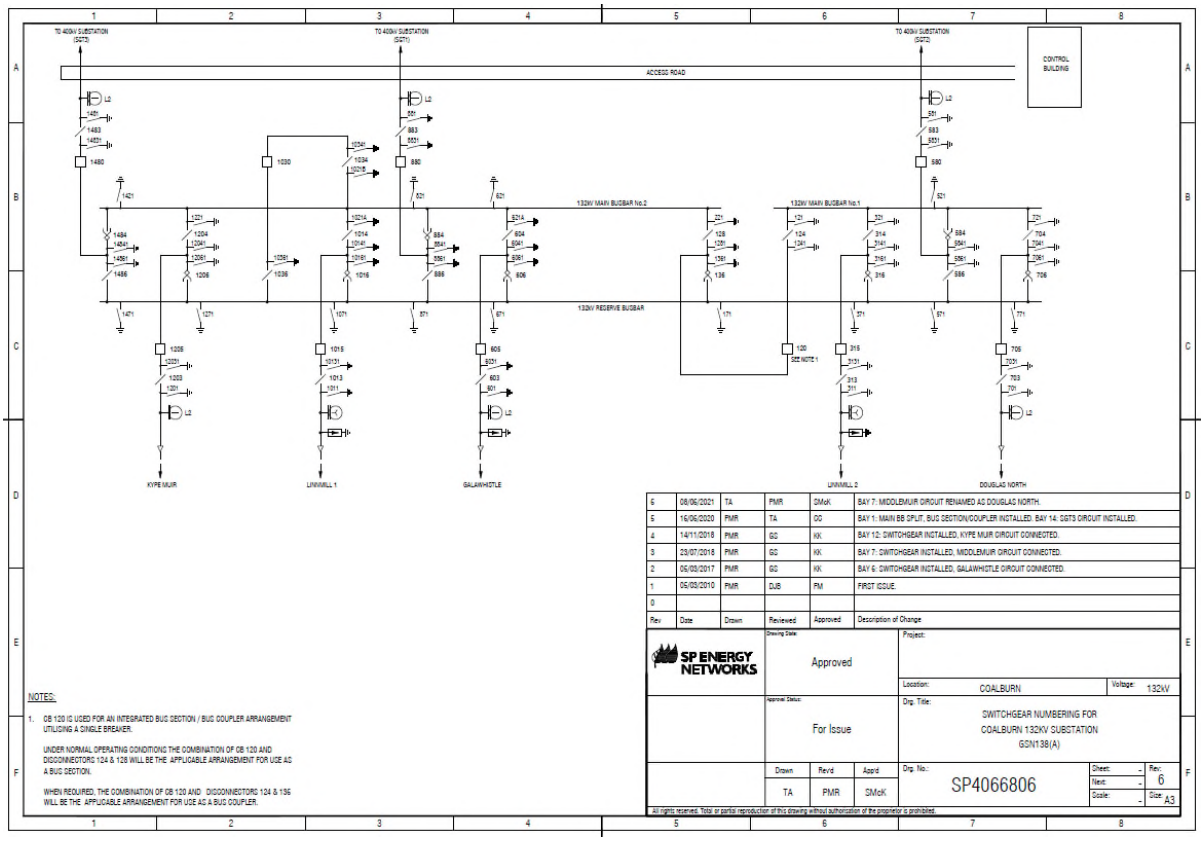

Figure 4 Existing Configuration – Coalburn 132kV Substation

5.2 Overview of Options

This section provides a description of each reinforcement option and details the key considerations. A summary of each option is described at the end of this section.

5.2.1 Option 1 – Do Nothing or Delay

A 'Do Nothing' or 'Delay' option is not credible in relation to this project and would be inconsistent with SPT's various 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 STC and associated Construction Planning Assumptions provided by NGESO. The proposed works are identified as Enabling Works in the connection agreements relating to the projects in Table 6.

5.2.2 Option 2 – New 132kV circuit to Kilmarnock South

This option would involve the establishment of a new 132kV circuit from Kilmarnock South to Coalburn with the intention of alleviating the additional loading on the Coalburn inter-bus SGT's arising from the contracted generation indicated in Table 6. The locations of Kilmarnock South and Coalburn are indicated in Figure 5 below.

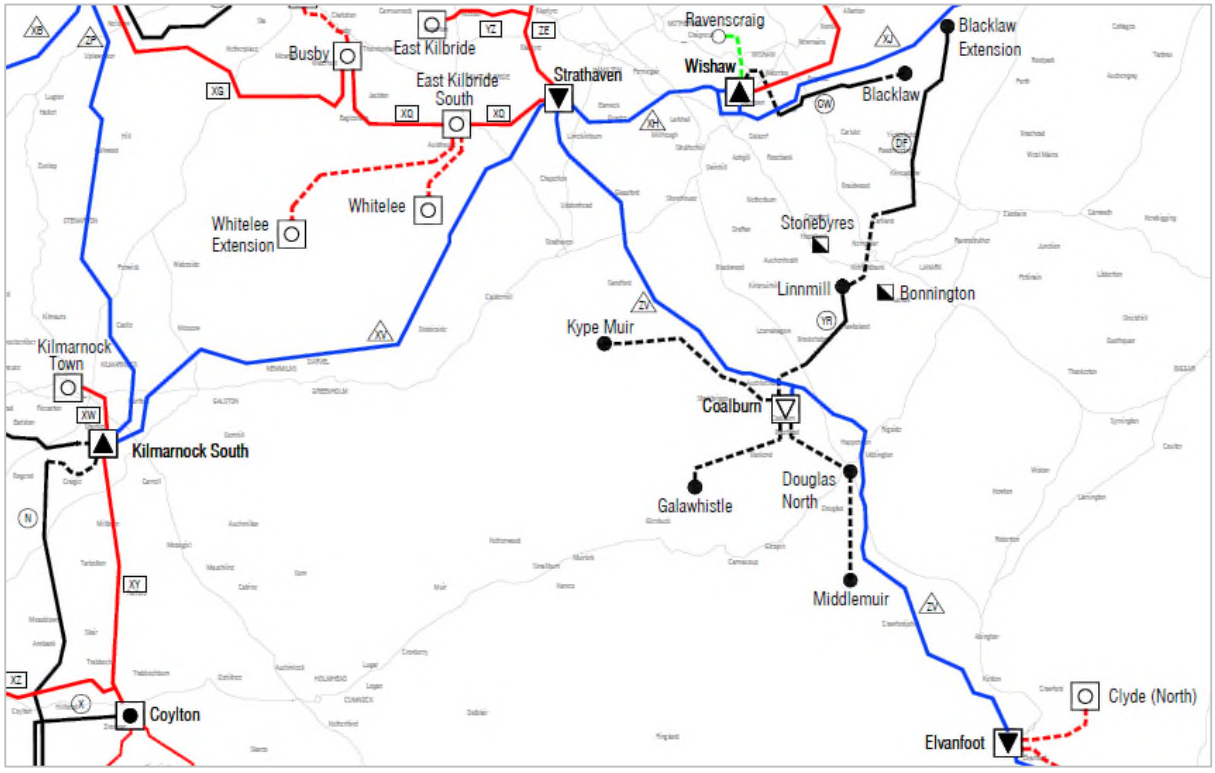

Figure 5 Geographic Indication of Kilmarnock South and Coalburn Substations

- This option was considered, however discounted in advance of a detailed cost estimating exercise, for the following reasons:-
- It is approximately 38km between the two sites 'as the crow flies' (approx. 80km via A class roads). New overhead line and/or cable infrastructure would be required through a rural area.
- It would not be possible to operate any new 132kV circuit 'normally closed' due to the configuration of the Supergrid system operating at 400kV.
- Modifications would be required to the 132kV busbar system at Coalburn to facilitate such a connection.

- The single 132kV mesh corner arrangement at Kilmarnock South would require significant modification/ replacement with a double busbar arrangement to accommodate additional 132kV connectivity.
- The existing 132kV inter-bus transformer at Kilmarnock South is a 240MVA unit connected to Kilmarnock South 275kV Substation, both of which already serve a wider group with a high penetration of connected and contracted renewable generation.
- A new 400/132kV 360MVA inter-bus transformer, with associated 400kV Gas Insulated Switchgear (GIS) and 132kV AIS switchgear, would therefore be required at Kilmarnock South, avoiding the additional generation from Coalburn adding to the pre-existing load on the Kilmarnock South 400/275kV inter-bus transformers and removing the need to modify/ replace the existing 132kV mesh corner.
- Given the scope of work summarised above and the associated delay to the connection of the contracted renewable generation capacity (given the requirement to secure consents/ land rights for, and then construct, a significant section of new 132kV overhead line and/ or cable), this option is not the most economic and efficient compared to alternative options described below.

5.2.3 Option 3 – New 132kV circuit to Strathaven or Elvanfoot 400kV Substations

This option would involve the establishment of a new 132kV circuit from Coalburn to Strathaven or Elvanfoot 400kV Substations, with the intention of alleviating the additional loading on the Coalburn Inter-bus SGTs arising from the contracted generation indicated in Table 6. The locations of Strathaven, Coalburn and Elvanfoot are indicated in Figure 5 above.

This option was considered, however discounted in advance of a detailed cost estimating exercise, for the following reasons:-

- The existing 400kV overhead line route is 22km in length between Strathaven and Coalburn and 27km from Coalburn to Elvanfoot. Any new overhead line and/or cable infrastructure between the sites would most likely be of similar or longer length through a rural area.
- It would not be possible to operate any new 132kV circuit ‘normally closed’ due to the configuration of the Supergrid system operating at 400kV.
- Modifications would be required to the 132kV busbar system at Coalburn to facilitate such a connection.
- No 132kV infrastructure exists or is planned at Strathaven 400/275kV Substation. While 132kV infrastructure is planned at Elvanfoot, the associated inter-bus transformer capacity is committed to other contracted developments at this time.
- A new 400/132kV 360MVA inter-bus transformer, with associated 400kV AIS and 132kV AIS switchgear, would therefore be required at either Strathaven or Elvanfoot.
- Given the scope of work summarised above and the associated delay to the connection of the contracted renewable generation capacity (given the requirement to secure consents/ land rights for, and then construct, a significant section of new 132kV overhead line and/ or cable), this option is not the most economic and efficient compared to alternative options described below.

5.2.4 Option 4 – Replace Existing Coalburn Transformers

This option would involve the replacement of the existing 400/132kV 240MVA units SGT1 and SGT2 with 360MVA units, which would operate alongside the existing SGT3 360MVA unit. The location of SGT1 and SGT2 within the Coalburn 400/132kV Substation configuration is indicated in Figures 3 and 4 above.

This option was considered, however discounted in advance of a detailed cost estimating exercise, for the following reasons:-

- While this option would involve the replacement SGT1 and SGT2 within the existing substation boundary, and therefore avoid the need to create one bay of additional 400kV and 132kV AIS switchgear as compared to Option 5, the two replacement SGTs would increase the installed inter-bus transformer capacity at Coalburn by 240MVA, to a total of 1,080MVA. This would fail to accommodate the connected and contracted generation at this time i.e. it would not enable the connection of an additional 274MW of contracted low carbon generation to Coalburn 400/132kV Substation, of which 244MW is already consented, nor would it provide any degree of headroom for future connections or additional capacity at already contracted sites.
- Such an operational configuration, with two 400/132kV 360MVA units in parallel with all of the connected generation would exacerbate fault infeed issues at Coalburn 132kV Substation, which are mitigated by the installation of a fourth transformer as proposed in Option 5. The fault infeed issue would only be exacerbated further were replacement transformers of a higher rating to be employed, due to the need to reduce their impedance further to ensure adequate load sharing.
- Replacement of SGT1 and SGT2, which were commissioned in 2009, would involve lengthy construction outages on each existing unit, with a corresponding impact on system access for those parties already connected to Coalburn 132kV Substation.

5.2.5 Option 5 – Install Coalburn SGT4

This option would involve the installation of a new 400/132kV 360MVA inter-bus transformer (SGT4), which would operate alongside the existing SGT1 and SGT2 400/132kV 240MVA units, and the existing SGT3 360MVA unit. The proposed configuration of Coalburn 400kV and 132kV Substations are indicated in Figures 6 and 7 respectively:

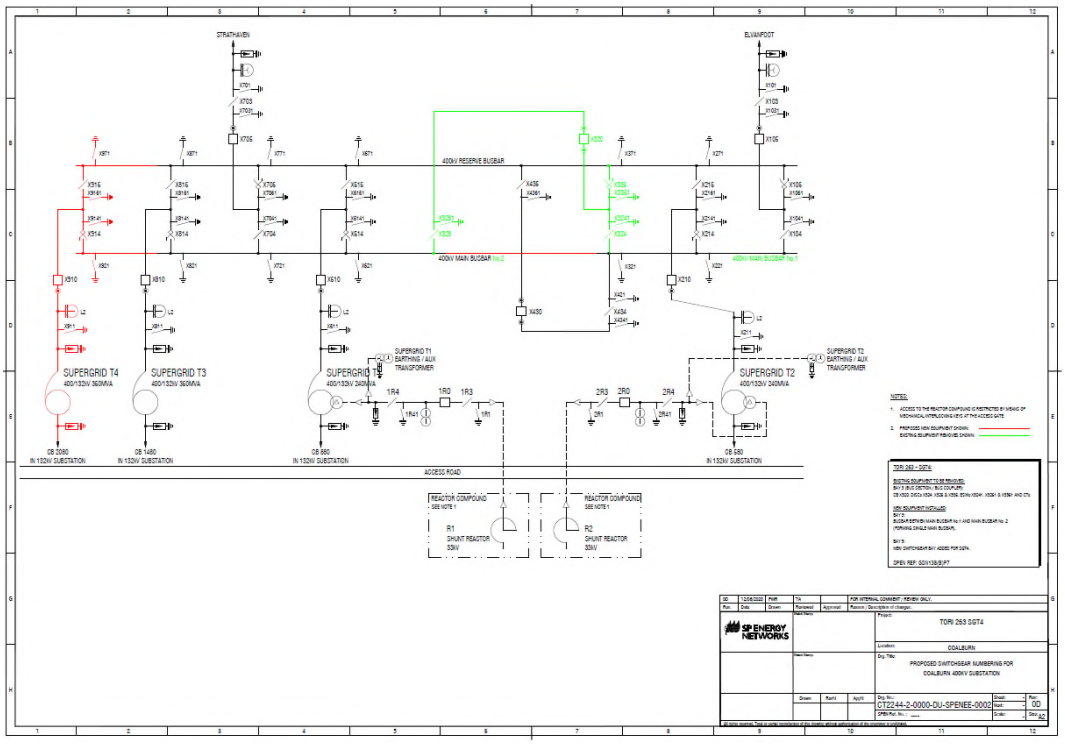

Figure 6 Proposed Configuration – Coalburn 400kV Substation[6]

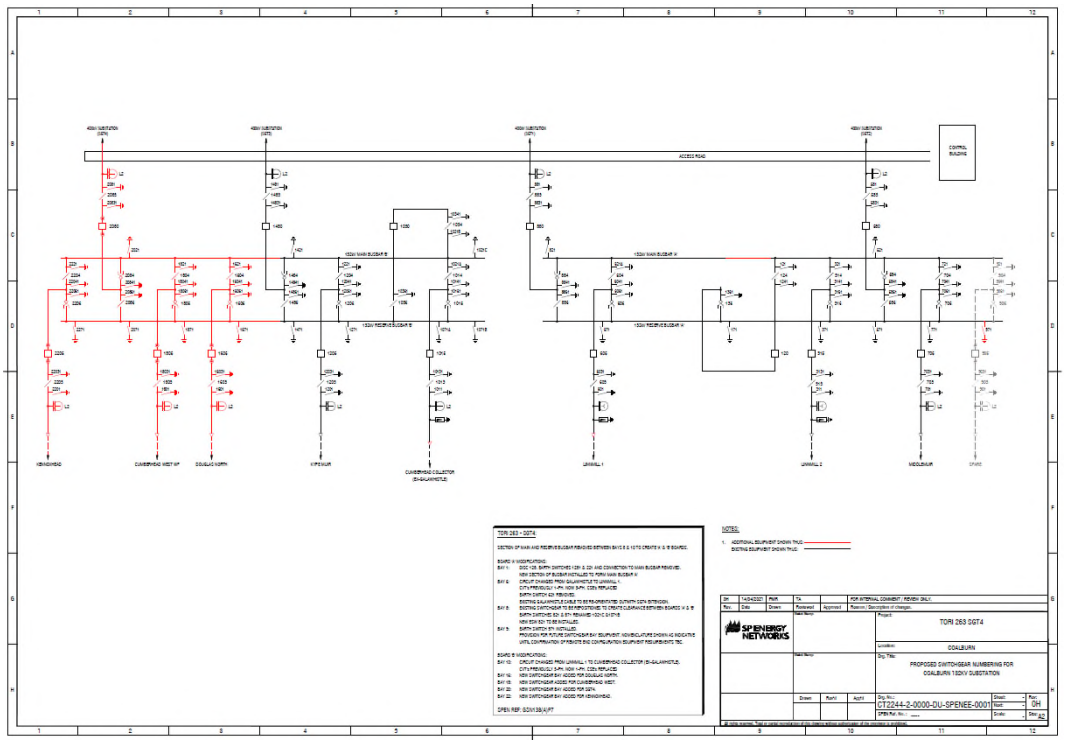

Figure 7 Proposed Configuration – Coalburn 132kV Substation[7]

[6] The second 33kV 60MVAr shunt reactor at Coalburn, R2, is a RIIO-T2 baseline project and is unrelated to the reinforcement works proposed.

[7] While indicated in red Figure 7 above, the installation of the three wind farm feeder bays does not form part of this reinforcement project.

The advantages of this proposal are:

- The new SGT increases the installed inter-bus transformer capacity at Coalburn by 360MVA, to a total of 1200MVA, accommodating all connected and contracted generation at this time i.e. it enables the connection of an additional 274MW of contracted low carbon generation to Coalburn 400/132kV Substation, of which 244MW is already consented, with additional capacity (equivalent to approximately 75MW) remaining for future connections.
- The additional transformer and switchgear arrangement alleviates fault infeed issues and will ensure equipment is not overstressed.
- The installation of a new SGT mitigates the impact of the unavailability of any single transformer (or associated asset) on the Coalburn site, relative to Option 4 above.
- The decommissioning of the 400kV cross coupler releases a 400kV double busbar bay within the existing compound for use as part of a contracted connection, while at the same time simplifying protection and control arrangements presently in place to manage unplanned fault outages.
- It is projected to take shortest amount of time to implement (noting the requirement for only a single new SGT as compared to Option 4 above).

While this option involves an extension to the existing substation compound to locate the new SGT4 and its associated 400kV and 132kV double busbar bays, the need to extend the compound is common to all options given the need to extend the 132kV busbar system to facilitate three new 132kV feeder bays, with this option requiring one additional 132kV bay relative to Option 4.

The need to extend the 400kV compound is also common to all options given the need to facilitate the other (400kV) contracted connections noted in Section 4.4, with this option requiring one additional 400kV bay relative to Option 4.

5.3 Option Assessment

As described in our RIIO-T2 Business Plan Annex 8[8], while most engineering justification papers have a Cost Benefit Analysis (CBA) aligned with the RIIO-T2 CBA model, projects in the following categories do not:

- Live projects rolling over from RIIO-T1, since they have already initiated, with decisions made during the previous price control.
- Customer connection projects, as the proposed approach is based on agreement with the connecting party as they will bear a sizeable proportion of the costs incurred.
- TO Reinforcements associated with new connections, where the options considered are evaluated purely based on the lowest cost solution, which meets the project objectives, as the benefits are all comparable.
- Projects justified through the Network Options Assessment Process as these are subject to an extensive and rigorous CBA process by the Electricity System Operator who can consider market options, and different options which may be offered by Transmission Owners.

Projects in the four categories above have an associated document (this MSIP Re-Opener application in respect of the Coalburn SGT4 project) explaining the feasible options and the reasoning behind the selection of the preferred investment option.

[8] Annex 8 - Cost Benefit Analysis Methodology (spenergynetworks.co.uk)

The options relating to the connection of an additional 274MW of contracted renewable generation capacity to Coalburn 132kV Substation are described in Section 5.2 above, while Table 7 below summarises the key benefits and disadvantage of each option, together with an indication of estimated cost.

Table 4: Option Benefits, Drawbacks and Selection Outcome

No.	Option	Estimated Capital Cost[9]	Key Advantage	Key Disadvantage	Option Outcome
1	Do Nothing or Delay	-	None	Failure to comply with statutory duties and licence obligations.	Rejected
2	New 132kV circuit to Kilmarnock South	£35.6m	Provides the necessary additional capacity.	Significant new 132kV circuit (OHL/cable) required (in addition to 400/132kV 360MVA inter-bus transformer and associated 400kV and 132kV switchgear) i.e. significant technical, economic, environmental and programme disadvantages relative to Option 5.	Rejected
3	New 132kV circuit to Strathaven or Elvanfoot	£24.0m (Strathaven) - £27.3m (Elvanfoot)	Provides the necessary additional capacity.	Significant new 132kV circuit (OHL/cable) required (in addition to 400/132kV 360MVA inter-bus transformer and associated 400kV and 132kV switchgear) i.e. significant technical, economic, environmental and programme disadvantages relative to Option 5.	Rejected
4	Replace Existing Coalburn Transformers	£9.9m	Avoids creation of one new 400kV double busbar bay and one new 132kV double busbar bay relative to Option 5.	Fails to deliver the necessary additional capacity and involves the installation of one additional 400/132kV 360MVA transformer relative to Option 5 (by decommissioning two assets commissioned 2009). Fails to mitigate fault level constraints. Additional construction outages required relative to Option 5.	Rejected
5	Install Coalburn SGT4	£15.46m	Provides the necessary additional capacity in line with contracted connection dates in 2024. Releases one 400kV double busbar bay for a contracted connection. Mitigates the impact of the unavailability of any single transformer relative to Option 4.	Requires creation of one new 400kV double busbar bay and one new 132kV double busbar bay relative to Option 4.	Proposed

The addition of a fourth SGT at Coalburn provides the required thermal capacity increase in the most efficient manner. Option 5 is therefore the preferred investment option, delivering the additional transfer capacity required at minimum capital cost.

[9] All values are in 2018/19 prices.

6. Proposed Works

6.1 Project Summary

As discussed above, the most appropriate option to deliver the required capacity upgrade at Coalburn 400/132kV Substation is to install a fourth SGT. Along with installing the additional Supergrid transformer, it is proposed to amend the substation layout so as to balance the incoming load between the new and existing assets and resolve a fault level issue that would arise with the connection of additional generation. The proposed configuration of Coalburn 400/132kV Substation is indicated in Figures 6 and 7 above.

The associated works are summarised in the following sections (a) to (e).

a) Installation of Additional Supergrid Transformer

Figure 8 below indicates the works summarised below on the proposed single line diagram for Coalburn 400/132kV Substation.

Item		Description of Works
1	-	Extend the existing substation fence line to accommodate extensions to the 132kV and 400kV busbar systems, install one new 400/132kV 360MVA SGT, one new 400kV and one new 132kV double busbar transformer bay. Note: The 132kV compound requires to be extended to accommodate the three additional wind farm feeder bays for Kennoxhead, Cumberhead West and Douglas North (the existing Douglas North bay will be dedicated to the Middlemuir and Kennoxhead Extension Wind Farm connections as a consequence of the connection of Hagshaw Hill Repower Phase 2 and Douglas West Extension). These works do not form part of SPT-RI-263.
2	-	Split existing 132kV main and reserve busbars to create two separate 132kV busbar systems.
3	-	Realign the SGT1 132kV bay.
4	-	Realign the Galawhistle Wind Farm and Linnmill No.1 cable systems.
5	-	Install a section of 132kV Main Busbar (adjacent to Bus Coupler CB120) to establish a double busbar configuration.
6	-	Decommission the existing 400kV cross coupler.
7	-	Install a section of 400kV Main Busbar adjacent to the bus coupler.

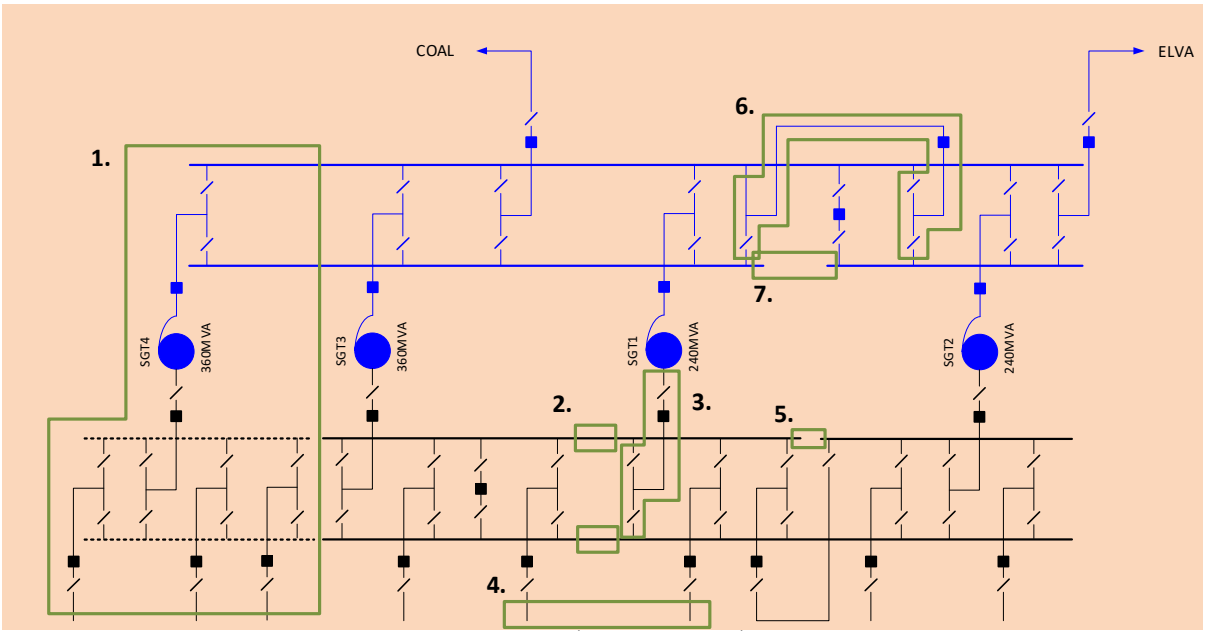

Figure 8 - Summary of Works Required Under SPT-RI-263

Note: While the three 132kV feeder bays shown connected to the dotted section of 132kV busbar above (in Item 1 above) do not form part of SPT-RI-263, their delivery will be fully co-ordinated with the delivery of SPT-RI-263.

In accordance with the SPEN RIIO-T2 sustainability strategy, SPEN is committed to the development and adoption of SF_6 free technologies. In line with this, SF_6 free AIS will be employed at 132kV.

b) Substation Layout Changes

The layout at Coalburn Substation will be changed to create two 132kV busbar systems, 'Busbar System A' and 'Busbar System B'.

It is proposed that Busbar System A will connect SGT1 and SGT2, with a non-firm thermal capacity of 480MVA and will serve Linnmill GSP, whilst Busbar System B will connect SGT3 and SGT4, with a non-firm thermal capacity of 720MVA.[10]

c) Protection & Control Works

Protection and control works are required on both the 400kV and 132kV busbar systems to allow for the two 132kV boards to be implemented. The modifications will include, but are not limited to:

- Reconfiguration of the 400kV and 132kV busbar protection systems.
- The existing transformer overload protection scheme which monitors the firm and non-firm generation across SGT1, SGT2 and SGT3 will be repurposed to monitor the firm and non-firm connections on 'Busbar System A'.
- A new overload protection scheme will be installed on the B board to monitor the firm and non-firm generation on 'Busbar System B'.

[10] It is noteworthy that this remains subject to engagement with the manufacturer of SGT4 regarding impedance specification, so as to ensure the parallel operation of SGT3 and SGT4 does not lead to fault infeed limits being exceeded. Should this not prove possible, an alternative arrangement which delivers a non-firm capacity of 600MVA per busbar system will be considered.

d) Environmental and Consent Works

The following will be required:

- Planning consent from South Lanarkshire Council for the extension of the existing Coalburn Substation compound. The extension sits out with SPEN's existing operational land area therefore Permitted Development Rights do not apply. Draft planning consent conditions have been received, and Planning Consent is currently expected February 2022.
- Relevant landowner agreements to extend the existing compound.
- Construction of a new oil containment scheme for SGT4 based on the current standards and pollution prevention guidelines.
- Ecological, hydrological and archaeological surveys have been carried out for the scope of works and the findings will inform the final detailed design and construction stages.

e) Pre-Engineering Works

The following surveys have been completed:

- Topographical survey of the site;
- Hydrology study – Assess the impact of the extension on the Site of Special Scientific Interest (SSSI) adjacent to Coalburn;
- Noise survey;
- GPR survey of areas to be excavated;
- Geo-environmental Investigation to identify the relevant geotechnical parameters to facilitate the civil engineering design works and to identify any contaminated ground present;
- Earthing Study; and
- Environmental Study.

A transportation study with a swept path analysis shall be undertaken to assess the impact on external and internal infrastructure. SPEN experienced engineering challenges when the 240MVA and 360MVA transformers were installed at Coalburn. In particular, it has still to be confirmed that items such as bridge and road ratings have not changed. The analysis shall detail any changes since the previous survey to facilitate the transportation and installation of the additional transformer.

f) Civil Engineering Works

The primary civil engineering works comprise:

- Substation platform extension and platform embankment development - the existing Coalburn 400/132kV substation platform will be extended to the west.
- The associated site drainage design will take into consideration the impact of the works on the Site of Special Scientific Interest located to the south of Coalburn 400/132kV Substation, ensuring that the runoff water supply is adequately maintained.
- Extension of the compound internal access road.
- The design and construction of new foundations and structures necessary to support the new equipment within the existing substation compound.
- Enabling works to achieve the above e.g. works to facilitate temporary and/or enduring accesses for construction, operation and maintenance purposes.

6.2 Benefits of the Proposed Works

The primary benefit of this proposal is that it allows the connection of an additional 274MW of contracted low carbon generation to Coalburn 400/132kV Substation, of which 244MW is already consented, with additional capacity (equivalent to approximately 75MW) remaining for future connections.

There are no relevant drawbacks associated this package of works.

7. Project Cost Estimate

As agreed with Ofgem, a further submission will be made at the right time relating to the associated amendments to the outputs, delivery date and allowances to be detailed in LSpC 3.14 Appendix 1. The detail in this section is therefore indicative pending that further submission.

7.1 Estimated Total Project Cost

Aligned with the format of the Re-Opener Pipeline Log, Table 8 details expected energisation year and our current view of potential direct capital expenditure in RIIO-T2.

Table 8: Estimated Incidence of Expenditure

	Potential direct capex value per year, £m, 18/19 price base									
Energisation Year	Pre-RIIO-T2: direct capex	Yr 21/22: direct capex	Yr 22/23: direct capex	Yr 23/24: direct capex	Yr 24/25: direct capex	Yr 25/26: direct capex	Yr 26/27 (T3): direct capex	Yr 27/28 (T3): direct capex	RIIO-T2 Total: direct capex	Total: direct capex
2023/24	0.771	3.147	7.187	3.824	0.535	0	0	0		15.464

7.2 Potential Volume Driver Allowance

Applying the RIIO-T2 Generation Connections VDUM to this project results in a £6.39m allowance provided by the VDUM. The allowance is calculated as per Table 9 below. Please note that this excludes the further allowance permitted under Licence Special Condition 3.36 Opex escalator to provide a better comparison to direct expenditure.

Table 9.1: Volume Driver Allowance

Volume Driver (*2018/19 price base*)		£m/unit	Unit	Volume Driver Allowance (£m)
Project	Fixed Cost	1.700	1.00	1.700
Shared Use	General Substation Works, MVA	0.010	360	3.600
	Cable <1km	1.820	0.6	1.092
Total				**6.392**

Table 9.2: Comparison of Volume Driver Allowance and Estimated Cost

	Potential direct capex value per year, £m, 18/19 price base									
Description	Pre-RIIO-T2: direct capex	Yr 21/22: direct capex	Yr 22/23: direct capex	Yr 23/24: direct capex	Yr 24/25: direct capex	Yr 25/26: direct capex	Yr 26/27 (T3): direct capex	Yr 27/28 (T3): direct capex	RIIO-T2 Total: direct capex	Total: direct capex
Allowance	0	2.131	2.131	2.130	0	0	0	0	6.392	6.392
Cost	0.771	3.147	7.187	3.824	0.535	0	0	0	14.693	15.464
Variance	-0.771	-1.016	-5.056	-1.693	-0.535	0	0	0	-8.301	-9.072

The potential VDUM allowance for the project is lower than the estimated cost by £9.07m. This is more than £4.24m, which is the threshold set in LSpC 3.14.6(a) for consideration under this uncertainty mechanism.

7.3 Regulatory Outputs

The indicative regulatory outputs for the project, including primary assets outputs, are identified in Tables 10 and 11 below:

Table 10: Primary Load Output

Primary Load Output Type	Economic Regulatory Unit
Generation Connection, MVA	360

Table 11: Regulatory Outputs Table (Volumes)

Asset Category	Asset Sub-Category Primary	Voltage	Forecast Additions	Forecast Disposals
Circuit Breaker	CB (Air Insulated Busbar)	132kV	1	
Circuit Breaker	CB (Air Insulated Busbar)	400kV	1	1
Other switchgear	Disconnector (AIB)	132kV	3	
Other switchgear	Disconnector (AIB)	400kV	2	3
Other switchgear	Earth Switch (AIB)	132kV	6	
Other switchgear	Earth Switch (AIB)	400kV	5	3
Wound Plant	Transformer	400kV<500MVA	1	
Instrument Transformers	Voltage Transformer (VT)	132kV	1	
Instrument Transformers	Voltage Transformer (VT)	400kV	1	
Instrument Transformers	Current Transformer (CT)	132kV	2	
Instrument Transformers	Current Transformer (CT)	400kV	1	2
Cable	Substation Cable - 1 core per phase	132kV	0.6	

7.4 Alignment with Other Projects

The Coalburn SGT4 project is one of several projects at Coalburn 400/132kV Substation during the RIIO-T2 period. Other project works include:

- Coalburn Shunt Reactor R2 (installation of a 33kV 60Mvar shunt reactor); and
- Various new connection projects, as summarised in Section 4.

The works for Coalburn SGT4 will be co-ordinated with these other projects.

The capital expenditure estimate in Section 7.1 is incremental to the projects detailed above and is related to the installation of Coalburn SGT4.

8. Project Delivery

We have applied our 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 this project. We have assigned a dedicated Project Manager to this project who will be responsible for overall delivery of the scope and is the primary point of contact for all stakeholders.

8.1 Delivery Schedule

A standard approach has been applied to the planning phase of this project and that will continue for the reporting and the application of processes and controls throughout the project lifecycle. Table 12 summarises the key project milestones within the delivery schedule.

Table 12: Key Project Milestone

Milestone	Project Phase	Estimated Completion Date
1	ITT Main Platform Enabling Works	June 2021
2	IP3 Stage 2	October 2021
3	Award Main Platform Works	January 2022
4	Consents Obtained	February 2022
5	Commence Main Site works	April 2022
6	Complete Site works	March 2024

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.

8.2 Project Risk and Mitigation

A Project Risk Register was generated collaboratively during the project kick-off meeting to identify any risks, which if realised, could result in deviation from the project 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 project risks are:

[redacted]

8.3 Quality Management

SPT Projects shall 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 shall be visual, with the person undertaking the inspection ensuring that evidence of the inspection and any actions raised are documented.

The following inspections shall be completed:

- Quality Inspections (monthly)
- Environmental Inspections (monthly, with weekly review by third party Environmental Clark 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.

8.4 Stakeholder Engagement

SPT is committed to delivering optimal solutions in all of 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 particular sensitivities that may require increased stakeholder consultation and details specific events that will be held with stakeholders during the course of the project.

As part of this project, SPT has engaged with statutory consultees associated with the planning application for these works - the Local Authority, SEPA and NatureScot - and the third-party landowner Forestry Land Scotland. We have also engaged with the other stakeholders, including community councils and local residents.

Due to the location and nature of this project, no particular sensitivities or community impact issues have been identified, but a general level of interest from local representatives has been noted and we will continue to engage with them throughout the project.

Stakeholder engagement to date has informed the details of the construction and permanent drainage details for the works.

9. Conclusion and Recommendations

This MSIP Re-opener application demonstrates the need to carry out infrastructure work at Coalburn 400/132kV Substation, within the RIIO-T2 period (April 2021 – March 2026), to enable the timely and efficient connection of 274MW of contracted onshore wind generation.

The main conclusions of this submission are:

- The timely connection of low carbon generation, such as onshore wind, will play a vital role in reaching legislated net zero targets, and is aligned with SPT's RIIO-T2 strategic goals.

- It is necessary to invest in transmission infrastructure at Coalburn 400/132kV Substation to facilitate the connection of 274MW of contracted onshore wind generation, this having been identified as the most economic and efficient option.

- Applying the RIIO-T2 Generation Connections VDUM to this project results in the £15.46m estimated cost being £9.07m higher than the £6.39m allowance provided by the VDUM. An MSIP Re-opener application is therefore required. Submission of this MSIP Re-opener application is aligned with the contracted connection programme.

We, respectfully, request Ofgem's agreement to the following:

- The option being progressed addresses a clear customer need and represents value to UK consumers, therefore, the project should proceed based on the preferred solution (Option 5).

- Efficient expenditure is fully funded, as necessary to maintain programme timelines and mitigate project delivery risk e.g. order long-lead equipment, prior to the second stage submission and assessment.

10. Appendix - SP Transmission System, Geographic Overview