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Appendix 10

Network Asset Management Strategy

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Contents

Executive Summary

Through RIIO-2 we have invested [cost-sensitive data] into our asset base and have delivered significant reductions in mains-risk and improved asset condition and modernised our network assets as well as developing our asset management capabilities to ensure we continue to adapt and improve.

We have established an enduring strategic asset management approach, underpinned by robust data and enduring tools that will be refined and managed as part of business-as-usual. Our enduring approach ensures we deliver best-in-class asset stewardship. This will enable us to create and maintain a 10-year rolling investment plan and respond rapidly to changing needs, as we shape the UK energy sector and move towards achieving net zero.

During RIIO-3, our Network asset strategy sets out to deliver stable asset health and performance, which is both affordable and delivers a quality, safe and reliable service to customers. Our strategy also significantly contributes to our net zero targets, through proactively intervening on our leakiest pipes through our Active Leakage Intervention Programme. Our strategy has considered how climate change, net zero ambitions, emerging technology and changing regulator and customer expectations needs to shape our network asset investments.

The following table highlights how we have met the sector specific business planning guidance issued in September 2024, and where to find further information.

BPG Ref	BPG Requirements	Key messages
5.2	The company should submit a Network Asset Management Strategy which sets out what they are doing to ensure best in class asset stewardship.	We have developed an enduring asset management approach, which is ISO 55001 accredited and subject to continuous improvement through periodic reviews. Refer to section 2.
5.3	The strategy should set out the asset management policy and strategy to promote asset health and long-term operational resilience across its asset including lead and non-lead assets. This should include a summary of the company's approach to the management of NARM and non-NARM assets on its networks, considering safety, compliance, and risk management	We have set out a comprehensive strategy that focusses on maintaining stable asset health and performance and supporting net zero targets through targeting our leakiest gas-mains. Refer to section 3. We have set out our investment methodology used to inform our RIIO-3 investment plan in section 5 of this document.
5.4	Business plans should set out the company's views on asset health, criticality, and replacement priorities for: • The start of the price control period (the baseline view), effectively reflecting its view on the asset health, criticality, and risk of assets on the network. • The end of the price control period with no intervention, effectively reflecting its view on asset degradation over the period. • The end of the price control period with proposed interventions.	In section 4 of this document, we provide a more detailed summary of: • what our proposed network asset investments are; • the level of investment needed; • the forecast work-volumes; • The NARM risk position at the start and end of RIIO-3
5.7	Companies should explain their long-term risk objectives and strategy, as well as the long-term benefits delivered by their proposed interventions.	Section 4 sets out the long-term risk objectives by summarising our Network Asset Risk Metric (NARM) targets and forecast fault rate and asset health for assets not managed through NARM.

Table 1: Sector specific guidance – Key messages.

1. Background

In our RIIO-2 business plan, we set out an ambitious 15-year strategy to:

- Transform our business performance on customer efficiency and develop a track record of delivery during RIIO-2. We are committed to a comprehensive programme of gas asset maintenance, replacement, and upgrades during RIIO-2, focusing on safety, leakage reduction, and improved customer service. Key initiatives included extensive mains replacements, upgrades to strategic gas sites, and major projects such as the [security-sensitive].
- Digitalise our business in RIIO-3, through the development of new technologies and ways of operating and moving from reactive to proactive management of our network whilst enhancing our resilience.
- Fundamentally changing the way our business looks and operates enabled by new technologies in RIIO-4. Our network operations will become a world leading net-zero network.

In the past five years, new challenges have pushed us to evolve our work to adapt to climate change, meet net zero goals, build resilience to security risks, meet customer expectations, and leverage emerging technologies, all while ensuring reliable, cost-effective service.

Our RIIO-3 strategy, as set out in our RIIO-2 business plan, is still appropriate. We will transform how our business thinks and operates. We will utilise our existing data, new data, and new analytical capabilities to move to a more proactive operating model focusing on operational excellence.

1.1. Our RIIO-2 Network Asset Management Plan

Our RIIO-2 network-asset management plan committed us to deliver a significant programme of asset interventions to ensure our gas network assets were managed and maintained efficiently, to deliver a safe and reliable system. We committed to:

- Being able to keep our customers-on-gas 99.9% of the time.
- Delivering improvements to the service to customers in multiple-occupancy buildings, by reducing the time interrupted from the gas-supply by 60%.
- Delivering circa 15% reduction in leakage from our networks.
- Delivering our monetised risk targets per network within the associated risk deadbands. Refer to the NARMs (Regulatory Reporting Pack) RRP 24 for further insights.
- Delivering the defined price control deliverables across our major projects.

We are on track to deliver these commitments in RIIO-2 and achieve our stated performance as indicated in our Strategic performance overview report (2024)[1], and the 2024 RRP. Despite significant focus on driving efficiencies into our cost base and a business wide-ranging digitisation and innovation transformation, we are forecasting an overspend of by [cost-sensitive data] relative to our RIIO-2 Totex [cost-sensitive data] allowance. This reflects the challenging economic environment that we have faced due to market pressures (including inflation), plus additional mandatory works that were not included in our RIIO-2 allowances, such as governor improvement, capacity upgrades and non-rechargeable diversions.

[1] Strategic performance overview report (2024)

2. Our best-in-class approach to asset stewardship

During RIIO-2, we have embedded significant improvements in our asset management capability, which has been used to inform our investment decisions within our RIIO-3 submission.

This section sets out our business-as-usual Strategic Asset Management framework and the processes, procedures and supporting tools used to inform effective and efficient risk-based investment decisions.

We have included a detailed discussion of how we have applied our framework to develop and derive the data and information in support of each Engineering Justification Paper (EJP), within section 4 of this document.

2.1. Key improvements made in RIIO-2 to our asset management capability

In RIIO-2 we have made key improvements to our asset management capabilities:

- Improvements to Asset Data, through a comprehensive review of asset data quality, 24 asset classes have been identified for improvements to asset data attributes through RIIO-2 to ensure we have the data we need to make good asset management decisions.
- Centralised asset data repository: We have developed a centralised data repository and tool which consolidates all our static asset data (at component level) and condition data into one single location, enabling more effective investment decisions.
- Investment decision-making and deterioration modelling: We have existing Asset Investment Manager (AIM) models developed for managing the NARM targets, across a defined set of assets. During RIIO-2 we have undertaken a full asset-data refresh, updated monetised risk valuations, incorporated long-term risk principles, and introduced wider system-resilience into the risk-maps. Refer to section 5.2.1 for more information.
- Leakage models: We have developed the capability to identify our leakiest pipes proactively through our enhanced shrinkage and leakage modelling. We now have tools to target interventions, via the Digital Platform for Leakage Analytics (DPLA), together with deployment of monitoring and detection technologies, which has enabled us to transition from fully modelled, to fully observed leakage reporting. These advancements have enabled us to provide better data-driven decisions for asset maintenance and replacement of gas-mains, ultimately supporting our sustainability strategy and ambition to reduce leakage during the RIIO-3 period.
- Unit cost workbook: We have developed an enduring business-as-usual, unit cost workbook to support investment decision making. This workbook will be subject to periodic reviews, improvement, and market-testing to ensure it comprises efficient rates.

2.2. Our enduring best-in-class approach to asset stewardship.

We have an established asset management approach, as shown in the hierarchy in Figure 1 below, which is ISO 55001 accredited, and forms the basis for our best-in-class approach to asset stewardship. Our approach to best-in-class asset stewardship will continue to evolve, to ensure we can make the most efficient risk-based decisions, which are data driven and consider wider climate change and system-resilience risks. We must also become more agile and be able to adapt to changing supply and demand requirements at a localised level as we transition to net zero.

Our best-in-class approach by the end of RIIO-3 will be enhanced and comprise:

- An improved and unified set of **asset investment portfolio management tools**
- **Capability to undertake future energy modelling** to inform supply-demand requirements, our overall investment decisions, and enable a more agile and adaptive planning approach.
- **Capability to analyse wider system resilience risks** (including climate change risks) and use this to inform investment decisions.

- **Enhanced shrinkage and leakage modelling** capability to target and reduce leakage more effectively, through our Advanced Leakage Detection and Intervention programme.
- **Enhanced visibility, automation, and control of our network assets**, enabled through investment in cyber-resilient operational technology
- **Improved data and insights to support investment decision making,** enabled by the planned investment in operational technology, centralising the operational control centre, and through improved data capture following an operational intervention.
- **Predictive analytics capability**: Developing the capability to proactively intervene prior to failure. The alarm and predictive analytic data will also feed into our asset models that form part of our long-term strategic investment planning framework to enable us to evolve our investment needs.

Further information on the above enhancements are detailed in section 4.1 of this document.

This approach has set the framework for the development our RIIO-3 plans.

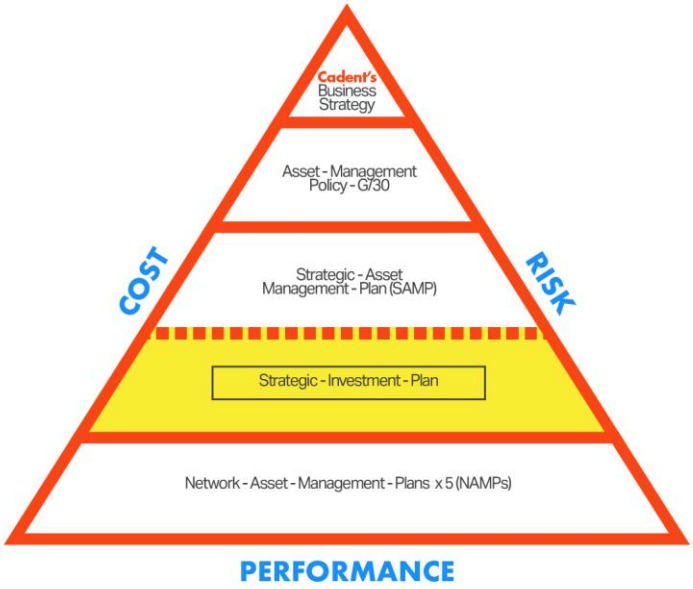

Figure 1: Our asset management hierarchy

In July 2022, we updated our Strategic Asset Management Plan (SAMP). To inform our RIIO-3 Network Asset Management Strategy, we have developed Strategic Investment Plans to achieve the objectives set out in the SAMP.

Our Strategic Investment Planning approach provides a structured approach to ensure that we optimise our investment to realise maximum value from our assets. See Figure 1.

To develop our Strategic Investment Plans, we consider:

- The Asset Investment Strategy (as defined in the SAMP) which sets out the asset management objectives. The document sets the approach and direction for our investment, and the business priorities and ambitions for investment. All investments promoted into the plan must support one or many of the identified asset management objectives.
- Technical Needs Cases: Technical Needs cases are created to identify the risks and technical needs across our asset classes. These can be identified through multiple routes; legislative or industry wide drivers, our AIM platform (decision support tool) or escalated as part of planned or reactive maintenance trends. The risks are quantified, and the highest priority sites and asset-systems are promoted for further investigation.
- Our Investment Justification Papers: These justification papers assess a comprehensive range of options, looking at ways to mitigate the risk, balancing strategic ambitions, technical need, risk, and affordability. We use cost-benefit analysis to support our investment decision-making process.

- Our 10-year Investment Plans: Our chosen investments are then developed into a 10-year view of investment based on current asset health, drivers, constraints, and risk. This investment plan is constantly evolving as the risk-position across our networks and assets change.
- Network Workbooks: These network workbooks develop a more targeted short term prioritised plan for delivery, based on the 10-year investment plan. The network investment planning teams use the latest view of asset performance and risk, to target and prioritise interventions for delivery.

2.3. Ongoing asset management benchmarking and capability assessments

We continually evolve our asset management capability through adherence to best practices and industry standards, which is demonstrated by our commitment to achieving and maintaining ISO 55001 certification. ISO 55001:2014 is a globally recognised standard for asset management, ensuring that we implement robust processes to optimise the value of its assets while managing risks effectively. We successfully underwent re-certification in February 2023, with the next review scheduled for February 2026.

Our Asset Management Policy (G30) defines the high-level principles and mandated requirements that guide our approach to asset management. This policy serves as the foundation for our asset management framework, ensuring alignment with organisational objectives and industry standards. Our SAMP translates these principles into long-term strategic objectives and outlines the processes and decisions needed to achieve them. The SAMP takes a holistic view by considering organisational needs, stakeholder expectations, and existing asset conditions. The plan is updated periodically to incorporate changes in external policies, regulatory requirements, and business strategies.

We benchmark our asset management practices against the Institute of Asset Management best practice framework using the Self-Assessment Maturity Model. Regular maturity assessments help identify areas for improvement, enabling continuous development of our asset management processes.

We also hold quarterly Management Review Forum meetings as part of the ISO 55001 assurance activities. Chaired by the Chief Operating Officer, these forums review whether the outcomes of asset management decisions support the organisation's objectives. This structured approach demonstrates our commitment to maintaining high standards in asset management and adaptability to evolving industry demands and regulatory expectations.

3. Understanding the changing drivers and challenges influencing our strategy

Our Network Asset Management Strategy for the next five years and beyond is shaped by our legal and regulatory obligations, our priorities, and ambitions as a transporter of gas, Government policy, the priorities of our customers and our RIIO-3 company-wide objectives. Since RIIO-2 new challenges and requirements have emerged.

In this section, we set out our long-term asset strategy and discuss the things we have considered in forming our position.

3.1. Our company-wide ambitions and alignment with our Network Asset Management Strategy

We are proud to provide a high quality of service to our customers by operating our gas distribution network at a high level of reliability and safety.

Our Network asset strategy in RIIO-3 sets out to deliver stable asset health and performance, which is both affordable and delivers a quality, safe and reliable service to customers. Our strategy also significantly contributes to our net zero targets, through proactively intervening on our leakiest pipes through our Active Leakage Intervention Programme (ALIP).

As set out in section 3.2, our longer-term asset strategy must align with the UK's plans for achieving Net Zero, but this transition is not yet certain. We recognise the need to have the capability to be able to model at a granular level, down to the demand each of the properties require. To meet these needs, we have developed and tested the principles of our future energy and resilience modelling capability (see section 4.1.2 and section 4.1.3 for more information). Both capabilities will enable us to make targeted risk-based long-term decisions on asset health and resilience. As we begin to understand the transition to net-zero and the use of alternative fuels (biomethane versus hydrogen) as part of this change, we will be able to identify areas of the network that must be retained and possibly reinforced versus areas of the network that can be downsized or decommissioned as the use of gas changes. We therefore expect that in RIIO-4 we will have a more diverse asset-strategy, where reducing asset health may be acceptable for some areas of the network where a more-rapid, localised reduction in gas-demand is predicted.

The following table sets out how our RIIO-3 network asset strategy aligns with our strategic goals.

Strategic Goals	Network Asset Management Strategy Outcomes
A. Safe Secure & Resilient supplies	• Delivery of a robust, like-for-like asset health programme that ensures we continue to meet or exceed our regulatory and legislative obligations and keep Network Asset Monetised Risk broadly neutral. • Deliver an ALIP, repairing over [commercially-sensitive] km of replaced or remediated pipework– this programme is a significant driver to both our net zero targets and to managing safe, secure, and resilient supplies. • Continuation of our HSE mandated Iron Mains Replacement Programme (IMRRP). • Implement a network fit-for-the-future as part of asset health programme, where practicable and economical, we will select materials that are compatible with alternative fuels (e.g. use of plastic pipes as part of our mains replacement programme). • Investments in capacity-driven upgrades where there is an immediate and sustained need based upon peak 1-in-20 year demand obligations. • Deliver the Physical Security upgrade programme, through identified mandated category 3 security upgrades. • Deliver high-priority asset health and resilience-driven major projects, including [security-sensitive]

Strategic Goals	Network Asset Management Strategy Outcomes
	• Modernising our instrumentation; leveraging the opportunity presented through our asset health programmes to comply with NIS[2] and provide modern-day-equivalent technology to support our data and digitalisation strategy.
B. Infrastructure Fit for a Low-cost transition to Net zero	• Deliver our pioneering Advanced Leakage Intervention Programme to address risk and emissions from mains outside of IMRRP. Enabled by our Advanced Leak Detection (ALD) and analytics (DPLA) we will be able to target interventions effectively. We have included funding in our plan to repair or replace these detected leaks.

Table 2: Our strategic goals and their alignment to our Network Asset Management Strategy

3.2. What we have considered in developing our strategy

3.2.1. Transition to Net zero and our approach to developing a long-term strategy

The UK's plans for achieving net zero, particularly with regards to adoption of a hydrogen network, are uncertain. We need to carefully balance the facilitation of a transition to hydrogen whilst ensuring we pursue only no-regret investment to protect our customers from stranded assets.

The specific challenges facing the gas sectors, as highlighted by Ofgem, include:

- Balancing the level of investment needed to maintain a safe and reliable network with the uncertainty around the pace at which gas demand declines across different parts of Great Britain.
- Uncertainty in the extent to which existing gas network assets may be repurposed for hydrogen or Carbon Capture, Utilisation and Storage.
- Deciding how costs for both historical and future investment are recovered over time from a declining customer base to ensure fairness and protect both consumers and investors against the risk of asset stranding.
- Tackling the issue of how to pay for the potential decommissioning of assets where they are no longer required through the 2030s and 2040s.

The Future Energy Scenarios (FES) 2024, developed by the National Energy System Operator (NESO), provides a high-level roadmap for the UK's energy transition. However, the national-level modelling, particularly within the Holistic Transition pathway, relies on optimistic assumptions about consumer behaviour, technological adoption rates, especially concerning heat pumps, and the achievability of ambitious carbon budgets. This top-down approach fails to capture the nuanced regional variations in gas demand, infrastructure needs, and decarbonisation pace across our network.

Our key concern is the disconnect between the FES's projected decline in domestic gas demand and the realities of current infrastructure development and potential demand from hard-to-decarbonise sectors. This disconnect, coupled with uncertainty surrounding disconnection and connection rates, makes it difficult to accurately forecast demand and project asset utilisation, potentially leading to underinvestment and network resilience challenges. Our modelling shows that the adoption of renewable heating technologies (for example heat pumps) is dependent on several factors: particularly demographic, property energy performance certificate rating and affordability. As such, we expect the adoption of these technologies to be scattered across our existing customer base rather than concentrated in specific areas. Hence, we anticipate needing to keep the majority of today's network operational for the next 15-20 years to serve even if our customer numbers reduce by 50%.

Additionally, the FES underestimates the potential of biomethane, presenting a significantly reduced role compared to previous iterations and our own projections, despite its potential as a readily deployable green-gas solution. We are committed to collaborating with NESO and Regional Energy Strategic Planners, providing data and expertise to refine the FES and ensure future scenarios realistically reflect the complexities of the energy transition at a regional basis.

[2] National Information Systems Regulations 2018.

The following summarises how Cadent will approach it's RIIO-3 Network Asset Management Strategy, to support the transition to net zero.

- The FES provides a high-level roadmap to potential changes to gas supply-demand over the longer term; however, we do not have sufficient granularity at a network or local level to be able to model how FES will impact investment decisions over the medium term.
- We are already working on developing our own internal supply-demand modelling capability, to be able to carry out the detailed and localised scenario analysis, as we transition toward a net-zero future. This new capability will be developed in collaboration with NESO, other gas distribution networks (GDNs) and the wider energy sector to inform our long-term strategy. Whilst we have a proof of concept, most of the platform has meant we are unable to set out this long-term strategy within our RIIO-3 submission. For more information on our RIIO-3 ambitions to develop our Future Energy Modelling capability see section 4.1.2.
- We anticipate that we will need to maintain today's network for the next 15-20 years to serve even 50% of our customers. Any asset health investments proposed in RIIO-3 must enable us to comply with our current 1-in-20 year daily peak-winter demand, which is not forecast to change throughout RIIO-3. Therefore, our RIIO-3 asset-health investments will be based on a like-for-like asset size / site-configuration.
- To future-proof our asset investments, we will consider the materials we use when replacing each asset. For key mechanical or pipeline assets that are at end-of-life, we will consider equipment that is hydrogen ready; however, for shorter life assets such as electrical or instrumentation this would not be appropriate. Our mains replacement programmes will consider hydrogen-ready plastic pipe, where feasible.
- For any investments driven by changes to network capacity, particularly pressure reduction stations (PRSs), offtakes and governors or pipeline reinforcements, we are only investing where we can demonstrate that the site does not meet our 1-in-20 year obligations[3] now through until 2031, having taken into consideration any wider system resilience available.

3.2.2. Changing regulatory priorities

During the RIIO-2 period there have been several fundamental shifts in our regulatory landscape resulting from societal priorities. The principal changes are:

- The duties of Ofgem have evolved between RIIO-2 and RIIO-3 to reflect the changing energy landscape, specifically with regards to net zero.
- Legislative changes, the most impactful change is the application of the Network and Information Systems Regulations 2018 by Ofgem.
- The Health & Safety Executive (HSE) are close to concluding their review of the Iron Mains Replacement Programme, with clear intent to mandate Advanced Leakage Detection and more interventions focused on Tier 2 & 3 assets.

This section outlines how these changes have shaped our Network Asset Management Strategy.

Ofgem expects us to deliver four principal regulatory outcomes:

- Secure and resilient supplies: Network companies must deliver a safe, secure, and resilient network that is efficient, data rich and responsive to change. Consumers should have access to gas and electricity supplies that are resilient to physical, financial, climate and cyber shocks.
- Infrastructure fit for a low-cost transition to net zero: Network companies must facilitate a low-cost, environmentally sustainable, low carbon energy system that enables the transition to net zero, with infrastructure built at pace.
- High quality of service from regulated firms: Network companies must deliver a high quality and reliable service to all consumers and network users, including those who are in vulnerable situations.
- System efficiency and long-term value for money: Network companies must deliver an efficient cost of service, minimise the costs to consumers of system transformation and ensure consumers and network users get a fair deal.

A significant change since RIIO-2 is the application of the Network and Information System Regulations 2018 to the energy sector, for which Ofgem are the leading Authority. We have worked extensively with Ofgem to benchmark our position against the Enhanced Cyber Assessment Framework and have initiated a programme of physical and cyber enhancement to our Operational Technologies to ensure continued compliance with this standard.

[3] 1 in 20 peak year planning obligation, as defined in the Gas Safety (Management) Regulations:1996 Cadent Safety Case

The following summarises how we will approach our RIIO-3 Network Asset Management strategy, to align with Ofgem's priorities:

- We are continuing to prioritise programmes for asset health and mandated Iron Mains Replacement[4] to maintain secure and resilient supplies and have improved our risk modelling to assess risks to our services and therefore cost benefits of our programmes. Our economic testing considers the implications of Net zero transition, as described in the section above.
- We are also investing in high priority asset health and resilience driven projects, specifically [security-sensitive].
- We will continue to evolve the maturity of our Asset Management capability in RIIO-3 by modernising and digitising our operations to enable more dynamic scenario testing of investment strategies in future. We are also continuing to seek innovative solutions to our engineering problems and to evolve the costing methodologies we deploy to produce robust cost forecast. For more details, please refer to Appendix 14: Digitalisation Strategy and Appendix 8: Innovation strategy.
- As part of the evolution of our asset management maturity, we will build and embed resilience (including climate resilience) modelling capability so that we can quantify and respond to risks with potential to cause large scale loss of supply events. We will use this to embed these risks into our investment decision making processes. For more details, please refer to Appendix 2: Climate Resilience Strategy.
- We have engaged our customers at several different levels to better inform the direction of our plan. This is described in section 3.2.3.
- We have adjusted the asset strategies for our Operational Technology assets (Electrical, Telemetry and Instrumentation and Pressure Monitoring and Control) to reflect the need to continually refresh these assets to manage evolving cyber threats. For more information on the NIS programme please refer to our Appendix 4: Cyber Resilience.

The HSE mandated IMRRP programme is ending in 2032, and this poses a question as to what comes next in ensuring the ongoing risk-level and safety of our network is managed. Although the immediate risk on tier 1 mains (up to 8-inch diameter) within 30m of property will have been addressed, there is still significant volume of mains of other sizes which are of similar age and construction. We foresee that these mains will have an increasing influence over our risk and emissions as they continue to deteriorate. We historically invest in these where cost benefit analysis has been positive.

As part of our recent engagement with the HSE we have established that there is an appetite to address the enduring risk on these mains in a more programmatic way. A revised Enforcement Policy for Iron Mains is presently being developed by the HSE in collaboration with network operators and is expected in January 2025.

The latest view of expected changes on the enforcement policy are:

- Expectation on operators to deploy condition monitoring techniques such as ALD Technology on all iron mains (irrespective of distance to buildings)
- Changes to the Tier 2 Risk Action Threshold risk methodology to address several known issues with the way the enforcement policy is implemented.
- Comply with Regulation 11 and 12 of the Pipeline Safety Regulations, when considering mains-replacement programmes. The regulations place a duty on us, to intervene if the pipe is found to be leaking, under the premise that they "have not been maintained in an efficient state". This legal obligation will apply to all pipes, not just iron pipes.

The following summarises how we will approach our RIIO-3 Network Asset Management Strategy, to align with the priorities of the HSE.

- We are continuing the mandated IMRRP to reduce the risks posed by tier 1 and 2A mains and services.
- We are continuing to work with the HSE and Ofgem on the future position of the mains replacement programme post the end of 2032.
- We are continuing to deploy ALD technologies and the Strategic Investment Funded DPLA to enable us to monitor, prioritise and plan mains replacement based upon observed leakage and carbon emissions.

We will continue to invest in remediation and replacement of our non-IMRRP Mains to deliver Scope 1 and 2 carbon emissions to support our net-zero targets.

[4] Enforcement Policy for the iron mains risk reduction programme 2021 - 2026 - HSE

3.2.3. Customer insights

In our High quality service chapter of the main business plan we show the main findings from our customer and stakeholder engagement programme.

We have undertaken extensive research to ensure that our proposals represent value to the customers that we serve. We have undertaken a combination of online survey, face to face regional workshops and customer value working groups to understand what services our customers value[5]. The key findings of our research are:

- Customers have consistently told us that safety and reliability of the gas network is a top priority. They feel a reliable gas supply is a minimum service level we should provide and expect resolution of issues in a quick time frame. However, only a minority prefer that we invest more heavily in being able to reconnect supply more quickly.
- Customers told us that they see net zero as an important social driver and that mains replacement and enhanced leakage detection are key drivers, as well as ensuring safety and reliability. They were supportive of our approach towards emissions reduction.
- Customers identified energy security in the UK as one of their top priorities. It is important to customers that the UK produces its own energy and that we facilitate energy security in the UK. They expressed concerns about outages, the UK's stance in the global gas market, the sufficiency of alternative energy sources and the cost of striving for energy independence. They were positive and supportive towards our approach to enable biomethane connections.
- Customers did indicate that they prefer us to invest more in reducing the risk of large-scale loss of supply and underline that they see it as our duty and responsibility to minimise the risk of such events.
- Cost of living continues to shape customers' view of value for money and expressed general unhappiness and fatigue with the cost of living. Most customers were not aware of the small proportion of the bill which covers our services, but most felt as though there should be enough money in the sector to pay for improvements.

The following summarises how we will approach our RIIO-3 Network Asset Management Strategy, to align with the values of our customers.

- We will continue to deliver our asset health and IMRRP programmes to deliver a secure and reliable service to our customers.
- We will invest based upon robust cost benefit analysis to ensure continued value for money. We will consider risk to service to make responsible investments which are justifiable within the next 15 - 20 years, to align with our projections for net zero transition.
- We will enhance our resilience modelling capabilities to ensure we can robustly adapt our networks to prevent large scale loss of supply events.
- We will continue to facilitate connections of Biomethane and other green gasses onto our network.

No investment decisions on our network assets have been taken in a manner contrary to the above stakeholder feedback.

3.2.4. Longstanding legislative drivers underpinning our strategy

Our customers expect a safe and reliable gas network and place trust in us to deliver this in the most cost-effective manner. We have a variety of legal and regulatory duties to provide and maintain a safe and resilient network. These will continue to underpin our asset investments in RIIO-3.

The following summarises how we will approach our RIIO-3 Network Asset Management Strategy, to deliver against our legislative drivers.

[5] Studies include DJS Multiple Angles Research and NERA Triangulation and Willingness to Pay Research

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Investment	Health and Safety at Work Act 1974	Pipeline Safety Regulations 1996	Gas Safety (Management) Regulations 1996	Pressure Safety System Regulations 2000	Dangerous Substances and Explosive Atmosphere Regulations	Construction (Design and Management) Regulations 2015	Security of Network & Information Systems Regulations 2018	Electricity at Works Regulations 1989	Building Safety Act 2022	Gas (Calculation of Thermal Energy) Regulations 1996	New Roads and Street Works Act 1991	Gas Safety (Installation and Use) Regulations 1998	Building (Amendment) Regulations 2018
EJP01 - Civil Interventions	●	●		●		●							●
EJP02 - Electrical, Instrumentation & Telemetry on Offtakes & PRS	●				●		●	●					
EJP03 - Filters on Offtakes a& PRS	●	●		●	●								
EJP04 - Governor Interventions	●	●		●	●								
EJP05 - Services not associated with mains replacement	●	●	●										
EJP06 - Housing Interventions	●				●								●
EJP07 - Mains Diversions (chargeable & non-chargeable)	●	●	●										
EJP08 - Mains IMRRP (including associated <-2" Steel)	●	●	●										
EJP09 - Cost Beneficial Mains Replacement	●	●	●										
EJP10 - MOBs Risers	●	●											
EJP11 - PE Riser Interventions	●		●						●				●
EJP12 - Pipeline Integrity	●	●		●									
EJP13 - Pipeline Isolation Valves	●	●	●									●	
EJP14 - Pipeline Monitoring & Protection	●	●		●		●					●		
EJP15 - Preheat on Offtake and PRS	●	●		●				●					
EJP16 - Pressure Monitoring & Control on Governors	●		●		●		●	●					
EJP17 - Pressure Reduction on Offtakes and PRS	●	●		●	●								
EJP18 - Reinforcements (Below 7 Bar)	●	●	●										
MJP01 - Capacity Upgrades	●		●										
MJP02 - [security-sensitive]													
MJP03 - FWACV Compliance (MSU)	●		●				●	●		●			
MJP04 - [security-sensitive]													
MJP05 - [security-sensitive]													
MJP06 - [security-sensitive]													
MJP07 - [security-sensitive]													

Table 3: Legislative drivers by investment case

4. Our RIIO-3 Network Asset Plan

4.1. Transforming our asset management and operational capability and how this will support best-in-class asset stewardship.

During RIIO-3 we will transform our organisation to develop new technologies and ways of operating to increase our ability to intervene proactively, whilst enhancing resilience. As a result of investments in other areas of our business plan, it will be possible to significantly enhance our approach to best-in-class asset stewardship as follows.

4.1.1. Modernising our Asset Investment Portfolio Management tools

We will implement a unified Asset Investment Portfolio Management (AIPM) during RIIO-3 as part of our wider data and digitisation plans. Building upon our work in RIIO-2, we are creating a dedicated application for investment planning at different planning horizons. This will allow us to undertake more dynamic scenario modelling and stress testing using a wider range of internal and external data sources to assess investments.

We will also develop tools to modernise and automate our Regulatory Reporting in line with the SSMD requirements. This will not only allow us to transition to digital assets but will also allow a greater level of integration with our AIPM platform, for end-to-end traceability of our investments.

4.1.2. Building Future Energy Modelling Capability

Through RIIO-2, we have started work to develop tools to allow us to model future energy requirements scenarios to inform our long-term investment strategies. In RIIO-3 we plan to continue this activity by creating a dedicated digital solution to allow us to flex our assumptions and constraints to reflect the changing requirements of regulators and industry partners. We will integrate this modelling into our AIPM toolset to allow us to dynamically and holistically model current and future investment scenarios.

We will also continue to invest in developing our data sharing infrastructure, working with the NESO to securely share data between Cadent, NESO and other GDNs to support the development of robust whole system energy plans. Refer to Appendix 14[6] for more information on Building Future Energy Modelling Capability.

4.1.3. Building System-Resilience Capabilities:

We will have enhanced tools to identify and quantify the additional resilience and flexibility required in our network to move gas to where it is needed to respond to:

- The threats our asset posed by climate change, and physical and cyber security threats
- Adapt to more local / short-term demand and gas supply needs, as customers move to other energy sources, a greater number of biomethane connections are made and we shift to hydrogen over the medium-term.

Climate change modelling and risk assessments: Climate conditions in the form of extreme weather, floods, extremes of temperature and any resultant power resilience issues are also a key consideration in adapting to the future and there is a growing need to ensure that we have incorporated these risks into our broader approach to resilience. We will implement robust, forward-looking, and quantified risk assessment to manage climate risks to our assets, with specific plans to enhance our standby power capacity, flood, and fire defences. For further information refer to Appendix 2[7], Appendix 8[8], and Appendix 14[9].

Network Modelling to identify system level risks: As per recommendations from the National Infrastructure Commission Anticipate, React Recover report in May 2020, we will enhance our modelling capability to enable stress testing of a wide range of supply scenarios to understand any system-level risks to gas supply and service. These scenarios will also consider how our local supply and demand is changing due to decarbonisation of our gas-supply, new biomethane connections and reducing demand as customers use other energy sources.

[6] Digitalisation Strategy, section 4, pages 47-51
[7] Climate Resilience Strategy, section 5, page 28
[8] Innovation Strategy, section 6.4, page 23
[9] Digitalisation Strategy, section 4, pages 47-51

Workstream	Relevant Business Plan Appendix
Climate change modelling and risk assessments	Appendix 2[10] Appendix 8[11] Appendix 14[12]
Network modelling to identify system level risks	Appendix 8[13]

Table 4: Further information on Building System Resilience

4.1.4. Investment in Operational Technology to enhance visibility, automation, and control of our network assets, whilst maintaining resilience to cyber threats

As part of maintaining the asset health of our Electrical, Instrumentation and Telemetry equipment, our IT strategies[14] will require more modern network infrastructure and Operational Technologies to comply with the NIS regulations. This will not only provide enhanced cyber security but will unlock new functionality we can exploit, including improved monitoring granularity, remote diagnostics, and potential for automation. It is critical that our Operational Technology is continually invested in to mitigate the emerging risks, and we have adjusted our strategies accordingly.

The need to comply with NIS also present an opportunity to modernise our Energy Control Centre. Our ambition is to develop a “single pane of glass” (ie a consolidated view) Supervisory Control and Data Acquisition (SCADA) platform and control centre to enhance cyber security and rationalise our aging infrastructure. We also intend to modernise the supporting IT systems to streamline and rationalise the way that our control room interacts with our other work management systems.

We are also planning to increase the sensorisation of our network and exploit our operational data using AI tools so that we can work more smartly and efficiently by enabling remote diagnostics and interventions.

We will implement a modernised Field Services management system, to support the efficient management of planned and reactive work and improve our ability to capture asset performance and condition data. This will not only make us more efficient in capturing data but allow far greater end to end visibility on asset condition and failure modes. Our improved Field Services Management system coupled with increased sensorisation will change the way our field operatives work, reducing the need for reactive manual interventions.

From an asset management perspective this improved data and insights will feed into our AIM models discussed in section 5.2 and give us a more accurate picture of the health and risk level of our assets.

Workstream	Relevant Business Plan Appendix
Network Infrastructure (Modernise Operational Technology)	[Security-sensitive data] Appendix 9[15]
Modernise our Energy Control Centre	Appendix 9[16]
Modernise Field Service Management	Appendix 9[17]

Table 5: Further information on Operational Technology and the enhanced automation and control enabled.

4.1.5. Predictive Analytics.

By creating a single SCADA platform, we will rationalise and streamline our data and alarm management processes into a common platform.

In the longer term we will seek to analyse data trends to identify early warnings around potential network failures with a view to predictive intervention to prevent service risks. With real-time insight into the condition and performance of our assets, the output of our analytics we will be able to optimise our scheduled maintenance to strike the optimum balance between cost and benefit, leading to a more proactive approach that relies less on

[10] Climate Resilience Strategy, section 5, page 28
[11] Innovation Strategy, section 6.4, page 23
[12] Digitalisation Strategy, section 4, pages 47-51
[13] Innovation Strategy, section 6.4, page 23
[14] See our “IT and Telecom Strategy” and “Digitalisation Strategy” Appendices for more details.
[15] IT & Telecoms Strategy, section 4, page 20
[16] IT & Telecoms Strategy, section 4, page 21
[17] IT & Telecoms Strategy, section 4, page 21

time-based maintenance moving towards a condition-based approach, and allows us to focus resource where they are needed most.

Alarm and predictive analytic data will also feed into our asset models that form part of our long-term strategic investment planning framework to enable us to evolve our investment needs.

Workstream	Relevant Business Plan Appendix
Network Infrastructure (Modernise Operational Technology)	[Security-sensitive data] Appendix 9[18]
Modernise our Energy Control Centre	Appendix 9[19]

Table 6: Further information on predictive analytics

4.1.6. Enhancing our shrinkage and leakage modelling capability to target and reduce leakage more effectively.

We have led the UK gas industry with our ALD investments in our London network and the subsequent collaboration with the HSE to embed the benefits of this technology into industry. We will continue to develop and enhance our approach to identifying and targeting interventions to reduce leakage from our network.

- Investment in ALD technology to detect methane emissions from assets (mains through technology like Picarro, PRIs through other OT sensors), and enable us to capture the real value of leakage-investments.
- Analytical tools to collate / assess results of sensors and prioritise investments to reduce emissions and risks from our assets.
- Develop enhanced shrinkage and leakage models, moving from the current modelled Shrinkage and leakage model to an observed view, ensuring we can accurately estimate our emissions and effectively target our interventions
- Embedding network emissions management across our networks, and annual surveys to pinpoint leaks proactively to reduce reactive jobs.

Further information can be found in Appendix 14[20] and EJP09.

4.2. Our RIIO-3 network asset investment plan

We have identified a comprehensive programme of investments to manage the asset health and resilience of our gas-assets and ensure compliance with our Legal obligations (refer to section 3.2.2).

In section 3, we have explained how our proposed RIIO-3 network asset investments support the delivery of our strategic goals and our customers, stakeholders and Ofgem's priorities.

This section sets out a summary of our RIIO-3 Network Asset investment plan; the costs, outputs, and outcomes the plan will deliver. This summary is supported by the following EJPs and major project justification papers (MJPs).

Justification Papers		
Repex	EJP05: Services not associated with mains-replacement **EJP07: Mains Diversions** (chargeable / non-chargeable)** UM.A.03 **EJP08: Mains IMRRP** (including associated < = 2" Steel)** EJP09: Cost Beneficial Mains Replacement	EJP10: Multiple occupancy buildings (MOBs) Risers EJP11: PE riser interventions EJP18: Reinforcements below 7 bar
Capex	EJP01: Civil Interventions EJP02: Electrical, Instrumentation & Telemetry on Offtakes & PRS EJP03: Filters on Offtakes & PRS EJP04: Governor Interventions EJP06: Housing Interventions EJP12: Pipeline Integrity	EJP13: Pipeline Isolation Valves EJP14: Pipeline Monitoring & Protection EJP15: Preheat on Offtakes & PRS EJP16: Pressure Monitoring & Control on Governors EJP17: Pressure Reduction on Offtakes & PRS.

[18] IT & Telecoms Strategy, table 6, pages 12-13
[19] IT & Telecoms Strategy, table 5, pages 11-12
[20] Digitalisation Strategy, section 4, pages 47-51

Major Project	MJP01: Capacity upgrades MJP02: [security-sensitive] MJP03: Flow Weighted Average Calorific Value Compliance MJP04: [security-sensitive]	MJP05: [security-sensitive] MJP06: [security-sensitive] MJP07: [security-sensitive]

Table 7: Justification papers produced

There are several justification papers that contain high levels of uncertainty (bold and marked **) and refer to proposed Uncertainty Mechanisms.

The proposed uncertainty mechanisms applicable to the work proposed in the network asset strategy are:

- EJP08 Mains IMRRP: UM.A.7 and UM.A.8 which deal with uncertainty associated with Iron stub pipes and iron mains within London subway / utility tunnels.
- EJP07: Mains diversions chargeable and non-chargeable: UM.A.4, deals with the uncertainty associated with diversions driven by new development.
- MJP02: Mandated Category 3 Security: UM.A.1 deals with the uncertainty associated with addressing site and system resilience comprising both compliance with DESNZ requirements and addressing climate resilience.

The investment methodology used to develop this plan is set out in section 5 of this document, which should be read in conjunction with the supporting justification papers.

4.2.1. Our RIIO-3 network asset investment plan

The following section sets out our Repex and Capex investment plans and the proposed major projects greater than £5m. The outcomes and performance that will be achieved by these proposed investments are covered in section 4.2.2 below.

Capex investments

Our Capex programme will deliver a comprehensive investment programme to manage the asset health and resilience of our local transmission system from our Offtake sites through to our District Governor sites.

Our local transmission system comprises the following assets.

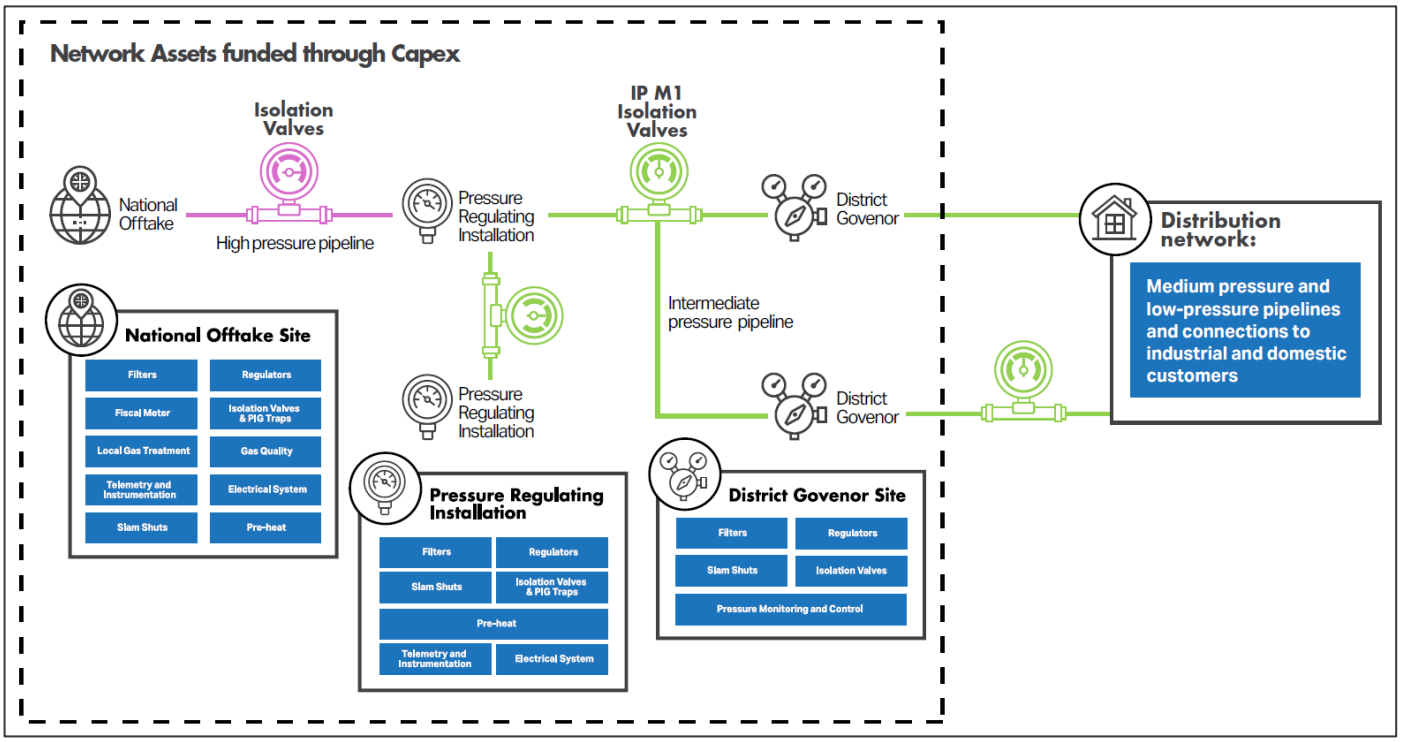

Figure 2: Local transmission system

The following provides a summary of the gas-assets in our four networks, which receive Capex investment:

- 48 Offtake sites

- 932 above ground installations above 7 bar, and 11,524 below 7 bar PRS sites, also known as district governors.
- 4,931km of high-pressure pipelines, of which 80% are piggable and the remaining 20% are unpiggable. These pipelines also comprise monitoring and protection systems including cathodic protection, sleeves, and marker posts.
- ~25,000 pipeline isolation valves across our high-pressure, intermediate, medium, and low-pressure network. (circa 16% high-pressure, 10% intermediate, 60% medium, 14% low-pressure)
- 620 of the above 7 bar sites contain 847 pressure reduction systems, comprising the following major components: regulators, flow control valves and slamshuts.
- 1,562 Filters across both Offtakes and above 7 bar pressure reduction systems.
- 33,522 Governors on below 7 bar sites.
- 1,463 Preheat units across both Offtakes and pressure reduction systems (multiple types including boilers, heat exchanges, water bath heaters, thermosyphon units and electric heaters)
- 1,307 Offtakes and PRS sites contain electrical, instrumentation and control equipment. Approximately 50% of these are managed by the Engineering Control Centre. The remaining 50% are not monitored centrally and contain power, heating, and lighting systems.
- Pressure monitoring and control systems installed at 12,106 sites, at strategic points in the low pressure and medium pressure networks.
- 1,222 Housings on above 7 bar sites, and 9,201 Housings on below 7 bar sites. There is an extensive population of security and civil structures across our estate.

The following table highlights the proposed investment on our local transmission system, as set out in supporting EJPs.

Asset	EJP	Description	Cost forecast	Work volume
Civil Interventions	EJP01	To manage the health and safety risk posed by deteriorating civil assets comprising roads, walkways, retaining walls, traffic collision protection, ground-stability	[cost data]	Volume not pre-defined but derived from RIIO-2 to provide intervention following inspection
Electrical, Instrumentation & Telemetry on Offtakes & PRS	EJP02	To manage stable asset health and ensure compliance with National Information Security Regulations (2008)	[cost data]	Replacement of [commercially sensitive]
Filters on Offtakes & PRS	EJP03	To comply with Pressure Systems Safety Regulations (2000) and manage stable asset health	[cost data]	Replacement of [commercially sensitive] filters
Governor interventions (below 7 bar)	EJP04	To comply with Pressure Systems Safety Regulations (2000) and manage stable asset health	[cost data]	Replacement of [commercially sensitive] governors.
Housing interventions	EJP06	To manage the asset health of housings, and therefore protect the gas-carrying assets housed within from damage	[cost data]	[commercially sensitive] interventions to above and below 7bar Housings
Pipeline integrity	EJP12	To remediate pipeline defects identified through routine pipeline inspections to comply with Pressure System Safety Regulations. (2000)	[cost data]	[commercially sensitive] interventions to HP pipelines, PIG trap vessels and crossings
Pipeline Isolation Valves	EJP13	To manage the asset health of our pipeline isolation valves and comply with Pipeline Safety Regulations 1996 (PSR), the Gas Safety Management Regulations 1996 (GSMR)	[cost data]	[commercially sensitive] interventions on pipeline isolation valves on the high, medium, and low-pressure system
Pipeline Monitoring & Protection	EJP14	To manage pipeline monitoring and protection systems, comprising cathodic protection (CP), sleeves and marker posts, depth-of-cover (RDoC), to ensure the pipelines comply with the Pipeline Safety Regulations (1996)	[cost data]	[commercially sensitive] interventions across CP, RDoC and Sleeves
Preheat on offtakes and PRS	EJP15	To comply with Pressure Systems Safety Regulations (2000) and manage stable asset health	[cost data]	Replace [commercially sensitive] preheat systems; [commercially sensitive] at Offtakes and [commercially sensitive] at PRS sites

Asset	EJP	Description	Cost forecast	Work volume
Pressure monitoring & control on Governors	EJP16	To manage stable asset health, and therefore ensure safe operating pressures are maintained in the below 7 bar distribution network extremities, to comply with the Gas Safety (Management) Regulations 1996	[cost data]	Replace [commercially sensitive] pressure monitoring and control devices
Pressure reduction on Offtakes and PRS	EJP17	To comply with Pressure Systems Safety Regulations (2000) and manage stable asset health	[cost data]	Replace [commercially sensitive] pressure reduction systems (regulators and slamshuts). [commercially sensitive] as Offtakes and [commercially sensitive] PRS sites

Table 8: Summary of Capex investments

Repex investments

Within our four distribution networks, there are over 132,000km of distribution mains and over 11 million service-pipes. These gas-mains range from greater than one metre in diameter in the major cities to approximately 2 inch. The gas distribution system also comprises gas-riser pipe systems that are used to supply gas to circa 55,000 high-rise and medium rise residential buildings. There are circa 114k of these gas-riser systems, with 60% of these located in London

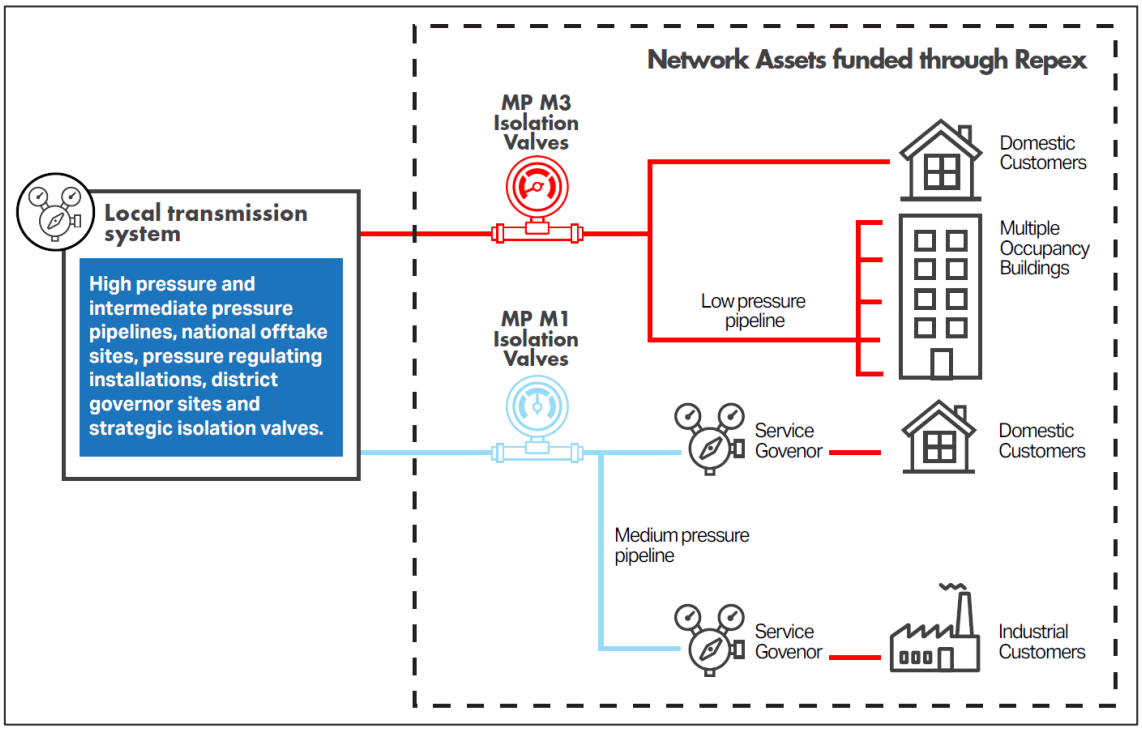

Figure 3: Distribution network

The following table highlights the proposed Repex investment on our distribution network, as set out in the supporting EJPs.

Asset	EJP	Description	Cost forecast	Work volume
Services not associated with mains	EJP05	To carry out interventions on services, due to service alterations, service relays after gas-escapes, smart-meter relays, and other service relays including bulk steel relays, which are not associated with mains-replacement activities.	[cost data]	Replace [commercially sensitive] services

Asset	EJP	Description	Cost forecast	Work volume
Mains diversions	EJP07	Diverting mains where they are at risk due to encroachment from third party assets.	[cost data]	Forecast of [commercially sensitive] km of chargeable and non-chargeable mains diversions.
Iron Mains Replacement Programme	EJP08	Replacing iron mains, including associated services < = 2 inch steel, as mandated by the HSE	[cost data]	[commercially sensitive] km of Tier 1 mains replacement and [commercially sensitive] of associated services. This programme will also replace iron stubs and steel < = 2 inch along with small amounts replacement of other mains Tiers (2A / Other).
Cost Beneficial mains	EJP09	Replacing other mains where it is cost-beneficial to do so, to support the delivery or our net zero targets.	[cost data]	751km of other distribution mains replacement (including iron > 30m, steel > 2 inch, Tier 2b and 3 and [commercially sensitive] services. This programme comprises 50km of robotic repair of joints.
MOBs risers	EJP10	Replacing aging riser-pipes systems within multiple occupancy buildings.	[cost data]	Delivery of [commercially sensitive] riser interventions.
MOBs PE Risers	EJP11	Removing the risk from polyethylene risers within multiple occupancy buildings.	[cost data]	Delivery of [commercially sensitive] PE riser interventions
Reinforcements below 7 bar	EJP18	General mains-reinforcement due to general growth in demand and to enable mains-replacement via insertion, to ensure we meet our 1 in 20 year peak winter License obligation.	[cost data]	Deliver [commercially sensitive] km of mains reinforcement.

Table 9: Summary of Repex programme

Proposed major projects

To support maintaining a safe secure and resilient system, we will deliver seven major projects.

Asset	EJP	Description	Cost forecast	Work volume
Capacity Upgrades > 7 bar sites All networks	MJP01	Upgrade the capacity of components within Offtake and PRS sites, where we forecast under-capacity in RIIO-3 (non-compliance with License Obligation)	[cost data]	Delivery of [commercially sensitive] capacity upgrades and studies
[security-sensitive]	MJP02	[security-sensitive]	[cost data]	[security-sensitive]
Flow weighted average calorific value compliance All networks	MJP03	Upgrade the gas-quality and metering systems at Offtake sites per improvement plan with UNC performance assurance committee	[cost data]	Completion of investment in Offtake metering. Design and build remaining [commercially sensitive] gas quality and metering systems
[security-sensitive]	MJP04	[security-sensitive]	[cost data]	[security-sensitive]
[security-sensitive]	MJP05	[security-sensitive]	[cost data]	[security-sensitive]
[security-sensitive]	MJP06		[cost data]	[security-sensitive]

Asset	EJP	Description	Cost forecast	Work volume
		[redacted]		
[security-sensitive]	MJP07	[security-sensitive]	[cost data]	[security-sensitive]

Table 10: Summary of major projects within RIIO-3

4.2.2. Forecast RIIO-3 performance: Long term risk objectives

Our CAPEX investments hold risk deterioration broadly stable through our monetised risk outputs. Our REPEX investments within legislative and CBA driven work are working to reduce our overall monetised risk position over the period.

Our RIIO-3 Network Asset Management Plan will deliver the following output commitments.

Table 11: Network Asset Strategy: Output commitments

The following tables provide detail on the NARM monetised risk targets, by asset class, proposed for target A2.1. Both a Cadent and network-level summary has been provided.

The tables summarise the forecast risk position at the start and end of RIIO-3 with and without intervention[21], as per Ofgem's sector specific business plan guidance paragraph 5.4 and 5.7. Risk population movement is shown in each of the tables but the key metric for Cadent's target setting is Long-Term Risk Benefit which is new to GDNs for the RIIO-3 price control.

A1 NARM interventions reduce the overall risk position by a combined £72m monetised risk points (R£m) with ring-fenced projects (A3 interventions) further offsetting the deterioration within the price control. Further detail on all risk movement from RIIO-2 to RIIO-3 is detailed within the accompanying [commercial-sensitive data]

Table 12: Cadent Monetised Risk Delivery through NARM

Table 13: Eastern Monetised Risk Delivery through NARM

[21] [commercial-sensitive data]

Table 14: North London Monetised Risk Delivery through NARM

Table 15: North West Monetised Risk Delivery through NARM

Table 16: West Midlands Monetised Risk Delivery through NARM

The following table sets out how asset performance is forecast to change as a result of the chosen investments versus our baseline option for our key gas-assets, based on our asset deterioration models. We have included the performance of our baseline option (which reflects no proactive intervention), rather than performance for "no intervention" or do-nothing, because this is our do-minimum option and is consistent with our cost-benefit assessments presented in our EJPs. Further information on the risk of "do-minimum" for each asset-class can be found in the supporting EJPs.

	Measure[22]	RIIO-3 trend with chosen intervention	Commentary	RIIO-3 Trend with baseline option	Commentary
Governors	Average asset health score	Broadly stable / slight increase	The average asset health risk score remains stable from [commercially sensitive] during RIIO-3	Broadly stable	The average asset health risk score deteriorates from [commercially sensitive] during RIIO-3 with no proactive investment
Preheat	Average asset health score	Broadly stable	The average asset health risk score remains stable from [commercially sensitive] during RIIO-3	Deteriorating trend	The average asset health risk score deteriorates from [commercially sensitive] during RIIO-3 with no proactive investment
Filters	Average asset health score	Broadly stable	The average asset health risk score remains stable from [commercially sensitive] during RIIO-3	Deteriorating trend	The average asset health risk score deteriorates from [commercially sensitive] during RIIO-3 with no proactive investment
Pressure reduction systems	Average asset health score	Broadly stable	The average asset health risk score remains stable from [commercially sensitive] during RIIO-3	Deteriorating trend	The average asset health risk score deteriorates from [commercially sensitive] during RIIO-3 with no proactive investment
Electrical, Instrumentation and Telemetry	Fault rate	Broadly stable	The forecast fault rate Decreases from [commercially sensitive] per year during RIIO-3.	Increasing trend	The forecast fault rate increases from [commercially sensitive] per year with no proactive investment during RIIO-3.
Pressure Monitoring and Control	Fault rate	Broadly stable	Holding fault rate stable [commercially sensitive] faults forecast during RIIO-3	Increasing trend	The fault rate is estimated to rise from [commercially sensitive] per year with no proactive investment during RIIO-3.

[22] In section 5.1 for the definitions of the asset-condition grades used.

	Measure[22]	RIIO-3 trend with chosen intervention	Commentary	RIIO-3 Trend with baseline option	Commentary
Iron Mains Replacement Programme	Fault rate	Significant reducing trend	Chosen option significantly reduces the total fault from [commercially sensitive] by the end of RIIO-3	Significant increasing trend	The forecast fault rate increases significantly from [commercially sensitive] during RIIO-3.
Mains: Cost beneficial	Fault rate	Broadly stable	The forecast fault rate increases slightly from [commercially sensitive] during RIIO-3.	Increasing trend	The forecast fault rate increases significantly from [commercially sensitive] during RIIO-3.
MOBs Risers	Fault rate	Broadly stable / slight increase	The forecast fault rate increases slightly from [commercially sensitive] during RIIO-3.	Increasing trend	The forecast fault rate increases from [commercially sensitive] during RIIO-3.

Table 17: Forecast Asset Performance

There are still several areas of investment where we do not yet have a deterioration model to inform our investment case and have used a top-down-methodology or an asset-condition based approach to forecasting investment levels (Refer to Section 5, Table 18). We therefore do not yet possess the same level of granular data to other investment cases but are confident our investment achieves stable asset health and performance. As such we have not presented data in Table 17, for pipeline integrity and protection, civil structures, housings, and security.

5. Our approach to developing the RIIO-3 plan

5.1. Introduction to our decision-making approach

We have continued to evolve and refine our investment decision making methodology throughout RIIO-1 and 2.

To inform RIIO-3 we now have a comprehensive set of tools and models (AIM), which embed a consistent approach to:

- Asset deterioration modelling
- Failure modes, probability, and consequence of failure
- Monetising the risk of failure through the application of a consistent service risk framework
- Considering a consistent set of options and their associated costs
- Cost benefit assessments
- Scenarios analysis and sensitivity testing
- Deliverability and affordability reviews.

A very high proportion of our RIIO-3 investment plan is now derived using these investment decision models and the above approach, which is all aligned with the NARMs methodology.

Several asset health EJPs have been developed without the use of an investment decision making model, using either a simplified top down or bottom-up approach. We have used this approach where:

- a deterioration model is not a realistic way of estimating likely future need (e.g. chargeable and non-chargeable pipeline diversions)
- where there is no direct correlation between asset health and service performance (civil assets and housings that do not have a direct impact on service performance)
- where granular asset condition data is not known, because the business takes a reactive approach to maintenance (i.e. maintenance of local site security).

A summary of these alternative methods is summarised below:

- Bottom-up; we have used our understanding of asset condition and historic intervention volumes, combined with fault and failure data, inspection pass/ fail data and replacement policy frequency to inform likely intervention volumes to hold risk stable or comply with regulations. We have used cost benefit principles to evidence that our chosen option is optimum.
- Top-down has been employed only where granular data does not exist and may take a view of the numbers delivered in each previous year forecasted forward on a moving average basis, or alternatively review historic spend or run rates. These areas of investment are typically asset classes that are reactively maintained when an operational risk is identified, with the primary goal of holding asset health stable.

The development of our Major Projects has used a combination of our investment decision models and detailed bottom-up failure modes and effects analysis to develop an understanding of the investment need and pre-investment risk position. We have undertaken feasibility studies to understand the scope of work and explore a range of options to address the risks identified. We have then undertaken Cost Benefit Analysis (CBA), to look at the costs and benefits of each option. In areas of greatest uncertainty, we have adopted a tipping point analysis to understand the level of risk reduction required to make the investment cost beneficial.

We define **asset health** as the need to ensure legal compliance, stable asset health (condition), performance (fault rate) and criticality (number of customers connected).

Using AIM	Bottom-up	Top down / other
Cost Beneficial Mains replacement MOBs Risers Offtakes & PRS: Filters, Preheat, Pressure Reduction Governor interventions	PE Riser interventions Housings interventions Pipeline integrity Pressure monitoring & control on Governors Pipeline isolation valves Pipeline diversions	Pipeline monitoring and protection Civil Interventions Reinforcements below 7 bar Mains diversions (chargeable & non chargeable) Services not associated with mains-replacement

Table 18: Investment Methodology used per investment case.

We have identified some investment areas where there is insufficient certainty to estimate work volumes, requirements, and costs adequately; this may be driven by the timing of new regulation, investment drivers that are outside of our control or high complexity needs that require in depth study to adequately develop a robust case.

Some areas of investment are uncertain, we are therefore proposing several uncertainty mechanisms. For more information see table 8 in section 4.2.1 of this document.

This next section focusses on our primary investment decision making methodology, supported by our AIM deterioration models.

5.2. Our primary approach to Investment Decision Making

In the following section we set out:

- How our risk and deterioration models have been developed and improved
- What data we have used and how we have cleansed and infilled the data
- How we have developed and identified the failure modes
- How we have considered both asset system resilience and network-resilience
- Data assurance and how we know our models reflect observed performance
- The intervention options considered, and how the cost per intervention have been derived
- How we have calculated the risk score reductions per intervention
- How we have valued the risk using our standard Service Risk Framework. (SRF)
- How we have updated NARM risk maps to incorporate Long Term Risk Benefit
- The standard set of intervention strategies used in our AIM modelling
- A consistent approach to sensitivity testing
- Cost benefit analysis and decision making.

5.2.1. What AIM models have been developed; how have they been improved?

Cadent has developed, in collaboration with our partner (ICS), five asset deterioration models using AIM software which have been used to support the RIIO-3 investment plan. Four of these are used to manage and report performance data for all assets managed through NARM:

- Mains and Services
- MOB Risers
- PRS / Offtakes which includes Filters, slamshuts, regulators, pre-heating, and odorisation & metering
- Governors
- Local Transmission System (pipelines) - not used for NARM reporting.

During RIIO-2 we have undertaken the following improvements to our existing AIM models:

- Incorporated long term risk principles: For RIIO-3, our NARM models will be able to report multiple years of risk benefit per intervention as well as single year benefits. This provides a longer-term view of the comparative benefits that our investments deliver for customers and a more robust basis for asset health (NARM) target setting.
- Monetised risk valuations: Updated the global values used for monetising the consequence of asset failure (service risk framework) using Ofgem valuations, cross GDN-values, and willingness to pay valuations for supply interruptions.
- Network system resilience: We have introduced consideration of wider-system resilience into the risk-maps, which means that models now also consider both the asset and the wider system resilience, resulting in assets on sites with lower system resilience attracting a higher risk score than similar condition assets on sites with robust system resilience.
- Asset data refresh: Carried out a data refresh to reflect the asset base as forecast at the end of RIIO-2.

5.2.2. What base data has been used in our models

The base data used in the models is sourced from [commercially sensitive], which includes asset condition, installation dates and failure records, as well as [security-sensitive].

Within Cadent we have adopted a standard Asset Health Index grading assessment, which is used consistently for all non-linear assets.

Grade	Definition
HI0	Not applicable
HI1	New or as new
HI2	Good or serviceable condition. No specific reliability or maintainability issues. More than 10 years remaining life span expected
HI3	Some deterioration in condition or reliability or maintenance issues that require monitoring and possible intervention in a 5 – 10-year timeframe
HI4	Intervention required within the next 3 – 5 years to prevent unacceptable failure rate or maintainability issues
HI5	Urgent intervention in order to avoid unacceptable failure rate or maintainability issues

Table 19: Standard asset condition grades used[23]

Data preparation involves extracting information from SAP and other systems, followed by validation, and cleansing to correct errors and fill gaps using rules-based methods and logical estimates derived from similar assets. Additional data is incorporated from business-maintained sources to supplement the core datasets.

To ensure data robustness, consistency checks are performed by cross-verifying information across multiple sources. Confidence flags are applied to track data quality and modifications. An Asset Data Management system is used to manage data assurance, and this is updated regularly to ensure the data remains current and accurate.

Overall, this systematic approach ensures that all data used in the models is reliable, accurate, and suitable for comprehensive risk modelling and investment planning.

5.2.3. Risk maps; failure modes, probability, and consequence of failure

Risk maps are a key feature of the AIM tool used to evaluate asset risks in our gas distribution network. These maps are essentially models that link an asset's probability of failure with the consequences of failure, helping us prioritise investments based on the monetised risk.

Risk maps are created for each asset type using a structured approach that integrates data on asset performance, failure history and condition assessments. The risk maps link each asset's failure modes to their respective probabilities and consequences, allowing for a comprehensive risk evaluation across the asset base.

Historical failure data, asset performance records, and maintenance activities are used to assess the current health of each asset. Data includes:

- Installation and age information.
- Condition grades (e.g., based on visual inspections, material analysis).
- Past failure records, fault rates, and cause of failures.
- Operational data, such as pressure and environmental conditions.

Condition of assets is derived by combining age, historical performance, and maintenance history with known deterioration patterns (e.g., corrosion for pipelines). Missing or incomplete data is filled using rules-based methods, where health are inferred from similar assets.

Deterioration curves are developed by plotting failure rates against asset age and health score, allowing the model to predict how the likelihood of failure changes as assets age or deteriorate further. A variety of methods are used to generate robust deterioration curves using actual performance data or standard reliability modelling techniques, developed as part of the cross-GDN NARM modelling approaches.

Failure modes are a key competent of AIM's risk maps and are generated using a combination of historical data, industry-standard methodologies (like NARM[24]), and risk modelling approaches specific to each asset class.

Each asset type can experience several failure modes. For each mode, different probabilities and potential consequences are assessed.

[23] There are some asset specific variations on this scoring methodology. Where this applies, these are explained in the individual EJP and MJPs.

[24] The NARM Methodology outlines how to identify and model failure modes for various asset types, ensuring consistency and comparability in risk assessments. This methodology is crucial for ensuring that failure modes are defined in a way that is both accurate and aligned with industry standards

For mains & services assets, failure modes are defined using data from sources like the [security-sensitive]. This involves classifying failures such as pipe fractures, corrosion and joint issues and using NARM's guidelines to model these failures within the AIM tool.

Consequences are quantified for each failure mode based on historical impact data. The potential impacts include safety hazards (e.g., gas leaks), environmental effects (e.g., carbon emissions), and service interruptions. Monetary values are assigned to these consequences from NARM, with the addition of further private costs of failure, environmental cost (shadow cost of carbon), and willingness to pay costs for avoiding supply interruptions.

Customer interruptions risk is factored in, with the impact on system (asset resilience within an asset system) resilience being tied to the number of customers affected. The AIM tool allows assets to be optimised individually or grouped (e.g., whole processes or sites), accounting for redundancy within systems like Governor stations. By doing so, the AIM tool ensures that critical failure points are addressed while maintaining overall system functionality.

The risk maps consider how asset-failures can impact the broader gas distribution system, through considering their effect on system-performance, such as pressure reductions or over-pressurisation, which could disrupt gas flow to critical parts of the network.

Network characteristics and system resilience are also considered, such as the number of properties served, system resilience (e.g., backup systems), and proximity to other critical infrastructure. These factors help assess the risk posed by asset failures in terms of their broader impact on the system. We have categorised each site based on system-resilience by identifying strong and weak multiple sources vs sites that are single-source and calculating the numbers of properties served using updated property data and spatial analysis techniques.

The result is a risk score or monetised value for each failure scenario, enabling a comprehensive view of the asset's risk profile within a given system. This allows for effective prioritisation of replacement and refurbishment activities based on both probability and consequence of failures.

Overall, risk maps are built using a robust data-driven approach that integrates historical failure data, condition assessments, and predictive models to evaluate the risk associated with various failure modes for each asset.

All AIM models are updated periodically, to align to latest guidance, or where new data is available. Any updates are aligned with the GDN NARM Methodology, and comparisons to previous failure rate models are performed to ensure that changes are consistent with the provided source data. For example, adjustments were made to account for the COVID-19 lockdown period, during which working restrictions caused a lag in repair activities, potentially leading to misinterpretation of increased deterioration rates. Changes to consequence models are less frequent, but when modifications occur (e.g., the number of properties at risk of supply interruption due to new data), they are cross-referenced with previous datasets to ensure the changes are logical and consistent with the updated data.

5.2.4. Intervention Modes: their costs and level of risk reduction

Feasible intervention options

Within our AIM modelling and scenario analysis we can ask the model to select the optimum programme of work, based on a defined set of goals e.g. lowest whole life cost or maximum whole life net benefit, within a defined set of constraints (a cap on the volume of work or spend).

The model is provided with a range of feasible intervention options / modes which it can select to develop the optimum programme. This section discusses how we have identified and developed the feasible intervention options for each investment case.

We have considered the following intervention modes / timing-choices. The following table shows an example of the typical options considered for most investment cases.

Intervention Mode	Reactively (after a "failure" or after a defect is identified)	Proactively, prior to a failure or defect is identified.	Discussion
Repair: not life-extending	✓	✗	A component repair would typically be carried out reactively to get the asset operational again, but does not improve asset health or extend asset life. This is typically considered as Opex and is often sub-optimal because the work does not allow for labour and the supply chain to be optimised.
Minor: Refurbishment of an asset component	? May be feasible in some circumstances if work is quick and simple to mobilise.	✓	These interventions are typically carried out proactively prior to a failure, but can be undertaken reactively upon failure. (inspection defects can prompt proactive remediation). These are considered life-extending and are generally considered as Capex-funded.
Major: Refurbishment of a component		✓	
Replacement: of a system or a component		✓	

Table 20: Examples of typical intervention options considered.

Cost of Interventions

This section sets out how we have developed the costs for each intervention option considered.

For all feasible proactive options, we have used our costing methodology (see section 5.5) to derive the unit costs per intervention. Refer to each EJP for further information on the specific unit costs used.

The AIM models assume a cost per failure, which reflects the average cost of responding to that fault, including the cost of a repair. There may be additional impacts and costs of a failure, relating to investigation costs, customer visits to safely restore supplies, fines, GSOP payments, legal penalties, additional lane-rental for working in the highway and costs to re-house business-occupants and residents. These are monetised within the CBA and included as "Other private costs".

Risk reductions assumed per intervention

The level of risk assumed following an intervention is defined within the NARM methodology.

Reactive repair post inspection or failure; we assume this intervention does not extend the life of the asset.

Full system replacement: this option provides a new asset; therefore, the asset life is reset to zero (as new).

Minor / Major refurbishments or partial system replacements This option extends the asset life by an amount determined by the NARMs deterioration curves and the modelled change in failure rates and/or condition grades post-intervention. As above, replacement of partial systems (or components) are treated as refurbishments.

5.2.5. Developing our intervention strategies

We have used the AIM models to test different intervention strategies and assess how each affects system-wide risks. This involves looking at things like maintaining stable asset health across the system and minimising risks to the gas supply network.

Once the asset data and required interventions (with associated costs) are available, the next stage is to define the intervention-strategies to be modelled. The AIM model requires two key elements to be defined:

- Objectives: what is the required business outcome for the optimisation? Examples include minimise investment (lowest Capex); minimise whole life costs (minimise Capex and Opex over the planning period); and maximise whole life net benefit (maximise benefits compared to Capex/Opex costs over the planning period). It is also possible to create objectives based on engineering considerations, such as minimise carbon emissions or minimise fatalities.
- Constraints: what needs to be considered by the optimiser when trying to achieve the defined objective? Examples include maintain asset health (stable condition) or Capex/Opex spend constraints (e.g. spend no more than £x million per year). Constraints can also allow deliverability considerations to be applied, such as intervention volume/length and planning constraints such as network outages or local authority access.

To ensure consistency, we have developed a consistent set of objectives and constraints for our Capex assets. For Repex, we have expanded these objectives to include specific requirements for safety compliance and future carbon abatement targets.

In our baseline intervention strategy, in accordance with Ofgem guidance, we constrain the model to only be able to select the reactive repair intervention-options. This intervention strategy assumes that we intervene post inspection or failure, with no proactive repair or replacement. These intervention strategies will also include the cost of any routine maintenance or inspections.

Each intervention strategy has been entered into the CBA template as an Option.

Ref Number	Option (Intervention Strategy)	Explanation
0	Reactive only	No proactive investment in the asset (intervene post inspection or failure)
1	Engineering only prioritisation*	Investment based solely on technical prioritisation of the Investment Priority List
2	Max whole life net benefit with RIIO-2 spend cap	Max whole life benefit with a fixed spend of £xm (RIIO-2 allowance) over the RIIO-3 period
3	Max whole life net benefit uncapped	Max whole life benefit with no fixed spend over the RIIO-3 period
4	Max whole life net benefit spread over RIIO-3 & RIIO-4	Max whole life benefit with a fixed spend of £xm (RIIO-2 allowance or forecast) over the RIIO-3 & RIIO-4 periods i.e. demonstrate deferred investment where appropriate
5	Minimum investment to maintain stable asset health of asset class	Minimise investment to keep health score stable (2024 level) and remove systems in condition grades 4 and 5
6	Minimise carbon (fixed budget of £xm)	Minimise carbon footprint within the RIIO-3 period with a fixed spend of £xm (RIIO-2 allowance or forecast)
7	Minimum investment to hold R£m risk stable of asset class	Minimise investment to keep monetised /service risk steady

Table 21: Example of Standard intervention-strategies developed

5.2.6. Sensitivity testing, testing uncertainty.

We have reviewed the Ofgem guidance around the need to undertake sensitivity testing and have considered the following areas of uncertainty, as part of our business risk review.

- Asset performance / health deterioration rates assumed
- Ongoing efficiency assumptions
- Future energy pathways: reduction in demand and population connected in future years.
- Future utilisation of assets
- Deliverability constraints due to constraints in workforce / supply chain.
- Non-viable repair / replacement methods (e.g. Pipeline repair methods such as [commercially sensitive]).

Our assessment of areas of greatest uncertainty and our business risk-review is contained in section 5.7.

We have undertaken the following sensitivity tests, to test the impacts of these uncertainties and risks on our preferred investment plan.

Scenario	Scenario description	Apply to which investment cases
Test 1: Cost uncertainty	Increase unit cost of interventions, assess impact on payback of investment	All
Test 2: delivery constraint	Constrain level of work in year 1 to 3, to mimic supply chain capacity constraints, how does this impact on preferred plan	E&I, Mains & Services due to higher levels of deliverability risk
Test 3: non-viable intervention option	Remove an intervention option, to mimic limited supply chain capacity, and re-run preferred scenario, whilst achieving same payback period	Mains & services: remove CISBOT as a viable intervention option
Test 4: asset life / deterioration rates	We have applied an additional factor to our probability of failure to mirror a faster or slower asset deterioration rate	All investment cases
Test 5: shadow cost of carbon	How is the CBA impacted using the high/ low cost of carbon	All investment cases
Test 6: Future Energy scenarios	Applies an additional “discount” factor to the long-term benefits of each investment case, to model the impact from reducing customer numbers and demand	All investment cases
Test 7: Willingness to Pay of supply-interruptions	We have removed the benefit of mitigating supply-interruptions (using our customer willingness to pay valuations)	Primarily Repex, as supply interruptions is a key driver

Table 22: Summary of Sensitivity Tests applied.

For RIIO-3, Cadent alongside other gas networks, have agreed to move away from strict adherence to FES and instead rely on a combination of robust historical data, legislative drivers, and planning assumptions. During RIIO-3, our base-case supply-demand scenario used demonstrates that asset-health replacements should be a like-for-like sizing due to a stable 1 in 20 year peak-winter demand. We have therefore not tested the impact on the RIIO-3 investment case to reducing demand in RIIO-3 over and above the base-case supply-demand scenario, because we must design for certainty driven by our absolute due to comply with our license obligations. Test 6 above, tests the impact that reducing demand and customer numbers has on the benefit from investment in RIIO-3, over the longer-term and the NPV of each option.

5.3. Developing our service risk framework.

The following section sets out how we have developed a consistent service risk framework (SRF) that builds on our NARMs methodology and applies to all non-NARMs assets to give a common risk currency. We have developed this to ensure that we can make risk based investment decisions consistently across our asset portfolio to inform our investment prioritisation. Whilst this has been used to build our RIIO-3 asset investment plan, we intend to refine and grow this methodology across our portfolio.

5.3.1. Overall approach

The monetised risk of failure used with the SRF uses the following data sources:

Data Source	Used for which risk / consequence
NARMs	Property damage costs Legal penalties Compliance costs Compensation payments Traffic disruption costs
Willingness to Pay (WTP) studies / Customer research	Supply interruptions
Cadent historical cost records (Financial system)	Private Costs of failure, and failure avoid – e.g. maintenance and repair costs or fines, traffic management and legal penalties
Ofgem RIIO-3 CBA Template (v5)	Shadow cost of **Carbon** **Safety risk**: Fatal / Non-Fatal injury Wholesale cost of gas.

Table 23: Data sources used for SRF risks

This has allowed us to compare the cost of investment versus the benefits of investment in a robust and detailed CBA. The approach to gathering this information is described under phase 4 of our engagement approach.

5.3.2. Willingness to Pay research: Supply interruption valuations

We engaged NERA to conduct Willingness to Pay (WTP) research to understand customer preferences and the value they place on various service improvements. The research covered both domestic and non-domestic customers and assessed attributes such as response times for gas supply interruptions, welfare services for vulnerable customers, environmental impact reduction, and minimising disruption to communities.

The methodology comprised three key components: stated preference research, revealed preference research, and benefit transfer literature review. The stated preference research used discrete choice exercises, where customers made trade-offs between different service levels and associated bill impacts. This was complemented by a contingent valuation exercise to estimate the maximum WTP for improvements across all attributes, ensuring robust and consistent results. Revealed preference studies and external literature, such as the Ofgem/DECC value of lost load study, were used to triangulate findings and validate WTP values.

The outputs provided a range of valuations for both customer segments. For domestic customers, low, central, and high valuations were derived from a mix of stated preference results and conservative benefit transfer values. For non-domestic customers, the valuation range varied from zero to the highest observed values.

We have been conservative in the application of willingness to pay to inform the supply interruption societal valuations. We have compared the RIIO-2 and RIIO-3 willingness to pay results for domestic and non-domestic customers and while the RIIO-3 research evidenced an increase, we have adopted our RIIO-2 conservative figures.

We have applied a consistent set of valuations across the four regions, given the estimated values per region closely align.

For our London Medium Pressure cost benefit assessment, we have undertaken supplementary analysis of the value of interruptions of different lengths in the relevant central London locations by Lower Super Output Area.

The valuations used in our CBAs are summarised below:

Metric	£'s per property interrupted (central estimate)	Rationale / Source
< 24nr interruption: Household	[cost data]	RIIO-2 value inflated
< 24hr interruption: Non Households	[cost data]	RIIO-3 WTP estimate from NERA study
Over 24hrs: Household	[cost data]	RIIO-2 value inflated (1 to 7 day estimate
Over 24hrs interruption: Non Household	[cost data]	RIIO-3 WTP estimate from latest NERA study (1 to 7 day estimate)

Table 24: supply interruption societal valuations used in the CBA

5.4. Cost Benefit Assessment Methodology & Decision making

5.4.1. Our approach

We have derived our cost benefits assessments for RIIO-3 using two primary approaches:

- For most of our investment areas, we have used our AIM models to generate the CBAs to inform our decision-making process. The models can be given goals and asked to goal-seek and identify the optimum investment programme based on deliverability, cost, or risk. These optimised scenarios can be compared against engineering bottom-up programmes, to inform the selection of our preferred plan. The AIM models now support [commercially sensitive] of the net investment in RIIO-3 network assets.
- For assets outside of the AIM models, or for high-complexity risks that may span multiple assets and / or multiple sites, we have used the principle of CBA to inform decision making.

5.4.2. Decision Rules

We have considered a wide range of factors when selecting the optimum investment case.

Aligned with our strategy, our primary strategic investment goal for our network assets is to hold asset health and network resilience stable. We have defined **asset health** as the need to ensure legal compliance, stable asset health (condition), stable performance (e.g. fault rate) whilst considering asset criticality (number of customers connected) and wider network resilience.

Our decision rules include:

- Whether the cost benefit assessment has shown that the selected option has a reasonable payback period relative to the baseline option. (we have typically looked for options which deliver a 10 to 15 yr payback maximum).
- Our preferred option complies with our legal obligations and regulations. (see section 3.2.4).
- Achieves broadly stable asset health, by managing asset condition and performance.
- The option is deliverable: A top-down review of required internal and external delivery capabilities has been undertaken to ensure that Cadent can train and develop competent staff to deliver and maintain the asset-base and ensure it has appropriate long-term framework agreements with the supply chain to design, supply and install the planned interventions. Deliverability has been used to refine our chosen programme by ensuring workload and phasing is achievable across the RIIO-3 and 4 period.
- Considered the views of our stakeholders and customers around the level of ambition, the desired performance and general support for our investments, and their willingness to pay for changes to overall security of supply and resilience.
- Considered affordability of our plan. We have undertaken financial modelling to understand the bill impacts of our plan, which has been used to optimise the investments proposed across each of our four networks.
- Considered internal stakeholders views, to ensure we are selecting to intervene on the highest risk assets.
- Where decisions are more nuanced, and there are multiple options that are cost beneficial, we have assessed the amount of monetised benefit achieved across safety, security of supply and environment, to support the selection of the preferred option.

5.4.3. Cost and Benefit assumptions in CBA tables

Each investment case and the relevant justification paper contains further information on any specific adjustments to the method used to calculate the benefits used per option. The following section sets out general assumptions that apply to the majority of CBA calculations.

Long-term assumptions: We have taken a conservative approach to long-term assumptions in our CBA calculations, choosing to use present day assumptions across the full planning horizon. We have therefore NOT increased the following over the longer term, which could all increase the benefit to cost (NPV and payback) of our proposed investment:

- Costs in RIIO-4 onwards (Capex & Opex costs) to account for anticipated real price effects, given historic and likely future trends in inflation across different cost types.
- Future property prices (when calculating property damage) to account for anticipated real price effects, given historic and likely future trends in house prices compared to the wider economy.
- Population density changes (when calculating fatality risks) which could increase monetised fatality risk avoided by our proposed investment.
- Demand changes (when calculating leakage volumes) which could increase monetised benefits of leakage avoided by our proposed investment.

All benefits are calculated as per the NARMs methodology, using service risk valuations discussed earlier. The only exception is the use of our willingness to pay research to value supply-interruption benefits. Some consequences such as traffic disruption, property damage, safety risk, have been uplifted from the standard figures used in the models, for areas such as London to reflect increased population density or property valuations in these areas.

Refer to the NARMS business plan data table (BPDT) narrative and NARMs methodology for specific information on how the NARMS tables and monetised risk benefits have been calculated.

5.5. Costing Methodology

[commercially sensitive]

5.5.1. Cost methodology: Summary of approach

[commercially sensitive]

5.5.2. Developing our Unit Cost Workbook

[commercially sensitive]

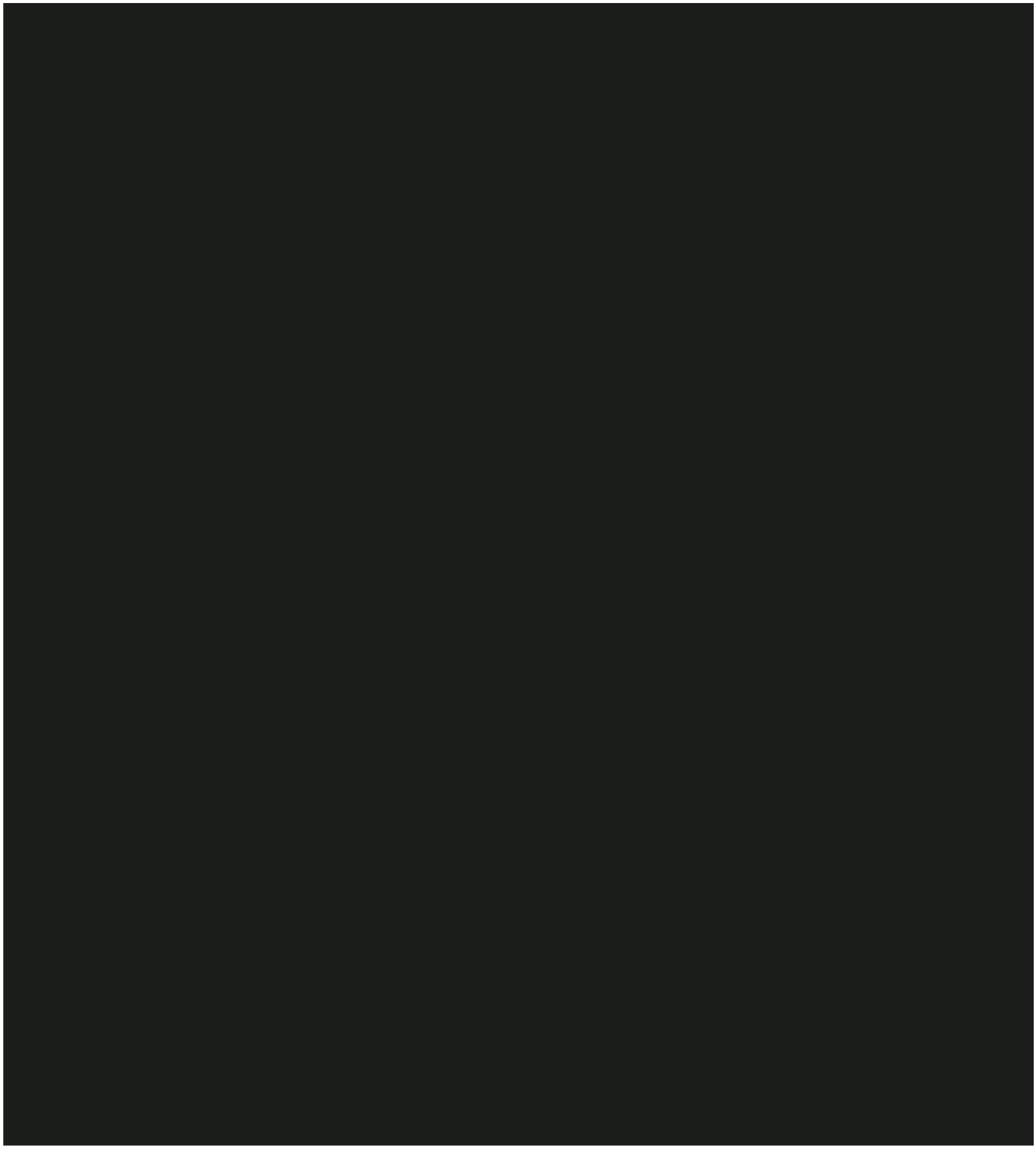

Table 25: [commercially sensitive]

5.5.3. Efficient Costs

[commercially sensitive]

5.5.4. Risk and Cost Confidence

[commercially sensitive]

5.5.5. In period, ongoing efficiency gains

[commercially sensitive]

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5.6. Assurance

Our assurance strategy for the RIIO-3 Asset Investment Plan employed a three-tier approach to ensure thorough review and validation of the plan's accuracy, ambition, and efficiency:

- First-Level Assurance:
  - Internal reviews and self-assessments conducted by internal teams and subject matter experts to validate data, policy adherence, and compliance to Cadent and Ofgem requirements.
- Second-Level Assurance:
  - Reviews by our internal Assurance Team, focusing on critical areas and ensuring alignment with strategic objectives.
- Third-Level Assurance:
  - Independent external audits providing an objective review and validation of complex methodologies and data integrity.

The level of assurance required is determined based on the level of step change in investment required vs RIIO-2 and whether the investment is mandatory or discretionary.

5.6.1. External Assurance Areas

External assurance was applied to critical elements like CBA methodology, cost methodology and BPDT compilation. Independent reviewers conducted detailed testing and provided technical challenges, ensuring the robustness and compliance of our RIIO-3 submission, supporting strategic objectives, and meeting Ofgem's requirements.

Assurance	Description	Criteria for sample selection	Selected sample papers
Cost Benefit Analysis external assurance	Nera have carried out an Assessment of our interpretation of the Ofgem guidance, compliance with it and deep dives into specific CBA's identified by our internal Assurance Team	- At least one high and one low value investment - At least a major project and one that is not a major project - At least one investment for each of the drivers identified - At least one investment for each complexity level	Cost beneficial mains replacement [security-sensitive] MOBs Riser interventions Mains IMRRP [security-sensitive] Governor interventions
Asset Management & Costing Methodology external assurance	KPMG have carried out an assessment of our methodology, with specific 'deep dives' into asset groups and Major Projects including detailed review of specific asset costing	- Materiality/ proportion of total business plan value - Investment drivers and risks of regulator challenge to the proposed investment - Areas of significant change since RIIO-2 - Compliance with Ofgem guidance. - Complexity	Pressure Reduction on Offtakes & PRS Electrical, Instrumentation & Telemetry on Offtakes & PRS Mains IMRRP Cost beneficial mains replacement MOBs Riser interventions [security-sensitive] [security-sensitive] Services not associated with mains replacement

Table 26: External assurance provided on the Network Asset Management Strategy and supporting components

5.7. Business Risks: Risk Register

The following tables summarises the key business risks reviewed. These have been used to inform the sensitivity testing of our RIIO-3 network asset investment plan.

Risk	Impact	Likelihood	Mitigation
Faster / slower reduction in gas-demand than predicted	More or less reinforcement required / differing levels of asset decommissioning possible.	Low	Develop in-house capability to model FES, to provide greater certainty. Prioritise reinforcement projects that fail to meet our 1-in-20 year peak demand licence obligation now and throughout RIIO-3.
Greater / Reduced levels of biomethane available to meet demand	More or less network reinforcement required to accommodate new supply, or reduced decommissioning of assets possible.	High	
Higher levels of attrition of competent workforce (difficulty retaining competent skills sets) – high competition across other sectors, inconsistent workload.	Costs increase due to higher demand / reduced competition, or there is a delay in the delivery of the plan.	High: Repex including MOBs risers, diversions and reinforcement, E&I and FWACV Low: Capex: Governors, Preheat, Pressure monitoring, pressure control, Security	Early supply chain engagement to secure resources, review of FTE competency requirements and count. Manage workload variability where possible. Detailed in Appendix 17
High level of competition in supply chain for E&I and pipeline-interventions.	Costs increase due to higher demand reduced competition, or delay to workload. This risk is highest for mains & services and electrical / instrumentation.	High: Mains & Services, E&I investments (cyber related) Low: Other asset types	Early supply chain engagement to secure resources. Advanced purchase of required materials including consideration of storage facilities. Utilise Enabling Budget for specific areas of concern for Yr 1 & 2.
Intervention options not viable due to lack of supply chain capability, no framework agreements in place.	NARMs delivery risk between intervention types.	Medium-High: Capex Portfolio Low: Other intervention types	Engagement with delivery teams to understand ratio of interventions required, develop understanding of risk trading across Cadent, utilise portfolio tool to monitor performance.
Quality of Asset Data / Assumptions used in deterioration models.	Estimates of future workload; costs are based on core system data with some data processing which could lead to inaccuracies.	High: Number of MOBs risers per MOB. Low: Other Models	Ongoing project to refine asset data quality, improve understanding of data collection importance and refine current methods.
Asset health deterioration rates may be different to assumed values	The assets could deteriorate faster or slower than the industry standard deterioration rates, levels of investment to hold asset health stable may be inaccurate as a result.	Medium: any Non-NARM Assumptions or inferred rates based on condition-based assessment.	Carry out further survey work to establish more accurate estimates of asset-life.
Unit Cost Certainty: We have lower certainty around some unit rates due to reduced delivery experience	Costs could be higher of lower than predicted for specific investment cases.	Medium-High: Tier 2b, 3 mains replacement workload, Capex Portfolio Medium: all other areas	Market testing performed to develop cost certainty.

Table 27:Key Business Risks identified.

6. Glossary

Term	Definition
AIM	Asset investment manager
AIPM	Asset investment portfolio management
ALD	Advanced leakage detection
BPDT	Business plan data tables
CBA	Cost benefit analysis
DPLA	Digital Platform for Leakage Analytics
EJP	Engineering justification paper
FES	Future energy scenarios
GDN	Gas distribution networks
GIS	Geographic information system
HSE	Health & safety executive
IMRRP	Iron mains replacement programme
MJP	Major project justification papers
MRF	Management review forum
NARM	Network asset risk metric
NESO	National energy system operator
PRS	Pressure reduction stations
SAMP	Strategic asset management plan
SCADA	Supervisory Control and Data Acquisition
TNC	Technical needs cases