

RIIO T3 Transformer Refurbishment Programme - OFGEM Justification Paper	
Name of Scheme/Programme	RIIO T3 Transformer Refurbishment Programme
Primary Investment Driver	Asset Health
Scheme reference/mechanism or category	SPNTL2075 – 2077 / Transformer SPNLT 2079 - 2084 / Transformer
Output references/type	NLRT2SP2075 / 2079 / 2080 / 2081 - Lead (275kV Transformer) NLRTSP2076 / 2077 / 2082 / 2083 / 2084 – Lead (132kV Transformer)
Cost	RIIO T2 spend: £ 0.27 m Total spend: £ 5.79 m (RIIO T2: £0.27 m + RIIO T3: £ 5.52 m)
Output delivery Year	SPNLT2075: 2028 SPNLT2076: 2029 SPNLT2077: 2030 SPNLT2079: 2031 SPNLT2080: 2031 SPNLT2081: 2028 SPNLT2082: 2029 SPNLT2083: 2030 SPNLT2084: 2031
Reporting Table	C0.7 / C2.2a_AP / C2.2a_CI / C2.3 / C2.4b / C2.5 / C2.5a
Outputs included in RIIO T1 Business Plan	No

Issue Date	Issue no.	Amendment details
23/07/2020	1	First issue of document

Table of contents

1	Introduction	3
2	Background Information	3
3	Optioneering	4
4	Detailed analysis	5
4.1	Option Details	5
4.2	Environment & Sustainability	6
4.3	Innovation	6
5	Conclusion	7
6	Future Pathways – Net Zero	8
6.1	Primary Economic Driver	8
6.2	Payback Periods	8
6.3	Pathways and End Points	8
6.4	Asset Stranding Risks	8
6.5	Sensitivity to Carbon Prices.....	8
6.6	Future Asset Utilisation.....	8
6.7	Whole Systems Benefits.....	8
7	Outputs included in RIIO T1 Plans.....	8

1 Introduction

Through inspection, condition assessment and application of the NOMS models, a number of transformers have been assessed as being in a deteriorated condition and should be considered for intervention. This programme presents the assessment of each candidate and determines the level of intervention required to deliver a mid-life refurbishment to bring the assets back to a condition to maximise their remaining lives. The range of works will cover all aspects of the transformer and are expected to be a bespoke intervention for each for each asset. This paper supports a proposal to undertake the refurbishment of 9 off SPT transformers over the RIIO-T3 period.

This paper is presented as part of the T2 bid to reflect the fact that some initial costs for these works will be required to be funded within the RIIO-T2 period to allow the works to be undertaken within the RIIO-T3 Period. It is considered that these costs will contribute to the RIIO-T2/T3 fixed pot bridging fund as indicated in the draft determination.

2 Background Information

A detailed review of the SPT transformer and reactor asset base identified 63 transformers for which consideration of an intervention was required. This intervention could either be replacement or refurbishment. The candidates identified have were assessed by a desktop survey to review oil and physical condition to determine the most appropriate course of intervention as per the methodology identified in TRAN-01-003. Of these 63, 34 were determined to be candidates for refurbishment.

Transformer refurbishment general requirements are detailed within the SPEN Document TRAN-03-034. Within this document it is a requirement that all transformers are tested prior to refurbishment. This ensures that the transformer is electrically suitable to be refurbished.

The 34 candidates determined for refurbishment were then prioritised to determine those which merited intervention in the RIIO-T2 period. Using the output of the NOMS deterioration models, the time to reach end of life was forecast for each transformer. This information was used to produce a prioritised list of the 34 transformers. All transformers whose condition needs to be managed in the RIIO-T2 period have been included in a separate paper. This paper focusses on the 9 off transformers that have been considered for inclusion in the RIIO-T3 price control periods.

Please find below the details of the transformers identified for intervention.

Table 1 Identified Transformer Refurbishments

SPEN corporate asset ID	Asset Description	Manufacturer	Year of manufacture
14237902	CLYDESMILL SGT2	PARSONS PEEBLES	1970
14157670	PARTICK GT2	BRUCE PEEBLES	1961
14161607	GLENLUCE T2	BONAR LONG	1970
14184872	WISHAW SGT7	PARSONS PEEBLES	1977
14184020	WISHAW SGT6	PARSONS PEEBLES	1977

14159668	AYR SGT1	BRUCE PEEBLES	1970
14220966	SALTCOATS T1A	PARSONS PEEBLES	1969
14161584	GLENLUCE T1	PARSONS PEEBLES	1969
14195988	DUNFERMLINE T1	FERRANTI	1967

3 Optioneering

The following is a summary of the options considered for this project.

	Option	Status	Reason for rejection
1	Replacement in RIIO-T3	Proposed	-
2	Refurbishment in RIIO-T3	Proposed	-
3	Replacement in RIIO-T2	Rejected	Replacement in RIIO-T2 is not an economic option as all transformers in this programme have condition issues that will not require intervention until RIIO-T3.
4	Refurbishment in RIIO-T2	Rejected	Refurbishment in RIIO-T2 is not an economic option as all transformers in this programme have condition issues that will not require intervention until RIIO-T3.

4 Detailed analysis

4.1 Option Details

With regard to transformers identified as requiring intervention, the methodology developed in TRAN-01-003 has determined that the main driver for replacement is the DGA condition and not age. In some circumstances, the condition assessment can also lead to a replacement if the unit is determined to be beyond economic repair. As part of the SPT asset management approach, the scope of works is not focussed solely on the T2 Period but across future price control periods to ensure a responsibly managed fleet of assets. This paper focuses on those candidates that have been assessed under this methodology and it has been established that refurbishment is an effective intervention within the T3 period.

The options considered for intervention for transformers were as follows:

- Option 1 – Replacement in RIIO-T3
- Option 2 - Refurbishment in RIIO-T3
- Option 3 – Replacement in RIIO-T2
- Option 4 - Refurbishment in RIIO-T2

Option 1 – Replacement in RIIO-T3

The baseline option is do nothing in T2 and undertake replacement in RIIO-T3. Deferring works until RIIO-T3 will increase network risk as the identified condition issues remain with a higher probability of failures before the intervention can take place.

Option 2 –Refurbishment in RIIO-T3

Following replacements in previous price controls, post mortem examinations have been undertaken to better understand the underlying health of the asset on replacement. This examination has informed the strategy for management of transformer life.

The oil analysis of these transformers, as per TRAN-01-003 determines that these assets do not require to be replaced and that targeted refurbishment is the most appropriate intervention to maximise the remaining lives of the transformers under consideration. This option proposes undertaking a refurbishment of these assets within RIIO-T3, deferring any replacement until the DGA results indicate an EoL of the active part.

Option 3 –Replacement in RIIO-T2

The third option in this case would be to replace the transformers in T2. As the forecast EoL is outside of the T2 window, this would be an earlier than necessary intervention.

Option 4 –Refurbishment in RIIO-T2

As with replacement within T2, the transformers noted for change are expected to have an EoL outside of the T2 price control period and as such do not as yet warrant intervention.

At present, the option selected as the preferred option is refurbishment, following on from the programme of works within the main T2 programme of works. As these works identified are in 7 years' time, these sites and works will require to be evaluated and verified over time through SPT condition assessments to ensure that refurbishment is still the best course of investment.

4.2 Environment & Sustainability

The SPT sustainability approach is to prioritise reuse, then refurbish and finally replace if there is no other option. Where there are opportunities to reuse or refurbish equipment they will be taken, and this is clearly evidenced in the adoption this Transformer refurbishment programme within the RIIO-T2 submission.

4.3 Innovation

Innovation is a key component to deliver developments in all aspects of work. A prime example of this is with the proposed Refurbishment of transformers. This process follows on from the successful programme of transformer refurbishments by SP Distribution Licence (smaller 33/11kV, 12/24MVA units) delivered under DPRC5 and RIIO-ED1. While the technology used in these projects will be standard, as yet there is no proven track record within the GB Transmission network for the life extension and consequences of interference with aged power transformer.

5 Conclusion

The refurbishment of transformers within T2 is programme that has been developed based on the findings of the post-mortems of transformers replaced in RIIO-T1. This programme continues through future price controls. Some of the transformers identified for refurbishment require to be intervened in the initial years of T3 and such funding is requested as part of the T2 Submission to allow the procurement of long lead time items and services to allow effective delivery in T3.

The project costs have been built up from individual costs for each element and included in a bill of quantities. The bill of quantities has been engineered from the design layouts developed for each option. The basis of individual unit costs has been the SP Energy Networks MoSC (Manual of Standard Costs) tool which makes reference to costs incurred during previous similar projects.

Options have been proposed for the management of the transformer fleet and the proposed costs reflect the scope of work for each transformer.

- Forecast cost (in T2): £ 0.259m
- Timing of investment: RIIO T3 period, works from 2026-2031.
- Declared outputs: Asset addition / activity
 - 132kV Transformer: 5 units
 - 275kV Transformer: 4 units

The overall costs based on the recommended investments for each scheme is summarised below.

Table 2 Overall recommendations and cost

Project	Proposal	T2 Cost (£ m)	T3 Cost (£ m)	Asset
CLYDESMILL SGT2	Refurbishment	£ 0.001	£ 0.68	Transformer
PARTICK GT2	Refurbishment	£ 0.001	£ 0.45	Transformer
GLENLUCE T2	Refurbishment	£ 0.10	£ 0.57	Transformer
WISHAW SGT7	Refurbishment	£ 0.08	£ 0.67	Transformer
WISHAW SGT6	Refurbishment	£ 0.08	£ 0.67	Transformer
AYR SGT1	Refurbishment	£ 0.00	£ 0.67	Transformer
SALTCOATS T1A	Refurbishment	£ 0.00	£ 0.59	Transformer
GLENLUCE T1	Refurbishment	£ 0.00	£ 0.59	Transformer
DUNFERMLINE T1	Refurbishment	£ 0.00	£ 0.60	Transformer
	Total Cost (£ m)	£ 0.27	£ 5.52	

The proposed investment for the transformer refurbishment programme is £ 5.52 m as outlined in Table 2. This will be profiled over the RIIO-T2 and T3 period and coordinated with other planned outages as far as possible. The spend profile has been split above to reflect.

The forecast spend is in line with the provisional proposed refurbishment dates for the transformers.

6 Future Pathways – Net Zero

6.1 Primary Economic Driver

The primary driver for this investment is asset condition and risk. The investment does not have a strong reliance on environmental benefits.

6.2 Payback Periods

A full CBA that would indicate the NPV results for all assessment periods will be carried out in the preparation of the RIIO-T3 business plan. Consumers benefit from reduced network risk immediately on completion of the project.

6.3 Pathways and End Points

The network capacity and capability that result from the proposed option has been tested against and has been found to be consistent with the network requirements determined from the ETYS and NOA processes. Additionally, the proposed option is consistent with the site-specific capacity requirements from SPT's Energy Scenarios.

6.4 Asset Stranding Risks

Electricity generation, demand and system transfers are forecast to increase under all scenarios. The stranding risk is therefore considered to be very low.

6.5 Sensitivity to Carbon Prices

Carbon price sensitivities will be applied to CBA proposed to be carried out for RIIO T3. The CBA outcome will be influenced by losses and will be sensitive to carbon prices.

6.6 Future Asset Utilisation

It has been assessed that the preferred option is consistent with the future generation and demand scenarios and that the risk of stranding is very low.

6.7 Whole Systems Benefits

Whole system benefits have been considered as part of this proposal. The capacity and capability of the preferred option is consistent with the provision of whole system solutions.

7 Outputs included in RIIO T1 Plans

This scheme does not contain any outputs or costs included in the RIIO-T1 business plan.