Engineering Justification Paper: EJP04

Governor Interventions

Cadent
Your Gas Network

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1 Summary Table

Name of Programme	Governor Interventions		
Programme reference	EJP04		
Primary Investment Driver	Asset health – Reliability		
Programme Initiation Year	2027		
Programme Close Out Year	2031		
Total Installed Cost Estimate (£)	[Cost data redacted]		
Cost Estimate Accuracy (%)	*±5%*		
Project Spend to date (£)	RIIO-2 spend to date is [Cost data redacted] RIIO-3 spend to date is [Cost data redacted]		
Current Project Stage Gate	Rolling programme of investment		
Reporting Table Ref	5.04 Governors		
Outputs included in RIIO-3 Business Plan	*Yes*		
Spend apportionment (RIIO-3)	**RIIO-2**	**RIIO-3**	**RIIO-4**
	[Cost data redacted	[Cost data redacted]	[Cost data redacted]
Proposed Regulatory treatment for RIIO-3 workplan	Managed via NARMs (network asset risk metric)		

Table 1: Summary Table

Unless otherwise stated, all prices are pre-efficiency and are in a 23/24 price base throughout this document.

This investment case does not satisfy the criteria for late competition or early competition and pursuing these activities would not be in the interests of the customer. We recognise the benefits that competition can bring to customers through efficiency and innovation. We continue to challenge ourselves as a business to ensure that we are harnessing competitive forces where they can provide these benefits. For specific detail on how we have assessed competition, please see Chapter 6 of the Workforce and Supply Chain Strategy (Appendix 17).

2 Executive Summary

Cadent owns and maintains below 7 bar pressure regulating installations. The installations (commonly referred to as governors) are typically where gas pressure is regulated from Intermediate Pressure (IP – between 2-7 bar) or Medium Pressure (MP – 75mBar to 2 bar), down to Low Pressure (LP – below 75 mBar) that is supplied to customers. This engineering justification paper considers all pressure reducing installations operating below 7 bar and include the following categories: district governors, industrial and commercial governors and service governors.

The primary driver for investing in our Governors is asset health. Ensuring we invest in our most aged systems, systems in the worst condition and those with the highest fault rates, in combination with network system resilience/criticality of each site. We have modelled the performance of our governor sites, in accordance with the NARM methodology. This demonstrates that we need to continue to invest in these assets to manage ongoing issues such as: poor performance linked to asset deterioration; efficiency; compliance with PSSR (for IP sites only) and potential interruptions to supply in the event of failures. If we do not invest, the risk of failures and other services impacts will rise quickly. We have used our asset model to derive a range of programme options based on different goals.

Cost and volumes for this and the previous price control have been included below, as well as a forward look to RIIO-4. Although the volumes between RIIO-2 and RIIO-3 look to be delivering less for the same expenditure, the volume unit for intervention is aggregated to system and therefore does not facilitate a direct comparison. In RIIO-3, intervention is reported per system to drive consistency across our networks for future reporting, investment modelling and decision making.

Our preferred option maximises benefit of investment over the lifecycle of the assets within the bounds of RIIO-2 expenditure. This option provides a strong positive Net Present Value (NPV) and satisfied the expectations of what our customers are willing to pay for considering the recent cost-of-living crisis. Additionally, it removed our poorest scoring assets in respect of asset health to operate a safe, secure and reliable network.

Commercially sensitive information redacted

Table 2: Cost and volumes across regulatory periods

Spend to date on this asset class within the RIIO-2 period is:

- District governors we have spent – [Cost data redacted]
- Service governors we have spent – [Cost data redacted]

3 Introduction

This document covers the engineering justification for our district governors, I&C governors and service governors. These systems are comprised of several individual components, the function of which is to reduce the pressure safely, efficiently and reliably to a level suitable for the downstream network. The governors operate at IP (Intermediate pressure 2-7 bar), MP (Medium pressure 0.075 - 2 bar) and LP (Low pressure 0 – 0.075 bar). Our investment scenario is based on the probability and consequence of failure at system level, regardless of whether they are a district governor, I&C governor or service governor. Systems operationally are the same and therefore their failure modes and consequence of failures are the same, however the impact of a failure could be different, as a service governor could feed 1 – 10 customers, were as a district governor could feed 100's or 1000's of our customers.

The investment expenditure and volumes discussed in this paper have been derived from our investment methodology (this is discussed in more detail in our Network Asset Management Strategy (NAMS)) through the assignment of health scores per equipment, asset criticality and service risk metrics. By developing standardised investment options, we can demonstrate an optimised programme to manage asset risk and maximise investment benefit. This has been developed using our asset model. This has looked at actual fault rates and has consequence of failure for each fault to derive a monetised risk value.

4 Equipment Summary

This section outlines the various governor stations in use and their components. A summary of their distribution by region and current condition of the asset stock is provided.

4.1 Overview of the assets

	Summary information
Location on the network	Governors are located across our four regulated distribution networks
Normal operating modes	Most of these systems operate in a working stream/standby stream configuration. One stream will have a higher set point than the other and this will be the working stream. The other (standby) stream will have a lower set point and only operate should the outlet pressure drop. The working stream will be designed to supply 100% of the demand, with the standby also capable of supplying 100% of the demand. This may be different with systems with more than two streams and may work in a 50%/50%/standby configuration, to be able to supply full load for extra network resilience. There are also some systems within our networks that are single streams. These are often used as a backup governor for integrated networks and will be used for low pressures, however these systems have no redundancy due to the single stream.
Redundancy architecture	We design the network to a N+1, where N = the total number of streams required to maintain designed capacity. This is an industry standard as per IGEM TD/13 edition 3.
Global equipment count	We have [sensitive information redacted] governors across our 4 distribution networks • [sensitive information redacted] are Industrial and commercial • [sensitive information redacted] are district governs • [sensitive information redacted] are service governors.

	Summary information
Breakdown of manufacturers / models	We have over 50 manufacturers of regulators in operation today, ranging from [sensitive data redacted]. We have nearly 300 different models in operation.

Table 3: Asset overview - Governors

Commercially sensitive information redacted

Figure 1: Typical lay out of a governor

The above schematic shows a typical arrangement for a governor, with a pressure monitoring and control system.

The stream mirror each other in design and are built with the following components:

- Valve – These are stream inlet and outlet isolation valves
- Filters with differential pressure gauges
- Slamshut or monitor regulator- These act as a safety device to stop over pressurisation of the downstream network and are the last line of defence. MP systems will have either a monitor or a slamshut. IP systems will have both
- Active regulator- This is the main working component of the system and regulates the pressure
- Relief valve- This acts as a safety device, like a slamshut, to stop over pressurisation of the downstream network
- Non return valve – these are there to stop any back pressure in the system

As mentioned in the summary table above we have over 50 manufacturers and 300 models in operation on our governor assets. This investment case addresses issues across our global population of relevant assets; however, we are observing issues specifically with [sensitive data redacted].

4.1.1 Donkin 303 Slamshut

Commercially sensitive information redacted

Figure 2: Donkin 303 slam shut

4.1.2 ERS Cartridge

Commercially sensitive information redacted

Figure 3: ERS cartridge

4.1.3 Auxiliary controlled district governors (J81 Regulators)

Commercially sensitive information redacted

Figure 4: Twin stream system with J81 regulators with auxiliary control and PMAC operation

4.2 Global equipment count

The following table summarises the total number of < 7 bar PRIs, split between district governors, industrial & commercial governors and service governors.

Commercially sensitive information redacted

Figure 5: Governor population split by asset type and network (Asset model - extracted November 2024)

The following table sets out a view of asset age of this asset class. These assets typically start to show elevated fault rates at around [commercially sensitive information redacted] from installation. See section 6 for more information on failure rates.

Commercially sensitive information redacted

Figure 6: Governors install years (Asset model - extracted November 2024)

These assets have a rolling programme of inspections and condition surveys, providing insight into asset condition. Our condition data is coupled with fault data which provides an overview on the health of an asset. It is the metric that is modelled to determine the need for investment. Table 4 shows the current average health score of these assets, split by network and a cadent average.

Asset health scores range from 1-5; 1 being excellent condition and 5 being very poor. See NAMS document for methodology on how these health scores are derived.

Network	Governors
Eastern	[sensitive information redacted]
North London	[sensitive information redacted]
Northwest	[sensitive information redacted]
West Midlands	[sensitive information redacted]
Cadent average	[sensitive information redacted]

Table 4: Average health score, by network and as Cadent average (Asset model - extracted November 2024)

5 Problem Statement

Our governors are critical asset within our distribution networks, as these take the gas from our offtakes and PRS, reducing the pressure and allowing for the safe transportation and distribution into the local networks and on to our customers. The investment driver for these assets is to mitigate the risk of supply interruptions caused by asset deterioration and failure. We have a statutory obligation per licence condition 16 to ensure security of supply to meet our peak 1 in 20yr peak demand. Further, we have a duty to comply with PSSR regulations 8 (inspections) and 12 (repair of pressure systems). In section 4.1, we discussed that J81's, Donkin 303's and ERS are increasingly prone to failure with access to spares declining, as validated through operational SME's (subject matter expert) and captured through our fault forms. Contravention of our statutory obligations is unacceptable, and we therefore must ensure that we manage the assets in our network that increase any such risk.

By the end of RIIO-2, our modelling informs us that [sensitive information redacted] of our governor assets will have a asset health score greater than [sensitive information redacted]

Our intent, as per our strategy, is to hold asset health stable, and ensure security of supply to our customers, whilst removing some systems with an asset health score of 5. We consider this a minimum standard for our investment as we are seeing operational challenges with systems that are asset health score of 5. Failure to invest in these systems would put us at risk of not meeting our statutory obligations of providing a safe and reliable gas supply to our customers or meeting our 1in 20yr peak demand. Our investment seeks to mitigate the risks posed by poorer performing assets and those with a decline of spares that are required through routine maintenance and failure of soft parts (the internal components of the asset). Due to newer more efficient technologies, this investment will also help reduce our carbon emissions.

5.1 What happens if we do nothing

As our assets age and deteriorate they are more prone to failures, which in turn affects the ability of these assets to meet safety and reliability requirements.

The following summarises the risks if we do nothing:

- Safety: We must comply with PSSR (2000) regulation 8 (written scheme of examination for inspections) together with intervention, as required, in relation to regulation 12 (maintenance and repair). We have an obligation to prevent serious injury from the hazard of stored energy because of the failure of a pressure regulating installation or one of its component parts. We have a robust maintenance regime for our governors, however due to the unreliability of some systems with no available spares, we are seeing an increased frequency of adhoc works being carried out to ensure operation and compliance. Without this maintenance regime on our governors, this poses a safety risk, due to the fire and explosion risk from a leak following a failure. The consequences we have modelled are fatalities and minor injuries following ignition.

- Environmental: Loss of containment will result in a gas-release to the atmosphere, with a resulting impact to carbon emissions. We have a target to reduce our emissions as per our EAP (environmental action plan) therefore any option that undermines our environmental commitments is not favourable.

- Regulatory compliance: We have a legal obligation to inspect and maintain these assets under the Pressure Systems Safety Regulations 2000 (PSSR) (IP Only).

- Security of Supply: We have a duty to comply with the terms of our gas transporter licence, specifically condition 16 (Pipeline system security standards) to manage our network to meet the demand of connected customers by supplying to meet the peak aggregate daily demand. Any option that prohibits the meeting of this condition is not favourable. Governor system failures could cause asset or site outage, resulting in customer supply interruptions. Depending on the configuration of the network and the size of the site, this could result in a significant number of customers being impacted. The impact of this could require significant resources to put customer supplies back on and would take some time to do so.

- Financial: Any governor system failure will have resulting costs to respond and mitigate the failure, to re-establish operation, repair and restore service. Repair costs also increase with the life of the assets. Options that negatively impact the customer bill or result in penalties through fines are not favourable.

- Customer Interruptions: Safety and resilience are non-negotiable. Customers place a high premium on the safety and resilience of the network. Therefore, any investment must focus on minimising and mitigating risks to prevent customer interruptions, ensuring a continuous, safe and dependable gas supply.

5.2 Key outcomes and understanding success

[Commercially sensitive information – section redacted]

5.3 Narrative real-life example of problem

[Commercially sensitive information – section redacted]

5.4 Project Boundaries

[Commercially sensitive information – section redacted]

6 Probability of Failure

[Commercially sensitive information – section redacted]

6.1 Failure modes

Commercially sensitive information redacted

Table 5: Failure modes and consequences

6.2 Failure rates for each failure mode

Commercially sensitive information redacted

Figure 7: Failure rates over time for reactive only, which is our baseline do nothing programme (Asset model - extracted November 2024)

6.3 Probability of Failure Data Assurance

7 Consequence of Failure

[Commercially sensitive information – section redacted]

Commercially sensitive information redacted

Table 6: Consequence of failure

8 Options considered

[Commercially sensitive information – section redacted]

8.1 How we have structured this section

[Commercially sensitive information – section redacted]

8.2 Modes of intervention

Commercially sensitive information redacted

Table 7: Intervention modes used in programme options

8.2.1 Mode 1: Repair of a governor

Commercially sensitive information redacted

Table 8: Intervention option 1: Reactive minor repair

8.2.2 Mode 2: Minor refurbishment

Commercially sensitive information redacted

Table 9: Intervention mode 2: Minor refurbishment

8.2.3 Mode 3: Major refurbishment

Commercially sensitive information redacted

Table 10: Intervention option 3: Reactive major repair

Mode 4: Full system replacement

Commercially sensitive information redacted

Table 11: Intervention mode 4: Full system replacement

8.3 Timing choices

[Commercially sensitive information – section redacted]

8.4 Options

[Commercially sensitive information – section redacted]

Commercially sensitive information redacted

Table 12: Intervention modes against timing choices

8.5 Programme Options

Commercially sensitive information redacted

Table 13: Programme options

8.6 Technical Summary Table: Programme options

[redacted]

Commercially sensitive information redacted

Table 14: Summary of programme option

Commercially sensitive information redacted

Figure 8: Condition profile for each programme option by end of RIIO-3 (Asset model – extracted November 2024)

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9 Business Case Outline and Discussion

[Commercially sensitive information – section redacted]

9.1 Key Business Case Drivers

[Commercially sensitive information – section redacted]

9.2 Business case Summary

Commercially sensitive information redacted

Table 15: Programme options comparison

9.3 Discussion of Results

9.3.1 Risk removal

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Figure 9: monetised benefit to avoid customer interruptions (relative to baseline option) per program option (Asset model - extracted November 2024)

9.3.2 Cost benefit analysis

Commercially sensitive information redacted

Table 16: Programme option 3 CBA factors

Commercially sensitive information redacted

Table 17: Programme options 2,6,7 and 9 CBA factors

9.3.3 Customer views

[Commercially sensitive information – section redacted]

9.3.4 Deliverability

[Commercially sensitive information – section redacted]

9.4 Programme Option Discussion

[Commercially sensitive information – section redacted]

9.5 Sensitivity analysis

Commercially sensitive information redacted

Table 18: Sensitivity testing

10 Preferred Option Scope and Project Plan

[Commercially sensitive information – section redacted]

10.1 Preferred Option

Commercially sensitive information redacted

Table 19: Intervention volumes; preferred programme option

10.2 Asset Health Spend Profile

Commercially sensitive information redacted

Table 20: Spend profile: Preferred programme option

Commercially sensitive information redacted

Table 21: Proposed programme of Governor interventions

10.3 Investment Risk Discussion

Commercially sensitive information redacted

Table 22: Risks

10.4 Project Plan

[Commercially sensitive information – section redacted]

10.5 Key Business Risks and Opportunities

[Commercially sensitive information – section redacted]

10.6 Outputs included in RIIO-2 Plans

[Commercially sensitive information – section redacted]

11 Regulatory Treatment

[Commercially sensitive information – section redacted]

12 Glossary Table

Term	Definition
CBA	Cost Benefit Analysis
EJP	Engineering Justification Paper
FES	Future Energy Scenarios
NARM	Network Asset Risk Metric
NPV	Net Present Value
PSSR	Pressure Systems Safety Regulations

Table 23: Glossary Table