Online DGA Installation Strathaven and Cockenzie - OFGEM justification paper	
Name of Scheme/Programme	Online DGA Installation Strathaven and Cockenzie
Primary Investment Driver	Asset Health
Scheme reference/ mechanism or category	SPNLT2062 Lead Asset – Transformer
Output references/type	NLRT2SP2062 / Lead
Cost	£ 0.12m
Delivery Year	RIIO-T2
Reporting Table	C0.7 Non-load Master / C2.2a Scheme Summary
Outputs included in RIIO T1 Business Plan	No

Issue Date	Issue No	Amendment Details
October 2019	Issue 1	First issue of document
December 2019	Issue 2	Cost updated

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1 Introduction

Through the RIIO-T1 period SPT targeted the removal and replacement of Bruce Peebles Transformers. This followed the almost catastrophic failure of a Bruce Peebles units in service, that was detected through gassing and DGA. The subsequent forensic investigations identified an irreparable manufacturing defect.

While units which have the defect were replaced during the RIIO-T1 period and a further one is proposed for replacement in RIIO-T2, there will be 2 units remaining in service.

This paper proposes to install 2 online DGA schemes to monitor the condition of these transformers to ensure interventions before failure.

2 Background Information

The Bruce Peebles defect, where a soldered connection overheats and leads to premature failure of the transformer, is a confirmed failure mode. To mitigate the risk of this failure, the RIIO-T1 programme was developed to begin to remove the transformers of this type from the SPT Network. This was prioritised by the severity of the effect of the defect as identified by DGA. This continues in RIIO-T2 with the proposed replacement of a unit at Shrubhill. The following units have been identified as having the defect. These units are:

	Location	Extended Name	Operating Voltage
1	STHA	Strathaven SGT1	275/33kV
2	COCK	Cockenzie SGT1	275/33kV

As part of the RIIO-T2 planning process, these units were assessed to investigate their condition. These surveys involved oil analysis and external condition assessments to determine the condition of the transformer. There were no internal investigations as this level of intervention would present a high level of risk of introducing contaminants into the transformers.

3 Optioneering

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

	Option	Status	Reason for rejection
1	**Replace the Units**: The presence of the defect would indicate the necessary replacement of the units	Rejected	Rejected on the basis that the DGA results and subsequent analysis indicate relatively low risks of failure compared to the rest of the population of this type.
2	**Installation of Online DGA Equipment:** Install Industrial standard equipment to undertake continuous DGA monitoring of the units	Proposed	-
3	**Do Nothing and replace the units based on EoL:** Defer all investment until the	Rejected	Rejected due to the presence of the defect that has been proven to result in failure.

	predicted end of life based on all condition points.		

4 Detailed analysis

4.1 Selected option

SPT has in place robust process with regard to inspection and maintenance that delivers high quality condition assessment of its assets.

The defect that was confirmed within the Bruce Peebles transformers resulted in a RIIO-T1 programme being developed to begin to remove the transformers of this type from the SPT Network. This was prioritised by the severity of the effect of the defect as identified by DGA.

This programme continues into RIIO-T2 with the proposed replacement of a unit at Shrubhill.

A forensic post mortem was undertaken on each decommissioned transformer to improve the understanding of transformer aging, deterioration and performance.

This has developed and refined our transformer asset management methodology to create enhanced knowledge of the condition of the assets. This has been reflected in our reduced Transformer replacement programme (when compared with RIIO-T1) and the introduction of a transformer refurbishment programme.

During this and working with external experts in the transformer industry, the following two transformers were considered for intervention.

	Location	Extended Name	Operating Voltage
1	STHA	Strathaven SGT1	275/33kV
2	COCK	Cockenzie SGT1	275/33kV

As part of the RIIO-T2 planning process, a detailed condition assessment was undertaken including a bespoke expert investigation by an external party to generate an updated and detailed understanding of condition of the assets.

These investigations determined, from the oil analysis, that the impact of the defect was not as severe as found in other transformers of the same type.

The conditions that exacerbate the early onset of failure due to the defect are sustained high loads or overloading. The relative absence of such conditions may be a factor in the relatively reduced impact of the defect when compared to other units.

The condition assessment results have been balanced with the presence of the inherent defect and the decision to defer replacement and install online DGA during RIIO-T2 has been taken. This will allow the continuous monitoring of the assets so that any deterioration in condition can be identified and allow an early intervention and risk mitigation plan to be put into action.

4.2 Innovation

The use of online DGA technology used in the project is well established but is being applied in this case to manage risk and defer investment, resulting in increased consumer benefit.

5 Conclusion

Transformers are critical assets in a transmission network with long lead times for replacement units. The presence of a known defect that leads to early failures of transformers results in a higher risk of failure of the transformers at Strathaven and Cockenzie that indicated by the condition assessment. However through investigations, these units do not demonstrate material signs of early failure. To mitigate the risk of failure and ensure that these transformers maintain the required levels of performance, it is proposed to install online DGA to ensure that any deterioration can be addressed as early as possible.

The proposed solution ensures that SPT can monitor the condition and performance of these two transformers to maximise their economic lives, producing the best long term solution for consumers.

- Costs: £ 0.12 m
- Timing of investment: RIIO-ET2 period
- Declared outputs: N/A

6 Future Pathways – Net Zero

We have reviewed this project against the criteria set out within the business plan guidance and have assessed that it does not prevent achievement of our Net Zero plans or lead to stranded assets.

7 Outputs included in RIIO T1 Plans

N/A