Scottish & Southern Electricity Networks

SSEN Transmission

RIIO-T2 Business Plan: T2BP-EJP-0035 Rev1.1

Culligran Substation Works

Core Non-Load

Engineering Justification Paper

Culligran 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 on the 132/11kV Generation Transformer (GT) at Culligran substation. The primary driver for the scheme is the asset condition.

In response to Ofgem's feedback from the Draft Determination document and associated reports, SHE Transmission commissioned an independent assessment of transformer asset condition at Culligran substation, included as Appendix 1 of this document. A refurbishment intervention option was also considered to investigate potential end-of-life extension of the assets.

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

- Establish and construct a new indoor 132/11kV single transformer substation near the existing site.

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

- A long term monetised risk benefit of [redacted],
- An immediate reduction of total network risk calculated [redacted]
- Improved operational flexibility and resilience in line with our goal to aim for 100% transmission network reliability for homes and businesses.
- Improved visual impact,
- Improved separation of assets between SHE Transmission and the customer,
- To reduce the risk of asset failure impacting on the generation customers.

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

[1] A Risk Based Approach to Asset Management

Name of Scheme/Programme	Culligran Substation Works
Primary Investment Driver	Asset Health (Non-Load)
Scheme reference/ mechanism or category	SHNLT208
Output references/type	NLRT2SH208
Cost	[redacted]
Delivery Year	RIIO T2
Reporting Table	C 0.7 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 Culligran substation as shown on the map on page 5 of this document.

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.

2.1 Post Draft Determination Update

In response to Ofgem's draft determination feedback, SHE Transmission undertook the following actions:

2.1.1 Asset Condition Review

Polaris Diagnostics & Engineering Ltd was commissioned to undertake a review of the SHE Transmission Asset Condition Report – Culligran 132/11kV substation[2] and historical oil data for Culligran GT1.

The conclusions of the Polaris report on Culligran GT1[3] (included as Appendix 1 of this document) identify that:

- the transformer is in a condition commensurate with age (58 years old), but will continue to deteriorate during the RIIO-T2 period;
- analysis of the oil records clearly shows that there is an increasing trend of contamination of the main tank oil, indicating an increased risk of failure beyond that of age-related deterioration;
- and that intervention on this asset is required, within the RIIO-T2 period, to mitigate this risk.

2.1.2 Development & Assessment of Intervention Options

Considering the recommendations of the Polaris report on Culligran GT1, SHE Transmission has developed the following range of intervention options to mitigate this increased risk of failure during the T2 period:

- **Replacement** – 2 replacement interventions were developed for delivery in RIIO-T2. These were an 'in-situ' option and an 'offline build – new substation' option.
- **Refurbishment** – SHE Transmission developed a refurbishment intervention to address the visual condition & asset performance deterioration factors, identified in the Asset Condition Report for GT1 and its associated non-lead assets.5The impact of this refurbishment intervention will ensure that the risk of asset failure during the RIIO-T2 period is mitigated, but further age-related deterioration will require asset replacement to be undertaken during a future regulatory period. Options for future replacement in the RIIO-T3 and RIIO-T4 regulatory periods were developed for consideration.

These interventions are subject to cost benefit analysis to derive the preferred option and optimum intervention time.

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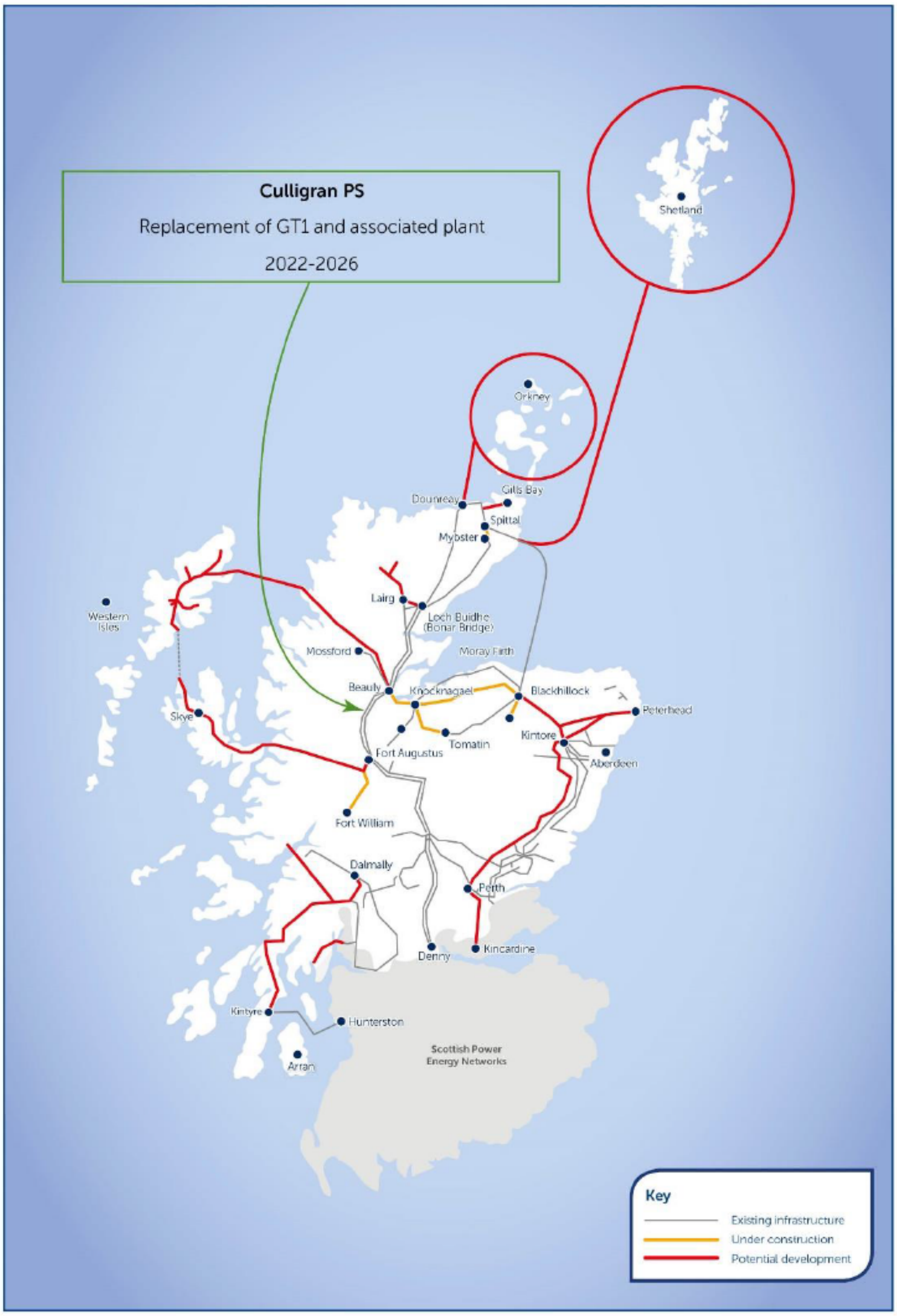
[2] Asset Engineering Condition Report – Culligran 132/11kV substation – Ref: T2BP-ACR-0024

[3] Polaris Diagnostics & Engineering Ltd - Summary Report on Culligran GT1 132/11kV Trans


Culligran PS
Replacement of GT1 and associated plant
2022-2026
Shetland
Orkney
Dounreay
Gills Bay
Spittal
Mybster
Lairg
Loch Buidhe (Bonar Bridge)
Western Isles
Mossford
Moray Firth
Beauly
Knocknagael
Blackhillock
Peterhead
Skye
Tomatin
Kintore
Fort Augustus
Aberdeen
Fort William
Dalmally
Perth
Kincardine
Denny
Kintyre
Hunterston
Arran
Scottish Power Energy Networks
Key
Existing infrastructure
Under construction
Potential development

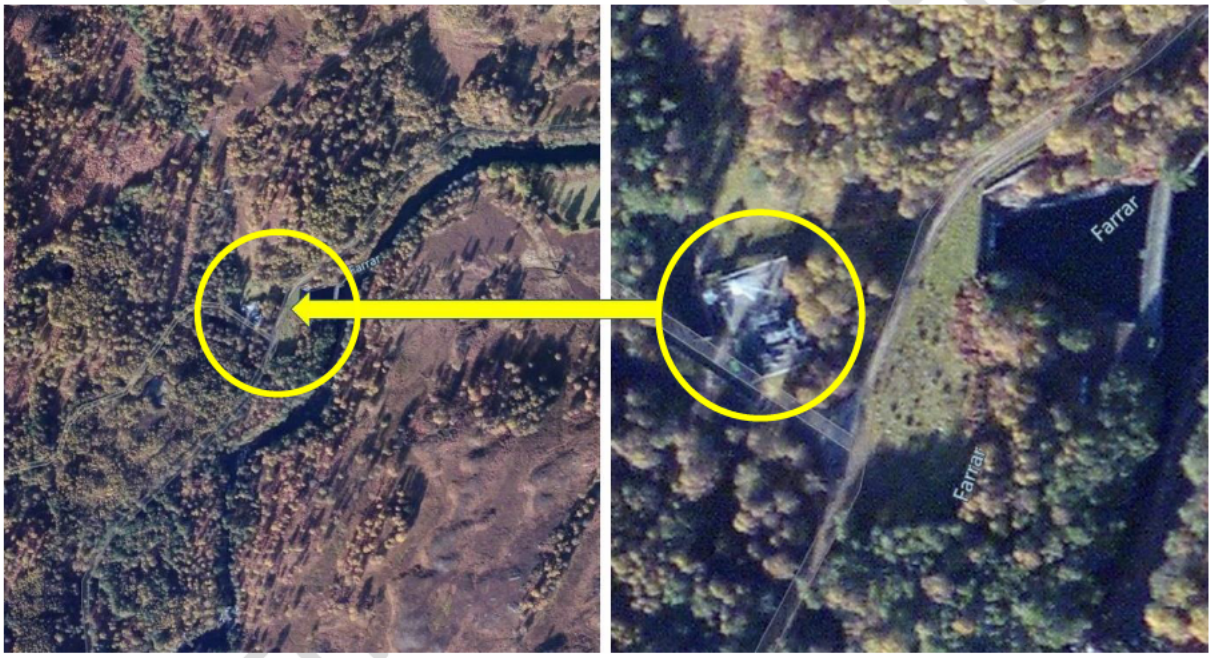
3 Need

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

Culligran 132/11 kV substation, built in 1959, is situated within the Braulen Estate, Glen Strathfarrar, Inverness-shire. The site is accessed via a single-track road which is itself accessed from the A831.

Figure 1 – Culligran Substation, located close to River Farrar



Culligran 132/11 kV substation exists to provide a hydro generation connection to the associated generator (19MW). The substation contains a single Grid Transformer (GT1), manufactured by Bonar Long in 1962. The transformer is a single rated 25MVA (ONAN) ground mounted unit situated outdoors.

3.2 Asset Need

Polaris Diagnostics & Engineering Ltd commissioned to undertake a review of the SHE Transmission Asset Condition Report – Culligran 132/11kV Substation[2] and historical oil data for Culligran GT1.

The conclusions of the Polaris report on Culligran GT1[3] (Appendix 1) identify that the transformer is in a condition commensurate with age (58 years old) but will continue to deteriorate during the RIIO-T2 period even with additional maintenance work.

Analysis of the oil records clearly show that there is an increasing trend of contamination of the main tank oil, indicating an increased risk of failure beyond that of age-related deterioration. The report concludes that intervention on this asset is required within the RIIO-T2 period.

The existing transformer protection is reliant on the operation of a third-party LV circuit breaker which is not an arrangement that meets current standards. The existing protection arrangements for the transformer is reliant on intertrips to Beauly (due to a lack of 132kV circuit breaker) and manual interventions to restore supplies to other substations supplied by the circuit. The current configuration also means that there is no Delayed Auto Reclose facility.

Battery and LVAC systems are shared with the customer and housed in space shared with the customer, a situation which does not meet with business separation requirements and also presents issues with access, control and security of assets.

As discussed in the Beauly – Deanie 132kV OHL Engineering Justification Paper[4] for the refurbishment of the BDN/BDS line which connects these substations, there is a need to address the pilot wire and PLC communications used by the intertripping schemes for these sites. Under the refurbishment of BDN/BDS a new Optical Ground Wire (OPGW) will replace the earth wire thereby providing adequate protection on these circuits. As well the consequential improvement in the protection provided by the BDN/BDS works, the necessary outages for tower painting and phase wire replacement, present a timely opportunity to undertake the upgrading of the ageing assets served by these circuits. This approach presents a coordinated package of work to the impacted local communities and improves the overall network impact, performance and risk.

In addition, the 132kV disconnector & earth switch are in poor condition and unable to be operated electrically. This means that in the event of failure of the transformer all customers connected to the circuit will lose supply and rely upon manual intervention taking many hours for staff to attend site. Previous work done on site to refurbish or maintain these switches has been unsuccessful and it is uneconomic to pursue this further due to obsolescence and lack of spares.

3.3 Growth Need

There are no known load related capacity increases in the immediate network which would drive upgrade work at this site. Therefore, the asset health of the plant, network operability, resilience and the nature of the site are the main considerations for the replacement work.

A meeting was held with the Culligran customer to discuss the customers portfolio of hydro generation schemes that would be affected by our works during the RIIO-T2 period. The generation site exporting at Culligran has no plans for increasing output in the foreseeable future and no capacity increase is proposed or required.

[4] Beauly – Deanie 132kV OHL Engineering Justification Paper T2BP-EJP-0034

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

Option	Option Detail	Cost (£m)	Taken forward to Detailed Analysis
0	Do Nothing	-	No
1	In-Situ Replacement	-	No
2	Offline Build	[redacted]	Yes
3	T2 Refurbishment and Replacement in T3	[redacted]	Yes
4	T2 Refurbishment and Replacement in T4	[redacted]	Yes

Option 0 - Do Nothing

The asset condition, as detailed in the Asset Condition Report**Error! Bookmark not defined.** and the findings of the Polaris Summary Report[3], conclude that a 'do nothing' approach will result in further deterioration of asset condition, resulting in an increased likelihood of failure of the transformer. This would result in the generation customer suffering an extended period of disconnection from the network in the event of a transformer fault (3-4 months for transformer replacement only) and impacting on the water management scheme in the area.

The conclusion drawn from this analysis is that 'do nothing' is not a viable option and that some form of asset intervention is required during the RIIO-T2 period.

NOT PROGRESS TO DETAILED ANALYSIS

Option 1 – In-Situ Replacement

Replace GT1 and install new 132kV and 11kV switchgear in a new indoor S/S in the existing S/S location which meets current engineering standards. In order to facilitate the necessary site upgrades that include a replacement 132/11kV Grid Transformer (GT) with associated HV and LV switchgear and a new control building, the overall site footprint will require a significant increase which is not available.

A key assumption at this stage is for all equipment to be housed in an indoor environment. Although there is no technical requirement for this (i.e. not a saline or corrosive environment), this decision is based on feedback from local council engagements and other recent planning applications regarding substations in similar rural locations. Small buildings are considered a preference to outdoor AIS compounds, primarily as a means of mitigating the overall infrastructure visual impact on the landscape. It is also noted that this location has three environmental designations: SSSI, SAC and SPA.

The major impact of this approach would be the requirement for a long-term outage (9-12 months) to be taken on the power station and overhead line circuit to Beauly (BDN circuit). This BDN circuit connects both this site and another at Deanie back to Beauly substation.

NOT PROGRESS TO DETAILED ANALYSIS

Option 2 - Offline Build

This option proposes a complete offline build of a new substation compound. The key benefit of this option is a reduced impact to both the local power station and wider network with minimal outage requirements.

The new site will contain a single transformer building including a 132kV circuit switcher and earth switch as well as control room housing 11kV switchgear, control and protection equipment as well as all other ancillary items. The new connection to the existing overhead line can be achieved via extension of the existing tee connection by an additional span to reach a new terminal tower at the new compound.

A key assumption at this stage is for all equipment to be housed in an indoor environment. Although there is no technical requirement for this (i.e. not a saline or corrosive environment), this decision is based on feedback from local council engagements and other recent planning applications regarding substations in similar rural locations. Small buildings are considered a preference to outdoor AIS compounds, primarily as a means of mitigating the overall infrastructure visual impact on the landscape. It is also noted that this location has three environmental designations: SSSI, SPA and SAC.

Building off line requires the same works as the in-situ replacement without the extended outage impacts on the local customer.

PROGRESS TO DETAILED ANAYLSIS

Option 3 – T2 Refurbishment and Replacement in T3

This option proposes to undertake the refurbishment of GT1 and the targeted replacement of non-lead assets in poor condition.

The key benefit of this option is a reduced intervention cost during the RIIO-T2 period and deferral of the substation replacement works to RIIO-T3.

The refurbishment will comprise a series of works to improve the external condition of the transformer. This work will include, but is not limited to, the replacement of all gaskets & seals; replacement of the marshalling kiosk; repair of oil leaks from all tanks & coolers; tap-changer refurbishment; regeneration of the insulating oil; and installation of on-line DGA to monitor any further deterioration associated with the underlying thermal abnormality within the transformer.

Targeted replacement of non-lead assets will include the replacement of the 132kV disconnector & earth switch that is in poor condition and unable to be restored to electrical operation, with a 132kV circuit switcher & earth switch. This will have the additional benefit of providing appropriate system operability.

A review of the protection modifications required at Culligran has identified that the very limited space available in existing protection panels will not be suitable for installation of the modern protection relays needed as a result of the works identified in Beauly – Deanie 132kV OHL Engineering Justification Paper[4]. The refurbishment option therefore includes the provision of a temporary, container-based blockhouse solution. The blockhouse will be located close to the existing transformer compound and will house the protection, control, telecommunications and ancillary equipment needed to maintain the performance & operation of the 132kV substation assets.

While the refurbishment intervention, described above, will mitigate the immediate RIIO-T2 risk of failure, there will be a requirement to return in the RIIO-T3 period to undertake replacement of the 132kV assets including the transformer at this site as they will reach end-of-life condition.

In order to fully assess the benefits of this refurbishment option, substation replacement in RIIO-T3 (in line with Option 2, above) will be considered.

Refurbishment in RIIO-T2, followed by replacement intervention at a later date will require additional outages on the substation, line and associated remote-ends during a subsequent price control period, to facilitate the replacement works. This approach will have a negative impact on the Generation assets connected to Culligran substation and on local stakeholders due to sustained construction works, spread over multiple regulatory periods.

PROGRESS TO DETAILED ANAYLSIS

Option 4 – T2 Refurbishment and Replacement in T4

Same as Option 3 but with the asset replacement work carried out in the RIIO-T4 period.

PROGRESS TO DETAILED ANAYLSIS

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) has been carried out in order to assess the preferred choice between Options 2, 3 & 4. Our CBA Methodology[5] sets the process and mechanics of our approach to CBA. In order to carry out this CBA, the following complete solutions were costed to allow comparison:

Table 2: CBA Solutions for Comparison

Option	Description	Cost (£million)
2	T2 replacement – offline build of a new 132kV substation	[redacted]
3	T2 refurbishment followed by Option 2 replacement during T3	[redacted]
4	T2 refurbishment followed by Option 2 replacement during T4	[redacted]

Table 3: CBA Total NPV

CBA Option No.	Total Forecast Expenditure (£m)	Total NPV	Delta (Option to baseline)	Total NPV (Incl. Monetised Risk £m)
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[5] Cost Benefit Analysis Methodology

The resulting CBA calculation has identified that the Baseline - Option 2 (T2 replacement offline build of a new substation) provides a higher NPV than Options 3 or 4.

As the assets in this assessment are already 58 years of age, they are already considered to be above the average replacement age of similar assets.

While refurbishment may extend the asset life beyond 2026, there is no guarantee this will prevent further internal deterioration of the transformer during the RIIO-T3 period considering the known thermal abnormality and overall transformer condition.

In addition to the above, a Risk Benefit Analysis of all options was carried out (see section 5.5) and was included in each CBA calculation.

It is clear from this analysis that the baseline - Option 2 provides the best overall NPV score, especially when monetised risk is also included.

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 4: 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. Test would have no impact on (feasible) option selection, only one option was taken forward to detailed analysis and therefore there is no impact on the preferred solution.
Demand variations	No significant demand forecast
Energy scenarios	Sensitivity considered in Section 3 (Need) already. 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	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 proposed solution is to build a new indoor 132/11kV single transformer substation near the existing site. The project will be energized within the RIIO T2 period. Table 5 below details the outputs:

Table 5 – Outputs from Preferred Option

Plant	Size of new plant	Replacement for
132/11kV Transformer	30/36MVA	22.5MVA
132kV Circuit Switcher	1 x 132kV circuit switcher (1250A)	NA
11kV Circuit breaker	2 x 11kV circuit breakers (1250A)	NA

5.4 Competition

The Culligran scheme is not flagged as eligible for early or late competition due it 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 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.

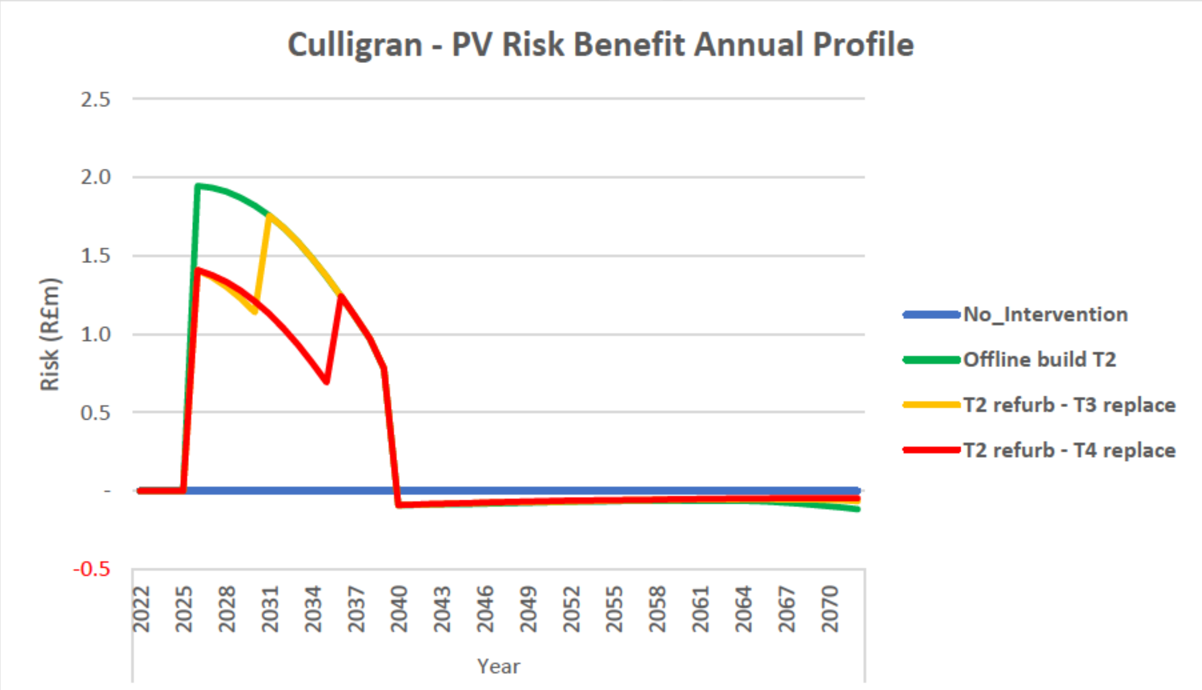
Table 6 – Long Term Monetised Risk Benefit

Option	LTMRB – R£ million
Option 2 – Replacement by offline build in RIIO-T2	[redacted]
Option 3 – Refurbishment in T2, followed by Replacement in T3	[redacted]
Option 4 – Refurbishment in T2, followed by Replacement in T4	[redacted]

The highest value of long-term monetised risk benefit for this project is delivered by Option 2 'Replacement by offline build during RIIO-T2', with a value of [redacted]. This preferred solution delivers more benefit to Consumers than the other options it was assessed against. Figure 2, below, illustrates the difference in LTMRB between the three options when they are assessed against the 'No Intervention' baseline.

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 R[redacted].

Figure 2: Long Term Benefit of Proposed Intervention – new substation



5.6 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.
The results of analysis for this project, are captured in the carbon footprint results table,

Table 7: Carbon Calculation Summary

	Project Information	Baseline
Project info	Project Name/number	0
	Construction Start Year	2026
	Construction End Year	2028
Cost estimate £GBP	Embodied carbon	£ 133,026
	Construction	£ 259,007
	Operations	£ -
	Decommissioning	£ 118,580
	Total Project Carbon Cost Estimate	**£ 510,613**
Carbon footprint tCO2e	Embodied carbon	1,776
	Construction	3,407
	Operations	-
	Decommissioning	341
	Total Project Carbon (tCO2e)	**5,524**

Project Carbon Footprint by Emission Category	Total Scope 1 (tCO_2e)	-
	Total Scope 2 (tCO_2e)	-
	Total Scope 3 (tCO_2e)	5,524
SF_6 Emissions	Total SF_6 Emissions 3 (tCO_2e)	-

5.7 Cost Estimate

The cost of the preferred option for works at Culligran 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 [redacted]

6 Conclusion

The primary driver for the replacement of the transformer and the associated works is the condition of the unit. There are consequential benefits of this of work as this would deliver a substation which meets our current engineering standards as well as delivering improved asset separation between, SHE Transmission and the customer.

In response to Ofgem's feedback from the Draft Determination document and associated reports, SHE Transmission commissioned an independent assessment of transformer asset condition at Culligran substation, included as Appendix 1 of this document. A refurbishment intervention option was also considered to investigate potential end-of-life extension of the assets.

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

- Establish and construct a new indoor 132/11kV single transformer substation near the existing site.

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

[redacted]A long term monetised risk benefit [redacted]

- An immediate reduction of total network risk calculated as [redacted],
- Improved operational flexibility and resilience in line with our goal to aim for 100% transmission network reliability for homes and businesses.
- Improved visual impact,
- Improved separation of assets between SHE Transmission and the customer,
- To reduce the risk of asset failure impacting on the generation customers.

The Culligran scheme is not flagged as eligible for early or late competition due 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 1 – Polaris Diagnostics & Engineering Ltd Summary Report – Culligran GT1

Polaris Diagnostics & Engineering Ltd

Polaris Diagnostics & Engineering Ltd has been commissioned by Scottish Hydro Electric Transmission (SHE Transmission), to carry out a Level 1 condition assessment of Culligran GT1 132/11kV Transformer.

The level 1 condition assessment has been carried out, based on a review and independent assessment of the historic oil data and SSEN Report T2BP-ACR-0024, both supplied by SHE Transmission.

Based on the assessment of the historical & current asset condition data, GT1 is in a condition commensurate with age and the transformer condition will continue to deteriorate, by ageing, during the RIIO T2 period. There is an increased risk of failure of the asset within this period due to contamination of the main tank oil. Further intervention will be required within the RIIO-T2 period to mitigate this increased risk of failure.

There is evidence that the transformer has externally deteriorated and requires immediate action, as defined by the iSIM system. Additional inspection and evaluation is required. The transformer is wet, as evidenced by a very erratic main tank moisture levels and despite the oil being reconditioned and regenerated, the moisture levels return to what is considered high levels. This suggests that there is either moisture ingress into the main tank, or the active part insulation is wet. Oil processing of the main tank oil has had a dilution effect on the measured 2FAL concentrations and as this is used to predict the condition of the paper insulation and "estimated residual life remaining" of that insulation, the estimate of 43% life remaining is considered optimistic.

This transformer is internally in "reasonable condition" but has a potential underlying thermal abnormality, which could manifest into a more serious deterioration. The transformer is wet and has a history of oil leakage. The main tank oil will require monitoring in the form of increased oil surveillance and may require enhanced maintenance within this period to prevent deterioration that may lead to failure. A 'mid-life' refurbishment should be considered in order to return the asset to a condition such that it will extend the asset life.

In order to mitigate the risk of an increased likelihood of failure during the RIIO T2 period and to understand the scope of work for a "mid-life" refurbishment, the following recommendations are made:

- Frequency of oil sampling should be increased to monitor both dissolved ethylene and moisture content and dielectric breakdown voltage. This should be done every 6 months with additional oil analysis (over and above routine measurements).
- Detailed inspection of the asset – outage required.
- Inspection and assessment of the moisture management system.

- 132kV bushings should be oil sampled for DGA and moisture analysis and assessed by the criteria set out in National Grid TGN 82. In addition the bushing power factor and capacitance should be measured. This would require an outage and the removal of the 132kV and 11kV bushings to facilitate the testing.
- Detailed condition assessment of the transformer to include Sweep Frequency Response Analysis (SFRA), Dielectric Frequency Response (DFR), 10kV Power Factor, 5kV Insulation Resistance and DC Winding Resistance testing. This would require an outage and the removal of the 132kV and 11kV bushings to facilitate the testing.
- Following detailed inspection continue with routine inspection.
- Continue with routine maintenance.
- Detailed load flow monitoring.

Author	Issue Authority
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