Engineering Justification Paper: EJP16

Pressure Monitoring and Control on Governors

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1 Summary Table

Name of Project	Pressure Monitoring and Control (PMAC)		
Primary Investment Driver	Asset Health- Reliability/Resilience		
Project Initiation Year	**Start date for proposed RIIO-3 work plan**: 2026		
Project Close Out Year	**Completion date for proposed RIIO-3 work plan**: 2031		
Total Installed Cost Estimate (£m)	[cost data redacted]		
Cost Estimate Accuracy (%)	+/-5%		
Project Spend to date (£m)	[cost data redacted]		
Current Project Stage Gate	Strategic plan for rolling asset health programme		
Reporting Table Ref	5.06 Other Capex: Electrical and mechanical Instrumentation		
Outputs included in RIIO-3 Business Plan	Yes		
Spend apportionment (for RIIO-3 plan £m)	**RIIO-2**	**RIIO-3**	**RIIO-4**
	[cost data redacted]	[cost data redacted]	[cost data redacted]
Proposed Regulatory treatment for RIIO-3 workplan	**Base**		

Table 1: Summary Table

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).

All costs presented in this paper are pre-efficiency and are in 23/24 price base, unless otherwise stated.

2 Executive Summary

Pressure Monitoring and Control (PMAC) is used to monitor and control the company's below 7 bar distribution network to optimise system pressures. Under our Safety (Management) Regulations 1996 (GSMR) safety case, we design and operate our network to adequate pressure is maintained to ensure safe supply to our customers. We balance this with the need to reduce emissions through leakage by optimising pressures. This supports our Shrinkage Incentive performance and align with our Environmental Action Plan and the Climate Change Act 2008.

Successful investment in RIIO-3 will be to hold our risk profile stable throughout the period, with no supply interruptions and a stable failure rate.

In January 2024 we initiated a Cyber Security programme through RIIO-2 reopener to ensure compliance with Networks Information Systems regulations 2018 (NIS) by 2027. This programme triggered a change in our RIIO-3 IT and Telecoms strategy and initiated investment in our Operational Technology, including the [sensitive data redacted] systems. Whilst the PMAC equipment is out of scope of the Cyber Security programme, the PMAC [sensitive data redacted] system is included. This creates uncertainty in compatibility of current PMAC equipment with the IT strategic direction for [sensitive data redacted].

In RIIO-2 we stated that we would invest in:

- Upgrading the Public Switched Telephone Network (PSTN) components before the industry decommissions the PSTN infrastructure
- Fixing existing Pressure Monitoring & Control Installations by replacing components every 12 years
- Installing new Pressure Monitoring & Control systems to accommodate changes in the distribution network

Our plan for RIIO-3 is to continue pre-emptively replacing components in our PMAC systems, in line with part of our RIIO-2 strategy to "Fix existing Pressure Monitoring & Control Installations by replacing components every 12 years". This will cost [cost data redacted] and involve replacing approximately [sensitive data redacted] pressure monitors. As the upgrade of the PSTN network components will be completed in RIIO-2, no further investment in PSTN is planned for this period.

Successful investment in RIIO-3 will be to hold our risk profile stable throughout the period, with no supply interruptions and a stable failure rate.

Below is a table which summarises RIIO-2-GD3 spend and volume:

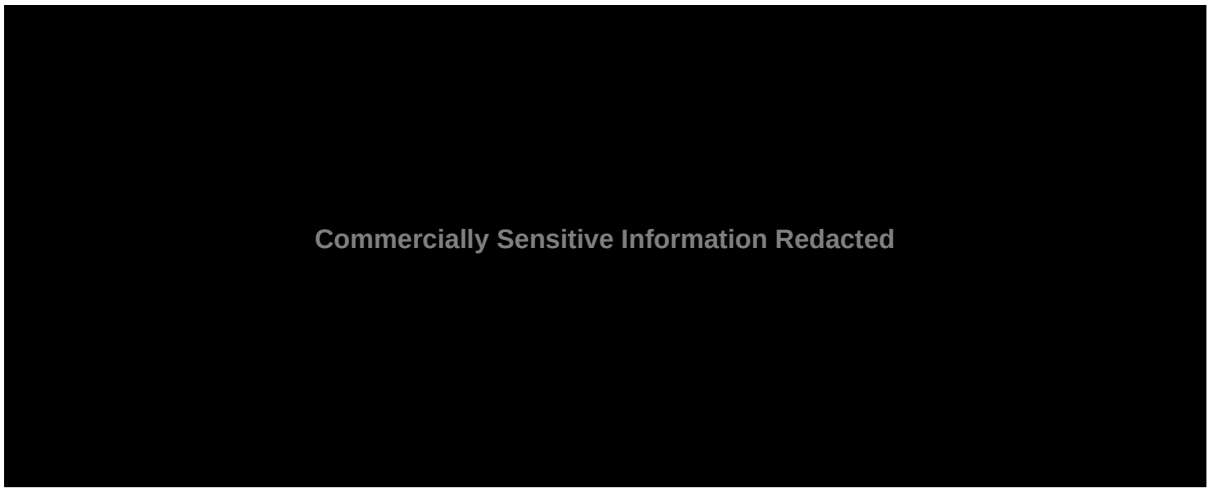

Table 2:RIIO-2-GD3 Volume and Spend Profile

3 Introduction

This investment case has been derived based on a review of available historic failure data of PMAC equipment. This data has enabled us to make an informed decision to determine a sustainable workload allowing us to maintain our current failure rate and minimise the associated operational risks and expenditure from failing systems.

We have a good understanding of the volume of our pressure monitoring units. In RIIO-2 we have a risk-based investment programme to swap at 12 years to balance the financial impact on the customer and acceptable risk in the network.

Our strategic approach for RIIO-3 is to continue the RIIO-2 strategy to replace components at 12 years which is approximately 8% of the asset population per year.

This strategy will ensure we continue to hold asset health stable, maintaining our current failure rate, while we navigate the uncertainty for an approved operational technology solution to comply with the NIS regulations.

We have considered a pre-emptive and reactive approach to replacing this equipment. We have developed a rationale which is included in Section 8.

If we were to solely rely on reactive replacement our analysis has identified that the refresh rate will increase to approximately 14 years. This would result in an increase in failures and reactive repairs which would see a deterioration in asset health, be more impactful on our services and would also be much less resource efficient than a proactive programme.

4 Equipment Summary

This section provides a summary of the number of PMAC systems by type and region, and then gives a summary of the current condition of the asset stock.

	Summary information
Location on the network	Control systems are located on the LP (Low-Pressure) & MP (Medium Pressure) network Monitoring Equipment is covered on all pressure tiers: (HP (High Pressure), IP (Intermediate Pressure), MP, LP)
Normal operating modes	We use an electronic PMAC systems to manage pressures on the LP&MP network, covering Pressure Reduction System (PRS) sites and network monitoring points attached to network mains at strategic locations
Redundancy architecture	PMAC systems are powered by solar power and battery, they have a mechanical failsafe
Global equipment count	PMAC systems are installed at [sensitive data redacted] sites

Table 3: Equipment Summary Information

4.1 Overview of the assets

There are a range of assets which form the parts of the overall PMAC system. Depending on the site configuration, demand requirements and criticality this will vary from site to site. The PMAC assets which form part of the system are listed below with an example of the overall PMAC system.

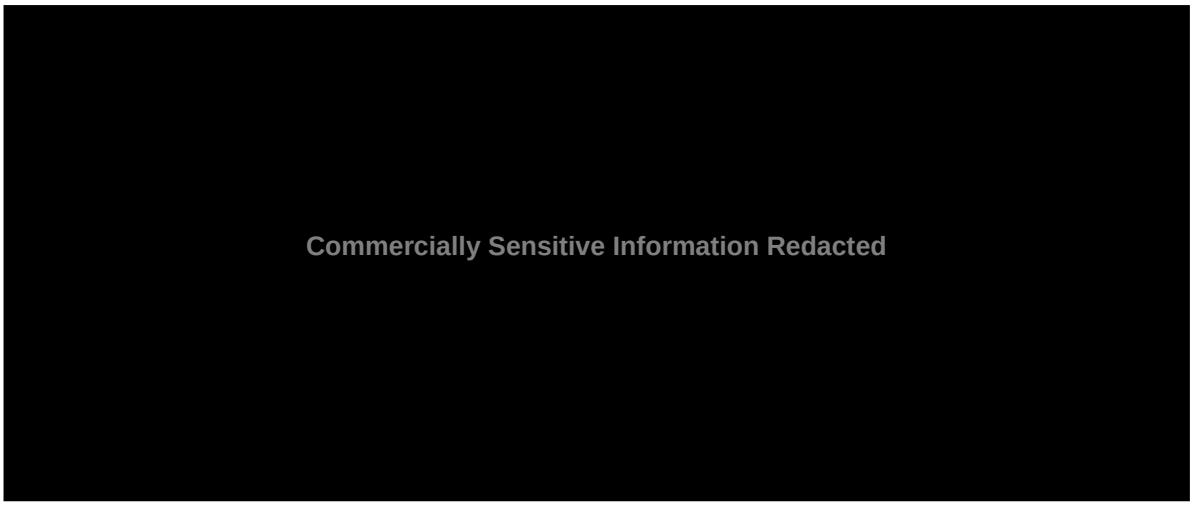

Figure 1: Example of PMAC system

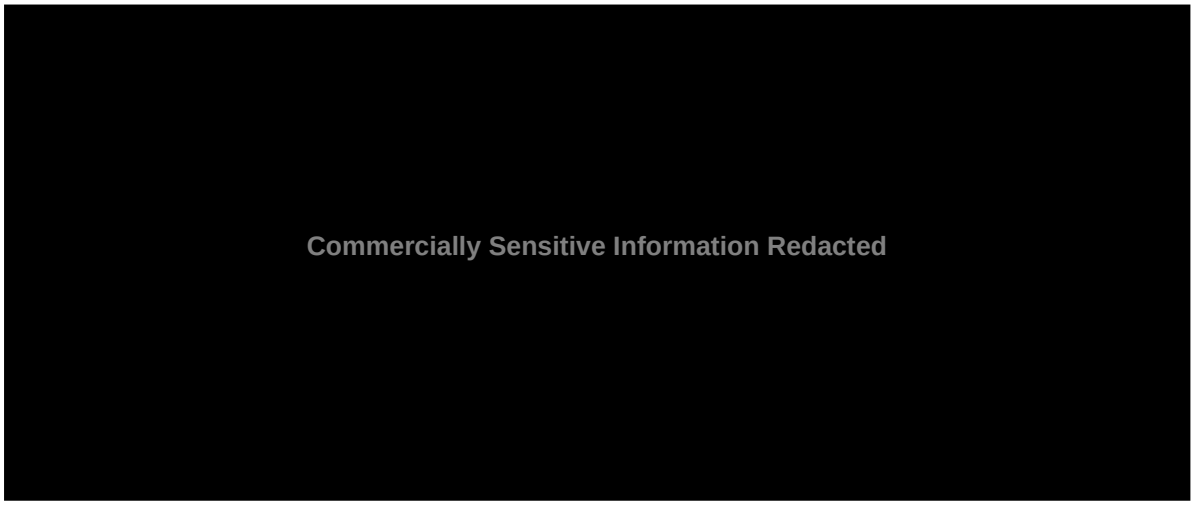

Figure 2: Example of PMAC Clocked Controller

Fixed Control: Mechanically set with a simple datalogger to monitor and report the pressure at the associated Pressure Reduction Installation.

Clocked Control: Programmed to switch between 2-3 mechanically set pressure settings based upon clock / time setting to control the outlet pressure of the associated Pressure Reduction Installation.

Monitoring Equipment:

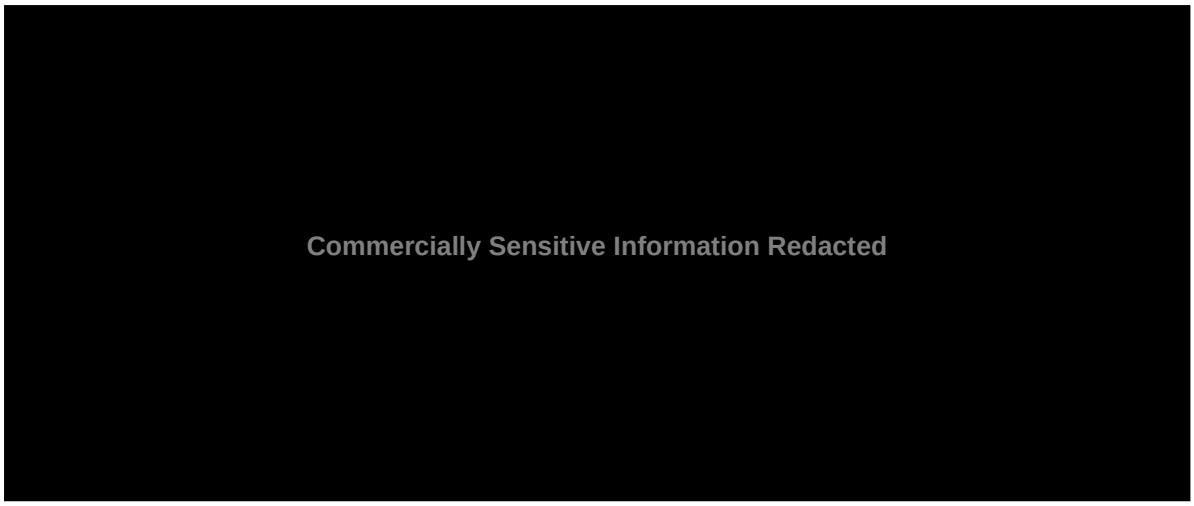

Figure 3: Example Newlog 4 Datalogger

Datalogger: Remotely programmed with a profile to control the outlet pressure of the associated Pressure Reduction Installation. This contains the daily and safe profile and communicates with the Profile pressure controller to set valve positions for desired outlet pressure.

Profile Pressure Controller: Controls the pressure, this works in conjunction with the attached logger and communications equipment to open/close valves based on a logger's profile.

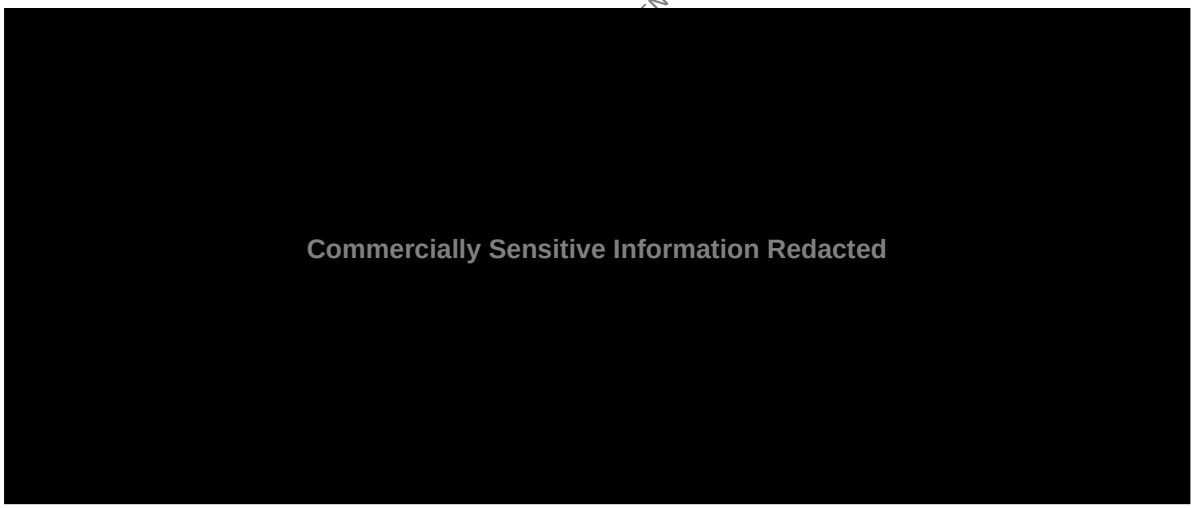

Figure 4: Example of PMAC Profile Pressure Controller

Extremity Low Pressure (LP) Point: a simple datalogger normally installed on a mains pressure post to monitor network pressure. These are normally sited so that the lowest pressure point on the gas network can be monitored (system extremity)

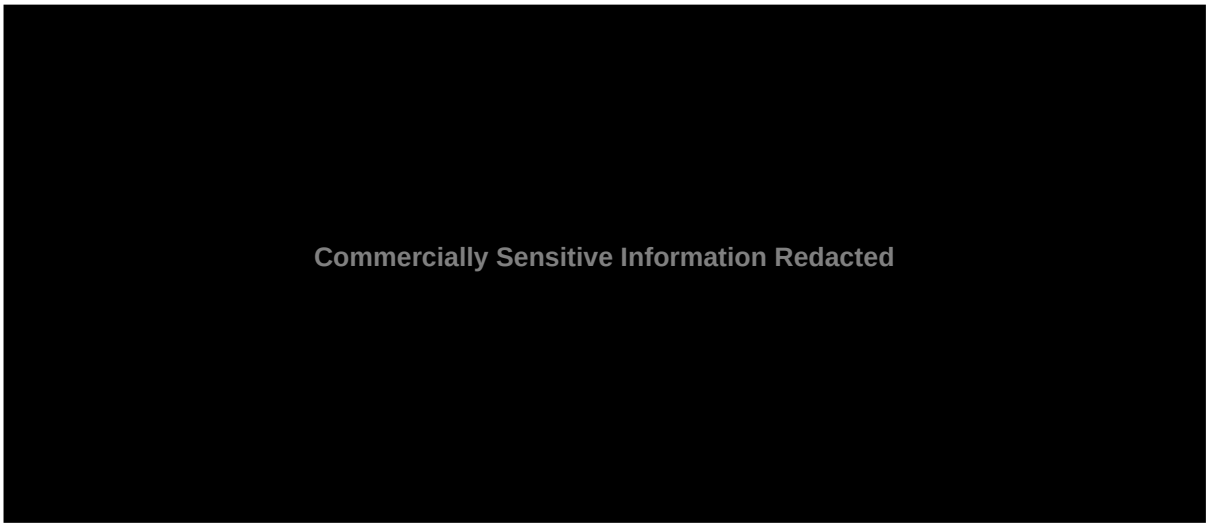

Figure 5: Example of PMAC Data logger

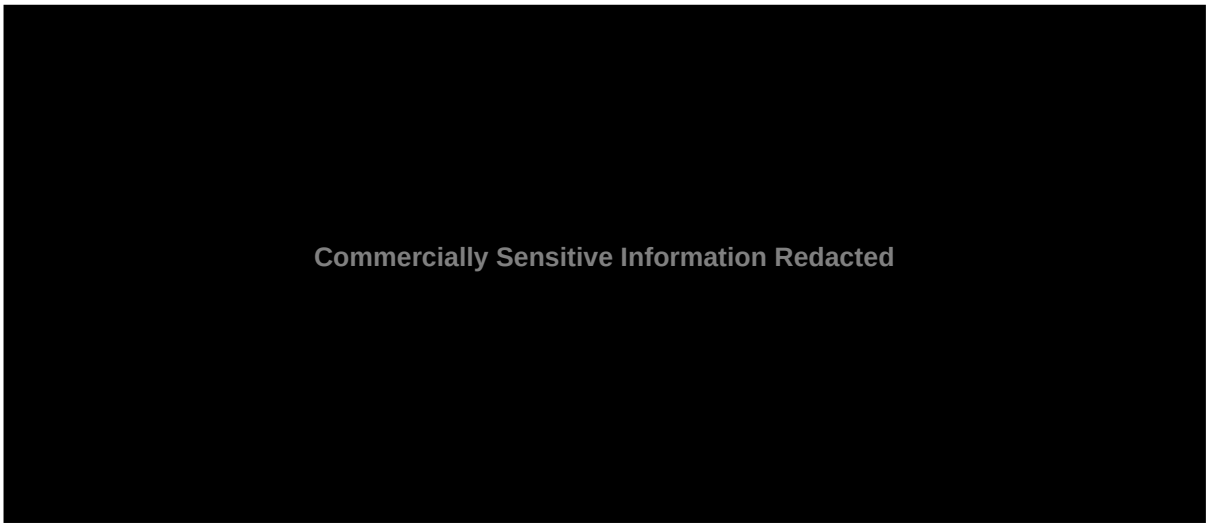

Figure 6: Example of Autogas Datalogger/Pressure controller

Autogas Datalogger/Pressure controller: Single unit combining the Logger and Controller.

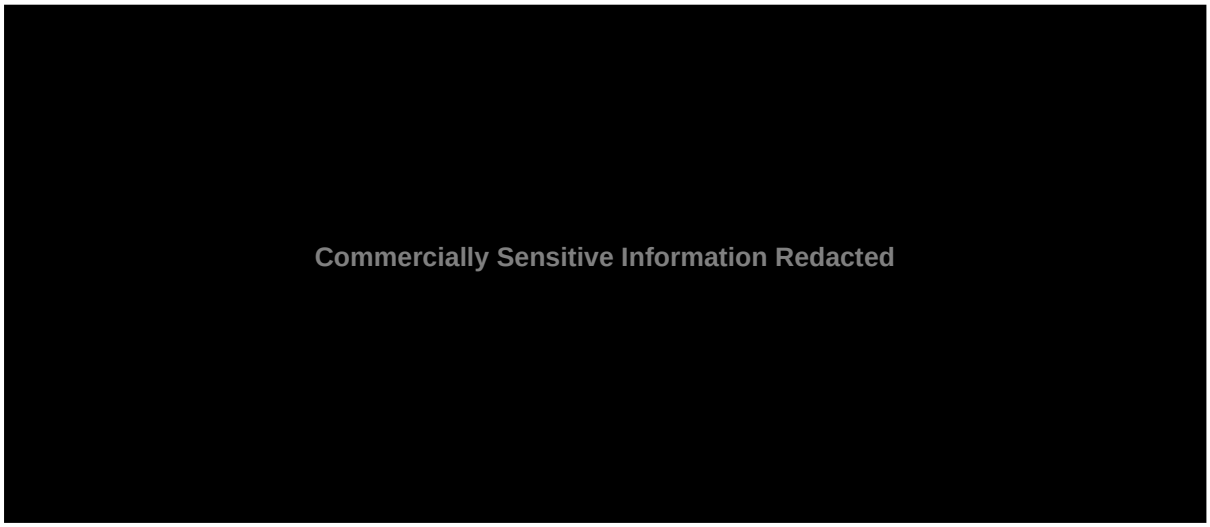

Figure 7: Example of PMAC Solar Panel

Solar Panel - Provides power to the unit.

Telecommunications Equipment

Modem: Provides over the air communications**.**

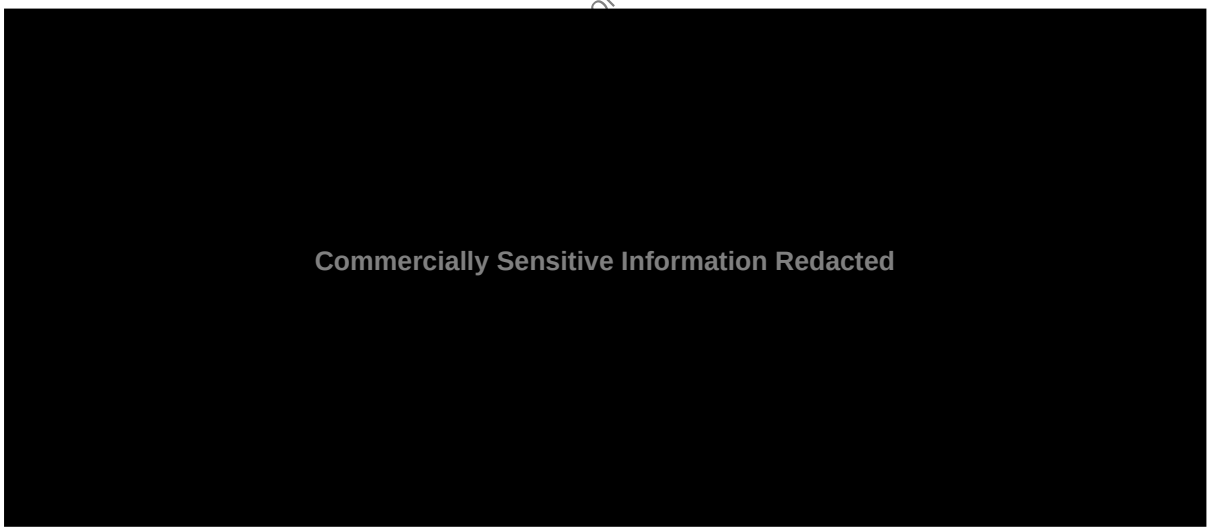

Figure 8: Example of Cello Modem

Modular Comms box: Provides protection to the communications equipment from the elements with a suitable Ingress Protection (IP) rating.

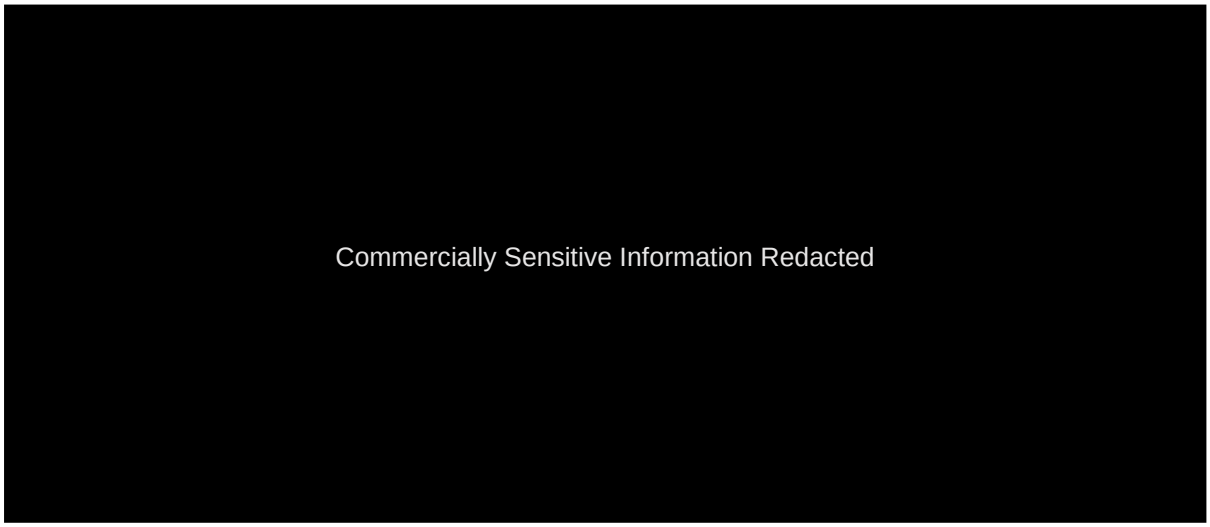

Figure 9: Example of Modular comms box

4.2 Detailed equipment summary

The number of systems within scope of this investment case have been identified from our corporate [sensitive data redacted] system. There are a collective total of [sensitive data redacted] sites which compromise of Fixed, Clock, Profile, and low-pressure validation logger PMAC systems. The site and Network split can be seen below.

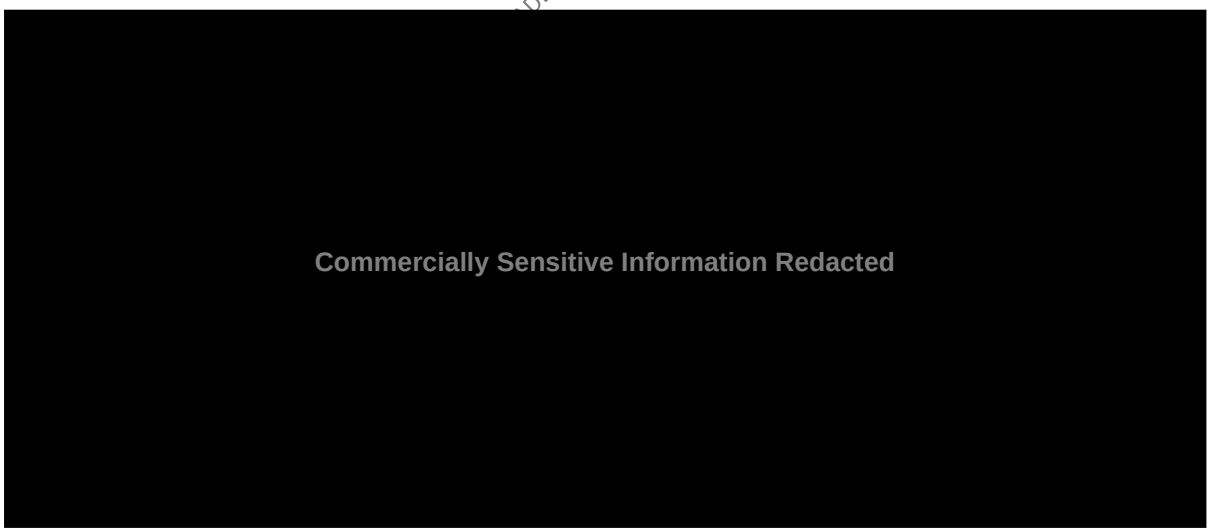

Table 4: Summary of PMAC systems broken down by type and network.

4.3 Asset Age Profile

PMAC assets are short-life assets (circa 10-year design life, as recommended by the manufacture), we currently operate a 12-year cyclical replacement programme.

Throughout the RIIO-GD1 and RIIO-2 periods, these systems are subject to a continuous programme of inspections, maintenance, and component replacements. This pre-emptive strategy ensures their reliability, and longevity, enabling us to meet the operational need to manage our network and deliver a continued service to our customers by holding our failure rate at a steady state.

When assets exceed their intended designed service life, the likelihood of non-repairable failures increases. We have observed in RIIO-GD1/2 that when assets exceed their maximum design life, they are more prone to non-repairable failures.

4.4 Asset Condition Profile

All PMAC assets are captured in our asset data core systems, the data is continuously updated when old assets/systems have been replaced with new. The survey gives each PMAC asset a static Health Index score between 1-5, 1 being new and 5 being poor.

Below is a visual representation of the condition grade of our PMAC assets from September 2024.

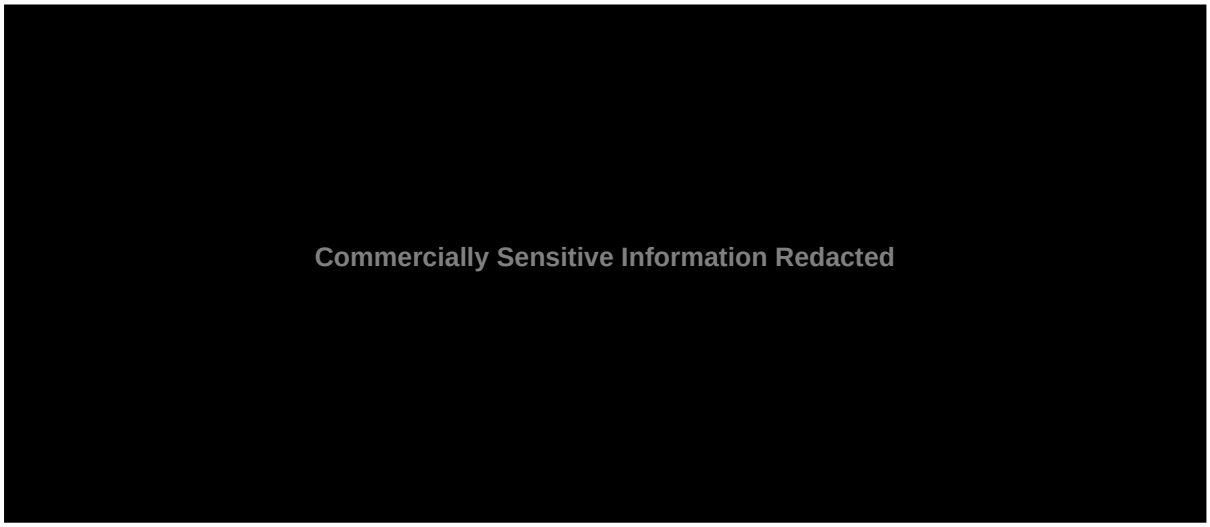

Table 5: Condition Profile of PMAC Assets by Network

As expected, the observed health of our PMAC components is reflective of these assets being short-life assets i.e. majority are health score 1-3. This indicates that the performance and degradation fall within the anticipated range for components of this type and age.

Because of this, we do not usually observe significant wear and tear (represented by health conditions 4-5) unless a component has already experienced a failure and requires replacement immediately. However, as these components continue to operate beyond their intended design life, the likelihood of failure increases.

This heightened risk of failure associated with aging components raises concerns regarding the long-term sustainability of our systems. Specifically, it has the potential to adversely affect our ability to consistently meet essential safety and reliability standards. Therefore, pre-emptive mitigation strategies, such as planned replacement schedules, are crucial to ensure continued operational integrity.

5 Problem/Opportunity Statement

Under the safety case, distribution systems are designed and operated to ensure that safe operating pressures are maintained at the system extremities. This ensures that we comply with the Gas Safety (Management) Regulations 1996 (No 551 Schedule 3, part 1, paragraph 3). A secondary driver is reduction in environmental emissions through leakage, which is achieved by optimising system pressures. This supports our Environmental Action Plan and aligns with the 2050 emissions target in the Climate Change Act 2008.

Through our investment approach, we expect to sustain the health of this asset group. We seek to maintain our demonstrable safety and compliance record as well as ensure the operation of our below 7 bar governors does not contribute to any emissions.

Our PMAC systems compromise of deteriorating assets, we need to ensure that we manage the assets appropriately in the realms of uncertainty of future integration while mitigating the risk of stranded investment.

5.1 What happens if we do nothing?

As our assets age and degrade, it has been observed from RIIO-GD1 to RIIO-2 they become increasingly prone to failure when they exceed their maximum design life, which, in turn, compromises their ability to meet essential safety and reliability standards by monitoring and controlling our network. PMAC systems are incorporated in our network to mitigate the following.

Doing nothing will pose the following risks:

- Safety: No investment in PMAC poses a safety risk; the loss of control and/or monitoring of the network could lead to over pressurisation of the network increasing the risk of explosion from a leak
- Environmental: Any leaks could result in the release of gas into the atmosphere, contributing to carbon emissions. Additionally, the loss of the ability to remotely control and manage our network will reduce Biomethane input
- Regulatory compliance: Failure to maintain our PMAC systems will lead to non-compliance with the Cadent Safety Case, Gas Safety Management Regulations, and the DSEAR Dangerous Substance and Explosive Atmospheres Regulations 2002 (schedule 1,2,3)
- Security of Supply: Ensure continuity of supply by effectively managing system pressures throughout our MP/LP network, including mitigating the risk of failure in aging metallic mains
- Customer Satisfaction: Failures leading to poor gas pressure and leaks can severely impact customer satisfaction. Inconsistent gas supply causes significant inconvenience and frustration
- Financial: Any PMAC failure will have resulting costs to respond and mitigate the failure, to re-establish operation, repair and restore service

With “do nothing” excluded from our options as it would be inconsistent with the safe, secure, and resilient operation of the system and would not be consistent with our regulatory obligations under the Gas Safety (Management) Regulations 1996, we seek to minimise the need for reactive / unplanned remediation and pre-emptively remediate to ensure security of supply and reliability.

5.2 Key outcomes and understanding success.

[Commercially sensitive information – section redacted]

5.3 Alignment with overall RIIO-3 investment strategy

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5.4 Narrative real life example of problem

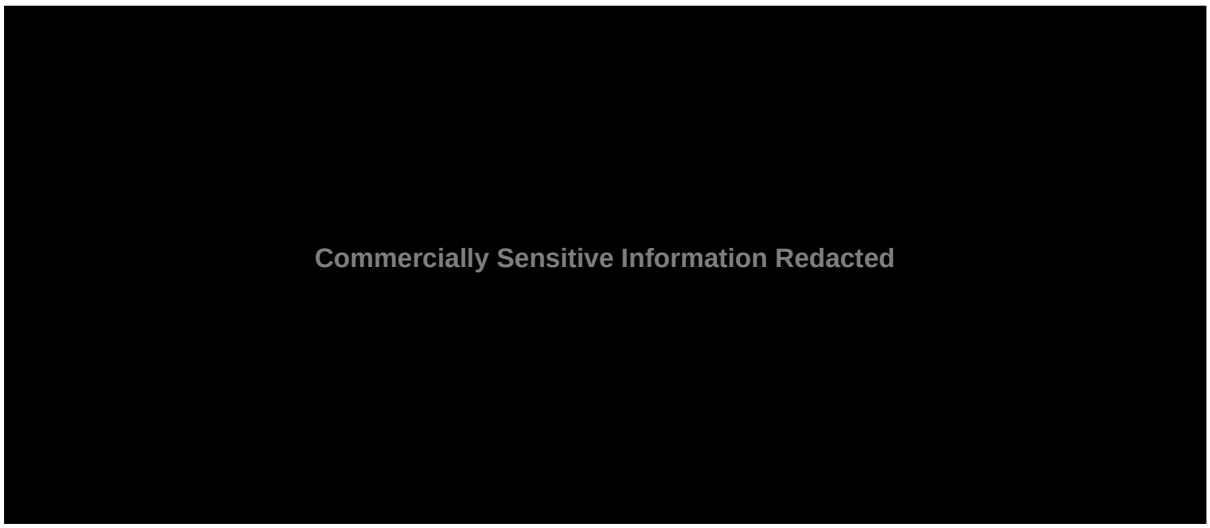

Figure 10: PMAC component failure example [sensitive data redacted]

5.5 Project Boundaries

[Commercially sensitive information – section redacted]

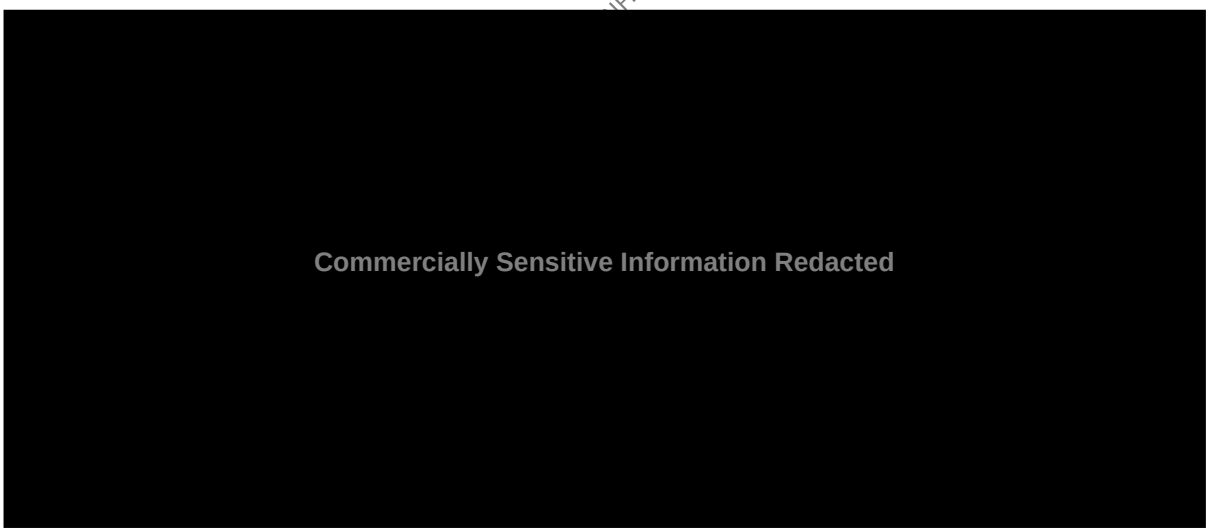

Figure 11: Diagram of PMAC system, drawing identifies the project boundaries of investment

6 Probability of Failure

[Commercially sensitive information – section redacted]

6.1 Failure modes

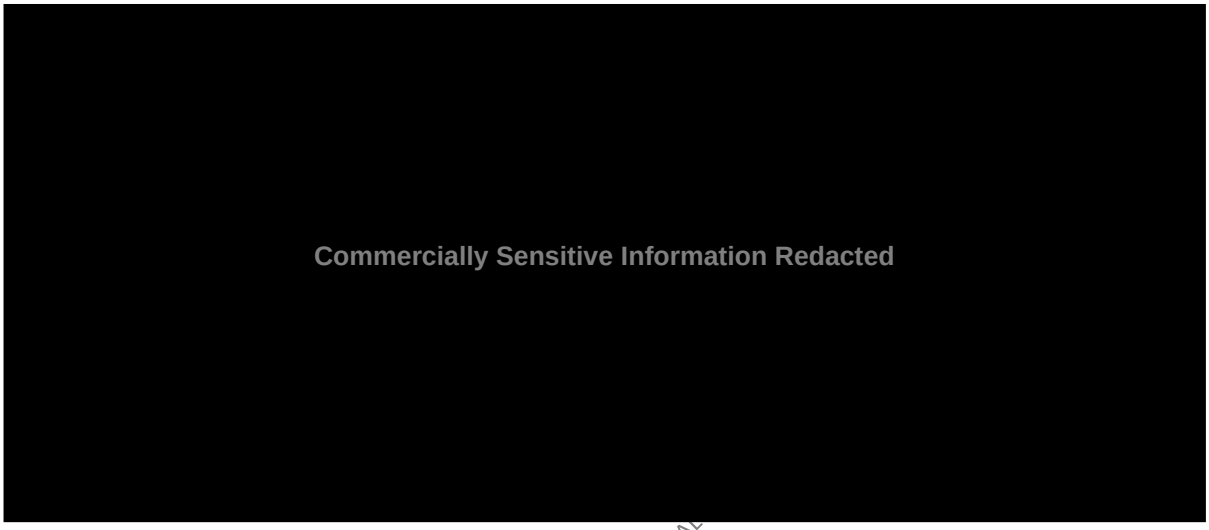

Table 6: PMAC fault and failure mode

6.2 Failure rates for PMAC

[Commercially sensitive information – section redacted]

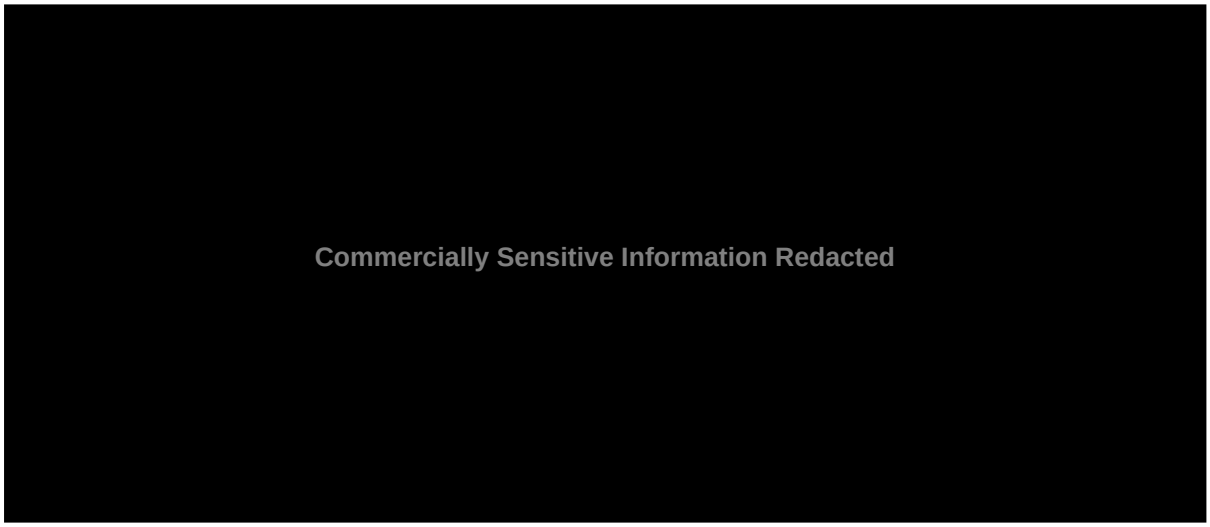

Table 7: Failure rate comparison of RIIO-GD1 to RIIO GD2 – Source EM profile and logger failure data

6.3 Probability of Failure Data Assurance

7 Consequence of Failure

[Commercially sensitive information – section redacted]

7.1 Safety

7.2 Security of Supply

7.3 Environmental

7.4 Future Energy Scenarios (FES)

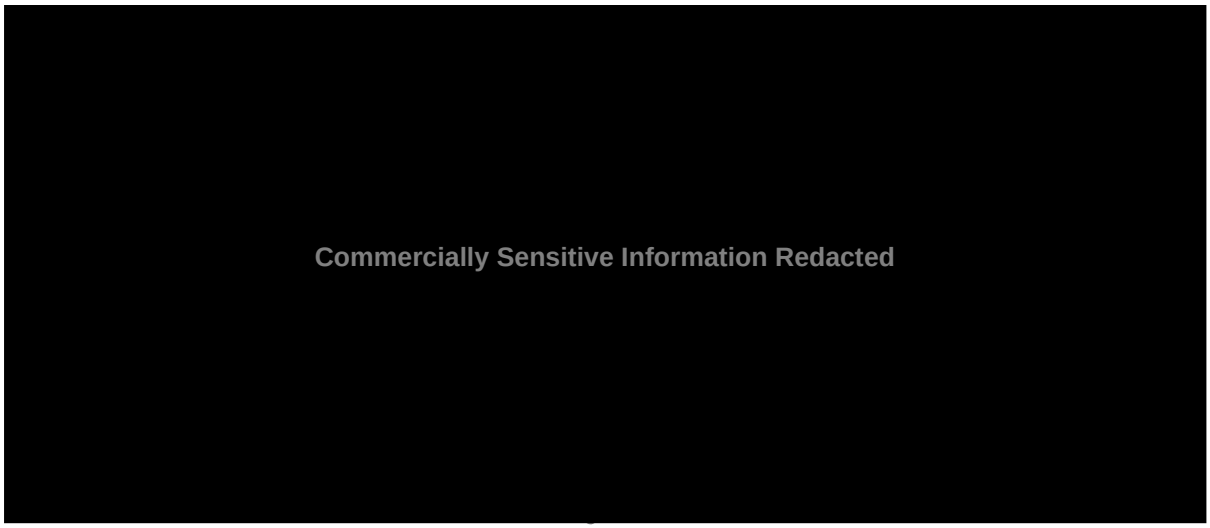

Table 8: Monetised risk of "baseline" reactive replacement on failure

8 Options Considered

[Commercially sensitive information – section redacted]

8.1 Modes of Intervention

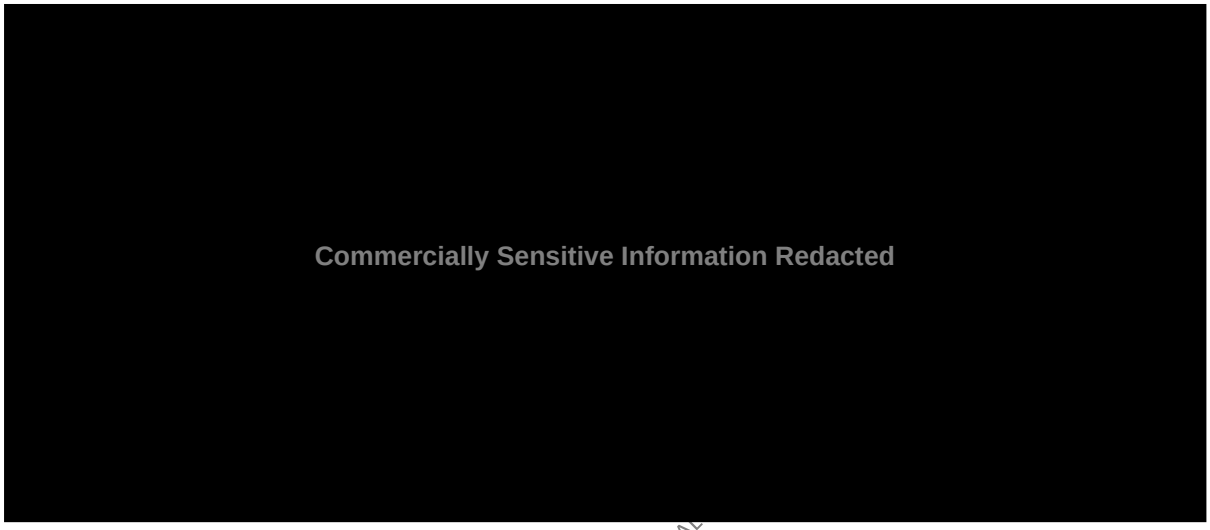

Table 9: Modes of Intervention

8.1.1 Repair of PMAC Assets

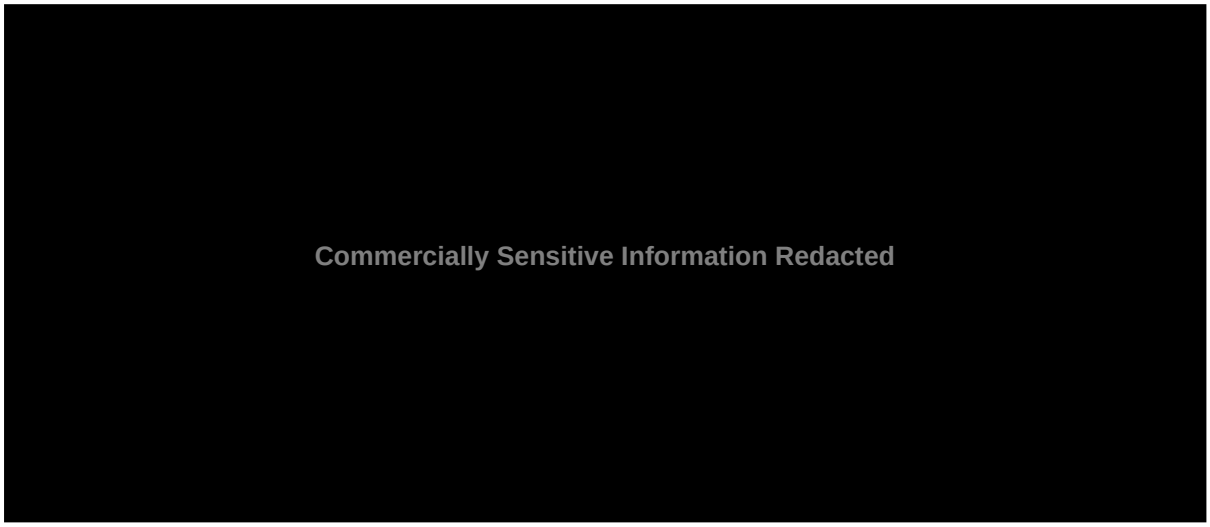

Table 10: Intervention mode 1: Repair of PMAC Assets

8.1.2 Minor Replacement of PMAC Assets

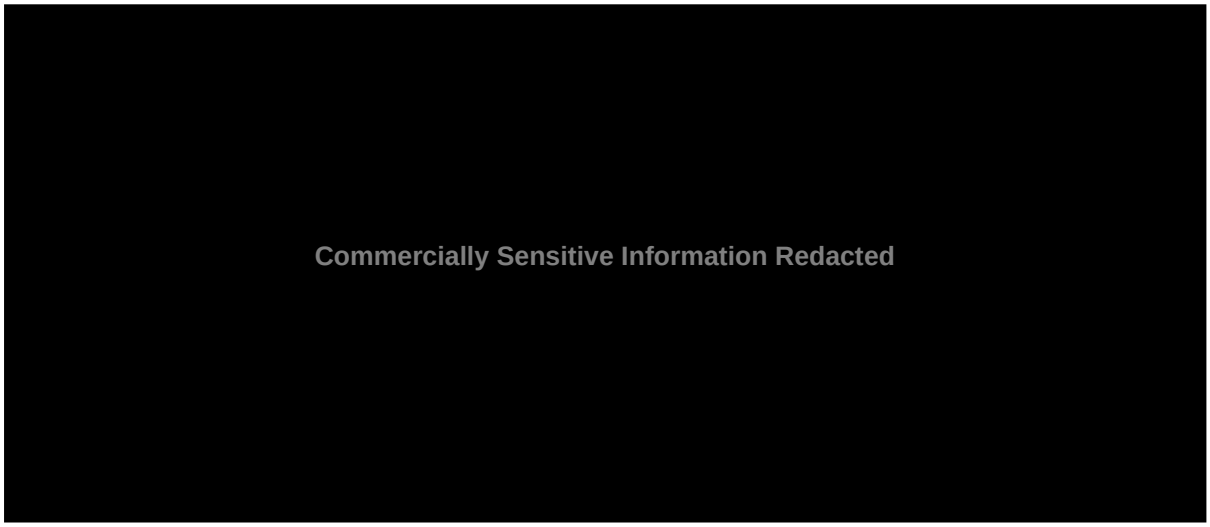

Table 11: Intervention mode 2: Minor Replacement of PMAC assets

8.1.3 Full Replacement of PMAC system

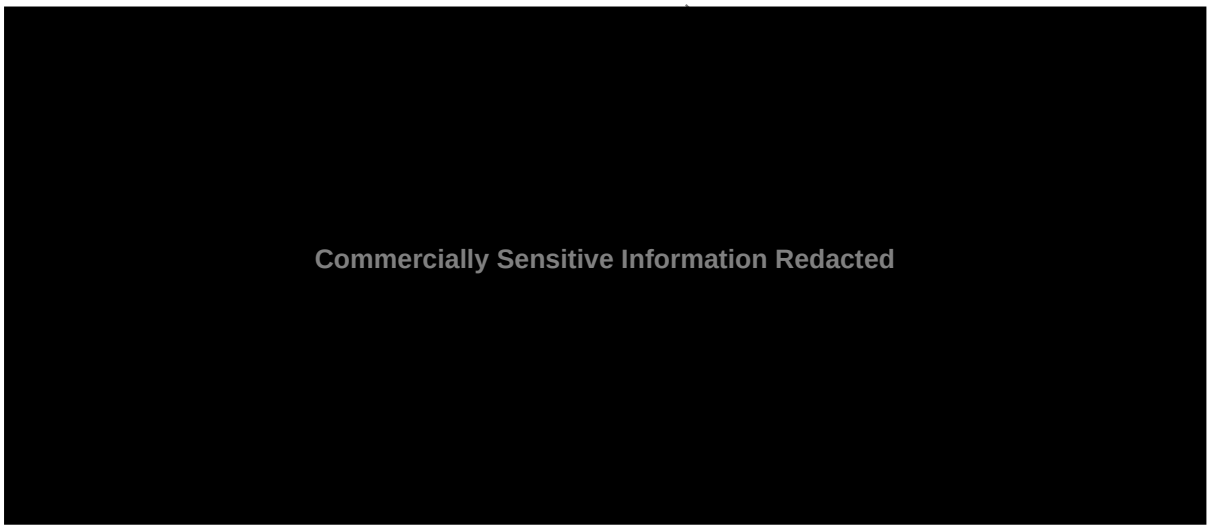

Table 12: Intervention mode 3: Full replacement of PMAC system

8.2 Timing choices

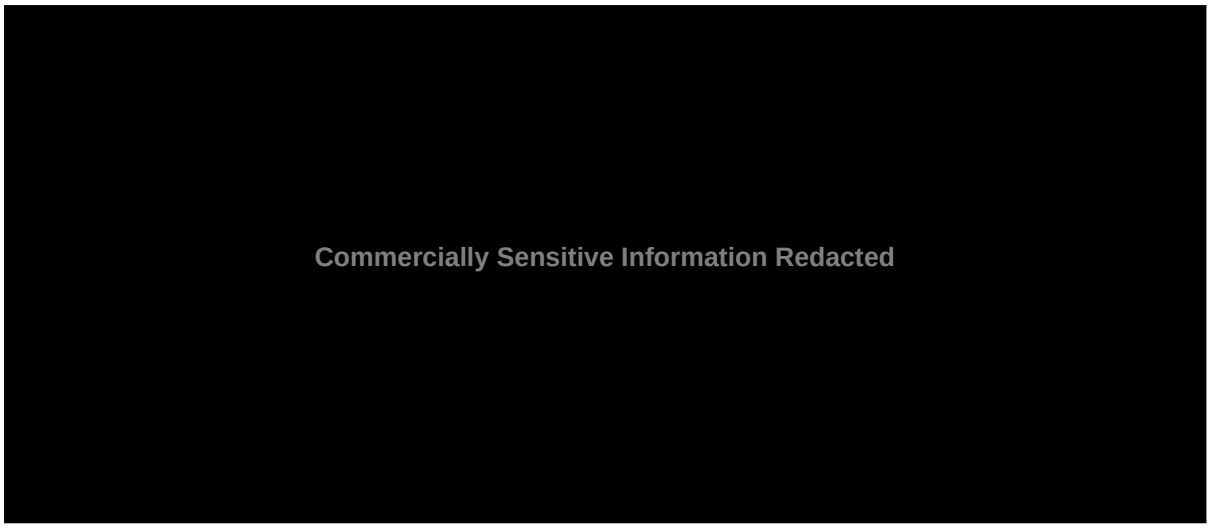

Table 13: Intervention mode timing choices

8.3 Programme Options

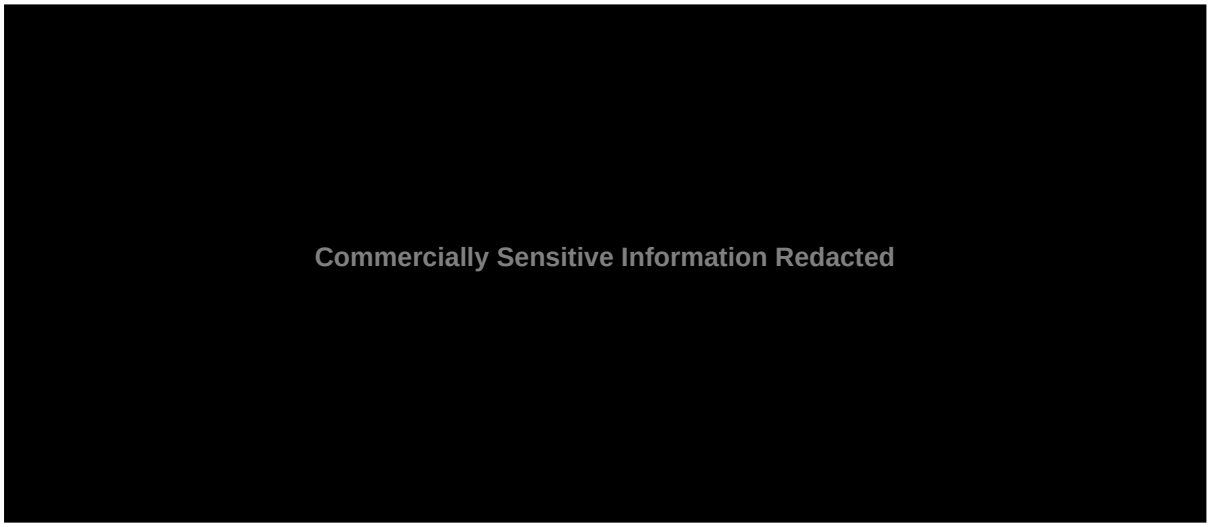

Table 14: Initial Programme options

8.3.1 Basis of Programme Volumes

8.3.2 Basis of Unit Cost

8.3.3 Programme option 1: Pre-emptive 10-year component replacement

Commercially Sensitive Information Redacted

Table 15: Programme option 1: Pre-emptive 10-year component replacement

8.3.4 Programme option 2: Pre-emptive 12-year component replacement

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Table 16: Programme option 2: Pre-emptive 12-year component replacement

8.4 Technical Summary Table: Programme Options

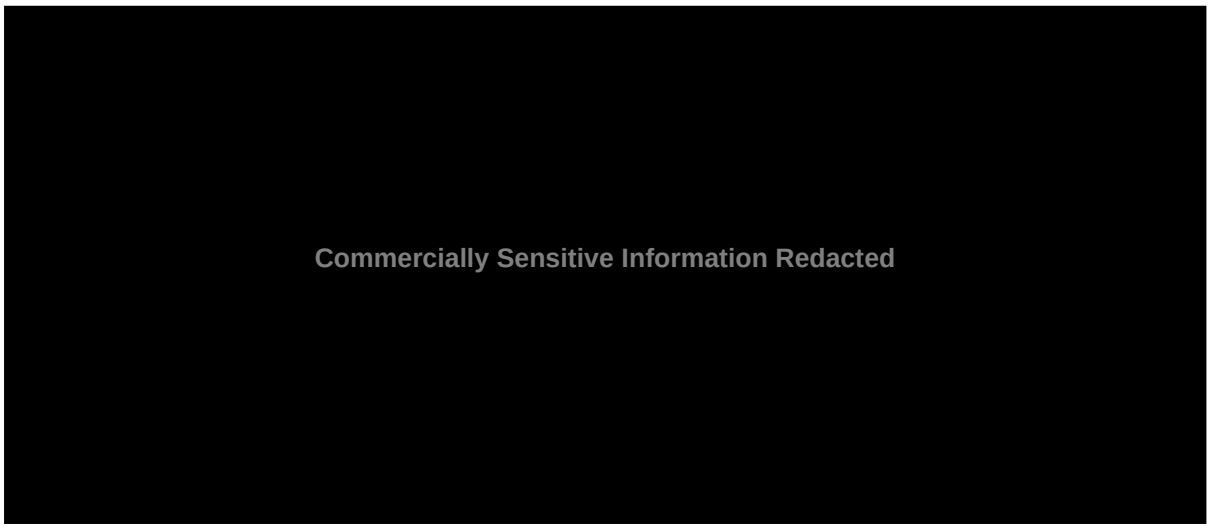

Table 17: Technical summary of Investment options.

9 Business Case Outline and Discussion

[Commercially sensitive information – section redacted]

9.1 Key business case drivers description

9.2 Business Case Summary

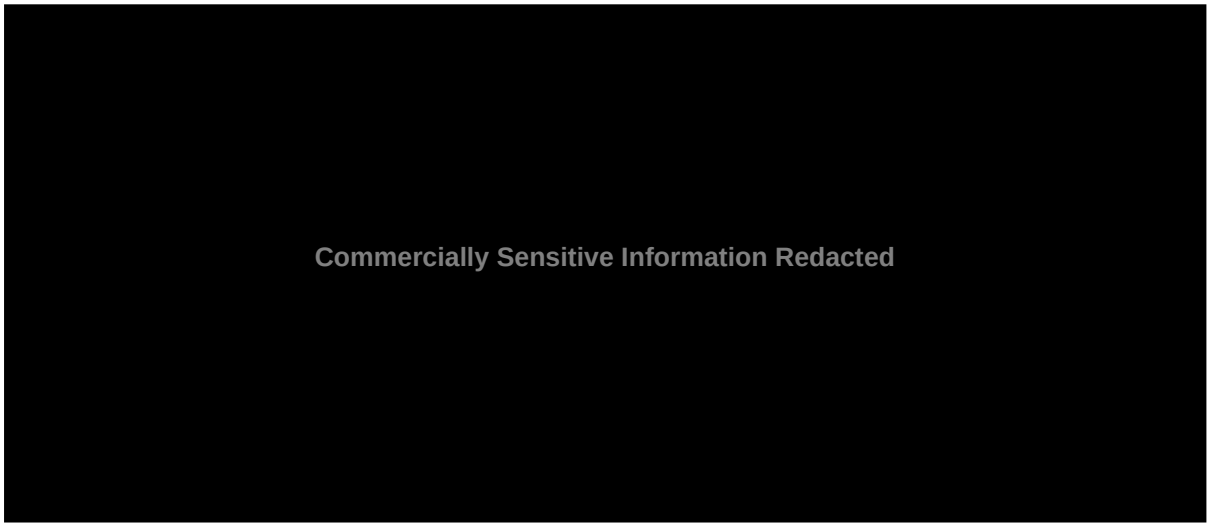

Table 18: Perceived value of each option as a business case

9.2.1 Discussion of results

9.2.2 Customer View and Willingness to pay

9.2.1 Sensitivity Testing

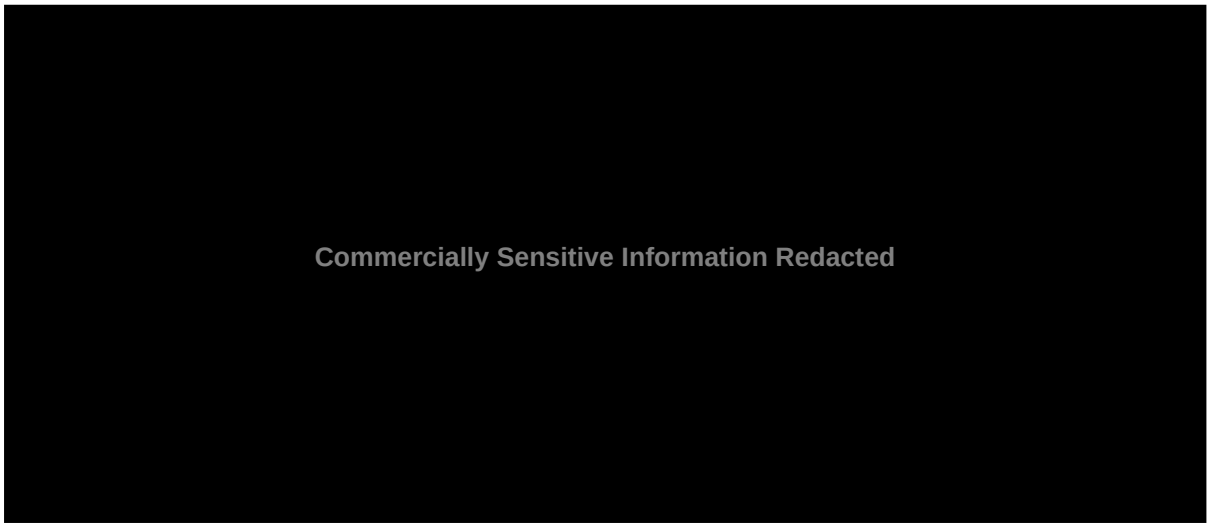

Table 19: Sensitivity Test Table

9.2.2 Conclusions

10 Preferred Option Scope and Project Plan

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10.1 Preferred Option

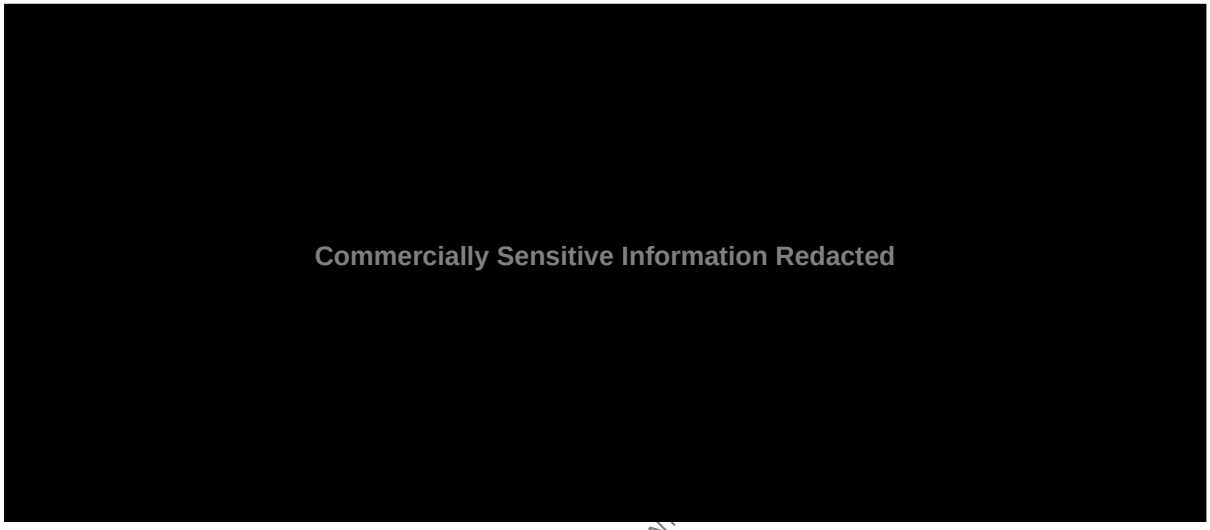

Table 20: RIIO-3 Volumes by network

10.2 Asset Health Spend Profile

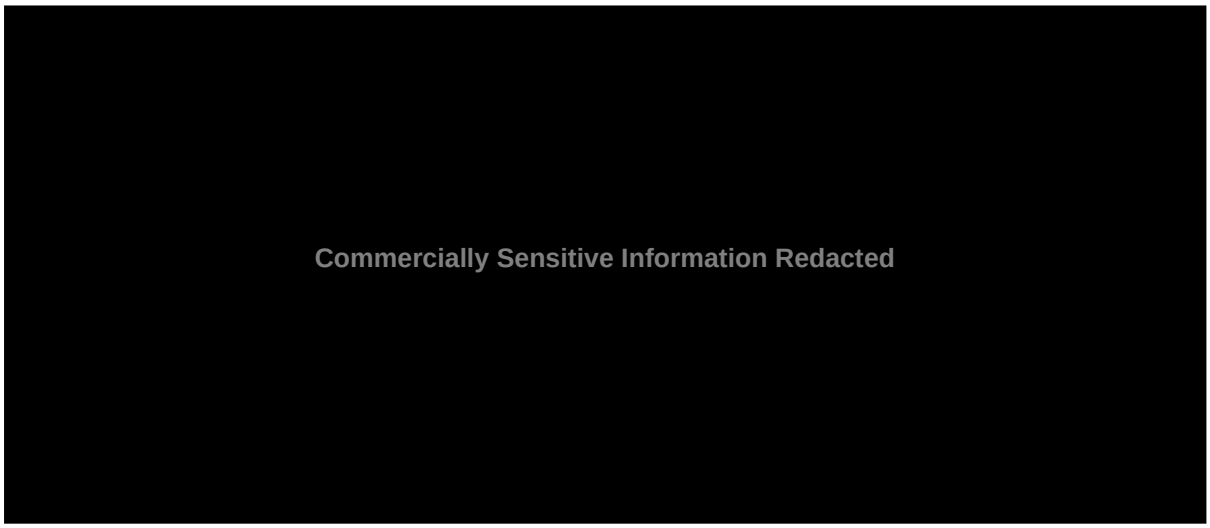

Table 21: RIIO-3 expenditure by network

10.2.1 Investment Risk Discussion

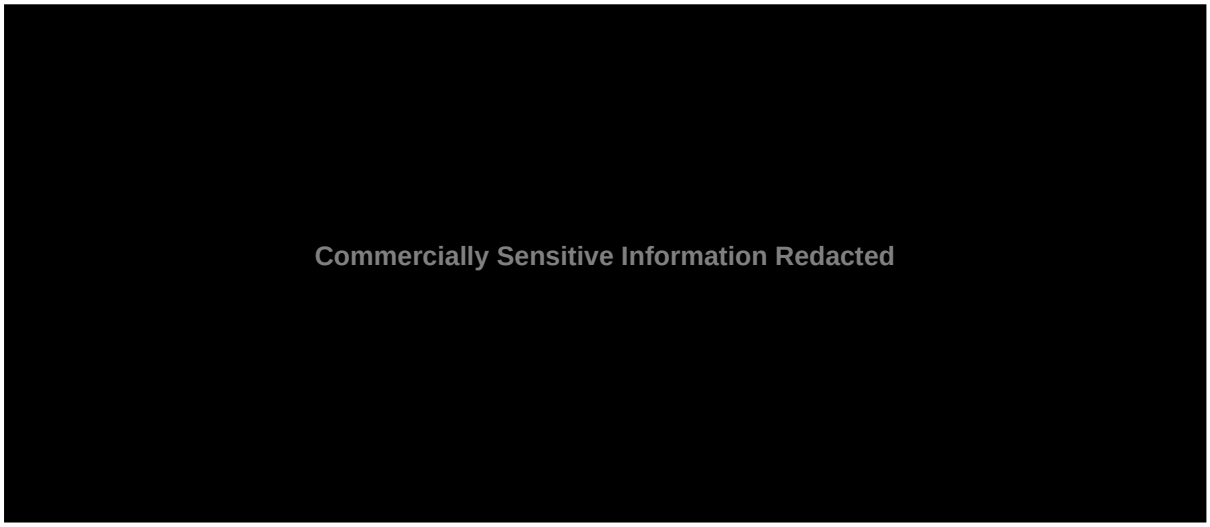

Table 22: Investment Risk Discussion

10.2.2 Project Plan

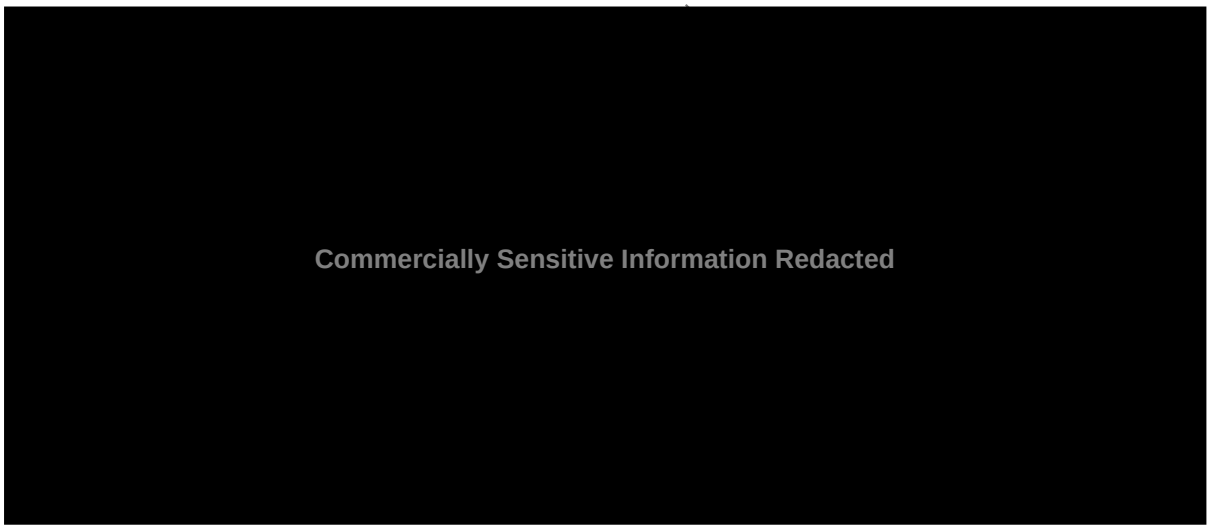

Table 23: PMAC Project plan Volume per year (Split by system)

10.3 Key Business Risks and Opportunities

10.4 Outputs included in RIIO-2 Plans

11 Regulatory Treatment

12 Glossary

Term	Definition
AAR	Automated Alarm Response
CBA	Cost Benefit Analysis
EJP	Engineering Justification Paper
FES	Future Energy Scenarios
NIS	Networks Information Systems
NPV	Net Present Value
PMAC	Pressure Monitoring and Control
[sensitive data redacted]	[sensitive data redacted]

Table 24: Glossary Table