Scottish & Southern Electricity Networks

SSEN Transmission

RIIO-T2 Business Plan - T2BP-EJP-0029

Redmoss Substation Works Engineering Justification Paper

1 Executive Summary

Our paper, A Risk Based Approach to Asset Management[1] sets out our approach to network risk and how we subsequently identify assets that require intervention to limit the rise of risk over the RIIO-T2 period.

This paper identifies the need for intervention at the 132/33kV Redmoss substation in Aberdeen driven by asset condition as detailed in the associated Asset Condition Report.

Following a process of optioneering and detailed analysis, as set out in this paper, the scheme benefits which will be delivered are:

- Address oil leaks on GT1 and GT2 main tanks and tap changers.
- Mitigation of Operational Restriction on the tap changers of GT1 and GT2.
- Grid transformer bunds to be made compliant.
- Replacement of earthing transformers and NERs associated with GT1 and GT2.
- Refurbishment of 132kV switchgear mech boxes and replacement of the mechanism of disconnector 403.

This scheme will cost £0.5m and will deliver the following outputs and benefits during the RIIO T2 period:

- A long term monetised risk benefit of -R£20.1m, see Section 5 for details.
- A reduction of total network risk calculated as R£3.3m.

The Redmoss works are not flagged as eligible for early or late competition due to the cost being under Ofgem's £50m and £100m thresholds respectively.

[1] A Risk Based Approach to Asset Management

Name of Scheme/Programme	Redmoss 132kV substation works
Primary Investment Driver	Asset Health (Non-Load)
Scheme reference/ mechanism or category	SHNLT2024
Output references/type	NLRT2SH2024
Cost	£0.5m
Delivery Year	Within the RIIO-T2 period
Reporting Table	C0.7 Non-Load Master Data
Outputs included in RIIO-T1 Business Plan	No

2 Introduction

This Engineering Justification Paper sets out our plans to undertake condition-related work during the RIIO-T2 period (April 2021 to March 2026). The planned work is at Redmoss substation as shown in Figure 1 below.

The Engineering Justification Paper is structured as follows:

Section 3: Need

This section provides an explanation of the need for the planned works. It provides evidence of the primary and, where applicable, secondary drivers for undertaking the planned works. Where appropriate it provides background information and/or process outputs that generate or support the need.

Section 4: Optioneering

This section presents all the options considered to address the need that is described in Section 3. Each option considered here is either discounted at this Optioneering stage with supporting reasoning provided or is taken forward for detailed analysis in Section 5.

Section 5: Detailed Analysis

This section considers in more detail each of the options taken forward from the Optioneering section. Where appropriate the results of Cost Benefit Analysis are discussed and together with supporting objective and engineering judgement contribute toward the identification of a selected option. The section continues by setting out the costs for the selected option.

Section 6: Conclusion

This section provides summary detail of the selected option. It sets out the scope and outputs, costs and timing of investment and where applicable other key supporting information.

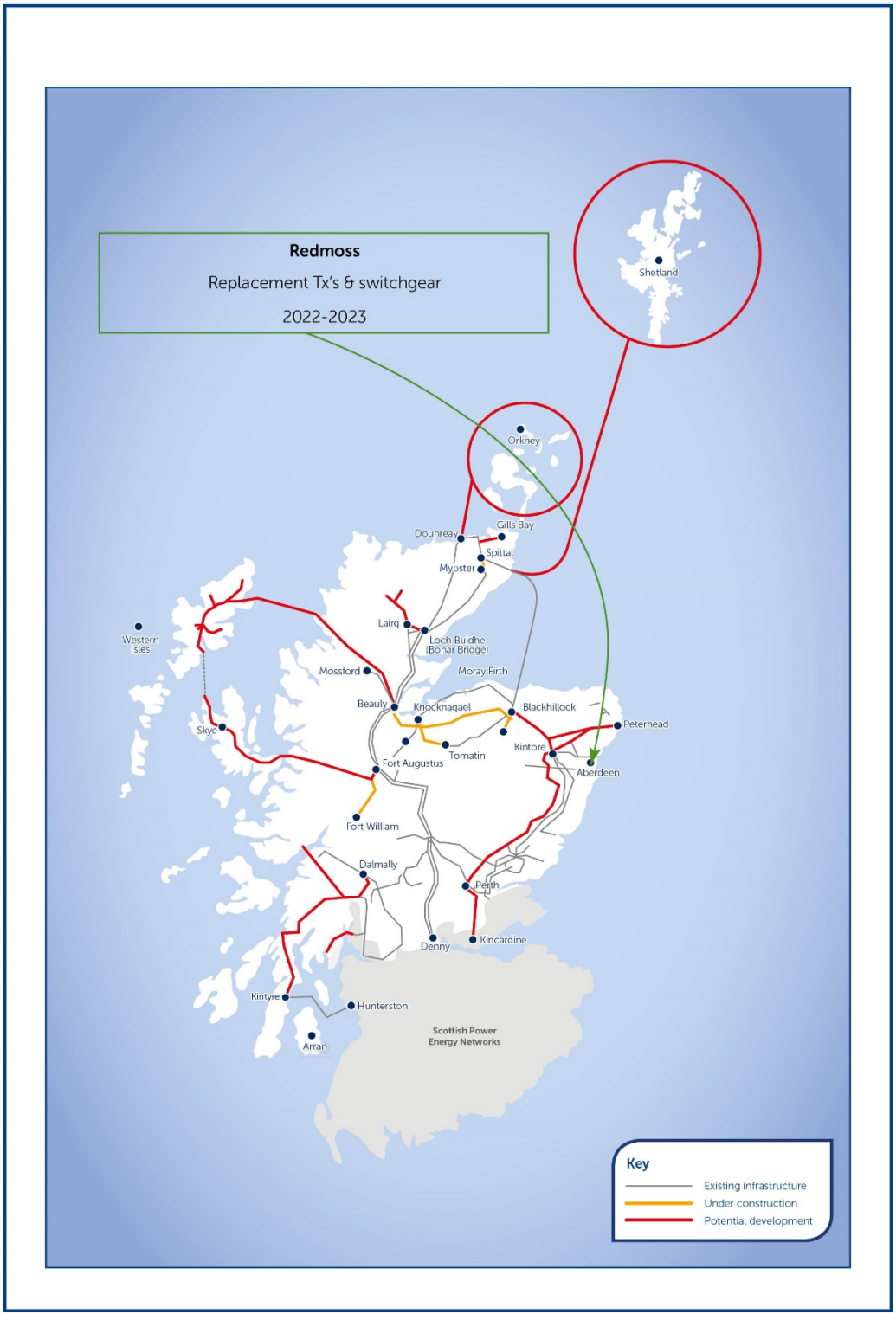
Section 7: Price Control Deliverables and Ring Fencing

This section provides a view of whether the proposed scheme should be ring-fenced or subject to other funding mechanisms.

Section 8: Outputs included in RIIO-T1 Business Plan

This section identifies if some or all the outputs were included in the RIIO-T1 Business Plan and provides explanation and justification as to why such outputs are planned to be undertaken in the RIIO-T2 period.

Figure 1: Geographic position of Redmoss 132/33kV substation.



3 Need

3.1 Background

Redmoss substation, constructed in 1973, is situated approximately 3.5km south of Aberdeen city centre. It sits on the twin circuit 132kV Aberdeen ring as shown in Figure 1 and Appendix A. The substation comprises two 2 x 60MVA 132/33kV grid transformers (GT1 and GT2) teed off the 132kV ring and connecting to a 33kV switchboard owned by SHEPD. The single line diagram for the substation is shown in Appendix B.

SHEPD recently replaced its 33kV switchboard which as well as feeding local distribution circuits is also the point of connection for the [redacted] offshore windfarm.

3.2 Asset Need

The Asset Condition Report[2] (ACR) details site inspections, data gathered from testing and analysis, and subsequent desktop assessment. The ACR describes in detail the condition of existing assets and makes recommendations for intervention in the RIIO-T2 period, as well as further investigations in the immediate short term.

The summary conclusions from the ACR are as follows:

- The internal condition of GT1 and GT2 appears satisfactory. Oil leaks and civils deficiencies (bunding arrangements) will require to be addressed.
- 132kV switchgear is obsolete, installed in an unconventional arrangement, and beyond its design life. Disconnector 403 is without telecontrol and is the subject of an OCLR (Operational Capability Limit Record) due to very stiff operation. Past intervention has been unsuccessful and replacement of the mechanism is required to rectify.

3.3 Growth Need

No growth needs have been identified for this substation.

[2] Redmoss Substation Asset Condition Report T2BP-ACR-0014

4 Optioneering

This section presents all the options considered to address the need that is described in Section 3. Each option considered here is either discounted at this Optioneering stage with supporting reasoning provided or is taken forward for detailed analysis in Section 5.

The poor asset health is the driver for intervention at Redmoss.

The asset condition, as detailed in the Asset Condition Report, means that further deferral of the asset replacement works is not viable and intervention in the RIIO-T2 period is required.

Do Nothing Option

The do nothing option does not undertake any intervention on the transformers. This option has been discounted at this stage as the network asset risk and asset condition assessments have concluded a need to intervene and replace the assets.

NOT PROGRESSED TO DETAILED ANALYSIS

Option 1

The necessary refurbishment works recommended by the Redmoss Asset Condition Report to be undertaken in T2 are summarised below:

i. GT1 and GT2: address oil leaks on both the main tank and tap changer.

ii. Mitigate the operational restriction on the tap changers of GT1 and GT2.

iii. Grid transformer bunds to be made compliant.

iv. Replace earthing transformers and NERs associated with GT1 and GT2.

v. Refurbish 132kV switchgear mech boxes to address corrosion.

vi. Replace the mechanism of 132kV disconnector 403.

PROGRESSED TO DETAILED ANALYSIS

5 Detailed Analysis

This section considers in more detail each of the options taken forward from the Optioneering section. Where appropriate the results of Cost Benefit Analysis are discussed and together with supporting objective and engineering judgement contribute toward the identification of a selected option. The section continues by setting out the costs for the selected option.

5.1 Cost Benefit Analysis

Only one technically acceptable solution has been identified during optioneering, therefore no Cost Benefit Analysis has been undertaken.

5.2 Project Sensitivity

As outlined in our core RIIO-T2 business plan document, "A Network for Net Zero", we believe we have a critical role to play in delivering Net Zero ambitions in both the UK and Scotland. Therefore our plan has been carefully designed with the flexibility to deliver pathways to Net Zero. Our policy paper "A Risk-Based Approach to Asset Management" outlines our approach to monitoring and assessing the condition of our assets to maintain the reliable and resilient network that is expected by our stakeholders. Where asset condition deteriorates, we undertake a programme of cost-effective, risk-based interventions to maintain the longevity and performance of the transmission network. Each of our non-load related projects for T2 is underpinned by Asset Condition Reports which clearly outline that the works are necessary and driven by reliability.

Table 3: Sensitivity Analysis table

Sensitivity	Test and impact observed – switching inputs
Asset Performance / deterioration rates	Switching deterioration assumption: The asset performance / deterioration rates can only improve or deteriorate. As the need for this project is driven by an asset condition report (as outlined in Section 3), the asset condition will not improve in the intervening period. The second option is for the asset performance to deteriorate and therefore the need remains, and the project would be considered for advancement within available outages.
Ongoing efficiency assumptions	Switching efficiency assumption (increased or decreased) would have no impact on (feasible) option selection. Only one option was taken forward to detailed analysis and there is therefore no impact on the preferred solution.
Demand variations	No significant variation in demand forecast.

Energy scenarios	As this is a non-load project and the need is driven by the asset condition, the work would be required regardless of any changes to the energy scenarios.
Asset utilisation	Our policy paper "A Risk-Based Approach to Asset Management" outlines our approach to monitoring and assessing the condition of our assets to maintain the reliable and resilient network that is expected by our stakeholders. Where asset condition deteriorates, we undertake a programme of cost-effective, risk-based interventions to maintain the longevity and performance of the transmission network. Each of our non-load related projects for T2 is underpinned by Asset Condition Reports which clearly outline that the works are necessary and driven for reliability.
Timing / delivery	Where applicable, we have considered timing of investments as part of our CBAs.
Consenting / stakeholders	Where applicable we have considered consenting and stakeholder engagement as part of section 5 (Detailed Analysis) and the impact which this has had on the selection of the preferred solution.
Public policy / Government legislation	We have considered the impact of public policy, government legislation and regulations as part of the need (section 3), optioneering (section 4) and detailed analysis (section 5) and the impacts this has on the selection of the preferred solution. For example the projects have considered the impact of the UK Governments' Net Zero emission by 2050 target, SQSS and ESQCR.

5.3 Proposed Solution

The scope of the selected solution is to implement the recommendations of the Asset Condition Report summarised above in Section 4.

This involves refurbishment of GT1 and 2 and associated equipment and bunds to address the condition defects, refurbishment of the 132kV switchgear and replacement of disconnector 403 mechanism.

5.4 Competition

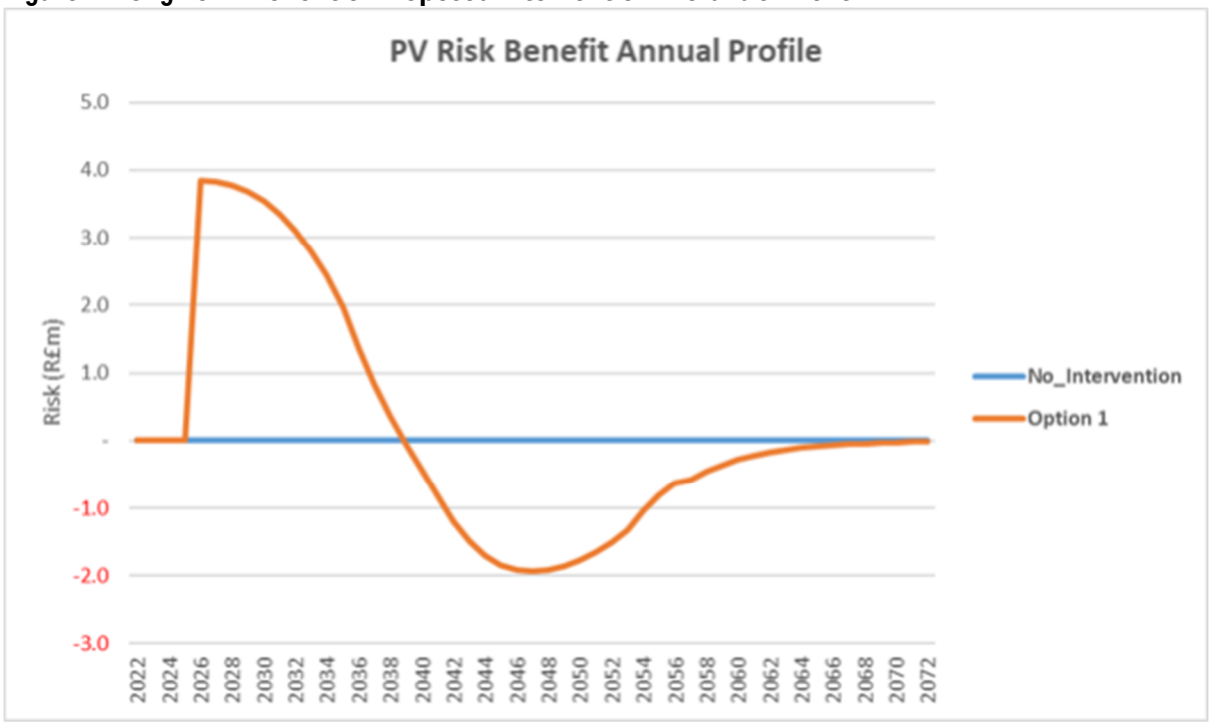
The Redmoss works are not flagged as eligible for early or late competition due to the cost being under Ofgem's £50m and £100m thresholds respectively.

5.5 Risk Benefit

A Risk Benefit Analysis has been carried out in order to compare "no intervention" against the selected "with intervention" option. Please not that while monetised risk is denoted as a financial figure, it is important to note that it is not "real" money and does not correspond to the cost that SHE Transmission would incur if an asset was to fail and these values are thus identified with R£ prefix (for more details please refer to A Risk Based Approach to Asset Management1).

The long-term monetised risk benefit which would be realised through the completion of this project is -R£20.1m. As this project is for refurbishment only, the life extension of the asset is anticipated to be 5 to 10 years. Therefore, the long term benefit calculation over 50 years becomes negative as it assumes no further intervention in future years. The long-term benefit is derived by consideration of the risk of the asset experiencing a catastrophic failure weighted by the probability that the asset will survive for the Options and "no intervention" scenarios. The long-term benefit is an aggregation of the risk of all assets being considered within the option. The risk of each Option is then compared with the "no intervention" scenario. The "no intervention" scenario assumes that when the asset experiences a catastrophic failure the asset is replaced.

Figure 2: Long Term Benefit of Proposed Intervention - refurbishment



In addition to assessing the long-term risk benefit, a monetised risk benefit has also been determined. The monetised risk benefit which would be realised through the completion of this project is R£3.3m.

5.6 Cost estimate

The cost of the preferred option for works at Redmoss has been developed using rates from existing substation framework contracts and benchmarks from delivered RIIO-T1 projects. The total cost for delivering the scope of works for the proposed solution is £0.5m.

6 Conclusion

This paper identifies the need for intervention at Redmoss 132/33kV substation. The primary driver for the scheme is the condition of the substation assets.

The proposed works are to be undertaken in the RIIO-T2 period at a cost of £0.5m and deliver the following benefits:

i. GT1 and GT2: address oil leaks on both the main tank and tap changer.

ii. Mitigate Operational Restriction on the tap changer of GT1 and GT2.

iii. Grid transformer bunds to be made compliant.

iv. Replace earthing transformers and NERs associated with GT1 and GT2.

v. Refurbish 132kV switchgear mech boxes to address corrosion.

vi. Replace the mechanism of 132kV disconnector 403.

This scheme will cost £0.5m and will deliver the following outputs and benefits during the RIIO T2 period:

- A long term monetised risk benefit of -R£20.1m, see section 5 for details,
- A reduction of total network risk calculated as R£3.3m,

The Redmoss works are not flagged as eligible for early or late competition due to the cost being under Ofgem's £50m and £100m thresholds respectively.

7 Price control deliverables and ring-fencing

As set out in our Regulatory Framework paper (section 1.12 and Appendix 3) we support a key principle from Citizens Advice – one that guarantees delivery of outcomes equivalent to the funding received - to ensure that RIIO-T2 really delivers for consumers.

For our core non-load projects this means that we commit to delivering our over-arching NARMs target. If we do not deliver the NARMS target, or a materially equivalent target, then we should be subject to a penalty. Equally, if we over-deliver against our target and are able to justify that the over-delivery is in the consumers' interests and could not have been reasonably factored into our business plan at the time of target setting then we should be made cost neutral for this work.

Core non load projects should not be ring fenced. This is to allow for substitution of projects in order to meet that NARMs target. We need flexibility to respond to up to date asset data information or external influences on our network during the price control; this information might drive us to substitute one project for another in order to ensure a reliable and resilient network. Ring fencing projects may result in sub-optimal decisions, having adverse consequences for the health of our network, which will ultimately be reflected in the NARMs target.

8 Outputs included in RIIO-T1 Plans

There are no outputs associated with this scheme included in the RIIO-T1 plans.

Appendix A: Aberdeen 132kV ring network

CONTENT DELETED

Appendix B: Existing Redmoss substation - Single Line Diagram