Scottish & Southern Electricity Networks

SSEN Transmission

RIIO-T2 Business Plan T2BP-EJP-0040 Rev1

Quoich Tee 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 on the 132kV switchgear at Quoich Tee switching station. The primary driver for the scheme is the asset condition and performance with a secondary driver of network resilience.

Following a process of optioneering and detailed analysis, as set out in this paper, the proposed scope of works is as follows:

- Construction of a new switching station near the existing tee off
- The installation of circuit breakers and replacement of the existing 132kV switchgear
- The replacement of the existing LVAC, battery, and site diesel generation with a blackstart resilient system;
- The diversion of existing overhead lines to the new switching station location designed with vehicular access

This scheme will cost £[redacted] and deliver the following outputs and benefits during the RIIO T2 period:

- A long-term monetised risk benefit [redacted]; see Section 5 for details
- A reduction of total network risk calculated at -R[redacted] see Section 5 for details
- The improved condition of non-lead assets
- Improved customer security of supply and resilience in line with our goal to aim for 100% transmission network reliability for homes and businesses.

[1] A Risk Based Approach to Asset Management

The Quoich Tee scheme is not flagged as eligible for early or late competition due to it being under Ofgem's £50m and £100m thresholds respectively.

This paper has been revised in response to the Draft Determination of the business plan submitted in 2019. The Draft Determination concluded that the condition of the Quoich Tee 132kV switchgear did not warrant its replacement. The Asset Condition Report shows that the visual condition is satisfactory, however it also points to the numerous interventions that have already been carried out on this plant. Since refurbishment and maintenance programmes have already been carried out on the disconnector mechanisms to address their operability, replacement is the only next available option. This paper discusses the replacement options and concludes that the best option is still complete replacement of the substation as proposed in the original issue of the business plan.

Name of Scheme/Programme	Quoich Tee Substation Works
Primary Investment Driver	Asset Health (Non-Load)
Scheme reference/ mechanism or category	SHNLT2013
Output references/type	NLRT2SH2023
Cost	[redacted]
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 Quoich Tee switching station the location of which is shown in Figure 1 on the next page.

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.

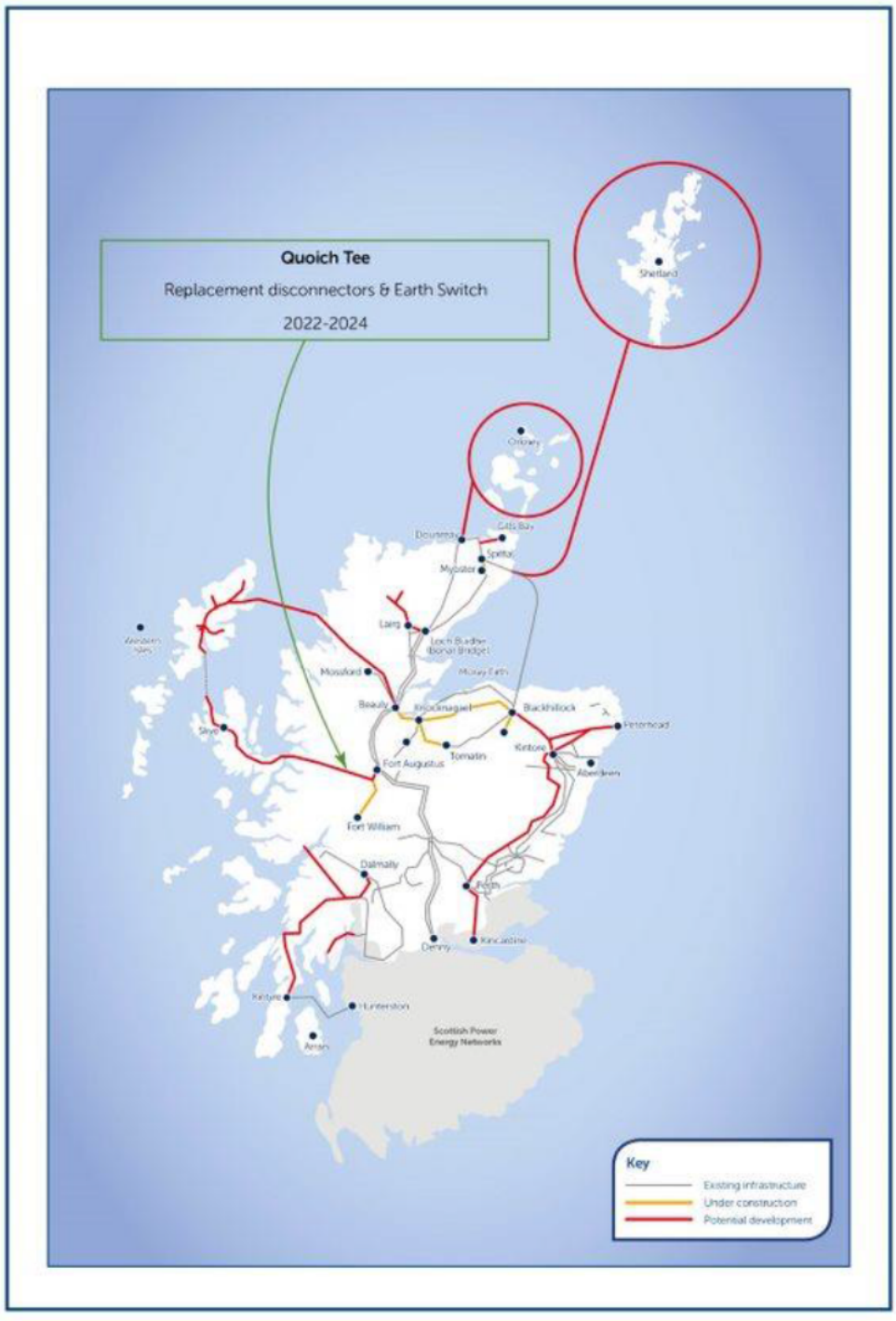


Figure 1 - Geographical Representation

2.1 Post Draft Determination Update

This document has been updated in response to the Draft Determination on the RIIO T2 Business Plan submission. The Draft Determination from Ofgem deemed that SHE Transmission had not demonstrated the need for replacement or refurbishment of the disconnectors, although the justification for the improved network operability was robust.

The Background, Need and Optioneering sections have all been revised to demonstrate that the status quo cannot be maintained. To not intervene at this site would continue to put a significant and costly part of our network at risk of loss of supply. A failure of the 132kV plant could cause an unplanned outage affecting around 20,000 customers, for a number of days, at a cost of circa £120k per day in diesel generation. Any solution to plant failure would be temporary until a satisfactory permanent solution could be delivered.

It is accepted that the visual condition scores, as per the asset condition report, are reasonably good. However, these do not reflect the ongoing issues that our maintenance teams have with the disconnectors at this site. Both disconnectors have had additional refurbishment and maintenance carried out on the mechanisms to ensure that they continue to operate satisfactorily. These interventions have been carried out on multiple occasions and have been unsuccessful. Therefore, intervention by refurbishment to extend the useful life of the switchgear has been exhausted and replacement is the next avenue.

The 132kV switches are obsolete and spares cannot be sourced. The replacement of these units with current standard equivalent items precipitates the upgrade of the ancillary plant and in doing so addresses many of the other drivers. The off-line replacement of the switching station is the only viable solution since the existing site cannot be extended to accommodate the new plant items. The offline design allows us to address the security of supply to Skye and Western Isles and provides a site that is flexible and extendable if future development requires it.

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.

3.1 Background

Quoich Tee switching station, which is situated to the north of Loch Poulary and east of Loch Quoich, is an important site on the 132kV network. An illustration of this part of the network is provided in Appendix A.

Quoich Tee forms one link in the chain of the circuit providing the sole connection between Skye & the Western Isles and the Main Interconnected Transmission System (MITS). At the switching station itself there are two sets of isolators and earth switches to allow the isolation and earthing of the circuits running to Fort Augustus and Broadford (as illustrated in Appendix B). The disconnectors are now at the end of their useful life.

Any significant fault or failure on the Quoich assets would disconnect all customers on the Western Isles circuit, with backup generation on the Skye and the Western Isles being called on to maintain supplies while the issue is resolved. Depending on the failure mechanism this may also impact the export of hydro generation connected at Quoich.

This single radial circuit starts at Fort Augustus Substation and is routed from there to Quoich Tee; is routed off the mainland, along the length of the Isle of Skye and is transformed to 33kV and connected to the Western Isles via a Distribution owned 33kV subsea cable. On the Western Isles it is transformed to 132kV again and runs the length of islands up Stornoway. The circuit is over 270km long. The loss of this circuit and the disconnection of the islands requires that diesel generation provides the backup supply at a cost [redacted]. Additionally, the ability to restore all customer supplies from the power stations in the Western Isles is becoming limited due to load increases, largely in Skye; this means that any network failure may result in extended customer interruptions and the requirement to install mobile diesel generators. These additional costs have not been factored into this paper. The figure below shows the geography of the radial between Fort Augustus and Stornoway. Each substation or switching station in this link is critical to its function.

In RIIO-T1, the Fort Augustus to Stornoway line was on outage for [redacted], with power station costs of £[redacted] The Fort Augustus-Quoich and Quoich-Broadford circuits have been on outage for maintenance or repair for a total [redacted]. At £[redacted] er day in power station costs, this totals [redacted] Note these costs do not include any maintenance or repair costs, but are purely related to the running of the power station.

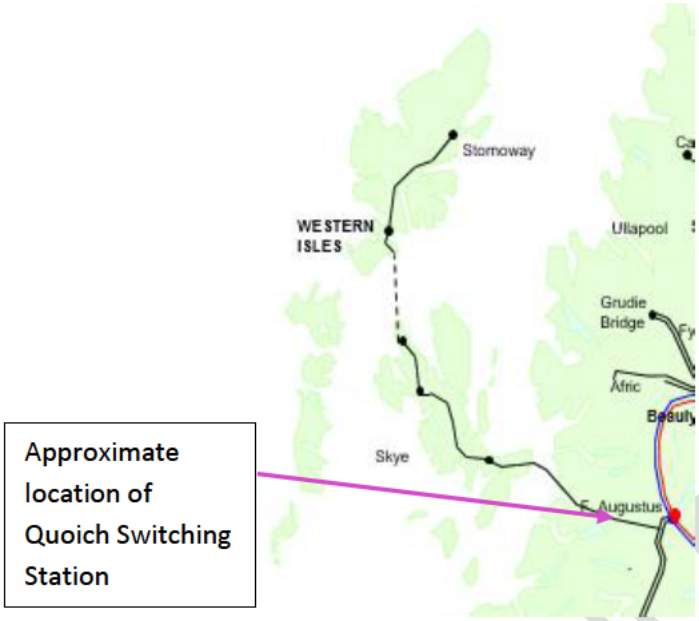


Figure 2 - Location of Quoich Switching Station

At the switching station there are two sets of isolators and earth switches to allow the isolation and earthing of the circuits running to Fort Augustus and Broadford (as illustrated in Appendix B).

3.2 Asset Need

A report containing all the historic condition information gathered on the Quoich Tee assets was compiled. The resulting asset condition report[2] provides, in detail, the condition of existing assets and recommendations for intervention in the RIIO-T2 period. A summary of the highlighted condition related issues are:

- The two disconnector/earth switches are obsolete with spare parts unavailable, they are exhibiting corrosion and the mechanisms are unreliable;
- PLC line traps exhibit clear weathering and corrosion.

The following photographs taken in late 2018 show the external condition of the plant.

[2] Quoich Tee Substation Works Asset Condition Report T2BP-ACR-0015

The above photograph is of Disconnector and Earth Switch 303/301 and associated line traps; showing the space constraints of the site and the poor condition of the line traps.

The switching plant was manufactured in 1978 and is obsolete. The lack of spare parts for these means the circuit is vulnerable to a failure of these switches. Should they fail to close when returning the circuit to service after an outage this would cause an unplanned outage extension with diesel generation continuing to run. The worst-case solution would be to bar the circuit through, with return visit at a later date to carry out a permanent fix. The existing units are operated using a 48V DC control system, unlike a new equivalent and not in line with current standards; therefore, any permanent solution requires the upgrade of the current LV systems and the installation of a 110V DC supply.

The photographs included above shows the corrosion on the main plant items. Visually they otherwise appear to be in reasonable condition for their age. The ACR however is clear that there have been ongoing issues with the disconnector mechanisms since at least 2005. Interventions have been carried out repeatedly on the mechanism in the RIIO-T1 period to ensure full operability of the disconnectors, this has been unsuccessful. No maintenance or refurbishment of the switchgear will resolve this issue. There are no available spares for the plant and all equipment is obsolete.

The following photographs demonstrate the inadequacies of the site access, the limitations to extension and the unacceptable housing for the protection control and ancillary LV plant.

In addition to the condition and performance related issues outlined above, there are multiple operational limitations at the existing switching station:

- There is no switchgear at Quoich Tee which means the circuit from Fort Augustus to Broadford (via Quoich Tee) is protected using a Distance Protection Scheme as shown in Appendix D. The circuit Tee'd to Quoich Hydro has a shortening effect on the distance protection. This leaves the circuit vulnerable to sustained fault damage if the distance scheme fails to 'see' the fault and the network is reliant on the backup schemes to clear it.

- The lack of switchgear does not allow the isolation of the overhead line running between Quoich Tee Switching Station and Quoich Hydro substation, leaving the circuit vulnerable to a fault on the short section of line connecting the hydro station. A fault between the T point and the hydro station would be cleared by circuit breakers opening at Fort Augustus and Broadford (90km 132kV single circuit OHL), and the connection of the islands to the mainland would be lost. The nature of the geography that the circuit is routed through between Quoich and Broadford means the line is susceptible to transient faults. This lack of sectionalising and fault discrimination means the demand and generation connected at Quoich and the connection to the islands could be taken out of service unnecessarily. The diesel generation impact of this has already been highlighted.

- There is no switchgear or protection that would clear a fault on the overhead line running between Quoich Tee and Broadford. Similar to the scenario above the fault is cleared by opening the breakers at Fort Augustus and Broadford and the demand and generation customers at Quoich are taken off supply.

- The 48V batteries onsite are not compliant since they are located in the control room rather than a dedicated battery room, and the board is at full capacity. There are no 110V batteries which would be needed to comply with current switchgear standards. Therefore, any replacement of the switchgear will require the upgrade of the 48V DC system and the installation of a 110V DC system.

- The LVAC board and standby generator are insufficient to meet blackstart requirements; The site at Quoich is not classed as [redacted], but as with all our sites the extended loss of grid during a blackstart scenario would deplete both battery and any diesel supplies. This would leave the site "dead" with no remote control, metering or ability to operate without attendance to charge batteries and bring up the control systems and primary equipment operating supplies. This leaves the power station, and any demand, unable to take part in the recovery, adding to the already reduced generation capacity across the network. By being ready to receive energising supplies whilst in a fully operational state, the complexity of restoration, time and wasted resources are reduced significantly. A compliant supply system means can close up and reconnect, instead of waiting many days for a

portable generator and staff to be available, and then restarting the systems with the associated risk of failures.

- The site is only accessible on foot (see previous picture), introducing manual handling risks as well as issues with site evacuation and emergency services attendance;
- Site communication for protection, SCADA, and telephony do not meet current standards leaving the site and protection susceptible to mal-operation or a failure to operate correctly when required

Should either of the disconnectors fail, spare parts cannot be sourced. This potential event has a significant and costly impact on the supply of energy to the Western Isles. The most likely failure scenario is a failure to close post planned outage. In this event the only recourse is to bar through the circuit, removing the disconnector, until such times as a larger scheme can be planned and delivered to replace the disconnectors as per the options discussed in Section 4. This failure mode could cost between [redacted] in diesel generation for the temporary works.

The disconnector mechanisms have had additional maintenance regimes carried out on multiple occasions since 2005 to address their operability, however they continue to be unreliable.

3.3 Growth Need

Any works and associated outages at Quoich Tee Switching Station should take into account the need to minimise disconnection of the Skye and Western Isles circuit, and the associated requirement for the use of backup generators situated there.

There are a number of contracted generation connection offers in the north of Skye. Proposed development for this part of the network may require the extension of the Quoich Tee site in the future.

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.

Table 1 - Options Summary

Option	Option Detail	Cost (£m)	Taken forward to Detailed Analysis?
0	Do nothing	N/A	No
1	Refurbishment of Existing Switchgear	N/A	No
2	In-situ rebuild	N/A	No
3	Offline rebuild (including the addition of circuit breakers)	[redacted]	Yes

4.1 Option 0 – Do Nothing

From the needs outlined in Section 3, refurbishment and additional maintenance has not successfully addressed the operational issues on the 132kV switchgear. Therefore, an intervention is required in the RIIO T2 price control period. The option of doing nothing is not acceptable to ensure the long-term operability and security of this part of the network.

NOT PROGRESSED TO DETAILED ANALYSIS

Option 1 – Refurbish existing 132kV switchgear

This option considers refurbishing the existing 132kV switchgear.

As discussed in the sections above, spare parts for these disconnectors are not available and disconnectors using a 48V DC supply are not to current standard.

Additional maintenance and refurbishment has already been unsuccessfully attempted during RIIO T1, and to continue to carry out these works throughout RIIO T2 and expect them to be successful in the longer term is not acceptable.

This refurbishment option does not address any of the secondary drivers: it does not improve flexibility in terms of network isolation and fault clearance; fails to address the poor site access, outdated communications equipment, and insufficient blackstart capability of the LVAC/DC supplies

with the generator insufficient for any autonomous operation ; and does not consider the future development of this part of the network. This option does nothing to ensure the security of supply to Skye and Western Isles and is not progressed any further.

NOT PROGRESSED TO DETAILED ANALYSIS

4.2 Option 2 – In-situ rebuild of existing assets

This option considers the installation of the new equipment within the footprint of the existing substation compound.

This option is for the replacement of the 132kV plant within the existing compound. In situ replacement of the disconnects and earth switches cannot be done whilst achieving current engineering standards for MEWP access, LV supply resilience and appropriate housing of protection control and supply equipment. As discussed previously any new 132kV plant will require a 110V DC supply; which do not already exist at this site.

This option would require an expanded site to accommodate the 132kV plant. Further site expansion would be also be required for new control building to house the new 110V battery system, upgraded 48V battery system as well as the new protection and control systems.

The existing site is bounded by steep slopes and has an access track that is too steep for wheeled vehicles. Delivery of this option requires the site compound to be expanded, and a new access track to be created. The site also needs to be able to be expanded again in the future to accommodate the development of this part of the network. The topography deems this expansion impractical.

Had the civil works been deliverable this in-situ replacement proposal would cost between [redacted] and [redacted] in diesel generation as well as complex and costly Emergency Return To Service (ERTS) provisions.

This option has the following difficulties associated with it:

- It is not possible to achieve current engineering standards within the available area of ground, due to space constraints of the existing compound and the steep slopes that prevents further site expansion;
- Provision of an access track to allow safe access to the site would also be impractical as the surrounding land has too steep a gradient for access by wheeled vehicles.

This option has not been considered any further since the site cannot be extended (in the short and long term) due to the topography and it also does nothing to improve the security of supply to Skye and the Western Isles.

NOT PROGRESSED TO DETAILED ANALYSIS

4.3 Option 3 – Off line rebuild, replacing existing assets and adding 132kV circuit breakers

This option considers building a new site compound in a location relatively near to the existing site to ensure minimal diversion of the three overhead circuits. The new site would contain 132kV circuit breakers on the circuit to Broadford (Skye) and on the tee off circuit to Quoich Hydro; a control building housing protection, control and supply systems; and also allow the improvement of the site communications. An off-line build would allow:

- The outlined needs requirement to be met both from a network resilience as well as a condition perspective:
    - through providing space to build in CBs and associated protection to isolate faults in a way that keeps either the Western Isles main circuit or Quoich substation connected to the MITS;
    - through providing space to install an updated LVAC, battery, and diesel generation system in line with current standards and blackstart requirements;
- Reduction of the operational outage requirements to deliver the solution;
- Space for any future network development.

The preferred location is situated to the west of the existing substation, close to the Quoich – Broadford 132kV tower line.

PROGRESSED TO DETAILED ANALYSIS

4.4 Option summary

A "Do Nothing" option is not acceptable. Of the intervention options considered there is only one that can be successfully delivered.

The disconnectors cannot be refurbished due to lack of spares and any interventions carried out to date have been unsuccessful. To replace the plant on a like for like basis requires the site to be extended to accommodate the additional ancillary plant and to satisfactorily house the protection and control systems. The current site is not extendable. This leaves the only deliverable solution as the construction of a new replacement switching station site. Any new site will be in such a location as to minimise the 132kV overhead line works and be fit for expansion should it be required for future network development.

There are other projects within the Business Plan which interface with the scope of work proposed in this document. These need to be taken into account when reviewing the options and any outages taken at Quoich Tee must be coordinated with the outages for Broadford and Harris to Stornoway works.

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

A Cost Benefit Analysis (CBA) was not carried out due to Option 3 being deemed the only technically acceptable option as discussed in Section 4 above.

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 2: Sensitivity Analysis table

Sensitivity	Test and impact observed – switching inputs
Asset Performance / deterioration rates	Switching deterioration assumption: Improved - need driven by asset condition report and will not improve in intervening period. Deteriorated – Need remains, project would be considered for advancement within available outages.
Ongoing efficiency assumptions	Switching efficiency assumption: increased or decreased. Test would have no impact on (feasible) option selection, both the options move in parallel and have no impact on ordering within CBA.
Demand variations	No significant demand forecast

Energy scenarios	We have considered the potential for a marginal further increase in generation on the wider Skye and Western Isles network and factored that into our analysis.
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	We have considered timing of investments as part of our CBAs.
Consenting / stakeholders	Where applicable we have considered consenting and stakeholder engagement 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, optioneering and detailed analysis and the impacts this has on the selection of the preferred solution.

5.3 Proposed Solution

The scope of the selected solution is to construct a new site to contain the new air insulated substation (AIS) switchboard. A copy of the Single Line Diagram (SLD) is shown in Appendix C. Included in Appendix D is a protection SLD showing the improved fault discrimination and network operation.

Also included within the scope of works at the new switching station is the installation of a new LVAC system, 48V & 110V batteries, battery charger system, as well as a new diesel generator in order to satisfy current design and blackstart standards. The scope also includes the diversion of the three existing overhead lines to this new site. The project will be energised with the RIIO-T2 period. The table below details the outputs.

With the line protections moved to a digital technology (as opposed to reliance on Power Line Carrier) the resilience of the protection telecoms links is enhanced through the removal of single points of failure and allowing access to alternative routes in the event of link failure.

Plant	Size of new plant	Replacement for
132kV AIS switchboard	2x 132kV circuit breakers 6x 132kV disconnectors 5x 132kV earth switches	Existing 132kV AIS switchboard
Site services	48V & 110V batteries and chargers, LVAC, diesel generator	Equivalent systems at the old site
Overhead line diversions	9x 132kV supports & associated conductor 3x 132kV line gantries	Equivalent volume of 132kV supports, associated conductor and 132kV line gantries

Table 2 - Outputs from preferred option

5.4 Competition

The Quoich Tee scheme is not flagged as eligible for early or late competition due the cost of the option 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 note 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 Management[1].

The long-term risk benefit which would be realised through the completion of this project is -£15.6m. This is negative due to a limitation of the long-term risk modelling that it does not consider the improvements in network resilience, and the associated benefit to the critical connected customers, that the addition of the circuit breaker at Quoich Switching Station brings. 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.

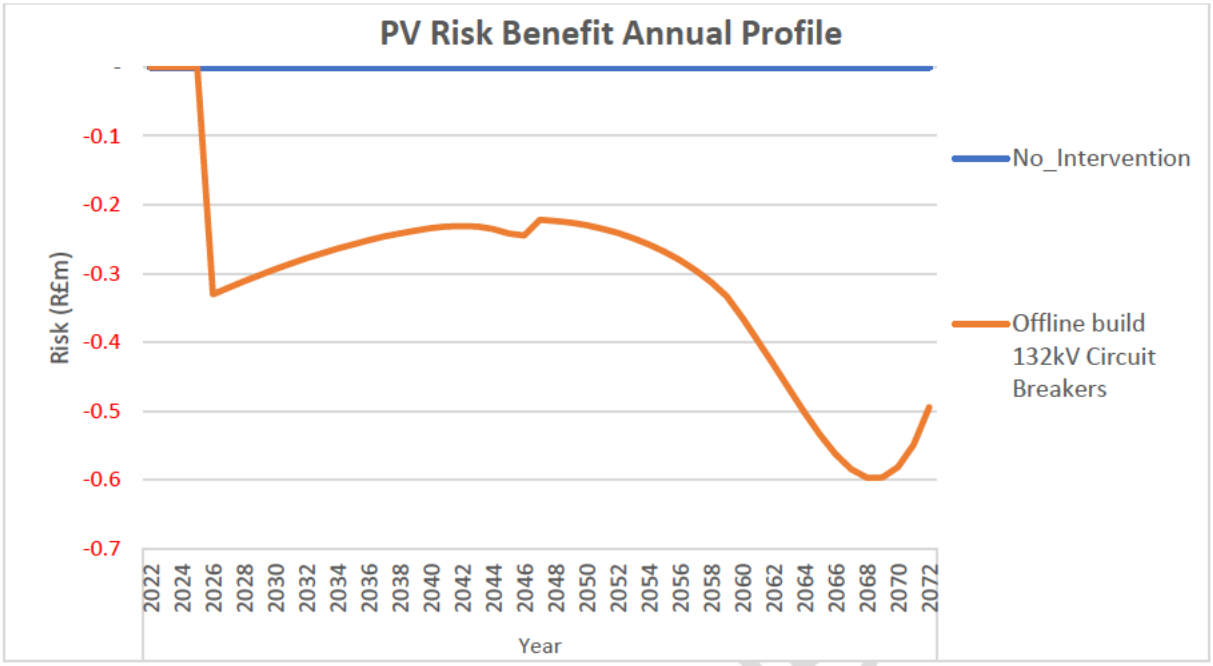


Figure 3 - Long Term Benefit

In addition to assessing the long-term risk benefit, an immediate monetised risk benefit has also been determined. The immediate monetised risk benefit which would be realised through the completion of this project is -[redacted].

The reason for the negative value is that while the issues identified in the needs section are remedied by the solution, there are no lead asset CBs at the original site thus no modelled risk mitigation associated with completing the works. On completion of works there will be two lead asset CBs installed, both of which introduce a network risk via the models for 132kV CBs.

5.6 Innovation & Sustainability

The proposed solution selected takes into account the need for further operational flexibility on the network in order to secure Skye and Western Isles main line in the event of a fault on the Quoich substation circuit (and vice versa). This not only secures customer supplies more robustly but also minimises the list of fault scenarios that would require diesel backup generation on the Western Isles to be used and reduces the associated greenhouse gas emissions associated with this inefficient form of generation. The sustainability of this scheme is also enhanced by the minimal outages the selected option will require again reducing the need for the backup generation. Moving the switching station to another location means that the site can be designed with network development in mind as the requests for the connection of renewable generation continue to increase.

5.7 Carbon Modelling

We are committed to managing resources over the whole asset lifecycle – i.e. including the manufacturing of assets, construction, operations and decommissioning activities – to reduce our greenhouse gas emissions in line with climate science and become a climate resilient business. It is our aspiration that the carbon lifecycle cost of investment options plays a key role within our project development and is considered in the selection of a preferred solution. We have therefore developed an internal carbon pricing model that estimates a carbon cost for each option considered in our CBA through deriving values for:

1. Embodied carbon, which relates to the carbon emissions associated with the manufacturing and production of the materials use in production of the lead assets (transformer, reactors, underground cables and overhead lines. Overhead line is made up of tower/wood pole/composite pole, conductor and fittings) procured and installed as part of the project.

2. The carbon emissions associated with the main stages of the project lifecycle (construction, operations and decommissioning).

It is our vision to embed carbon considerations within our strategic optioneering and project development processes, which will require us to determine a way of flagging high carbon options within our CBA outputs. We will continue to develop our thinking in this space, which will involve our model being validated by a third party, so the results included in this EJP are indicative and subject to change.

In terms of the results of analysis for this project, these are captured in the carbon footprint results table below for the option selected for detailed analysis.

	Project Information	Baseline
Project info	Project Name/number	0
	Construction Start Year	2026
	Construction End Year	2028
Cost estimate £GBP	Embodied carbon	£ 260,861
	Construction	£ 458,433
	Operations	£ 39,206
	Decommissioning	£ 209,883
	Total Project Carbon Cost Estimate	£ 968,384
Carbon footprint tCO2e	Embodied carbon	3,483
	Construction	6,030
	Operations	171
	Decommissioning	603
	Total Project Carbon (tCO2e)	10,288
Project Carbon Footprint by Emission Category	Total Scope 1 (tCO2e)	86
	Total Scope 2 (tCO2e)	85
	Total Scope 3 (tCO2e)	10,116
SF_6 Emissions	Total SF_6 Emissions 3 (tCO2e)	68

5.7. Cost Estimate

The cost of the preferred option for works at Quoich Tee switching stations 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 [redacted]

6 Conclusion

This paper identifies the need for intervention on the 132kV switchgear at Quoich Tee switching station. The primary driver for the scheme is the asset performance and condition with a secondary driver of network resilience.

Three intervention options were identified for this scheme. Of these, one option was taken forward and considered for detailed analysis.

The proposed scope of work selected (Option 3) is:

- Construction of a new switching station near the existing tee off
- The installation of circuit breakers and replacement of the existing 132kV switchgear
- The replacement of the existing LVAC, battery, and site diesel generation with a blackstart resilient system;
- The diversion of existing overhead lines to the new switching station location designed with vehicular access

This scheme will cost £[redacted] deliver the following outputs and benefits during the RIIO T2 period:

- A long-term monetised risk benefit of [redacted]; see Section 5 for details
- A reduction of total network risk calculated at -[redacted]m; see Section 5 for details
- The improved condition of non-lead assets
- Improved customer security of supply and resilience in line with our goal to aim for 100% transmission network reliability for homes and businesses.

The Quoich Tee scheme is not flagged as eligible for early or late competition due to it 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 deliver for consumers.

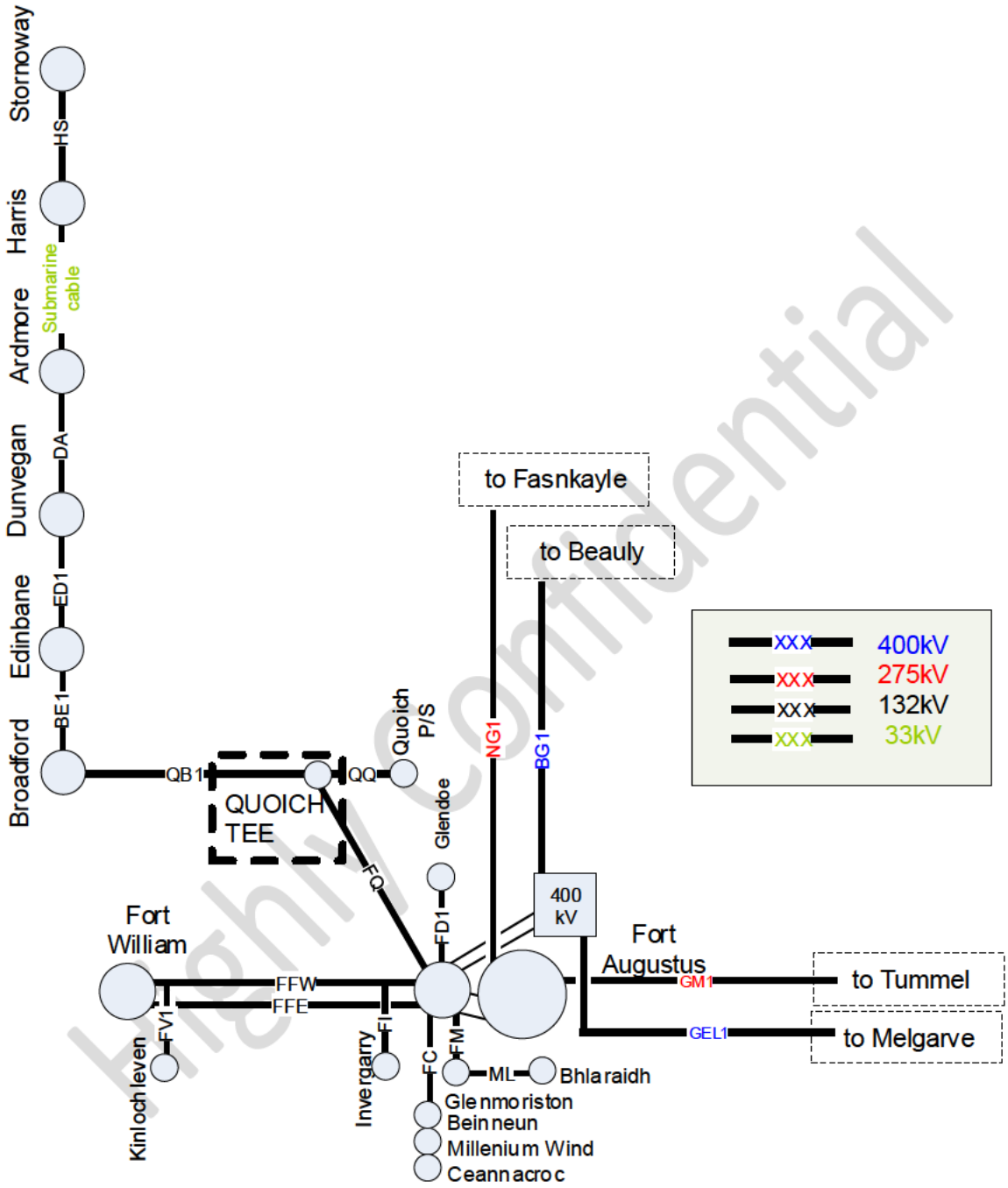
For our core non-load projects this means that we commit to delivering our overarching NARMs target. If we do not deliver the NARMS target, or a materially equivalent target, then we should be subject to a penalty. Equally, if we over-deliver against our target and are able to justify that the over-delivery 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.

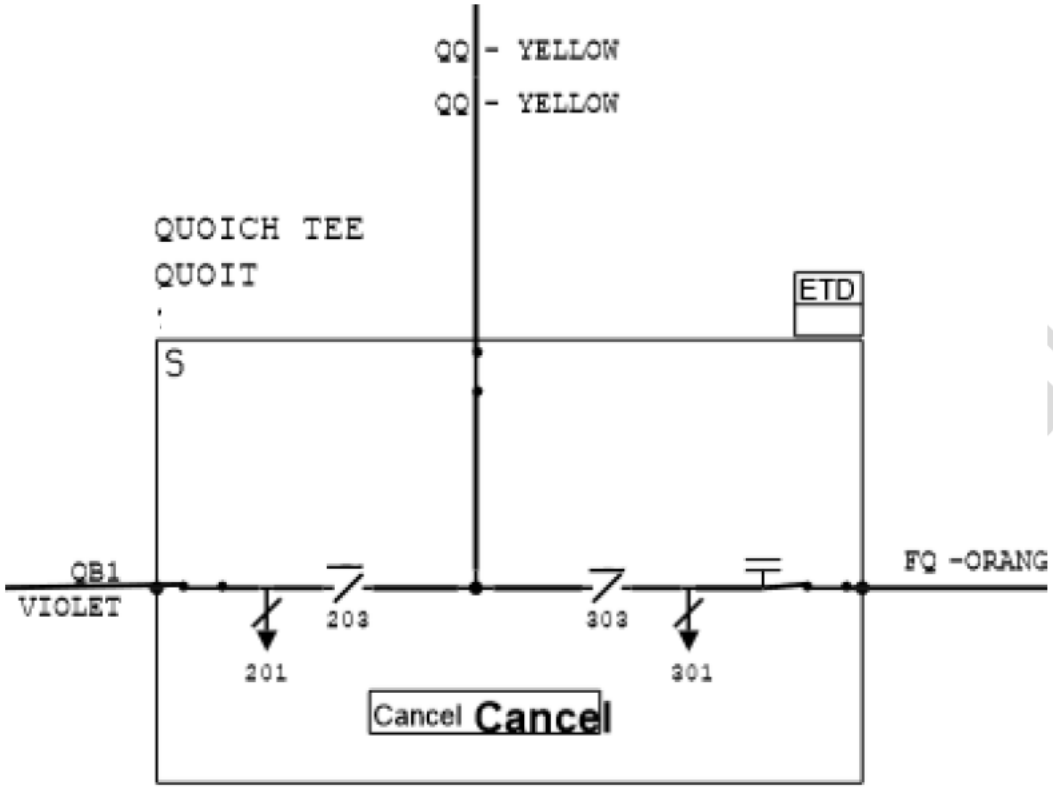
8 Outputs included in RIIO-T1 Plans

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

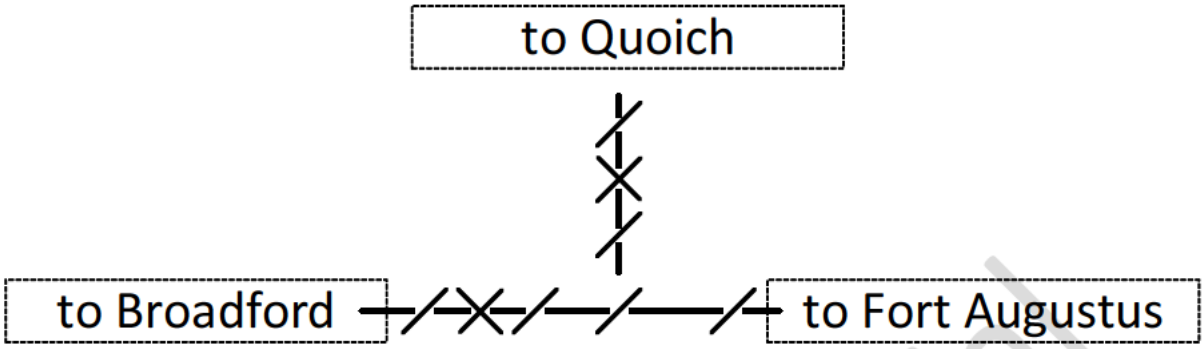
Appendix A: Overall MITS Network Diagram



Appendix B: Quoich Tee Network Configuration



Appendix C: SLD for Quoich Tee Works



Appendix D: Current protection scheme