Asset Health Engineering Justification Framework

Offtakes, PRIs & Storage

Legal Notice

Contents

1 Summary Table

Name of Project	Asset Health – Offtakes, PRIs & Storage
Scheme Reference	WWU.13
Primary Investment Driver	Asset Health
Project Initiation Year	2026
Project Close Out Year	2031
Total Installed Cost Estimate (£)	[redacted]
Cost Estimate Accuracy (%)	+/-15% based on significant experience of delivering this work and detailed work and cost records.
Project Spend to date (£)	[redacted]
Current Project Stage Gate	Not started
Reporting Table Ref	Table 5.01
Outputs included in and RIIO-GD3 Business Plan	Outputs will be in the BPDT, Table Ref. 5.01

Spend apportionment 23/24 prices	G2	G3	G4
	-	[redacted]	-

The apportionment should detail the spend for the project over multiple price controls, if applicable. G3 would represent the request for this submission.

2 Executive Summary

Gas enters the WWU Local Transmission System (LTS) from the National Transmission System at 17 Offtake sites across our network. Our LTS comprises these Offtakes, a network of steel pipelines transporting gas in bulk at high pressure across our geography and the associated above 7bar Pressure Regulating Installations (PRIs), as well as three High Pressure Storage Installations. Maintaining the functionality of the Offtakes, PRIs and Storage Installations is essential for providing a safe and reliable gas supply to our customers connected to the LTS and to the downstream local distribution networks fed from the LTS system.

The purpose of this investment in our Offtakes, PRIs and Storage assets is to ensure their continued integrity and compliance with WWU's Safety Case, as well as to meet stakeholders' requirements that we maintain risk and reliability in a financially efficient manner.

Our preferred option for these assets, our Balanced Plan, combines the flexibility of reactive maintenance with the reliability of planned replacement. This option offers the best of both worlds, the agility to address urgent issues promptly and the foresight to implement long-term improvements. It balances short-term operational necessities with strategic, long-term goals, ensuring the network's resilience and compliance with legislative standards.

The net-present value relative to baseline of our Balanced Plan option (in 2050) is:

- [redacted] for Filters
- [redacted] for Odorisation & Metering
- [redacted] for Pre-Heating
- [redacted] for Pressure Control

Failure to undertake this work will result in an increased risk of not satisfying the requirements of the legislation, or non-compliance with the WWU Safety Case and may result in a failure to deliver stakeholder outputs, or enforcement action by the Health & Safety Executive.

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

	RIIO-GD2		RIIO-GD3	
	Cost (£m)	Volume (No.)	Cost (£m)	Volume (No.)
Inspection / Fix on Failure	[redacted]	1,012	[redacted]	940
Sub-System Refurbishment		650		475
Sub-System Replacement		108		108
Total		**1,770**		**1,523**

3 Introduction

This document aims to provide a comprehensive overview of Offtakes, Pressure Reduction Installations (PRIs) and Storage facilities. It will highlight key information related to these asset groups and examine the probabilities and consequences of failures. Following this, it will explore various intervention strategies along with their associated costs, culminating in our recommended investment option for Offtakes, PRIs & Storage during RIIO-GD3.

Figure 1 - Aerial view of one of our biggest Offtakes, Dowlais

Gas enters the Wales & West Utilities' (WWU) Local Transmission System (LTS) from the National Transmission System (NTS) at 17 Offtake sites across our network. Our LTS comprises these Offtakes, a network of steel pipelines transporting gas in bulk at high pressure across our geography and the associated above 7bar Pressure Regulating Installations (PRIs), as well as three High Pressure Storage Installations. Maintaining the functionality of the Offtakes, PRIs and Storage Installations is essential for providing a safe and reliable gas supply to our customers connected to the LTS and to the downstream local distribution networks fed from the LTS system.

WWU Offtakes have inlet pressures between 31 and 70bar and our PRIs between 7 and 70bar, these installations provide volumetric or pressure control to ensure continuity of supply to the downstream pressure systems. Gas is supplied from the LTS to some directly connected large industrial and commercial consumers, and on to the distribution networks operating below 7bar, which typically supply domestic households and small businesses.

WWU operates three high-pressure storage facilities, each consisting of a series of horizontal storage above ground vessels which, along with linepack in the LTS pipeline networks, provide vital diurnal storage capacity to meet the daily demands of the gas network.

We have established efficient procedures to manage the risks associated with these asset groups; without these measures, we would fail to meet key stakeholder requirements and adhere to our legal obligations.

Each maintenance and inspection visit is an opportunity for our Operatives to raise any issues or observations through our fault reporting processes. These fault records, and results of other routine activities, feed into our risk models, ensuring that we are making decisions based on recent accurate records and data.

The proposed level of investment has been set to maintain the current risk outputs and compliance with the relevant legislation.

4 Equipment Summary

The diagram below, Figure 2 depicts the role and position of Offtakes, PRIs & LTS Storage within the gas distribution network, Figure 3 illustrates the geographic location of these sites. Note, all mentioned pressures refer to gauge pressure unless otherwise specified.

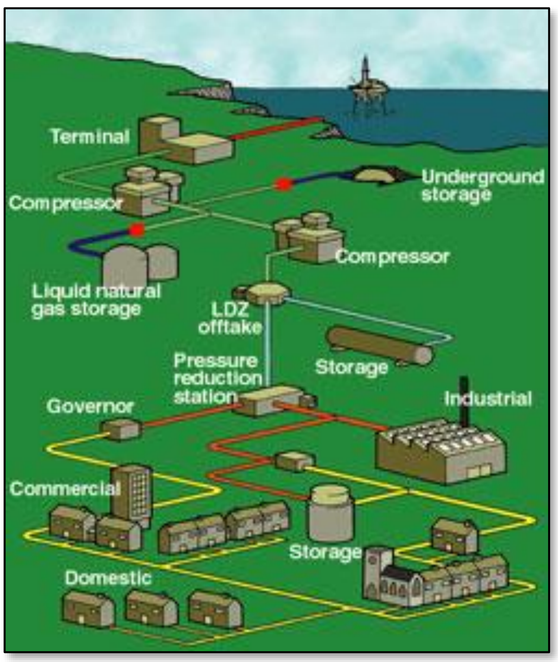

Figure 2 - Gas Distribution System

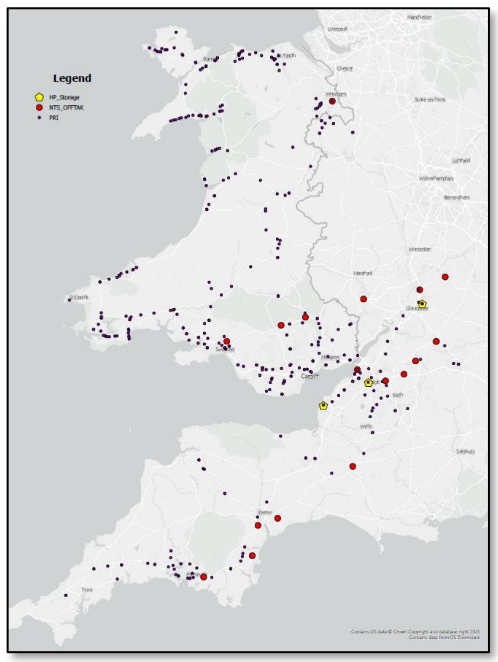

Figure 3 – Overview: Offtakes, PRIs & LTS Storage

Offtakes form the physical interface between National Transmission System (NTS) owned by National Gas and the WWU gas distribution network system and assets. At these Offtakes, which are owned by the gas distribution network operator, gas is metered, and its calorific value is measured for custody transfer, before it enters the LTS pipelines system and on through the associated pressure reduction installations (PRIs) and LTS storage installations. PRIs regulate flow and pressure in the downstream pressure systems, reduce the pressure for direct supply to end users, or provider further pressure reduction in the distribution network as necessary.

Table 2 - Asset Populations (Forecast as of Year 1, RIIO-GD3)

	PRI	Offtake	Storage
Population	306	17	3
Fewest Customers Supplied	1	10,284	27,200
Most Customers Supplied	233,489	419,721	81,381

The sub-systems of a PRI can be all of, or a number of, the below:

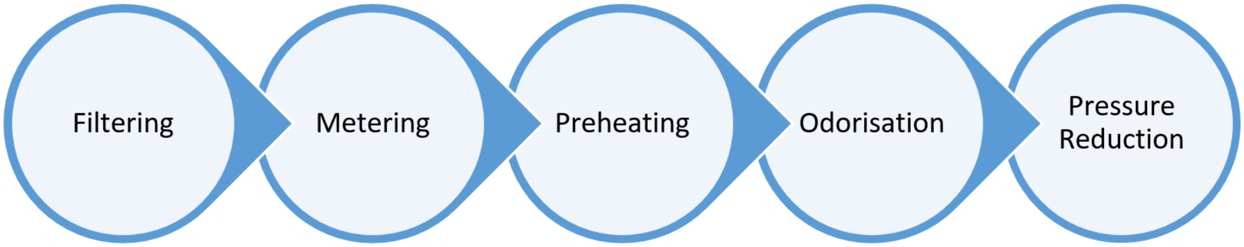

Figure 4 - Sub-systems of a PRI

Table 3 - Summary of key sub-systems

	Purpose	Prevalence
Filtering	To remove debris and dust from the gas to prevent it causing blockages on pressure regulation components and downstream equipment.	All PRIs/Offtakes
Metering	*Fiscal* - To measure gas to ensure correct consumer billing. *Non-Fiscal* - To monitor flow rate through sites where throughput has no implications on billing.	All Offtakes for measurement of custody transfer, along with the majority of PRIs dependent on system operation and modelling requirements
Preheating	To prevent low gas temperatures that could lead to freezing, causing, amongst other issues: loss of control of the site, supply interruptions, increased explosion risk, damage to downstream equipment, pipe embrittlement and ground heave.	On sites at risk of freezing due to the magnitude of the pressure reduction [Joule-Thomson effect]
Odorisation	To treat gas with a stenching agent to comply with GS(M)R for the safety of downstream consumers in the early detection of gas leaks.	All offtakes
Pressure Reduction	To regulate and reduce gas flows and pressures to supply downstream sites and end users with gas at an appropriate pressure.	All PRIs/offtakes

PRIs contain a large number of components – each site has a detailed schematic showing all key components:

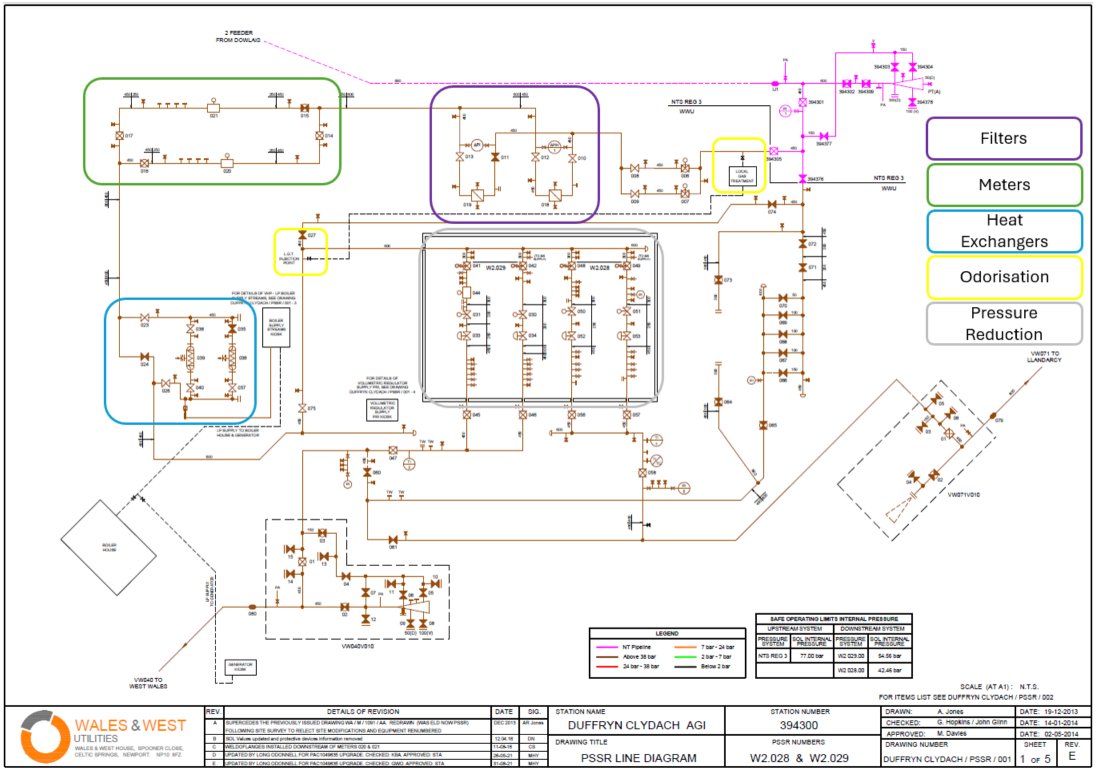

Figure 5 - Site schematic, PSSR line diagram

The schematic illustrates how the filtering subsystem is composed of two filters in parallel, to provide working and backup streams. Similarly, the pressure regulating subsystem is composed of a working and a standby stream, each of which contains two regulators for pressure reduction – one operates as the working regulator, the other provides the required level of redundancy. The configuration of primary and secondary pressure control devices and safety devices is set out in industry design code IGEM/TD/13.

Figure 6 - Example of pressure regulating streams, Dowlais Offtake

5 Problem/ Opportunity Statement

The purpose of this investment in our Offtakes, PRIs and Storage assets is to ensure their continued integrity and compliance with WWU's Safety Case, as well as to meet stakeholders' requirements that we maintain risk and reliability in a financially efficient manner.

As part of annual programmes of maintenance and intervention, each visit is an opportunity for our Operatives to raise any issues or observations through our long-established fault reporting processes. These fault records, and the results of other routine activities, feed into our decision-making processes, ensuring that we are making decisions based on recent, accurate records and data.

We also carry out sample audits on completed works and we conduct post-investment appraisals. The learning points inform future investment decisions and improve remediation techniques and when taken with the aforementioned processes, provide an appropriate level of assurance.

The proposed level of investment has been set to maintain the current risk outputs and compliance with the relevant legislation.

The work covered by this EJP is made up of planned proactive interventions, non-routine maintenance, and reactive interventions to resolve faults identified during maintenance activities. This work will ensure that the installations are fit for purpose and maintain compliance with the following Regulations:

- The Pipelines Safety Regulations 1996
- The Pressure Systems Safety Regulations 2000
- The Gas Safety (Management) Regulations 1996

Failure to undertake this work will result in an increased risk of not satisfying the requirements of the legislation, or non-compliance with the WWU Safety Case and may result in a failure to deliver stakeholder outputs, or enforcement action by the Health & Safety Executive. In addition, these installations may suffer an increasing fault rate due to advanced deterioration, incurring additional costs and in extreme cases an interruption of supplies.

The outcome we want to achieve is the continued safe transportation, distribution and storage of gas and to deliver a safe and reliable supply of gas to the public, commercial establishments, and industry. In carrying out its undertaking, WWU protects the safety of its employees and the community, and safeguards the environment from the effects of accidents, incidents and pollution. As a minimum, WWU must always comply with all relevant legislative, regulatory and statutory obligations.

We will measure success through several performance indicators including:

- Customer interruption numbers
- Monetised risk levels (NARM)
- Fault and failure rates

5.1 Narrative Real-Life Example of Problem

The following examples show some previous intervention works on these asset groups:

Cefn Onn PRI, Near Cardiff, South Wales - PRI Refurbishment

Site ID	WWU-WA-MN-506803
Project ID	13874 & 13887
Completion Year	2023
Total Cost	[redacted]

There are many locations on a PRI that can be susceptible to early degradation and thus the need for regular inspection to confirm condition. When we undertake a subsystem refurbishment particular attention is paid to these areas to mitigate the risk of degradation and where necessary to improve access for future inspection and maintenance. These areas are for example where the pipe work comes up through the ground; where it passes through walls; or where it is in direct contact with pipe supports or stands, which have the potential to capture moisture and create a localised corrosion zone where rapid degradation can occur. The below example highlights these areas and illustrates the intervention required to ensure the ongoing integrity of the site.

Cefn Onn PRI was identified from our risk model and was scoped in detail during site inspections. The work identified included replacement of 32 pipe supports, refurbishment of 8 wind and water lines, 2 through-wall sleeves and several areas of patch painting.

Pipe Supports – Figure 7 and Figure 8 show the replacement of a pipe support and the associated patch painting refurbishment work of the pipework. The new supports are galvanised, have an open construction and a course thread which can be kept lubricated to allow for easy future inspections, as opposed to the original tubular supports that corroded internally and seized in position preventing inspection.

Figure 7 - Original pipe support, unable to inspect between pipe and support

Figure 8 - Following refurbishment, with adjustable support and neoprene insert

Wind and Water Lines - A pit is excavated to allow for detailed inspection of the pipe, as shown below. The pipe is then re-coated with a multi-component liquid coating, and the pit backfilled with a fine material which is easy to remove to allow for future inspection.

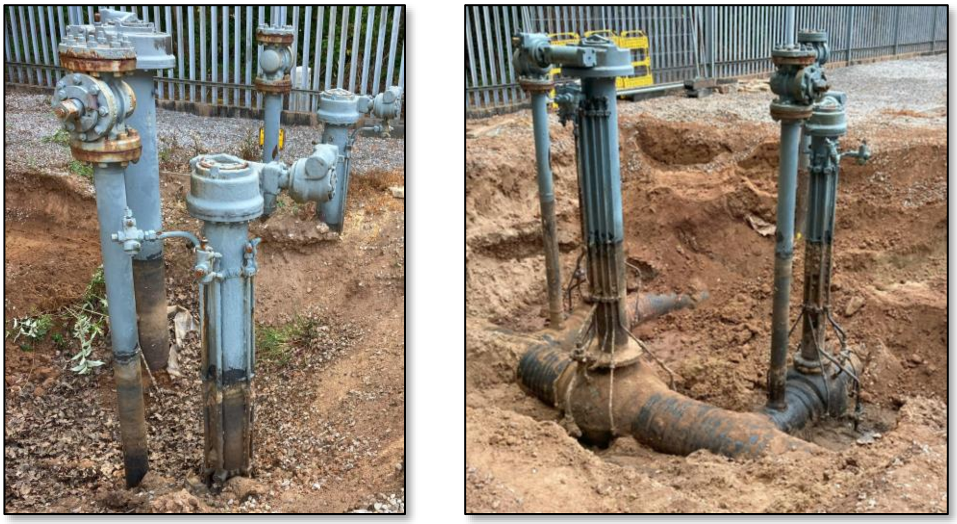

Figure 9 - Removal of a section of compound ground and condition assessment of pipework performed

Figure 10 – New multi-component coating system applied to pipework to 500mm above ground level (left) and reinstated with sand and rodent-guard mesh panels to facilitate future inspection (right)

Through-Wall Protection - these locations are similar to the wind and water lines, however, it is where the pipe passes through the wall of a building, rather than up through the concrete slab. There is potential for moisture to build up in the annulus between the building and the pipe, creating an environment for early corrosion.

Figure 11 – Original close transition through building wall cut away

Figure 12 - Assessment carried out, new coating applied to pipework and removable weather guard installed

Brynna PRI, Near Bridgend, South Wales - PRI Filter Replacements

Site ID	WWU-WA-MN-164764
Project ID	15030
Completion Year	2021
Total Cost	[redacted]

The 12-yearly major inspection (magnetic particle inspection to identify any surface breaking defects) as part of the Written Scheme of Examination (WSoE) was carried out on the two high pressure filters at Brynna, and crack-like indications were identified. In order to understand remedial actions, a damage assessment was carried out by our appointed Competent Person (DNV) and this confirmed that the filter needed significant remedial work to grind out defects followed by a rigorous monitoring programme that may lead to further repair or replacement. With this information, along with and assessment of cost options, WWU Asset Management took the decision to replace the two filters, which represented the lowest whole-life cost solution.


Figure 13 - Old defective filter following inspection (left) and new filter (right)

Tigley PRI, Near Totnes, South West - PRI Boiler System Replacement

Site ID	WWU-SW-MN-706107
Project ID	11726
Completion Year	2022
Total Cost	[redacted]

We are currently in a programme of replacing boilers before they reach end-of-life. We prioritise our replacement programme based on usage, fault rates, age and obsolescence, ensuring that existing boilers (Figure 14, left) are replaced with new boiler packages (Figure 14, right) before they fail. These boilers are more efficient and also produce less emissions, ensuring we meet current & future emissions standards. We propose to continue this programme replacing older, less-efficient boilers in RIIO-GD3.

Figure 14 - old, non-condensing boilers, right: new, 2x 90kW condensing boilers

Hendreowen PRI, Pontyclun, S. Wales - PRI Pneumatic Controller/Jetstream Replacement

Site ID	WWU-WA-MN-401402
Project ID	15766
Completion Year	2023
Total Cost	[redacted]

We are delivering a programme of work replacing pneumatic controllers with a non-venting solution, to reduce own-use gas (shrinkage) and reduce the impact of our operations on the environment. At Hendreowen we have replaced our Heeco Jetstream Regulators (Figure 15, left) with a Pietro Fiorentini integrated, non-gas venting solution (Figure 15, right). Hendreowen is one of 12 sites, collectively housing 50 regulators and 89 venting controllers that we are replacing in RIIO-GD2. We propose to continue this proactive programme into RIIO-GD3.

Figure 15 - Left: original, venting flow controller. Right: new, non-venting flow controller

Cardigan City Gate PRI, Near Cardigan, S. Wales - PRI Full Site Replacement

Site ID	WWU-WA-MN-203008
Project ID	6229
Completion Year	2023
Total Cost	[redacted]

We undertook a wholesale replacement of our PRI at Cardigan City Gate to address end of life integrity issues and relocated to a more suitable site with improved access and additional space to meet modern design standards. A number of options were considered including a mix of refurbishment and replacement of sub-systems at the existing site, however the only way to resolve all of the integrity issues, deal with inadequate access and meet modern design codes was to relocate.

The reasons for replacement and relocation included:

- unable to close the inlet pipeline valve to isolate site;
- site inlet pipework didn't have the correct through wall protection;
- unable to close filter valves and carry out PSSR inspections;
- housing too small to safely maintain equipment, in poor condition and needed replacement, larger kiosk unable to fit existing site footprint;
- inefficient heating arrangement, with long sections of above ground pipework
- pressure regulating streams in poor condition;
- site retaining wall, which also supported pipework, cracked and bulging, due to poor structural design and drainage, and;
- access road to the site was very narrow single track access to residential properties, owned by a third-party, and was being undercut by the adjacent river.

Figure 16 – Top left: old compound, top right: old subsystem, bottom left and right: access to old site

Figure 17 - Left: new compound, right: new subsystem

5.2 Project Boundaries

Examples of project spend boundaries can be seen below:

- **Wholesale Replacement** – replacement of sub-system(s), including all components (including valves), ancillary equipment and pipework
- **Component Replacement** – replacement of main component(s) e.g. filter, regulator, etc.
- **Refurbishment/Repair** – removal of old coating system and application of new one, and where applicable, replacement of pipe supports and installation of appropriate wind and water line transition

6 Probability of Failure

Failure modes and probabilities of failure have been agreed, assessed and documented as part of the cross-GDN process to develop NARMs models. This was done through a number of cross-GDN workshops with asset experts and through careful analysis of available data held by companies to assess and quantify the rates of failures and future asset deterioration.

Figure 18 is an illustration of the process to monetise risk. It shows the relationship between the asset (left) and the total monetised risk value (right), taking into account the failure modes, the probabilities of failure, the consequences of failure and the costs of these consequences occurring.

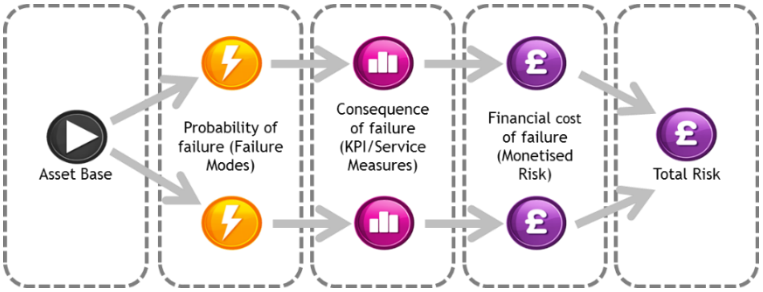

Figure 18 - From the asset to the total monetised risk, illustrative example

The failure modes for Offtakes, PRIs & Storage include:

- **General Failure** - general faults that require attention i.e. a site visit with associated repair costs, but which don't lead to customer-facing issues
- **Release of Gas** - a loss of containment event due to corrosion on pipework/components or issues with component seals
- **High Outlet Pressure/Temperature** - faults leading to high outlet pressure/temperature
- **Low Outlet Pressure/Temperature** - faults leading to low outlet pressure/temperature
- **Capacity Issue** - failure of the site to meet downstream demand under peak operating conditions

The predicted failure rates of the equipment are derived from WWU historical data and experience from the wider pipeline operator industry, in particular for high consequence, low probability events, where pooling data is necessary due to limited volume of these events.

6.1 Probability of Failure Data Assurance

Fault and failure data is collected when a defect is identified during routine or reactive inspection. This data is recorded through our robust fault reporting process into our core asset repository, SAP. This process allows us to attribute faults and failures against individual components and provides a full record of integrity issues identified over time across WWU's Offtake, PRI and Storage asset base. All faults and condition reports are investigated, and plans put in place to address the issues found, to restore or maintain integrity. These fault records and results of other routine activities feed into our health and risk models, ensuring that we are making decisions based on recent accurate records and data.

7 Consequence of Failure

The consequences of failure are:

- **Downstream Over-pressurisation** - leading to damage and/or loss of containment
- **Loss of Gas**
- **Explosion** – an explosion, either on site or in the downstream network
- **Ground Heave** – events resulting in damage to structures, roads and other assets due to low outlet temperatures [preheating-related only]
- **Site Failure + Supply Interruptions** – a site failure resulting in loss of supply to downstream domestic, commercial or industrial consumers
- **Odorant Release/Public Reported Gas Escapes** - an increase in Public Reported Escapes (PREs) in the vicinity of the offtake due to odorant release [odorant-related only]
- **Under odorisation** – leading to undetected gas escapes downstream [Offtake odorant system related only]
- **Over odorisation –** leading to an increase in Public Reported Escapes downstream of the network, over-stretching the emergency service capability [Offtake odorant system related only]

Consequence values are dependent on the consequences being assessed, and some of these consequences are interrelated.

These consequences are forecast using previous experiences across the UK gas network through assessment of pooled data from all four GDNs, as well as spatial analysis through GIS systems and network modelling to determine downstream customers. More detail can be found in the published GDN monetised risk methodology.

8 Options Considered

This section details the options considered for managing our Offtakes & PRIs population, following on from the Problem/Opportunity Statement set out in Section 5, and the probability of failure and consequences of failure, set out in Sections 6 & 7, respectively.

8.1 Baseline Option Summary: Reactive Only

This option focuses on ensuring compliance with existing legislative requirements through the implementation of basic repair and refurbishment activities, as necessary. The nature of the actions taken is generally reactive, responding to issues as they arise rather than through pre-planned interventions, implementing temporary and/or short-life fixes.

Unlike a proactive, long-term approach, this reactive option focuses on immediate compliance and minimal intervention, prioritising repairs based on legislative urgency and operational necessity. Generally, this option enables quick response times to critical issues while deferring less urgent repairs to align with budgetary constraints.

Table 4 - Benefits & Disbenefits of Baseline Option

Benefits	Description
Cost	Lowest initial cost option, maintaining and repairing only, to remain compliant

Disbenefits	Description
Reliability	Lack of redundancy (multi-feed), decommissioning sites that can’t be repaired
Safety	Require Operatives to work on increasingly dangerous assets
Environment	Increased leakage occurrences, leading to increased gas emissions
Cost	Increased maintenance activities to manage deteriorating network
Cost	Cost of repairs will be increasingly expensive (mobilising multiple times, etc.)
Cost	Deferring significant works to future years, therefore more involved / expensive
Health / Risk	Health deteriorating, risk increasing, not what our stakeholders want from us
Reputation	Increasing reputational damage from incidents, increased public scrutiny
Regulator	Enhanced monitoring from HSE, leading to increasing scrutiny

Delivery Timescales: 2026 - 2031

8.2 1st Option Summary: Refurbishment Only

This option focuses on addressing and rectifying issues only when they arise rather than through routine or preventive maintenance. This approach is often adopted in cases where the operational environment is predictable, and the impact of failure is minimal or manageable. The strategy assumes that the impact of failures, should they occur, will not have severe repercussions on safety, environmental compliance, or financial stability. It also assumes that refurbishment is possible, and if it isn't the asset will be decommissioned.

This method also relies heavily on the quick availability of skilled personnel and resources for unplanned repairs. In critical environments, a purely repair-based approach may not be suitable; however, in non-critical, low-risk scenarios, it can be a viable and cost-efficient solution.

Table 5 - Benefits & Disbenefits of Option 1

Benefits	Description
Cost	Lower initial cost option, maintaining & repairing only, to remain compliant
Reliability	Assets are repaired / refurbished when performance / condition indicates need

Disbenefits	Description
Reliability	Lack of redundancy (multi-feed), decommissioning sites that can't be repaired
Safety	Require Operatives to work on increasingly dangerous assets
Environment	Increased leakage occurrences, leading to increased gas emissions
Cost	Increased maintenance activities to manage deteriorating network
Cost	Deferring significant works to future years, therefore more involved / expensive
Health / Risk	Population health deteriorating, risk increasing, not what our stakeholders want
Regulator	Enhanced monitoring from HSE, leading to increasing scrutiny

Delivery Timescales: 2026 - 2031

8.3 2nd Option Summary: Balanced Plan

This balanced plan option strategically integrates both reactive work and wholesale replacement activities, ensuring that it meets legislative requirements while optimising time, money, and resource allocation. By adopting a hybrid approach, the programme aims to provide a pragmatic solution that prioritises urgent repairs without neglecting the long-term sustainability of the network.

The balanced approach combines the flexibility of reactive maintenance with the reliability of planned replacement. This option offers the best of both worlds: the agility to address urgent issues promptly and the foresight to implement long-term improvements. It balances short-term operational necessities with strategic, long-term goals, ensuring the network's resilience and compliance with legislative standards.

Table 6 - Benefits & Disbenefits of Option 2

Benefits	Description
Reliability	Replacing assets with new (when applicable) will improve reliability / resilience
Safety	New, modern-standard assets will be safer to work on and for public in area
Safety	Balance of repair & replace with maintain high standards of safety
Environment	Replace end-of-life asset with new, long-life asset: less ongoing disruption
Environment	Reduced emissions from leaks & lower embedded carbon with effective spend
Cost	Similar levels of consumer contribution, in-line with stakeholder feedback
Cost	Replacing asset at end-of-life once exhausted repairs options = effective spend
Health / Risk	Health and risk of these assets maintained, in-line with stakeholder feedback
Regulation	Maintain good relationship with regulators: compliant, with minimal findings

Disbenefits	Description

Delivery Timescales: 2026 - 2031

8.4 3rd Option Summary: Replacement Only

The Replacement Only option focuses on a proactive approach to asset management, ensuring that any component or system that fails or shows signs of potential failure is promptly replaced. This not only mitigates the risk of extensive downtime and costly reactive repairs, but also enhances overall system reliability and safety.

This option however means replacement of assets before their end-of-life, whereby affecting a repair would be sufficient, and results in significant, ineffective cost.

Table 7 - Benefits & Disbenefits of Option 3

Benefits	Description
Reliability	Replacing broken assets with new will increase reliability / network resilience
Safety	New, modern-standard assets will be safer to work on and for public in area
Health / Risk	Improved health and risk metrics

Disbenefits	Description
Environment	Significant embedded carbon increase with construction of new/disposal of old
Disruption	Increased disruption to local communities as we carry out more involved works
Cost	Significant capital cost, unpalatable to our stakeholders based on feedback
Cost	Replacing asset before end-of-life (repair sufficient) results in ineffective spend
Safety	Large capital construction programme results in risk to workforce and public

Delivery Timescales: 2026 - 2031

8.5 Other Things Considered

As part of the option identification process, one thing was considered and discounted, and therefore not progressed through to a cost-benefit analysis assessment, documented below:

a) Do Nothing: we have legal obligations in primary and secondary legislation to manage our LTS Pipeline population, predominantly in accordance with the Pipeline Safety Regulations (1996) and the Pressure Systems Safety Regulations (2000), the option of doing nothing is not allowed. As a minimum, we need to continue our inspection and maintenance programmes, and fix what is identified as being defective.

8.6 Options Technical Summary Table

The below table details the technical summary of each option:

Table 8 - Options Technical Summary Table

	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment or Investment Design Life	Total Installed Cost
(Baseline) Reactive Only	Year 1 - 2026/27	Year 5 - 2030/31	940	~10 years	[redacted]
(1) Refurbishment Only	Year 1 - 2026/27	Year 5 - 2030/31	1,523	~10 years	[redacted]
(2) Balanced Plan	Year 1 - 2026/27	Year 5 - 2030/31	1,523	~10 - 45 years	[redacted]
(3) Replacement Only	Year 1 - 2026/27	Year 5 - 2030/31	1,523	~45 years	[redacted]

8.7 Options Cost Summary Table

The below table details the range of costs for each Offtake, PRI & Storage intervention option:

Table 9 - Range of unit costs for Offtakes & PRIs interventions, by option number

Intervention Type	(Baseline) Reactive Only	(1) Refurbishment Only	(2) Balanced Plan	(3) Replacement Only	Unit Cost Range (£)
Inspection / Fix on Failure	✓	✓	✓	✓	[redacted]
Sub-System Refurbishment		✓	✓		
Sub-System Replacement			✓	✓	

9 Business Case Outline and Discussion

9.1 Key Business Case Drivers Description

The table below sets out the top three value drivers for each CBA, demonstrating where the majority of the monetised risk benefit is represented:

Table 10 - Key Value Drivers for Each CBA Model

	Financial Node	Description	CBA Model Percentage
Filters	F_Carbon	The carbon footprint value associated with the gas lost from general emissions	~90%
	F_Domestic	Financial cost of supply interruption of a riser or lateral for a domestic customer.	
	F_Loss of gas	The cost associated with the retail value of loss of product	
Odorisation	F_Additional HO Response	Additional cost to repair leaks identified by high odorant levels	~99%
	F_Domestic	Financial cost of supply interruption of a riser or lateral for a domestic customer.	
	F_Restore Supply	Financial cost of restoring supply to downstream properties following a supply interruption	
Metering	F_Commercial	Financial penalty associated with inability to measure value of gas taken from the NTS by the shippers	~99%
	F_Additional HO Response	Additional cost to repair leaks identified by high odorant levels	
	F_Metering_Repair	Cost of resolving meter performance issues (assumed to be equivalent for high, low or no readings)	
Pre-Heating	F_Carbon	The carbon footprint value associated with the gas lost from general emissions	~87%
	F_Domestic	Financial cost of supply interruption of a riser or lateral for a domestic customer.	
	F_Restore Supply	Financial cost of restoring supply to downstream properties following a supply interruption	
Pressure Control	F_Carbon	The carbon footprint value associated with the gas lost from general emissions	~92%
	F_Domestic	Financial cost of supply interruption of a riser or lateral for a domestic customer.	
	F_Restore Supply	Financial cost of restoring supply to downstream properties following a supply interruption	

9.2 Business Case Summary

Our CBAs have been completed in line with Treasury Green Book Guidance and utilise the Ofgem issued model that is compliant with this guidance.

The tables below are extracted from the Ofgem issued CBA model, populated for our assets and the programmes of work considered. For further detail, please see the corresponding CBA models as submitted to Ofgem with the RIIO-GD3 Business Plan. For ease, all net-present values are summarised in Table 15.

Table 11 - NPV Relative to Baseline: Filters

[redacted]

Table 12 - NPV Relative to Baseline: Odorisation & Metering

[redacted]

Table 13 - NPV Relative to Baseline: Pre-Heating

[redacted]

Table 14 - NPV Relative to Baseline: Pressure Control

[redacted]

Table 15 - Summary Overview of NPV Relative to Baseline for all CBAs Associated with Offtakes & PRIs

[redacted]

10 Preferred Option Scope and Project Plan

10.1 Preferred Option

The below table sets out the preferred option to manage our Offtake, PRI & Storage population: **Option 2 - Balanced Plan**. Our plan includes all compliance-driven activities, in accordance with the Pressure Systems Safety Regulations (2000), plus also proactive interventions, where we favour refurbishment when it's still an option. Also included in the plan are any reactive interventions based on historical experience, see volumes below:

Table 16 - Intervention volume for preferred option: Option 2, Balanced Plan

Intervention Type	Volume
Inspection	940
Sub-System Refurbishment	475
Sub-System Replacement	108
Total	**1,523**

The CBA outcomes, state that Option 1: Refurbishment Only is the most favourable by 2050, however in reality, some of the assets that require intervention will have passed the point of refurbishment, and replacement remains the only option. Figure 19 illustrates this.

[redacted]

Figure 19 - Illustrative Chart of Capex vs. Balanced Capex / Opex Strategies

The orange line illustrates asset health over time, deploying our strategy of balancing refurbishment and replacement. The black line is a pure replacement approach. Refurbishment actively extends life and ‘sweats’ the asset delivering a lower whole-life cost. Whilst this pushes out end of life, it does not extend indefinitely and at some point refurbishment becomes lower value and higher cost. Much like maintaining a vehicle that will run longer with regular servicing but will not run forever.

When we develop investment plans, we utilise data on asset health, faults, failures and maintenance inspections. We also have experienced engineers reporting on the suitable options for each site. Our balanced plan reflects the minimum end of life replacements needed and maximum refurbishments based on data and engineering judgement. Refurbishment only options on all sites will not deliver the safety and reliability levels required by stakeholders and will not be accepted by HSE inspectors on end-of-life assets. This plan offers good value for money as demonstrated by the CBA early pack-back period.

10.2 Asset Health Spend Profile

The table below details the spend profile, by year, for the Offtakes, PRIs & Storage interventions:

Table 17 – Offtakes, PRIs & Storage spend profile

[redacted]

10.3 Investment Risk Discussion

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 Offtakes & PRIs 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 hydrogen 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.

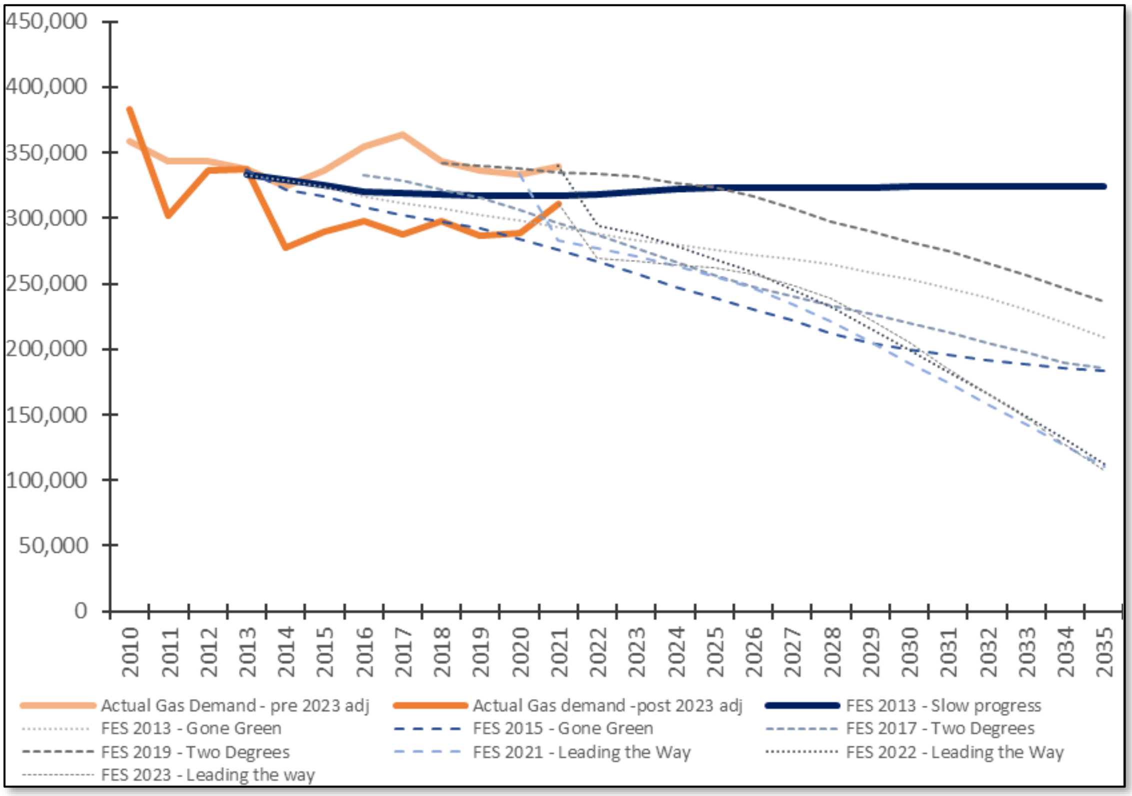

Figure 20 - Historical residential gas demand against most optimistic scenario in every 2nd year of publication, dating back to 2013

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.

10.4 Project Plan

The project plan in Table 18 below details the various stages of the project from the initial workload iteration stage through to record update and project completion. We don't envisage any long lead-time items that will put a RIIO-GD3 delivery in jeopardy, with all items able to be purchased and delivered within 3-6 months.

Table 18 - Project Plan of RIIO-GD3 Planned Investment

		RIIO-GD2 Year 5				RIIO-GD3 Year 1				RIIO-GD3 Year 2				RIIO-GD3 Year 3				RIIO-GD3 Year 4				RIIO-GD3 Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
RIIO-GD3 Programme - Year 1	First Iteration of Workload	■																							
	Detailed Scoping & Refinement		■	■																					
	Final Draft, Business Approval			■																					
	Purchase Long-Lead Time Items			■																					
	Project Delivery Period				■	■	■	■																	
	Project Completion, System Updates				■	■	■	■	■																
RIIO-GD3 Programme - Year 2	First Iteration of Workload					■																			
	Detailed Scoping & Refinement						■	■																	
	Final Draft, Business Approval							■																	
	Purchase Long-Lead Time Items							■																	
	Project Delivery Period								■	■	■	■													
	Project Completion, System Updates								■	■	■	■	■												
RIIO-GD3 Programme - Year 3	First Iteration of Workload									■															
	Detailed Scoping & Refinement										■	■													
	Final Draft, Business Approval											■													
	Purchase Long-Lead Time Items											■													
	Project Delivery Period												■	■	■	■									
	Project Completion, System Updates												■	■	■	■	■								
RIIO-GD3 Programme - Year 4	First Iteration of Workload													■											
	Detailed Scoping & Refinement														■	■									
	Final Draft, Business Approval															■									
	Purchase Long-Lead Time Items															■									
	Project Delivery Period																■	■	■	■					
	Project Completion, System Updates																■	■	■	■	■				
RIIO-GD3 Programme - Year 5	First Iteration of Workload																	■							
	Detailed Scoping & Refinement																		■	■					
	Final Draft, Business Approval																			■					
	Purchase Long-Lead Time Items																			■					
	Project Delivery Period																				■	■	■	■	
	Project Completion, System Updates																				■	■	■	■	■

10.5 Key Business Risks and Opportunities

The table below summarises risks and mitigations related to delivery of our plan for this asset group:

Table 19 - Summary of Risks & Impacts of the Delivery Plan

Risk Description	Impact	Likelihood	Mitigation/Controls
Programme does not manage risk to required levels	WWU would not be meeting agreed targets for RIIO-GD3	<=20%	We have invested in data and analytics. Probability of failure and deterioration curves have been validated against reality. As long as the physical programme is delivered, this risk is minimal.
Risk to delivery timescales	Increased cost to recover programme if falling behind. Benefits to consumers not realised in a timely manner. Wouldn't comply with HSE mandated requirements	<=20%	We have established processes in place to deliver programmes such as this and have successfully delivered in RIIO-GD2. We have a robust workforce resilience strategy as documented in our RIIO-GD3 submission. Delivery of our investment plans are monitored at Exec / CEO level in our organisation.
Risk to planned costs	Consumers and WWU paying more than planned for work making it less cost beneficial. If cost is below planned cost, then consumers and WWU benefit from Total Expenditure (Totex) sharing incentive	<=20%	We hold excellent data on these assets, and we scope work well in advance. We have an excellent track record in delivering programmes like these. We operate an insourced delivery model for the bulk of our Offtakes, PRIs & Storage programme. Therefore, risk is minimal.

10.6 Outputs included in GD2 Plans

Although preparatory work for the RIIO-GD3 programme will be completed in RIIO-GD2, no physical and hence, outputs, will move between the two price controls.