

St Fergus MCPD Emissions

Document Title: Asset Health Requirements

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ABBREVIATIONS & GLOSSARY

Unless otherwise stated in this document, capitalised terms that appear in this document have the meaning given to them in the following table.

AC	Alternating Current
CAB	Compressor Acoustic Building
CAPEX	Capital Expenditure
CSRP	Control System Restricted Performance
DC	Direct Current
DLE	Dry Low Emissions
ESD	Emergency Shutdown
EUD	Emergency Use Derogation
FEED	Front End Engineering Design
LV	Low Voltage
MCPD	Medium Combustion Plant Directive
NTS	National Transmission System
OEM	Original Equipment Manufacturer
PRA	Pressure Reduction Area
RIIO	Revenue = Incentives + Innovation + Outputs
RIIO-T2	Second RIIO Transmission Price Control Period – From 2021 to 2026
SCR	Selective Catalytic Reduction

Executive Summary

As part of the option selection process for the St Fergus MCPD project eighteen emissions compliance options have been reviewed. These options involve various combinations of the following solutions:

- Installation of multiple new emissions compliant gas turbine driven compressors and ceasing operation of the non-compliant Avon gas turbines from 1 January 2030.
- Retaining multiple Avon driven compressors under limited 500 hour per year emergency use derogation.
- Retaining multiple Avon driven compressors with the power derated such that emissions cannot exceed emissions limit values stipulated in MCPD (referred to as Control System Restricted Performance – CSRP).
- Retaining multiple Avon driven compressors with upgraded Dry Low Emission (DLE) combustion system. The Avon variant present on all St Fergus Avon powered compressors is the 1533 variant.
- A hybrid mix of new emissions compliant gas turbine driven compressors with either DLE or CSRP modifications in place.

Each of the above options will require different levels of initial asset health investment to ensure reliable ongoing operation as summarised in Table 1. A conservative approach has been taken to define the minimum required initial investment taking into consideration works already funded in RIIO-T2 under separate investment themes. This report provides an overview of each scope item with detail on how the scope has been determined.

CAPEX estimates for initial and ongoing asset health scope are based on the RIIO-T2 unit cost schedule. The RIIO-T2 plan assumed three new units would be installed for MCPD compliance and the Avons decommissioned by 2030.

Asset health interventions beyond 2030 have been determined based on existing maintenance philosophies and approximate forecast run-hours for each option. A similar approach has been applied for new units included in the various new build options. Due to the age of the Avon compressor machinery trains and associated equipment, much of which is beyond its original design life, an increased failure rate should be expected. This is reflected in the intervention frequency for Avons compared with new units.

1. Introduction

- 1.1. St Fergus MCPD Shortlisted Options
- 1.2. Document Purpose
- 2. Asset Health Interventions 2025 - 2030**
- 3. Asset Health Interventions 2030 - 2050**
- 4. Decommissioning**

1. Introduction

1.1. St Fergus MCPD Shortlisted Options

Eighteen options have been shortlisted for review via CBA and BAT assessment as summarised in Table 2. CAPEX estimates at $\pm 30\%$ certainty have been developed for each of the shortlisted options which will be used in CBA and BAT assessments to support the selection of a single preferred option.

Table 1 - Shortlisted Options

Option Ref:	Option Summary
Option 0	Counterfactual (Do Nothing). Derogate to 500 hours per unit after 2030.
Option 1	3 x New 15MW GTs at existing Plant 1 and Plant 2 location
Option 2	3 x New 15MW GTs in a new Greenfield location within site perimeter
Option 3	2 x New 23MW GTs at existing Plant 1 and Plant 2 location
Option 4	2 x New 23MW GTs in a new Greenfield location within site perimeter
Option 5	2 x New 15MW GTs and 1 x 23MW GT at existing Plant 1 and Plant 2 location
Option 6	2 x New 15MW GTs and 1 x 23MW GT in a new Greenfield location within site perimeter
Option 7	4 x New 15MW GTs at existing Plant 1 and Plant 2 location
Option 8	4 x existing Avon 1533s derated (CSRP)
Option 9	3 x existing Avon 1533s derated (CSRP)
Option 10	4 x existing Avon 1533s with Dry Low Emissions Modification (DLE)
Option 11	3 x existing Avon 1533s with Dry Low Emissions Modification (DLE)
Option 12	2 x new 15MW GTs at existing Plant 1 and Plant 2 location with 2 existing Avon 1533s with Dry Low Emissions Modification (DLE)
Option 13	1 x new 15MW GT at existing Plant 1 and Plant 2 location with 3 existing Avon 1533s with Dry Low Emissions Modification (DLE)
Option 14	3 x new 15MW GTs at existing Plant 1 and Plant 2 location 1 existing Avon 1533 with Dry Low Emissions Modification within Plant 1 and 2 location.
Option 15	1 x New 15MW GT and 1 x 23MW at existing Plant 1 and Plant 2 location
Option 16	2 x new 15MW GTs at existing Plant 2 location with 1 existing Avon 1533s with Dry Low Emissions Modification (DLE) within Plant 1
Option 17	1 x new 15MW GT at existing Plant 1 location with 2 existing Avon 1533s with Dry Low Emissions Modification (DLE) within Plant 2
Option 18	2 x New 15MW GTs at existing Plant 1 and Plant 2 location

1.2. Document Purpose

The purpose of this document is to define the scope of asset health investment required on existing units pre-2030 and during the period post installation and commissioning (2030-2050).

Funding mechanisms for various elements of scope are not discussed in this document but it is acknowledged that not all scope described herein will be included in the subsequent Emissions opener. Funding mechanisms will be confirmed once the MCPD option has been selected.

2. Asset Health Interventions 2025 – 2030

As part of our review of the future operating strategy for St Fergus, we have assessed all major asset types and existing defects across the site to identify other areas of work that will require intervention to meet the long-term operational requirements of St Fergus. These asset health interventions may not be directly linked to emissions compliance but will be required to continue site operation. This is a continuation of the approach which was employed during the RIIO-T2 business plan submission, for which we signaled an estimated asset health spend of £98.8m across RIIO-T2 and T3 (18/19 price base).

Since the business plan submission, work has been ongoing to scope, tender, survey and define the interventions required to repair or replace the assets identified. These assets include a mixture of baseline funded work, and unfunded work for which requests will be made as required. The urgency for remediation is also being considered as this will determine both delivery strategy, and timeline to request appropriate funding. The work can be split into two main categories; in flight work and development work.

The in-flight work forms part of National Grid's January Engineering Justification Paper submissions concerning Aftercoolers, Actuators, Cathodic Protection, Avon Relife and decommissioning. For the purposes of CBA, only work for Avon re-life and decommissioning have been included as these pieces of work are in early-stage delivery and therefore could have an impact on NPV. The remaining work is considered "sunk" cost.

The development work concerns all other assets, spanning across 6 of the 7 major asset health themes

Electrical	Compressors	Cab Infrastructure	Valves	Civils	Plant and Equipment
<ul style="list-style-type: none"> • Electrical Distribution • Distribution Boards • HV Switchgear • LV Switchboards • Lighting • Standby Generators • Transformers 	<ul style="list-style-type: none"> • HV Motor • Fuel Gas Heating 	<ul style="list-style-type: none"> • Fire Suppression • Fire Water Ring Main • Lube oil Systems 	<ul style="list-style-type: none"> • Isolation Ball Valves above and below ground 	<ul style="list-style-type: none"> • Significant Structural Assets • Roads and Access • Tanks and Bunds • Drainage Assets • Ducting 	<ul style="list-style-type: none"> • Metering • Corrosion • Plant 2 Aftercoolers • Vent Systems

All of these areas of work are considered in the CBA, however the majority of the work is not impacted by the options put forward and therefore does not have any impact on the CBA. For those asset health items which are impacted by the requirement for two plants, discussed in the resilience paper, these are being considered as a separate sensitivity. The total cost for these items is currently estimated to be circa £57m.

3. Asset Health Interventions 2030 - 2050

Upon successful implementation of the required solution by 1st January 2030, ongoing Asset Health intervention will be required to successfully maintain the compression assets through to 2050.

Asset health interventions beyond 2030 have been determined based on existing maintenance philosophies. A similar approach has been applied to new units included in the various new build options. Due to the age of the Avon compressor machinery trains and associated equipment, much of which is beyond its original design life, an increased failure rate should be expected. This is reflected in the intervention frequency for Avons compared with new units.

The following table shows the costed options specific Asset Health Interventions required from 2030 – 2050 which has been included within the Cost Benefit Analysis within the main body of the St Fergus FOSR.

The costs included within this table have been built using required maintenance intervention frequencies currently utilized across the entire compressor fleet.

Table 2 – Option Specific Asset Health Interventions 2030 – 2050

Option	Name	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
0	Counterfactual				T			T		T			T		T					T			£46,812,492
1	A1 (Brownfield) - 3 x new 15 mscmd GTs				█			■		T			■		T					T			£30,363,000
2	A1 (Greenfield) - 3 x new 15 mscmd GTs				█			■		T			■		T					T			£30,363,000
3	A2 (Brownfield) 2 x new 23 mscmd GTs				█			■		T			■		T					T			£20,242,000
4	A2 (Greenfield) 2 x new 23 mscmd GTs				█			■		T			■		T					T			£20,242,000
5	A3 (Brownfield) 2 x new 15 mscmd and 1 x new 23 mscmd GTs				█			■		T			■		T					T			£30,363,000
6	A3 (Greenfield) 2 x new 15 mscmd and 1 x new 23 mscmd GTs				█			■		T			■		T					T			£30,363,000

7	A4 (Brownfield) 4 x new 15 mscmd GTs				—			■		T			■		T					T			£40,484,000
8	E1 4 x Existing Avon 1533 15 mscmd derated				T			T		T			T		T					T			£52,940,492
9	E2 3 x Existing Avon 1533 15 mscmd derated				T			T		T			T		T					T			£39,705,369
10	D1 4 x Existing Avon 1533 15 mscmd DLE				T			T		T			T		T					T			£52,940,492
11	D2 3 x Existing Avon 1533 15 mscmd DLE				T			T		T			T		T					T			£39,705,369
12	AD1 2 x new 15 mscmd GTs (Brownfield) and 2 x Avon 1533 (15 mscmd) existing with DLE				T			T		T			T		T					T			£46,712,246
13	AD2 1 x new 15 mscmd GTs (Brownfield) and 3 x Avon 1533 (15 mscmd) existing with DLE				T			T		T			T		T					T			£49,826,369

14	AD2 3 x new 15 mscmd GTs (Brownfield) and 1 x Avon 1533 (15 mscmd) existing with DLE				T			T		T			T		T					T			£43,598,123
15	1 x 23 MW + 1 x 15MW (Brownfield)				—			■		T			■		T					T			£20,242,000
16	2 x 15MW (Plant 2) +1 DLE (Plant 1)				T			T		T			T		T					T			£33,477,123
17	1 x 15MW (Plant 1) + 2DLE (Plant 2)				T			T		T			T		T					T			£36,591,246
18	2 x 15MW (Brownfield)				—			■		T			■		T					T			£20,242,000

The summary of costs shown within Table 2 has been built from specific maintenance intervention requirements shown in the following tables. The tables highlight the required maintenance interventions along with the unit cost to undertake these works:

Table 3 – 2030-2050 Intervention Requirements for an existing Avon unit restricted to 500 hours.

Table 4 - 2030-2050 Intervention Requirements for an existing unit with Control System Restricted Performance.

Table 5 - 2030-2050 Intervention Requirements for an existing unit with Dry Low Emissions Modification.

Table 6 - 2030-2050 Intervention Requirements for a New Unit.

Table 3 – 2030-2050 Intervention Requirements for an existing Avon unit restricted to 500 hours

■		■		■		■		■		■		■		■		■		■	
■		■		■		■		■		■		■		■		■		■	
■		■		■		■		■		■		■		■		■		■	
■		■		■		■		■		■		■		■		■		■	
■		■		■		■		■		■		■		■		■		■	

Table 4 – 2030-2050 Intervention Requirements for an existing unit with Control System Restricted Performance.

■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■

Table 5 - 2030-2050 Intervention Requirements for an existing unit with Dry Low Emissions Modification.

■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■

Table 6 - 2030-2050 Intervention Requirements for a New Unit.

■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■

4. Decommissioning

Within the Final Options Selection Report and subsequent Cost Benefit Analysis there has been allowance made for decommissioning costs of the existing affected Avon units for the various Brownfield options located within the Plant 1 and Plant 2 areas and these can be seen within the cost build up for the various options. The allowances within these costs are for the decommissioning and removal of the existing Avon units to allow for construction of the new 'Brownfield' Gas Turbines. Costs will vary depending on the option presented but this is clearly identified within the CBA cost summary table.