Asset Health Engineering Justification Framework

Electrical & Instrumentation

Contents

1. Summary Table

Name of Project	Electrical, Instrumentation and Control Intervention		
Scheme Reference	WWU.11		
Primary Investment Driver	Asset Health, equipment obsolescence, DSEAR and NIS Compliance		
Project Initiation Year	2026		
Project Close Out Year	2031		
Total Installed Cost Estimate (£)	£[redacted]		
Cost Estimate Accuracy (%)	+/- 10%		
Project Spend to date (£)	£[redacted]		
Current Project Stage Gate	Not started		
Reporting Table Ref	SSC A40 5.01 LTS Storage & Entry SSC A40 5.04 Governors		
Outputs included in RIIO-GT3 and RIIO-GD3 Business Plan	No		
Spend apportionment 23/24 prices	GD2	GD3	GD4
5.01 LTS Storage & Entry	[redacted]	[redacted]	Not determined
5.04 Governors	[redacted]	[redacted]	Not determined

2. Executive Summary

This engineering justification framework paper seeks to gain regulatory approval for a capital investment sum of **£**[redacted] for delivery of this intervention programme in RIIO-GD3. The work detailed within will address asset end of life, obsolescence and regulatory change, to ensure continued statutory and legislative compliance and the ongoing reliability of our gas network.

This paper primarily focuses on E&I equipment on >7bar sites but also provides justification for workload associated with pressure management & control equipment associated with below 7 Bar distribution assets. These assets being key components to minimising shrinkage loss and continued control and monitoring of network pressures. This justification paper includes costs of **£**[redacted] associated with below 7bar pressure management and control projects, the workload(s) are signposted in the Governor EJD.

World events have seen both a change in appetite for security risk, as well as asset cost and availability of equipment and components, due to increased expectation around protection of physical and cyber security of assets from malicious actors across all critical national infrastructure operators, to maintain compliance with Network and Information Systems Regulations 2018.

HSE interest and expectations around functional safety and DSEAR compliance, documented through their intervention programme, has seen an increase in the expectation of risk management and mitigations required in both areas.

Obsolescence risk has accelerated in RIIO-GD2, partly driven by the availability of natural resources for electronic components. This has resulted in Original Equipment Manufacturers (OEM) moving away from legacy products, developing innovative solutions with more readily available resources. Companies are also shifting to more energy efficient technologies, again leaving legacy products unsupported in the future. This has driven an increase in investment to respond to obsolescence.

LTS AGI E&I Workload	**RIIO-GD2**		**RIIO-GD3**	
	Cost (£)	Workload (No. of Projects)	Cost (£)	Workload (No. of Projects)
Replacement	[redacted]	521	[redacted]	954

Governor & Pressure Management	**RIIO-GD2**		**RIIO-GD3**	
	Cost (£)	Workload (No. of Projects)	Cost (£)	Workload (No. of Projects)
Replacement	[redacted]	1190	[redacted]	1765

Table 1 – Cost & Volume Table, RIIO-GD2 to RIIO-GD3

The investment of [redacted] & £[redacted] respectfully through RIIO-GD3 will deliver the intervention workload as set out in figure 4 of this document, mitigating the risks of failure and delivering security of the gas supply.

3. Introduction

The serviceability of WWU electrical and instrumentation assets is critical to delivering a reliable gas supply to consumers, because these assets provide control functionality on volumetric sites and telemetry data back to the WWU Control Room from all critical sites. Instrumentation installed on our critical sites is key to quickly identifying potential issues and generating an appropriate response to reset or adjust systems from the Control Room, or to dispatch operatives to site before consequences of any alarm received is realised. This is critical to maintaining a safe and reliable supply of gas around the network. Data collected from instrumentation is also key to analysing the performance of assets over time, informing investment programmes.

In addition, inspection, maintenance and replacement of electrical assets ensures the safety of WWU staff from electric shock or faults in this equipment leading to the potential ignition of an explosive atmosphere.

WWU has put in place efficient processes to manage the associated risks, satisfying primary stakeholder needs and complying with our obligations under legislation, including:

- *The Electricity at Work Regulations 1989 (SI No.635)*
- *The Dangerous Substances and Explosive Atmospheres Regulations DSEAR (SI No.2776)*
- *The Network and Information Systems Regulations 2018 (SI N0.506)*

The purpose of this document is to set out the methodology for determining our future intervention strategy and the investment required to deliver our stakeholder focused outputs led business plan between 2026 and 2031.

4. Equipment Summary

Assets covered in this plan are Electrical and Instrumentation equipment at:

- 307 above 7bar Local Transmission System Pressure Regulating Installations
- 17 National Transmission System Offtake above 7bar Pressure Regulating Installations
- 3 above 7bar Storage sites
- 3,987 below 7bar District Governors, network sensing and validation low points

Electrical equipment on operational gas sites comprises the equipment which supplies power to the site, gas preheating systems, security systems, uninterruptible power supplies (UPS) and backup power generation and lighting. Together this equipment ensures that all subsystems on site functions as intended, including instrumentation, telemetry and security systems, even during power outages and that maintenance can be undertaken safely. Planned RIIO-GD3 Electrical Intervention is summarised in Table 1 below.

LTS / Offtake Electrical Workload Proposed for GD3				
Equipment Type	**Intervention Drivers**	**Role / Importance**	**No. in GD3**	**Total Population**
Generator replacement	End of Life, security of Gas supply	Power back up in event of loss of electrical power locally and regionally.	3	35
UPS Replacement	Obsolescence, End of Asset life	Power back up in event of loss of electrical power locally and regionally.	5	24
Electrical Rebuilds	End of Asset life	Power at site for monitoring control. access & egress lighting	24	307
Lighting replacements	Obsolescence, reduction in power consumption	Safe access/egress and working conditions on site.	42	307
CCTV - Replacement	End of Asset Life and Obsolescent equipment	Management of theft and vandalism at sites.	5	20
Type 2 SPD Installs	Protection of critical assets from Transient overvoltage and Lightning Protection	Protection of structures and assets from lightning and transient overvoltage. 18th Edition Amendment 2 Requirement.	50	34 sites of 307 currently have installs
Equipment Type	**Intervention Drivers**	**Role / Importance**	**No. in GD3**	**Total Population**
Electrical Rebuilds	End of Asset life	Power at site Access & Egress lighting	5	36

Table 2 - GD3 Electrical Equipment Intervention

Instrumentation equipment on operational gas installations includes transmitters, cabling, enclosures, remote telemetry units, communications systems, fiscal metering, all of which provide information to enable remote monitoring and the control of the flow and pressure of gas within the transmission and distribution network. Planned RIIO-GD3 Instrumentation Intervention is summarised in Table 2 below.

LTS / Offtake Instrumentation Workload Proposed for GD3				
Equipment Type	**Intervention Drivers**	**Role / Importance**	**No. in GD3**	**Total Population**
Flow Computer replacements	Obsolescence	Fiscal regulatory requirements, site flow and Odorant control	8	17
Fiscal Metering replacements	End of Asset Life	Fiscal regulatory requirements, site flow and Odorant control	5	17
Nanobox replacements	Obsolescence and Cyber Hardening	Fiscal regulatory requirements	7	17
Watson Smith – E/P Convertors	Obsolescence & reliability	Site flow and pressure control	20	20
Instrument / Telemetry Rebuilds	End of Asset Life	Site flow control, site monitoring and alarms to DNCC	52	307
LGT Controls Replacements	Improved safety & reduction in Emissions to air	Regulatory requirements, maintaining a safe Gas network to ensure gas leaks are identified prior to incident.	5	17
Telemetry (RTU's) Replacements	Obsolescence and Cyber Hardening	Site flow control, site monitoring and alarms to DNCC	160	307
GPRS Comms	OFCOM retirement of 2G/3G Comms	Site flow control, site monitoring and alarms to DNCC	180	307
Satellite Router replacements	Obsolescence	Site flow control, site monitoring and alarms to DNCC	100	307
Equipment Type	**Intervention Drivers**	**Role / Importance**	**No. in GD3**	**Total Population**
PMAC Stock Replacement	Obsolescence, reliability & Shrinkage	Distribution network pressure management, minimising shrinkage losses.	1580	3987
Validation Loggers	Obsolescence & reliability	Continued network validation and verification / modelling	180	548

Table 3 – GD3 Instrumentation Equipment Interventions

5. Problem/ Opportunity Statement

As a minimum, we must always comply with all relevant legislative, regulatory and statutory obligations, and deliver responsible stewardship of the assets in line with our asset management system requirements. These include stakeholder requirements, guidance from Ofgem, IEEE/IGEM standards, guidance from industry and trade associations, manufacturer's requirements, and all relevant WWU Policies, Procedures, and Specifications which make up our Asset Management System and underpin our Safety Case.

We are committed to ensuring that our gas transportation network and associated assets are designed, constructed, operated, inspected, maintained and decommissioned in a safe and efficient manner. These activities are carried out to appropriate national and international standards supplemented by company developed policies, procedures and business systems, designed to deliver a high level of reliability in line with our stakeholder expectations.

The electrical & Instrumentation assets are managed to ensure safe operation with a high confidence of security of supply of both the gas & electrical supply at site in order to meet our licence obligations and at an efficient whole-lifetime cost. The outcome of investment will achieve the following:

- Electrical safety of Wales & West Utilities assets for employees and the public
- Security of supply (Gas) – Backup electrical supply at critical sites ensuring continued control, monitoring, operability of safety functions and fiscal data recording.
- Security of Supply (Electricity) – The gas network is key to ensuring continuity of electricity supply from gas-fired power generation, especially during system stress events.
- Physical security of the asset – (Theft, Vandalism, Terror & Cyber)
- Compliance with law and regulation – HASWA, DSEAR, GS(M)R, EAWR
- Energy Efficiency and Environmental Sustainability – Contributing to Net Zero targets.

In order to achieve the above outcomes, the replacement of electrical & instrumentation equipment will be considered in cases of:

- Poor reliability, resulting in risk of loss of supply and increased fault attendance costs
- High maintenance and on failure unplanned costs
- Obsolescence of equipment
- Age & Condition – Lifecycle Management
- Failure of electrical equipment to meet minimum standards
- Failure of instrumentation to achieve acceptable calibration tolerances

Success of the intervention programme will be measured by fault and failure analysis of equipment. Current levels of reliability and safety are high and accepted by HSE and we will ensure there is no deterioration in performance.

5.1 Narrative Real Life Example of Problem

The investment detailed within this justification paper will replace aged assets nearing end of life. Examples can be seen in the photos from Yeovil PRI (Figure 2) and Stapleton Road PRI in Bristol (Figure 3). These projects form part of our RIIO-GD3 workload.

Figure 1 - Yeovil PRS Slam shut Switches & Instrumentation

Figure 2 - Stapleton Road Instrumentation and Electrical assets.

5.2 Project Boundaries

The boundary of spend includes replacement of aging, obsolete electrical and instrumentation assets. Including material costs, project management and resource costs to deliver the work.

Where projects require civils works or have a mechanical element, these costs have been included within the scope of the project, for example replacing ducting, supports or concrete bases.

5.3 Equipment Compliance

Electrical and instrumentation equipment is covered by specific regulations and standards which necessitate a minimum level of investment to ensure continued compliance. In particular:

- The Electricity at Work Regulations 1989 (EAWR)
- BS 7671 18th Edition Amendment 2 (Requirements for Electrical Installations)
- Dangerous Substances and Explosive Atmospheres Regulations 2002
- The Network and Information Systems Regulations 2018 (SI N0.506)

An example of a typical intervention project would be bringing a whole electrical sub-system up to current standards when a part of it must be replaced or modified as a result of component failure, this delivers a compliant installation in line with industry standards and is the most cost-effective approach.

5.4 Equipment Obsolescence

The largest challenge post-Covid in respect of electrical and electronic equipment has been obsolescence, primarily due to availability of semi-conductor components within legacy Original Equipment Manufacturer (OEM) equipment. This has driven both excessive component lead times, and in most cases OEMs to retire older products to focus on newer products to bolster post-Covid sales.

Examples of this have been seen in our Remote Telemetry Units, Fiscal Metering computers, UPS systems and CCTV equipment, as well as 2G/3G Communications equipment.

Two main drivers of this have been acceleration in roll out of 5G/4G communications, with the aim of increasing accessibility of mobile communications, leading to older versions becoming unsupported. The other is a post-Covid push from OEMs to focus on newer product ranges, driven by lack of accessibility of older versions of electronic microchips and components. There is also a drive from these businesses to recoup some of the lost opportunity from Covid lockdowns.

Other drivers towards more sustainable methods have led to discontinuation of products, such as electric-discharge lighting technologies including Fluorescent, Mercury and Sodium lighting.

5.5 Physical and Cyber Security

The increase in global instability seen through RIIO-GD2 has focused the Government's attention to the threat to our Critical National Infrastructure from external malicious actors. In turn the landscape on which wars are fought has changed, leading to an increased threat vector to our Information Systems that manage and control the transmission and distribution of gas around the network.

The Network and Information Systems (NIS) Regulations have been developed to provide guidance on adequate layers of protection, to mitigate such risks, to protect the company and the security of the gas supply system. A key element of managing these risks is to provide suitable and proportionate physical security provisions at our sites, in part to harden the assets against cyber driven threats, but also from physical intervention on site by any threat actor.

Whilst this has been mentioned in this justification paper, as it will include the installation of additional Electrical and Instrumentation assets, the workload, costs and deliverables have been grouped into the Physical security RIIO-GD3 submission.

5.6 Security of Electrical Supply

Changes in the climate and weather conditions experienced, has led to an increase in loss of electrical supply events to operational gas installations. Short duration loss can be managed via site UPS systems, but where sites have a more critical role to play in managing and controlling the gas network, the addition of fixed on-site gas-fired generators will play a key part of ensuring the flow of gas through our network is maintained. This is critical where our network feeds gas fired power generation facilities that are critical to the electricity distribution network across the UK and could further exacerbate an issue on the electricity network if interrupted.

The UK has seen repeated severe weather events in recent years, with the impact of some storms leading to Government questions around the resilience of the gas supply system in the event of the loss of electrical power. Which would have an impact on the ability of electrical distribution system to recover from black out, if gas supplies did not have adequate resilience to electrical power failure. Our investment in this area mitigates these risks.

6. Probability of Failure

Most electrical system failures on our sites are age and/or condition driven events that can lead to loss of supply, significant damage to gas assets, and in extreme cases even injury or death. The two most common causes of electrical-equipment failure are deterioration of electrical insulation, or degradation of ingress protection (seals and glands) allowing moisture ingress to cause accelerated deterioration of equipment. This leads to unsafe conditions for our engineers in Hazardous Areas and potentially compromises essential safety functions delivered by this equipment. Whilst intervention is largely driven by inspection, due to age related degradation of certain equipment a time-based replacement programme is applied to avoid these components staying in service beyond 15 years.

Degradation of electrical cables: - The service life of a cable is significantly reduced over a period of time, this can be caused by excessive moisture, heat or cold, exposure to chemicals, weathering, abrasion or animal damage. All these factors can cause dielectric breakdown of insulation, this leads to the potential for an electric shock, electrical fires, a gas supply failure or potential ignition of an explosive atmosphere that may be present on an operational gas site.

Degradation of electrical equipment: - Over time electrical equipment can become damaged as a result of its use, the environment in which it is situated or its operational duty cycle. Once damaged it will begin to deteriorate, leading to the same risks set out above.

Premature failure of Electrical Equipment: - As the electricity generation sector transitions to more sustainable means of operation, voltage regulation and overvoltage transients have become more prominent. In addition, the changing climate is leading to increasingly volatile weather and a higher risk of static discharge in the form of lightning. This has been recognised in BS 7671 18th Edition Amendment 2, in the requirement to install co-ordinated Surge Protection Devices (SPDs).

The Chartered Institute of Building Services Engineers (CIBSE) Guide to Ownership, Operation and Maintenance of Building Services gives economic life factors for electrical equipment as detailed below:

- Lighting installations 5 to 20 years
- Switchgear and distribution equipment, 20 to 25 years
- Mains cables (permanent installations), 25 to 30 years

Surveys carried out on instrumentation equipment (field monitoring) at sites across the Network, undertaken on a 5-yearly rotational basis, found equipment less than 15 years old to be in reasonable condition and functioning well, with a downward trend in faults recorded. Table 3 shows volumes of surveys conducted / planned in the RIIO-GD2 period.

2021	2022	2023	2024	2025
60	50	42	44	(47 Planned)

Table 4 GD2 Number of completed Asset Site E&I Audits

At sites surveyed with instrumentation equipment between 16 and 20 years old, instrumentation equipment was found to be in poor condition and in need of replacement, a greater number of faults were recorded from these sites as a result.

As a result of the above findings, it was concluded that an average life cycle of 15 years was most appropriate for instrumentation (field monitoring) equipment, currently installed across all sites, to forecast our future replacement workloads. It should be noted however that environmental conditions can significantly reduce the life span of this equipment, and the scheduled inspection and maintenance programme ensures seals and glands remain in good condition to ensure the expected asset life is achieved. This programme of inspection and testing, which is carried out in accordance with industry standards is used to provide the most current data to identify those sites requiring intervention work in any particular year.

6.1. Probability of Failure Data Assurance

Following analysis of 1,102 maintenance reports (see Table 4) completed by operational technicians (Electrical & Instrumentation), it has been established that the electrical and instrumentation installations at a number of sites within the Wales & West Network will reach end of life in RIIO-GD3. These sites must be brought back into a condition where they are compliant with the requirements set out in the Electricity at Work Regulations 1989 in line with WWU policies and procedures, by delivering the number of projects in figure 4

Maintenance Records Reviewed during Audit	Offtake	LDZ (Control)	LTS (non-control)
Maint 11/12 (E&I)	53	20	340
Maint 8 (LGT)	630	N/A	N/A
ME2 (Metering)	50	9	N/A

Table 5 Maintenance record reviews during Asset Audit 2021-date

Failure to undertake this work will result in an increased risk of not satisfying the requirements of the legislation detailed above. In addition, failures of electrical and instrumentation systems at these sites will increase substantially, incurring additional call out and maintenance costs and failing to adequately mitigate the associated risks.

7. Consequence of Failure

The consequences of failure identified related to these assets are: -

- **Reliability** - Electrical equipment failure, leading to loss of electrical supply to critical equipment (for example Gas preheating, Telemetry, Odorisation); resulting in a potential loss of gas supply to consumers.
- **Safety** - Faulty electrical equipment, leading to danger to our operatives or other persons from electric shock.
- **Reliability and Safety** – The risk that faulty equipment may result in an ignition of a flammable or explosive atmospheres that may be present on an operational gas installation, leading to a potential loss of gas supply, injury or even death of employees, emergency services personnel, or members of the public.
- **Reliability and Safety** – Instrumentation equipment failure, leading to loss of monitoring or control at the WWU control room; resulting in a potential loss of gas supply to consumers.
- **Security and Safety** – Security of Physical and Operational Technology assets from threat actors, vandalism, theft and damage, leading to potential loss of gas supply, and/or injury or death.

8. Options Considered

To properly consider options associated with this Electrical and Instrumentation engineering justification paper, it is necessary to understand the differing drivers for the works, these are broken down in Tables 1 *and 2* of section 4. The resulting workload can be split into three categories:

- End of Lifecycle & Obsolescence (including LGT)
- Fiscal Metering
- Distribution Pressure Management Control Equipment

Each of which has its own set of options considered as set out below.

8.1 First Option Summary

8.1.1 End of Lifecycle Replacement & Obsolescence

The options within this section consider end-of-life assets, as well as assets of which are no longer available or supported. Work falling within this category would directly impact ongoing statutory and regulatory compliance of Electrical and Instrumentation installations at operational sites.

Baseline Option – (Reactive only) No proactive interventions - This option means simply waiting for something to fail, then replacing equipment reactively. This would result in an unacceptable risk of the consequences of failure, is non-compliant with legislation and would lead to a higher overall cost to the consumer as well as an unacceptable risk to employees and the public.

Option 1 – (Balanced Plan) - An optimised mix of proactively identified work, determined through regular inspection of sites in accordance with industry standards. The workload consists of instrumentation rebuilds, telemetry rebuilds, electrical distribution rebuilds and LGT system upgrades. These interventions are delivered just before equipment reaches its at end of life, as determined from regular inspection, and engineers out obsolete components in a controlled way through proactive engagement with the supply chain. This approach delivers the minimum requirements to comply with legislation, is the least whole life cost and adequately mitigates the risks described in earlier sections.

8.1.2 Fiscal Metering

The options within this section consider the remaining Fiscal Metering installations which have not yet been upgraded to modern ultrasonic metering systems. Replacement reduces OPEX costs, whilst delivering the level of reliability required to record the amount of gas flowing into the network and the correct level of odorisation injection against volumetric flow through the network.

Baseline Option – (Reactive only) No proactive interventions - This option means simply waiting for something to fail and then replacing equipment reactively. This would result in an unacceptable risk of the consequences of failure, is non-compliant with legislation and would lead to a higher overall cost to the consumer as well as an unacceptable risk to employees and the public.

Option 1 – (Refurbish only) - Only refurbishment is considered as an intervention option. This would result in an increasing rate of failure over time, potentially resulting in non-compliance with the applicable Regulations and increased whole life cost. In addition, it is not possible to indefinitely refurbish this type of equipment.

Option 2 – (Balanced) Refurbishment where possible followed by replacement when an asset reaches end of life as determined by regular inspection. This approach delivers the minimum requirements to comply with legislation, is the least whole life cost and adequately mitigates the risks described in earlier sections.

Option 3 – (Replace only) Only replacements considered as an intervention option. This approach results in a higher whole life cost than the balanced approach, replacing assets before they have reached end of life, when a lower cost refurbishment would be more appropriate to extend their asset life.

8.1.3 Distribution Pressure Management Control Equipment

This equipment delivers profile control of the low-pressure system, minimising network pressures based on the expected profile of demand on any given day. The systems are all protected by pneumatic low and high-pressure overrides and alarm on failure, as such they have a very limited consequence of failure. The approach to the management of this asset group is operate to failure because of the limited consequence and ease of replacement, all components being relatively low cost and held in stock. Given the age profile and asset life of the equipment, it can be expected the failure rate will increase through GD3 without intervention. Loss of control or visibility of the network leads to increased shrinkage, and inability to react to network faults or failures in a timely manner.

Baseline Option – Allow equipment to fail and remove from service, allow low pressure networks to sit at peak demand summer and winter pressure set points regardless of demand. This option results in a higher rate of leakage from the network than profiling governor outlet pressures to deliver a minimum network pressure to meet demand. This results in an increased cost of gas loss due to shrinkage and a marginal increase in safety risk associated with gas leaks.

Option 1 – Replace equipment on failure, restoring low pressure networks to profile control shortly after failure of the equipment, minimising shrinkage loss. This is the least whole life cost and adequately mitigates the risks.

8.2. Options Technical Summary Table

8.2.1 End of Lifecycle Replacement & Obsolescence

Options Title – Electrical & Instrumentation Rebuilds including equipment obsolescence replacement.
First Year of Spend - 2026
Final Year of Spend - 2030
Volume of interventions - 949
Equipment design Life – 15 to 25 years
Total installed cost (Total Spend request) - £[redacted]

[redacted]

Table 6 Electrical & Instrumentation rebuild / replacement options summary table.

8.2.2 Fiscal Metering

Options Title – Fiscal Metering replacements
First Year of Spend - 2026
Final Year of Spend - 2030
Volume of interventions - 5
Equipment design Life – 15 to 20 years
Total installed cost (Total Spend request) - £[redacted]

[redacted]

Table 7 LGT & Fiscal Metering replacement options summary table

8.2.3 Distribution Pressure Management Control Equipment

Options Title – Pressure Management Control replacements
First Year of Spend - 2026
Final Year of Spend - 2030
Volume of interventions – 1,580
Equipment design Life – 15 years
Total installed cost (Total Spend request) - £[redacted]

[redacted]

Table 8 Pressure Management & Control replacement options summary table

There is an increase in societal cost from removing equipment due to the increase in network pressures and therefore methane emissions. The value of the increased carbon is circa £[redacted], meaning that the cost to replace the equipment is paid back very quickly.

9. Business Case Outline and Discussion

9.1 Key Business Case Drivers Description

Electrical and instrumentation assets are managed to ensure safe operation with a high confidence of security of supply at an efficient whole lifetime cost. Drivers for investment include:

- Electrical safety of WWU assets and personnel
- Early warning of faults to reduce security of supply risks
- Additional physical security of Operational Technology assets
- Compliance with law and regulations (Electricity at Work regulations and Dangerous Substances and Explosive Atmosphere Regulations, NIS Regulations)
- Regulatory and Licence requirements.
- Management of obsolescence

9.2 Business Case Summary

Completion of the proposed RIIO-GD3 E&I Programme of works will ensure that all sites remain at an acceptable level of compliance with the Electricity at Work Regulations 1989 and provide data and early fault warnings so we can act to ensure security of gas supply to customers. Planned works are identified from analysis of inspection and maintenance reports, Asset audit findings, fault data and lifecycle management data. E&I assets are examined in detail to determine the essential work required to ensure compliance with the relevant regulations and prioritised for intervention based on risk and criticality to deliver the least whole lifecycle cost.

Additionally, the programme seeks to secure Operational Technology and physical assets at operational sites from threat actors, through a risk-based approach to increasing physical security provisions at our operational gas sites.

Failure to undertake this work will result in non-compliance with the legislation detailed in this paper. In addition, electrical and instrumentation systems at these sites will exhibit higher rates of failure, incurring additional call out and maintenance costs and increasing the risk of significant gas supply loss incidents. Failures could also leave the company susceptible to infiltration of its internal business data and infrastructure as a result of cyber-attack.

9.2.1 End of Lifecycle Replacement & Obsolescence

Obsolete equipment workload assumptions have been made on the basis of replacing a proportion of the obsolete equipment base, freeing up spare assets to replace any faulty equipment through RIIO-GD3 and RIIO-GD4. This provides the lowest cost solution to managing obsolescence over time. Some electrical and instrumentation works are necessary to meet compliance to standards and requirements of regulators such as HSE. Cost Benefit Assessment ensures our balanced investment plan offers value for money to our consumers

[redacted]

Table 9 below *shows the CBA for* Instrumentation and Telemetry systems within the proposed RIIO-GD3 programme

The CBA shows Option1 offers value for money over the baseline. The proactive spend provides benefits from reduced operating costs and network reliability. Our preferred option pays back before 2035.

9.2.2 Fiscal Metering

Fiscal metering systems are key to regulatory compliance and reporting but also play an integral role in volumetric storage control and odorisation of gas. Timely intervention is key to maintaining these systems, this is best achieved through replacement or refurbishment programmes of work, due to long lead times which have been seen recently for electronic components. Refurbishment only is mathematically modellable so included for completeness but based on inspections, previous experience and engineering judgement some assets are end-of-life and not actually refurbish able and that therefore this option isn't truly achievable. Cost Benefit Analysis of options for metering systems has shown for a moderate capital outlay the balanced option of pro-active refurbishment and replacement provides the best value and return on investment in the shorter term. Table 9 shows the cost benefit analysis undertaken for intervention works in respect to fiscal metering and LGT systems.

[redacted]

Table 10 Fiscal Metering replacement CBA

9.2.3 Distribution Pressure Management Control Equipment

Cost based analysis has been undertaken on the replacement of pressure management equipment, again some of the workload sits outside of CBA on the basis the work is being undertaken to ensure regulatory compliance. Failure to act leads to potentially unsafe ATEX equipment within hazardous areas which are closer to the public domain.

[redacted]

Table 11 Pressure Management CBA

These assets are hugely significant in reducing methane emissions from the low-pressure distribution system. The CBA demonstrates very significant value for the investment in pressure management and control Payback is well within theRIIO-GD3 price control period.

Figure 4. depict the high-level number of deliverables in GD3

			RIIO-GD3 Totals	RIIO-GD3 Deliverable Quantities				
				2026	2027	2028	2029	2030
Work Type	**Investment Paper**	**Spend Type**	**No. Req**	**Quantity**	**Quantity**	**Quantity**	**Quantity**	**Quantity**
Fixed Generator Installs/Replacements	PRIS and Offtakes E&I	Capex	3	1	0	1	1	0
UPS System Replacement	PRIS and Offtakes E&I	Capex	5	1	0	1	1	0
Flow Computer Replacements	PRIS and Offtakes E&I	Capex	8	2	1	3	2	0
USM Fiscal Metering Replacements	PRIS and Offtakes E&I	Capex	5	1	0	2	1	1
Nanobox Replacements	PRIS and Offtakes E&I	Capex	7	1	1	2	2	1
Watson Smith Replacements	PRIS and Offtakes E&I	Capex	20	4	4	4	4	4
Lighting Upgrades	PRIS and Offtakes E&I	Capex	42	8	9	8	8	9
Electrical Distribution Rebuild	PRIS and Offtakes E&I	Capex	23	6	6	4	4	3
Electrical Intake Rebuild	PRIS and Offtakes E&I	Capex	24	6	6	4	4	4
Solar Panel Installations	PRIS and Offtakes E&I	Capex	5	1	1	1	1	1
Instrument Rebuild	PRIS and Offtakes E&I	Capex	52	14	10	7	10	11
Telemetry Rebuild	PRIS and Offtakes E&I	Capex	52	11	10	7	12	12
CCTV Replacement	PRIS and Offtakes E&I	Capex	5	1	1	1	1	1
Type 2 SPD Installations	PRIS and Offtakes E&I	Capex	50	10	10	10	10	10
Gas Chromatograph Replacement	PRIS and Offtakes E&I	Capex	1	0	1	0	0	0
LGT System Upgrade	PRIS and Offtakes E&I	Capex	5	0	1	1	0	3
P4T & P6T Instrument Impulse Valve replacements	PRIS and Offtakes E&I	Capex	18	7	3	2	2	4
SCOFF Sites to SCADA	PRIS and Offtakes E&I	Capex	15	3	3	3	3	3
Replace Gas Chromatograph Secondary Instrumentation	PRIS and Offtakes E&I	Capex	5	3	1	0	1	0
UPS System Battery Replacements	PRIS and Offtakes E&I	Capex	60	12	12	12	12	12
Telemetry HMI Replacements	PRIS and Offtakes E&I	Capex	20	4	4	4	4	4
Heat Exchanger Burst Disc Replacements	PRIS and Offtakes E&I	Capex	60	12	12	12	12	12
Field Asset Equipment Failures	PRIS and Offtakes E&I	Capex	10	2	2	2	2	2
Net 0 - Smart Systems - Control Sites x 9	PRIS and Offtakes E&I	Capex	9	1	2	2	2	2
Net 0 - Smart Systems - Extremity sites x 10	PRIS and Offtakes E&I	Capex	10	2	2	2	2	2
Sixnet Telemetry RTU Replacements	PRIS and Offtakes E&I	Capex	160	32	32	32	32	32
GPRS Replacement (2G/3G Comms)	PRIS and Offtakes E&I	Capex	180	36	36	36	36	36
Satellite Routers Replacement	PRIS and Offtakes E&I	Capex	100	20	20	20	20	20
	Total LTS AGI E&I CAPEX		**954**	**201**	**190**	**183**	**189**	**189**
Electrical & Instrument Rebuild Incl Lighting Upgrades	Pressure Management	Capex	5	1	1	1	1	1
PMAC Stock Replacement (Wales)	Pressure Management	Capex	790	158	158	158	158	158
PMAC Stock Replacement (South West)	Pressure Management	Capex	790	158	158	158	158	158
Validation Loggers (Wales)	Pressure Management	Capex	90	18	18	18	18	18
Validation Loggers (South West)	Pressure Management	Capex	90	18	18	18	18	18
	Total Pressure Management E&I CAPEX		**1765**	**353**	**353**	**353**	**353**	**353**

Figure.3 Proposed phased Workload through GD3

10. Preferred Option Scope and Project Plan

10.1 Preferred Option

To allow the company to remain compliant with all relevant legislation, including that recently developed in response to the cyber threat landscape changes, whilst managing the increase in obsolescence of Electrical and Instrumentation equipment, this justification document proposes the following option as the RIIO-GD3 program of works:

10.1.1 End of Lifecycle Replacement & Obsolescence

Option 1 – (Balanced Plan) - An optimised mix of proactively identified GD3 work, consisting of instrumentation rebuilds, telemetry rebuilds, electrical distribution rebuilds and LGT system upgrades. Pre-emptively replacing Obsolete and End of Life equipment in advance of failure.

This is financially better as shown by CBA, the baseline option would expose the business and wider public to the following unacceptable risks: -

- Failed equipment which could become a source of ignition within a Hazardous Area
- Increased Loss of power at site, electric shock to personnel or members of the Public
- Under odorisation of gas leading to unreported gas escapes, leading to the potential for explosion
- Over odorisation of gas, leading to over reporting of Gas escapes
- Inability to accurately report on Fiscal requirements required by the NTS and regulatory authority.
- Loss of Control and/or visibility of Sites across the network, potentially resulting in loss of gas supply to consumers.
- Long term loss of redundancy built into systems for safety, due to long lead times for replacement equipment
- Increased OPEX costs through additional fault management and maintenance requirements

10.1.2 Fiscal Metering

Option 2 – (Balanced) - Refurbish where possible followed by replacement when asset reaches end-of-life. Replace remaining Fiscal metering systems, for this set of assets reflects the best cost option given the length of extension of life provided against the capital cost incurred Option 1, would expose the business and wider public to the following unacceptable risks: -

- Failed equipment which could become a source of ignition within a Hazardous Area.
- Under odorisation of Gas leading to unreported gas escapes, leading to the potential for explosion.
- Over odorization of gas, leading to over reporting of Gas escapes.
- Inability to accurately report on Fiscal requirements required by the NTS and regulatory authority.
- Long lead times of equipment, loss of redundancy built into inherent systems.
- Increased OPEX costs through additional fault management and maintenance requirements.

10.1.3 Distribution Pressure Management Control Equipment

Option 1 – Replace equipment on failure, networks continue to profile network pressure based on demand, minimising shrinkage loss.

Not investing in this equipment would expose the business and wider public to the following unacceptable risks: -

- Very significant increases in methane emissions which would fail to meet government targets and the needs of our stakeholders
- Failed equipment which could become a source of ignition within a Hazardous Area.
- Loss of Control and/or visibility of Sites across the network, potentially resulting in loss of gas supply to consumers. Increased OPEX costs through additional fault management and maintenance requirements

10.2 Asset Health Spend Profile

The investment and workload profile over the GD3 price control is indicated in Table 11&12 below: -

Year of Spend	*Spend (£m)*	*Workload Volumes*	*% Programme*
2026/27	[redacted]	201	[redacted]
2027/28	[redacted]	191	[redacted]
2028/29	[redacted]	183	[redacted]
2029/30	[redacted]	189	[redacted]
2030/31	[redacted]	190	[redacted]
Total	[redacted]	**9**	[redacted]

Table 12 GD3 Spend profile Electrical & Instrumentation Assets

Year of Spend	*Spend (£m)*	*Workload Volumes*	*% Programme*
2026/27	[redacted]	353	[redacted]
2027/28	[redacted]	353	[redacted]
2028/29	[redacted]	353	[redacted]
2029/30	[redacted]	353	[redacted]
2030/31	[redacted]	353	[redacted]
Total	[redacted]	**1765**	[redacted]

Table 13 GD3 Spend profile Distribution pressure management Assets

10.3 Investment Risk Discussion

10.3.1 Future Energy Scenarios

The future of energy in the UK is not certain over the long term, with the Future Energy Scenarios (FES) offer a number of pathways to 2050. We have considered these pathways when testing the robustness of our investment plan against future uncertainty, ensuring that it supports all credible pathways and avoids the risk of asset stranding.

The E&I assets identified for proactive intervention have been tested using CBA. This gives a view on the time period over which an investment pays back i.e. at what point in time it becomes lower cost to invest than to not invest. Our test is whether this point in time at which the investment pays back is within the useful lifespan of the asset. If an asset was expected to be needed as part of the UK energy network until 2040 but not beyond, investment paid back by 2035 remains beneficial to bill payers. If the investment didn't pay back until 2042 then we would consider options to extend asset life within the expectations on us to keep the public safe.

The ongoing role of the gas network and the importance of maintaining resilience and security of supply is widely recognised beyond government, even taking longer term uncertainty into account. For example, all Future of Energy (FES) 2024 scenarios involve at least 20% of homes still on natural gas in 2045, even as many transition to electrification or hydrogen4,5 and NESO's Clean Power 2030 advice on the required gas generation capacity referenced above. As the gas system needs to meet peak demands, substantial infrastructure for safe, reliable supplies will be required even in scenarios where annual throughput may have significantly dropped.

All Future Energy Scenarios show a decrease in gas volumes albeit over different time periods and to different scales. If 50% of consumers in a street came off the gas network, the pipes feeding the street would still be required to service the other 50% of consumers, as would the district governors feeding the street, the higher-pressure pipes feeding the governor, the PRIs feeding the higher-pressure pipes and so on.

This challenge is exasperated by government policy and approach to electrifying heat, where the decision is left to consumers rather than a mandated approach targeting regions. With this approach, it is incredibly unlikely whole areas will leave the gas network in the short and medium term. If it does happen, it will be a much more sporadic move from gas, resulting in a requirement to operate our assets until the last consumer in a region decides to transfer.

Another challenge is FES gives UK wide pathways and does not provide a view and data on the individual GDN regions. This presents significant limitations in its usefulness with very broad assumptions required to influence regional plans.

The chart below shows how previous FES scenarios have not reflected the experienced reality.

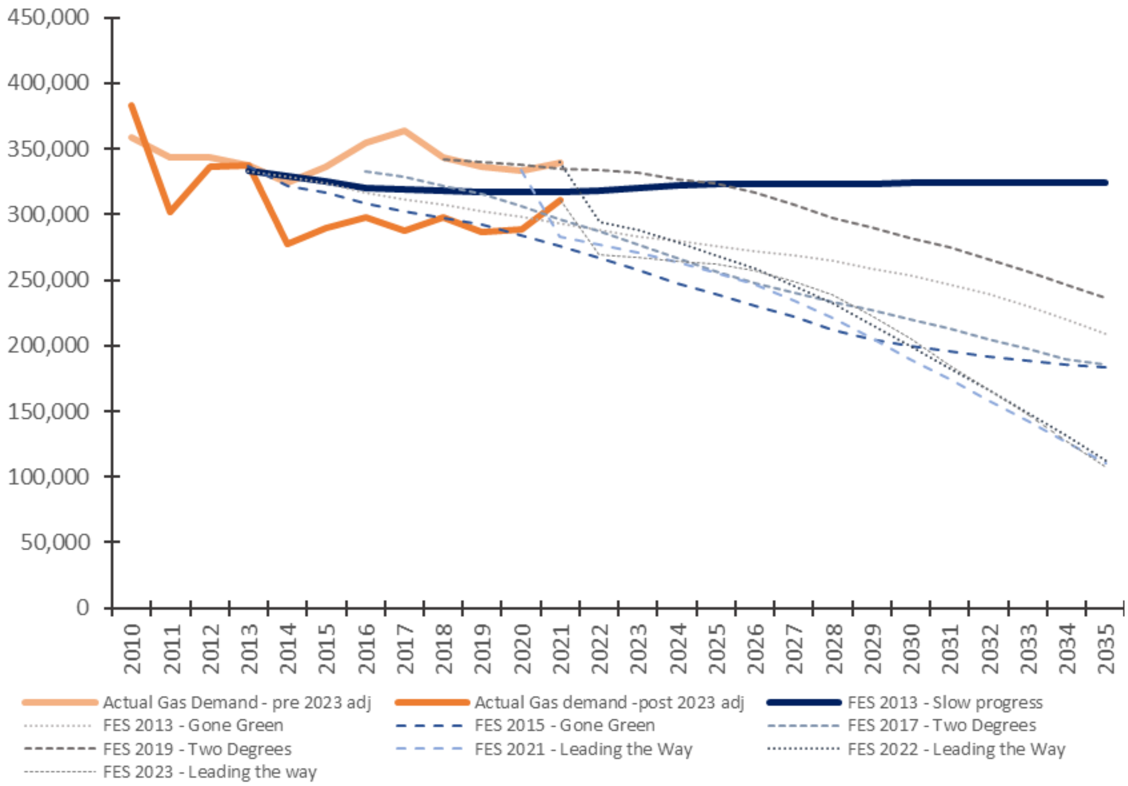

Figure 4 - Historical residential gas demand against most optimistic scenario in every 2nd year of publication, dating back to 2013

It should be noted that in the 2023 FES scenarios there was an adjustment to historical gas demand figures, and as such we have shown historical data both before and after the adjustment to maintain comparability with the original 2013 forecast. What is noticeably clear from these graphs is that, to date, the most accurate forecast appears to be the 2013 slow progress. As such it is difficult to have confidence that future forecasts will be any more reliable.

Due to slower and geographically dispersed take-up of heat pumps, and whilst we wait for the Heat Policy decision, moving to a short payback period cut-off for investments is not compatible with ensuring a safe, resilient, and efficient gas network while we transition to Net Zero. The gas sector collectively believes 25 years as a payback period is more realistic across all scenarios and prudent given the sector's legislative duties.

To manage sensitivities in delivery costs and benefits, we are using a prudent 20-year period to assess cost and benefits. This means investments paying back within this period can be justified with a high level of confidence.

10.3.2 Chosen Electrical & Instrumentation Workload

The workload has been selected based on thorough analysis of lifecycle maturity, fault and failure data, as well as the audit & maintenance inspections of asset health and condition. Changes to workload during GD3 would be primarily driven by yet to be determined asset obsolescence or asset vulnerability.

10.4 Project Plan

Figure 5 below, highlights the main phases expected to deliver the programme of works in GD3. Purchase of long lead time items will be mitigated by developing procurement frameworks which deliver value, whilst maintaining lead times in alignment with programme delivery. The review process will be utilised to refocus plans where needed, ensuring overall programme delivery.

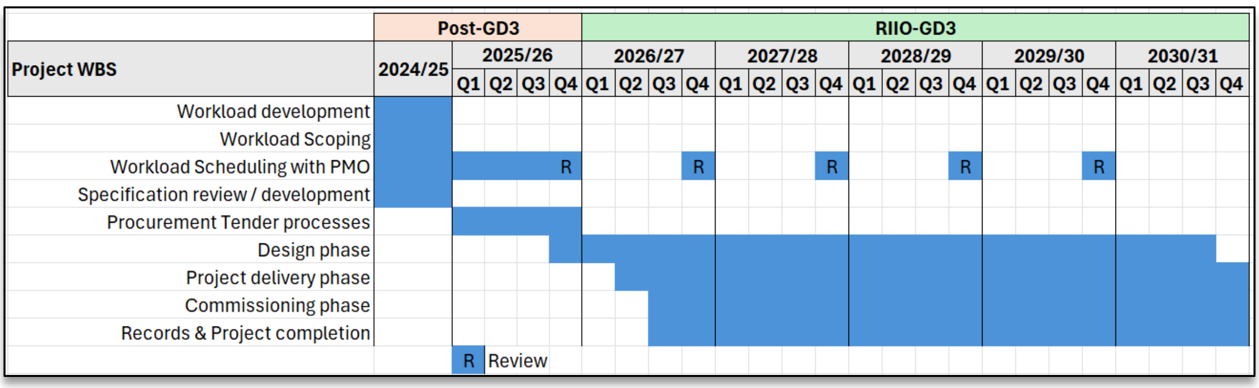

Figure 5 GD3 Indicated project work programme plan.

10.5 Key Business Risks and Opportunities

Table 13 below summarises risks associated with the described programme of works.

Risk Description	Impact	Likelihood	Mitigation/Controls
Risk to delivery timescales	Benefits of replacement are not fully realised in time, leading to increased OPEX costs associated with additional Maintenance and inspection requirements	<=20%	Workload quantified and agreed against resource modelling within capital delivery. Additional workforce requirements managed and discussed as part of the GD3 Submission. Internal delivery of projects provides increased assurance around every aspect of delivery.
	Long lead times on equipment prevents replacement in time, leading to increased OPEX costs associated with additional Maintenance and inspection requirements.	<=20%	Ensuring procurement frameworks exist to ensure costs are minimised in the purchase and delivery of equipment and services against agreed SLA's.
Risk to planned costs	Increased costs drive up project costs, drivers include supply chain restrictions, increased inflation and changes in legislation.	<=20%	
Risk that Intervention does not manage risk to required levels	WWU would not be meeting agreed targets for GD3	<=20%	Intervention is supported with inspection, maintenance and audit data. Replacement and recommissioning of assets will lower the risk of fire and ignition of explosive atmospheres.
Security of Gas Supply	Loss of gas supply to multiple customers due to loss of control and or visibility of an operational site	<=20%	Proposed intervention which mitigates the risk on failure of assets. Work undertaken by experienced personnel and under SCO processes. All work and designs undertaken through a defined management of change process.

Table 14 Project risks associated with GD3 Electrical & Instrumentation work programme.

10.6 Outputs included in RIIO-GT2/GD2 Plans

There are no outputs within the RIIO-GD2 plan that are expected to have not been delivered prior to the start of RIIO-GD3 from an electrical and instrumentation perspective. We therefore do not expect to carry any work over from GD2 plans into GD3.