Cadent

Your Gas Network

Appendix 09.04 Transforming the experience for Multiple Occupancy Building customers - Risers

Investment Decision Pack Overview

This Asset Health Engineering Justification Framework outlines the work that we will do to provide a safe and reliable gas supply to our 500,000 customers who live in Multi-Occupancy Buildings. We have prepared an enhanced Engineering Justification Paper (EJP) and a Cost Benefit Analysis (CBA) for these assets.

Overview

About 5% (13% in London) of our customers live in MOBs (Multi-Occupancy Buildings). These customers have not received as good a service as other customers. The Grenfell fire tragedy has raised the profile of safety in MOBs in particular aspects of building safety such as fire compartmentalisation and the ability of emergency services to respond to an incident, for example by closing valves that shut off the supply of gas. In addition, we discovered that we had inadequate records and IS systems in relation to MOBs, issues that have now been addressed but which contributed in the past to poor management of this portfolio of assets.

To ensure legislative compliance we are proposing to implement a programme of minor repairs work that is expected to address around 300,000 individual faults, such as valves which have been buried. This is a 60x increase in repair work volume compared with RIIO-1.

To mitigate gas process safety and customer performance related risks we are proposing an investment programme to refurbish and replace risers. This was subject to options analysis described in this paper the outcome of which is that we are proposing to increase our output by about 50% over the RIIO-2 & 3 period targeting the increase at riser pipes that have the highest safety risks. This will ensure all risers currently in the high safety risk priority category have their risks mitigated over 10 years.

We have created a national MOBs asset management and engagement team. The cost, currently un-funded, is included in our proposals and linked to the outputs they are delivering specifically:

- precautionary building specific plans to enable more rapid and effective emergency response and accelerate supply restoration and
- engagement with building owners in support of their building safety obligations, this latter point also linked to a proposed uncertainty mechanism that will fund additional operating costs if we are forced to move beyond liaison into taking actions.

We will also carry out an asset condition survey of I&C MOB buildings with complex distribution systems within them and 1% of MOB buildings with banks of meters or large diameter supply pipes. Faults identified during such surveys will be repaired however there is no intent to expand these surveys into a full inspection programme during RIIO-2, any required replacement programme will be included in the RIIO-3 submission.

These proposals have been subject to extensive stakeholder engagement including consultation with the HSE who are expecting significant improvement programmes in this area.

To enable replacement of associated iron mains we will be investing *XXXX* in riser work. This investment is shown in the MOBs part of the business plan although the driver for the work is the iron mains programme.

Summary of preferred option (RIIO-2 cost)	£
REPEX	Redacted due to commercial sensitivity
EXPENSED REPEX	
OPEX	
TOTEX	

Key changes from October plan

We have completed a market testing exercise on building fault interventions, costs are *XXXX* higher than previously estimated. We have now included MOBs activity driven by mains replacement work in this investment case rather than as a standalone item – investment in this project up *XXXX*, no change in total business plan figure.

Document Structure

This main document sets out:

- A summary of the asset base
- Our investment drivers
- Our current RIIO-1 performance
- How we intend to manage MOBs gas supply service in RIIO-2
- How we've built our plan
- A summary or our proposed RIIO-2 workload
- Our expected RIIO-2 performance
- Customer commitments

A detailed set of appendices provides more information, for each investment line, covering:

- The detailed investment need
- The approach taken to derive the investment case
- The options and analyses completed
- The workload and costs for RIIO-2

Contents

Executive Summary

Our vision is to set the standards that all of our customers love and others aspire to. This applies to our customers living in MOBs. Multi Occupancy Buildings (MOBs), i.e. apartment blocks, and their industrial and commercial equivalents, Complex Distribution Systems (CDS). These customers are supplied with gas by pipeline systems known as risers. They connect the gas main in the street to supply meter points in the homes or commercial units. Cadent transports gas to around 500,000 MOB connected customers.

During RIIO-1, our customers in MOBs have received a lower level of service (in particular relating to the average duration of supply interruptions) than other customers. We are committing to address this through a suite of improvements focussing on innovation to reduce the likelihood of supply interruptions, developing building specific remediation plans, tailored ongoing engagement and enhanced welfare solutions.

We cannot get away from the fact that it is more difficult to provide customers in MOBs because of the complexity of doing engineering works in large occupied buildings. We will work closely with customers and stakeholders to ensure understanding and collaboration is maximised, and; protect and support any vulnerable customers so that specific needs are identified and addressed.

In practical terms, achieving this vision will require that we have accurate information about all of our assets to manage their condition and any remediation proactively in as many cases as possible. It will also require that where an occasional reactive incident occurs, we are capable of minimising the impacts through avoiding interruptions, through effective and joined-up responses with all the stakeholders involved, and through compassionate and bespoke customer responses to any vulnerability issues within the group affected. In summary: to achieve our vision for MOBs customers, we must be prepared to deliver in a planned fashion, irrespective of whether there was a gas emergency or not.

Our strategic objectives

These objectives work together and will help us achieve our vision by the end of RIIO-2.

Never leave customers vulnerable without gas – reduce the number of interruptions and time off gas producing a 55% reduction in total MOB interruption duration by 2025/26, Appendix 07.03.06 refers

Reduce the impact of gas supply interruptions on our customers by responding to their needs – we will continue to evolve our welfare package and ensure it is flexible and responsive to customer requirements

Keep our customers safe – our plans will reduce riser pipeline safety risk by 23% and identified riser faults that impact building safety by 90%

Risks impacting the delivery of these objectives

When a riser fails in service it may have to be disconnected to ensure safety. In this event customers are impacted by supply interruption. After this we must work to restore supplies, and to support impacted customers.

A riser may also be impacted by the actions of others, for example building work, or deteriorate and need to be replaced, refurbished or have individual faults repaired.

Risk controls

We operate a series of controls to mitigate these risks. The principle is ‘defence in depth’ where the adverse outcome is mitigated by a series of controls which work together. Sometimes this is known as the Swiss Cheese model where the cheese slices represent the various controls which work together to reduce the likelihood of an unfavourable outcome. For a bad outcome to occur the holes in the cheese must align, the more effective each control (fewer and smaller holes) and the more controls (more cheese slices) the less likely and impactful the consequence.

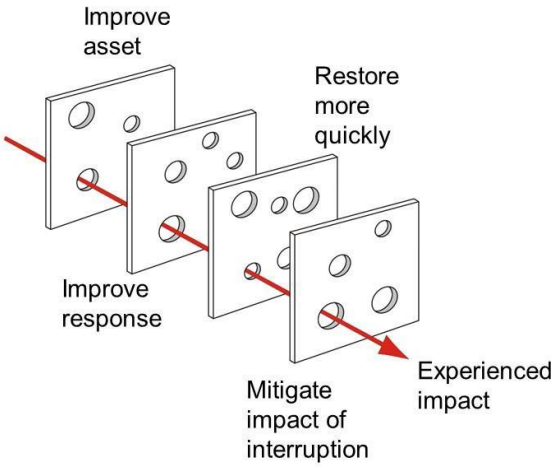


Figure 1:Control Measures Illustration

The picture shows our controls that reduce the impact on customers of being left vulnerable without gas. These controls span a range of operating and investment cost activities. As a result, this appendix covers all the activities that we will be doing and so deviates from the Ofgem format.

Later in this summary is a table showing the activities we will be doing, and which explains how they control the risks that we face and also details some enabling activities, which help our controls to be effective.

Review of past performance

MOB customers rely on us to provide the energy they need to heat their home, to cook and to wash. Customers should always have access to the energy that they need, and confidence that if there is a problem it will be resolved quickly and efficiently with as little impact on them as possible.

Our customer service in RIIO-1 has not been good enough, too many MOB customers have been interrupted and many interruptions have been longer than customers should reasonably expect.

There has never been an incident (explosion or fire causing loss of life or injury or significant property damage) caused by the failure of a riser in the UK, however MOB interruptions are caused by our intervening in an emergency and cutting off the supply to make safe. Safety and customer service are linked in this way.

What customers and stakeholders want us to deliver

We completed a structured engagement programme in which we spoke with customers about their priorities and how our services might be changed to meet their needs. To ensure that MOB customers were adequately represented we met separately with groups of MOB customers who have experienced an interruption. We combined the information obtained through these meetings with information we obtain through routine meetings with MOB stakeholders e.g. building owners and the consultation we did in 2018 in relation to developing our energy exchange programme. Since the October plan submission we have completed business options testing over 4 dedicated deliberative workshops.

Customers as a whole placed safety as the highest priority with supply security as second priority.

Impacted MOB customers are appreciative of the work we undertake to ensure their safety and restore supplies. At first it might appear to be strange that interrupted customers have a positive impression of our service, however there is a simple explanation. They witnessed the significant engineering work required to restore their supply and benefitted from the effort we put in to keep them safe and in mitigating the impact. They could not know whether we could have prevented the emergency from occurring or responded better in the initial phase and maintained supplies. Through conversations with these customers we received useful

feedback in respect of how we might improve communications, as well as suggestions about how we might better liaise with Local Authorities, Registered Providers of Social Housing and charities. We have built these thoughts into our plans.

We also put forward alternative investment priorities to MOB customers to gain feedback in respect of what they believed was most important. We did this by describing possible investment scenarios with projected outputs and customer bill impact. In keeping with the feedback we received from the general customer population safety was the most important consideration for MOB customers, with supply security in second place. In a second workshop customers were asked to provide their view of how we should balance our plan between safety and supply security and cost. The consensus was that we should adopt a plan that ensures safety, which was seen as an obligation we should simply comply with, whilst balancing improved customer service against delivery cost.

The Grenfell fire tragedy has had a profound impact on safety management of multi-occupancy buildings. In particular the significance of building safety related issues, such as the maintenance of effective fire compartmentalisation, has increased. Before the fire we focussed on gas pipe integrity to control gas related process safety risks and did little work to address other risks. There are many kinds of riser related faults that can affect the safety of a building and its occupants, and risers in a single building may have multiple faults of different types. Our RIIO-2 plans reflect the changed societal attitude to building safety risks.

The government set up the Hackitt enquiry to investigate and recommend safety enhancements in MOBs. It is expected that there will be legislation passed into law during RIIO-2 that will further improve safety in these buildings. We are engaging with the enquiry, the Ministry of housing, communities and local government and others in relation to these proposals and have included an uncertainty mechanism in our RIIO-2 proposals to ensure appropriate regulatory treatment.

The HSE have made MOB related safety a priority area for all GDNs. They are currently investigating the issues and issued two improvement notices (308867043 & 308867286) which we have fully complied with.

Following discussions with Ofgem we have put in place an improvement plan in relation to interruptions in MOBs, which increased in London Network in 2017/18.

Creating plans that reflect our objectives that are built on the customer engagement

We want to ensure customers are not left vulnerable without gas and that they are kept safe. This requires us to do work to address the risks to these objectives. We have two objectives however safety risk actually has two different aspects, so we have grouped the risks into three areas to more effectively consider the controls that are required:

- Customer service: reduce the number and duration of interruptions, and to continue to work to mitigate the impact of any interruptions
- Process safety – preventing a network gas escape causing an explosion or fire: we will invest to ensure that our assets remain broadly acceptable or broadly acceptable if ALARP (as low as reasonably practical) level risks, and by targeted intervention we expect to reduce risk exposures of most exposed customers; this programme will also reduce the number of interruptions
- Building safety – protecting customers from non gas safety risks associated with our apparatus: we will identify and fix faults and work with building owners, this will also establish relationships that help if we need to carry our work to restore supplies and mitigate the impact of supply failure

In producing our plans, we have analysed the impact they will have on each of these three areas.

Options considered in relation to investing in asset improvements and resources

We considered several options in respect of major work that will improve our assets by replacing and refurbishing them, they were:

- Investment focussed to deliver safety improvement at least cost

- Investment focussed to deliver improved customer interruption performance (2x that produced from safety investment option)
- Invest such that whole life benefit is maximised without an investment cost constraint
- Invest to hold monetised risk flat

We considered different phasing plans for the delivery of riser fault repairs, which tackle building safety issues.

- Minimal work, no improvement in overall condition
- Recover located fault population in the RIIO-2 period
- Recover located faults within designated fault repair time
- Accelerated identification and repair where inspections due in RIIO-3 are brought forwards to RIIO-2

Detail of the options considered is in the body text of this appendix.

When considering our options for RIIO-2 we anticipated how they contribute to future customer benefits in RIIO-3 and beyond. Our investment programmes to address process and building safety risks are in fact the first half of a delivery plan that runs to 2031. In considering the benefit of gas as a heating option for customers we have looked at alternatives that are likely to be available in the near term (to 2031); the scope of our energy exchange programme reflects this.

Making choices

In doing this we assessed deliverability and cost, identified statutory requirements and determined the impact that different options would have on customer outputs. An important component of this process was to carry out detailed cost benefit analysis of our investment plans to understand not just the resource requirements of different options but also the extent to which they benefitted customers.

The numerical analysis was important however another vital aspect of this process was referring our ideas to customers as described above.

Based on a combination of customer feedback and our cost benefit analysis we have selected the least cost option that delivers our safety obligations as the basis of our major interventions plan and to recover building safety related faults over the RIIO-2 period. The reason for these choices are:

- alternative options that deliver network improvement are more expensive for customers and impact affordability – in customer workshops our customers expected a safe Network but linked other output improvements to value and so affordability and
- we must ensure that safety is adequately safeguarded so we cannot avoid doing essential work.

Both our fault repair and major interventions plans are supported by inspections, customer and stakeholder engagement and improvements to asset management.

Summary of proposed actions – linked to what they deliver

Our proposed actions are designed to work together as a package. They deliver by improving our assets, dealing with issues more effectively and mitigating the impact of failure on customers.

Action	RIIO-2 cost in plan	How action improves safety	How action improves customer experience
Improve asset condition by targeted intervention: • Major interventions (riser replacement and refurbishment) targeted on most risky assets. • Minor interventions target and repair individual faults which could give rise to accidents or which contribute to building safety risks e.g. by breaching fire compartmentalisation.	Redacted due to commercial sensitivity	Reduces the risk of operating riser pipes by: • Improving their integrity thereby reducing the risk of explosion or fire • Reducing their impact on the safety of the building and its occupants e.g. by eliminating a trip hazard	Reduces number of interruptions by: • Better condition assets are less likely to fail • Repair of faults prevents their impacting customers Proactive work is less disruptive because customer needs can be anticipated, and the period of interruption is just a few hours as supply is transferred to the new asset.
Improve operational response to asset failure by: • More specialist personnel rapidly deployed to site enabling wider application of improved techniques / technology • Revised management structure and processes to facilitate this • Revised contracting strategy to improve control and responsiveness		Reduces risk through faster and more effective repairs that utilise the best possible techniques	Reduces number of interruptions by: • A higher proportion of failed risers are repaired. • Where repair is not possible improved response enables actions such as an increase in part isolations maintaining some supplies Delivers faster restoration times by: • technological development / use of technology which increases proportion of riser refurbishments (which are quicker) vs replacements • increased use of innovative access techniques

Action	RIIO-2 cost in plan	How action improves safety	How action improves customer experience
Create building specific management plans for all HRBs (High Rise Buildings) to improve delivery of proactive intervention and operational response. Building plans to be developed in consultation with the owner and where required shared with planning authority. Where proactive intervention will be required in period the plan will integrate this with the owner's building maintenance plans reducing impact on stakeholders: otherwise it will be created as a precaution against a possible future issue	Redacted due to commercial sensitivity	Working with the building owner enables a more holistic approach to safety. This is aligned with the principles being recommended by the Hackitt review. Closer relationship enables us to learn of and influence planned building change. This avoids riser pipes being damaged or rendered non-complaint e.g. by a developer covering over a valve Being able to anticipate the needs of vulnerable customers better enables us to safeguard them	Improves customer experience by: • Establishing a relationship with the building owner facilitating a joint response to any issues • Agreeing a replacement design that is likely to achieve required permissions if an interruption occurs. This speeds up restoration of supplies if lost. • Identifying vulnerable customers to anticipate their needs
Continually work to improve interruption mitigation measures: • Welfare package – expected to continue to evolve • Communications – explore opportunities to enhance • Compensation – speed of payment, direct payment amount paid		Safety extends beyond 'hard' measures such as gas pipe integrity. Improving welfare provision and response to customers will enhance their safety by avoiding dangerous behaviours such as the use of old standby appliances and avoiding 'cold homes'.	Improved welfare package reduces the impact of interruption on customers Improved communications throughout the period of interruption enables us to respond better to customer needs that may evolve Enhanced GSOP1 payment regime provides assistance to distressed customers: this includes advance payments for expected long duration interruptions. Seeking to pay direct so customer gets money swiftly.
Energy Exchange Programme, selective elimination of risk where there is cooking only load or very few customers in a large building		Eliminates ongoing gas related risk from impacted buildings	Only where customers are expected to be better served by alternatives and only when customers agree Progressively reduces number of inefficient to supply buildings reducing bills in the long run

Figure 2: Summary of proposed actions – linked to what they deliver

Enablers – required to enable our actions to succeed

Item	How it enables improved performance	RIIO-2 cost in plan
Inspections of risers in MOBs • Identify individual faults • Provide information for asset management • Inform building management plans	Provides asset condition information identifying faults and is the bedrock of asset risk modelling This process also enables asset records to be maintained e.g. if there is building change	Redacted due to commercial sensitivity
Enhanced asset management	Risk model all buildings, not just high rise, to determine relative risk Identify opportunities to enhance assets and management approach, integrate with building management plans	
Introduce MOBs specific customer satisfaction survey	Enables better performance monitoring and provides information that can be used to help us learn and develop	

Figure 3: Enablers

Note: the two costs shown as *XXXX* * are for the employment of additional staff for enhanced asset management which includes the creation of building specific plans and stakeholder engagement, in business plan data tables this cost is within work management costs, it is not separately identified. The figure has been shown twice rather than split between the two activities because any split would be arbitrary.

The total planned RIIO-2 MOBs related expenditure is *XXXX*. *XXXX* is to transform the experience of our customers. *XXXX* is riser work to support mains replacement. *XXXX* is to conduct inspections of CDS buildings (commercial premises with pipeline systems in the building) and sample surveys of multi-occupancy buildings with banks of meters in a single location or an individual supply to a boiler room, which heats the entire building.

Our *XXXX* transformational programme is around *XXXX* per year per connected MOB customer which compares favourably with the cost difference between them heating their home using electricity instead of gas. It would cost around *XXXX* per year more if they had to switch (based on a typical consumption of 4.5MWh for a MOB customer using gas for heating and hot water). These plans enable customers to continue to benefit from lower energy costs.

Measurable RIIO-2 performance – standards customers love

Earlier we identified the three risk areas which we are controlling and discussed the changes we are making to improve our service. The charts below summarise how our plans will drive key performance metrics.

Customer service – interruptions

The charts show the most recent two complete years in RIIO-1 and our anticipated performance in RIIO-2.

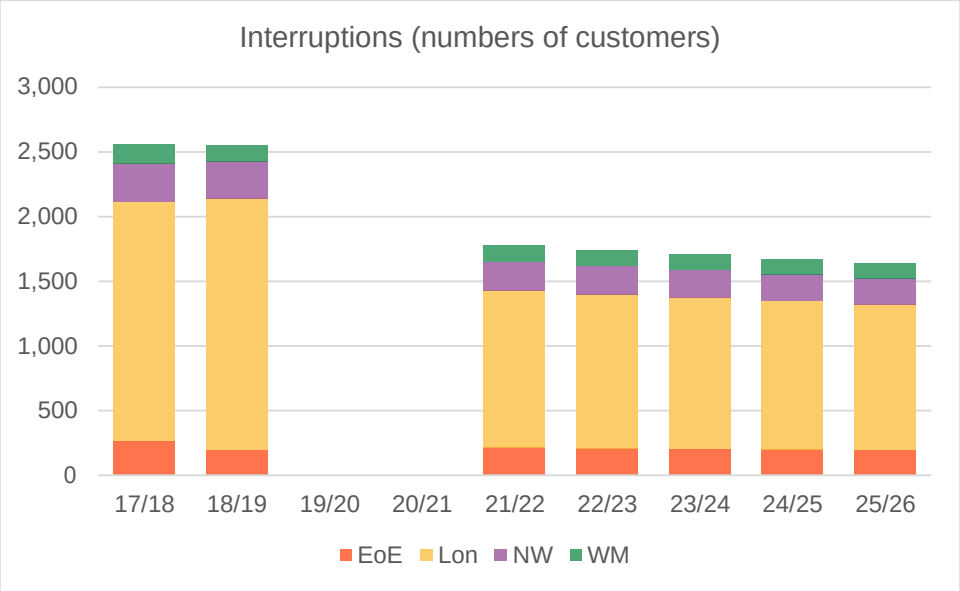


Figure 4: Customer Service Interruptions - Numbers

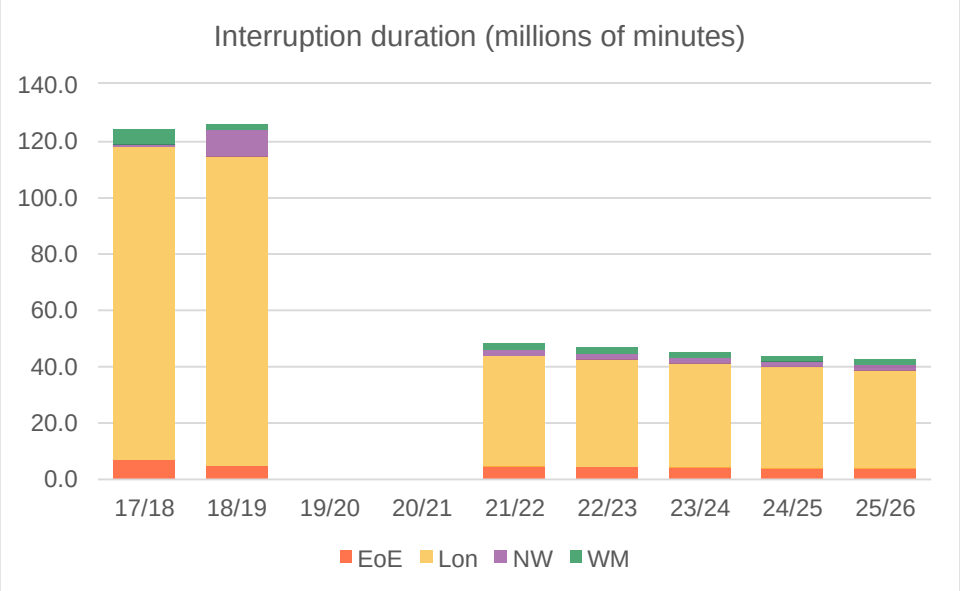


Figure 5: Customer Service Interruptions - Duration

Our plans, described in this appendix, are already being implemented. As already discussed with Ofgem this is the reason why we expect to start RIIO-2 with an improved level of performance.

We believe that both the numbers and duration of interruptions are significant measures. This is discussed in Appendix 07.03.06 Getting Our Customers Back On Gas.

Our objectives refer to not leaving customers vulnerable without gas. This is a wider understanding of customer vulnerability than referring to our undertakings to providing required services to customers on the Priority Services Register. When an interruption occurs we will seek to identify the particular circumstances of all affected customers and will respond to these e.g. a person with primary school age children has certain needs which we will address if they are interrupted however they would not normally be thought of as Priority Services Register customer. This is discussed further in section 6.1.5.

Pipeline integrity – modelled process safety risk

Process safety risk relates to the risk that gas escapes from a pipe or fitting and causes an explosion or f ire. Such incidents are very rare, however when gas escapes and, e.g. due to lack of access, the riser cannot be repaired it has to be disconnected resulting in an interruption.

The chart below shows how we expect our RIIO-2 asset intervention programme will reduce process safety risk in the HRB (high rise building) and MRB (medium rise building) populations.

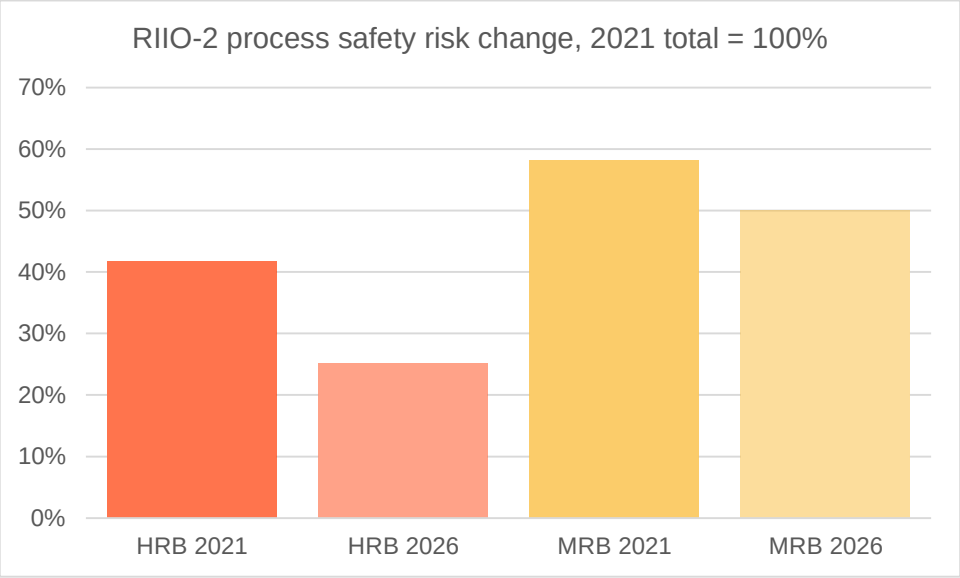


Figure 6: RIIO-2 Process Safety Risk Change

There are about twenty times more MRBs than HRBs. The average risk of a HRB is higher than a MRB because they have more pipes in each building and there are more customers exposed to the hazard were there to be an explosion. Therefore, our RIIO-2 focus is to reduce HRB pipeline integrity risk because working on these assets reduces safety risk most.

Our targeted investment plan is expected to reduce overall pipeline integrity safety risk by about 23%, HRB risk is reduced by 40%, MRB by 14% during the RIIO-2 period. The rationale behind this level of investment and so this level of safety output improvement is provided in detail in sections 3 and 4 and commented on below.

Delivery is discussed in more detail in sections 6, 7 and 8.2.

Building safety – numbers of outstanding faults

Faults are identified by our inspection programme which detects faults enabling them to be scheduled for repair. We will not visit every building in RIIO-2 and as a result not all existent faults will be detected by the end of the period; we expect to complete fault repair recovery in RIIO-3.

The chart below shows how many faults we estimate will exist on our network in the first and last RIIO-2 years, showing the improvement that our work programme delivers.

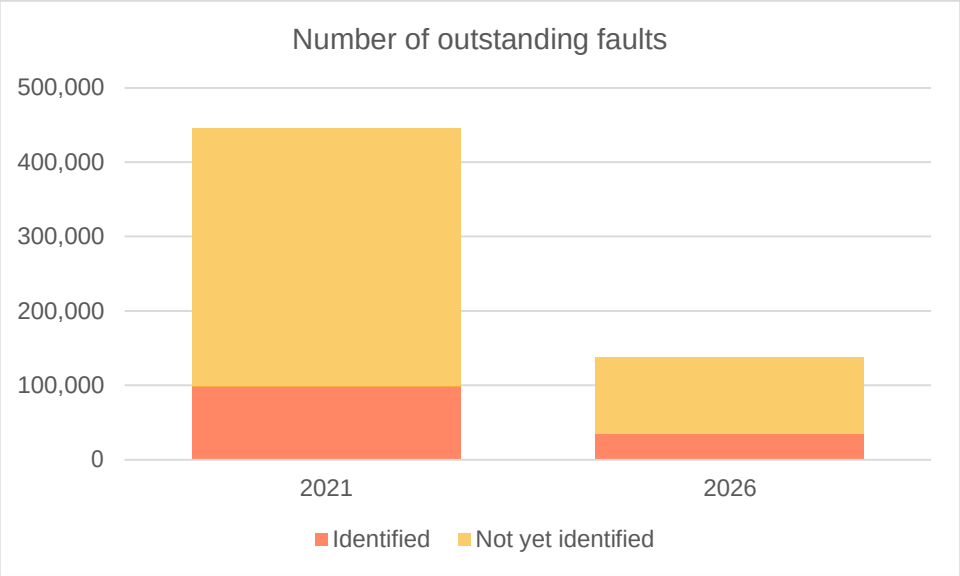


Figure 7: Number of Outstanding Faults

We will eliminate 90% of all building faults found by our ongoing inspection programme prior to 31 April 2026.

A list of fault types is provided in Appendix 4.

Why we have based our plan on these levels of output

Our plans will deliver legislative compliance, they balance outputs with cost efficiency and have been informed by customer and stakeholder input.

- customer service: our plans build from significant improvement in interruptions relative to our recent performance as required by Ofgem. The precise nature of output measures in this area have not yet been agreed with Ofgem.
- process safety risks: we are controlling pipeline integrity safety risk to satisfy the requirements of the Pipeline Safety Regulations and have structured our investment proposals in such a way that we maximise value to customers. We have used risk and CBA models to determine the most advantageous mix and level of work that fulfils our obligations, and which is aligned with the prioritisation feedback we received from MOB customers.
- building safety risks: we will progressively resolve outstanding faults. It is unacceptable to leave identified faults such as a sunken valve box outside a block of flats that somebody might trip over without a programme of work to put it right. Societal and regulatory attitudes are such that we should put these faults right as quickly as possible however there are practical considerations including access to the resources needed and the fact that we have to access homes to be able to do the

some of the work. Our proposals are designed to deliver the work as quickly as practical given the large volume and significant planning required.

Detail supporting the choices made is contained within the body of this appendix.

We recommend that the delivery of these commitments should be regulated through a number of mechanisms, including performance reporting, Price Control Deliverables (PCDs) and uncertainty mechanisms.

Given the materiality of this element of the submission and the interrelationships of investment and operational responses, we have not used Ofgem's standard Engineering Justification template. Instead, for this appendix, we have followed five steps, shown in the diagram below, to move from a clear articulation of customer needs through options development and analysis to develop performance commitments that set standards that our customers will love as well as appropriate regulatory treatment. These steps are repeated for each area of investment (set out in the appendices). Ofgem's required elements are still covered.

Figure 8: Five Step Process

Cost effectiveness of work delivery

We have based our plan costs on our current costs of delivering work in MOBs however in respect of the two largest cost items which are replacing and refurbishing riser pipe systems and the repair of riser faults we have assumed that we will be more efficient in RIIO-2.

Overall we are forecasting that we will be about *XXXX* (about 7.5%) more efficient in provide service to MOB customers in RIIO-2 than RIIO-1 at constant workload. Our RIIO-2 plan has higher annual TOTEX due to increased work, and a requirement to do more effective and comprehensive stakeholder engagement.

Major riser interventions – replacing and refurbishing risers, total RIIO-2 plan spend XXXX

Our unit price assumptions are shown in the table (in 2018/19 cost base):

RIIO-2 unit prices, major intervention cost per riser						
Building type	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
HRB			Redacted due to commercial sensitivity			
MRB						

Table 1: Price Assumptions (18/19 cost base)

The figures shown for 2020/21 have been derived from current performance. They are based on contract rates. We have assumed that RIIO-2 contract rates will be similar to existing rates however for plan purposes we have applied efficiency assumptions during the RIIO-2 period. This saves around *XXXX*.

Minor riser interventions – fault repairs, total RIIO-2 plan spend XXXX

Historically riser repair work has been delivered by our field force personnel when not employed on emergency and network repair work. However, for reasons described elsewhere in this appendix, projected RIIO-2 workloads are 60x greater than historic levels. This requires a different approach to ensure delivery.

During the summer and early autumn of 2019 we carried out a tendering exercise to obtain additional resources to deliver this work in 2020/21. The reason we did this is that we are scaling up delivery of this work and we need additional resources however it also provided a good opportunity to gain real market prices for us to use as a basis of our RIIO-2 plans.

We have obtained contract rates for our East of England, North West and West Midlands Networks however no contractors were prepared to bid for the work in our London Network. We believe that this itself is instructive and that it indicates that the London contractor market does not see this as attractive work.

Outside of London we obtained contract rates for the work execution activity that were between 26% and 30% cheaper than our employing our field force personnel to do the work. This is not unexpected because our personnel have to be trained to work on live gas whereas this work predominantly does not require training to such a high skill level and so commands lower pay.

The contractors included within their cost base the amount that they needed to carry out work management and their margin. When these costs are included in the analysis the rates we obtained were between 5% and 10% greater than if we used our personnel and did the work management.

We cannot redeploy enough of our existing personnel onto this work to deliver it in its entirety because with the increased workload required in RIIO-2 we would impact the delivery of our other work if we did this. We will be exploring ways to obtain the resources we need at cost effective prices. London may be particularly problematic. Not only did our tender not result in any bids the majority of our work is in London.

Despite our not obtaining favourable rates we have decided to retain an efficiency task in respect of this aspect of the plan. The reason for this is that compared to the historic costs we have used as a basis of our estimate there should be economies of scale and greater incentive to improve processes with much greater workload. We believe that a 15% task vs existing cost demonstrates a considerable efficiency ambition given the market feedback we have received. This gives an overall plan cost of delivering riser repair work of *XXXX* over five years.

Other activities – inspections, engagement, asset management and energy exchange, total plan spend XXXX

The other activities we are proposing, i.e. inspecting flats, liaising with tenants and building owners, influencing planning authorities, developing engineering designs in consultation with building managers etc. all require personal contact. The value add is in the quality of the interaction and that depends on adequate preparation and building relationships with the various interlocutors.

The proposed expenditure on our energy exchange programme is money paid to customers for them to agree to cease using gas where maintenance of supplies would otherwise place a grossly disproportionate burden on the overall customer population. From our experience around *XXXX* per supply point is the minimum payment that customers will accept and reducing this figure would simply result in an ineffective programme because uptake rates would be negligible.

In respect of the overall (that is to say including economics experienced by customers) cost effectiveness of Energy Exchange programme, full use MOB gas customers who use gas for heating, hot water and cooking save *XXXX* pa. by using gas instead of providing these services by using electricity. In contrast cooking only customers save nothing when standing charges are considered because their consumption is very low and the marginal saving in the cost of the fuel is offset by the additional standing charge. The cost to serve both sets of customers is the same therefore the Energy Exchange programme identifies cooking only buildings with a low proportion of live gas uses in a building and seeks to avoid the future costs of maintaining these supplies that are not cost efficient.

Innovation – we have indicated in our plan that we expect to be innovating in relation to MOBs

We are pursuing a range of innovations in relation to improving MOBs customer service. At a summary level they comprise:

- Technical innovations – to improve the range of tools and techniques available to do work
- Information systems and data capture innovations – to improve the effectiveness of work and asset management and to facilitate more effective customer response
- Organisational changes linked with improved and streamlined processes which promote accountability
- Cultural innovation to empower those dealing with customers
- Stakeholder engagement moved to a more effective and systematic approach
- Developing the energy exchange programme and linking this with future use of gas

Detail of these items in section 6.1.6.

Cadent is investigating the use of hydrogen gas as a heating fuel either in combination with fossil natural gas or renewable bio-methane or stand alone.

Riser pipe systems are constructed of steel or PE pipes that are suitable in principle for the transportation of hydrogen. Indeed, riser pipes that predate the conversion to natural gas in the early 1970s at one time carried 'towns gas', which contained hydrogen. There is no fundamental reason why risers should not carry hydrogen in the future and any work done to improve the condition of riser assets will help to ensure the retention of a hydrogen based heating solution for MOB customers.

The tables summarise workload and required expenditure. Individual network values are provided in the appendices.

Asset	Activity	Predominant expenditure type	2021/22	2022/23	2023/24	2024/25	2025/26	Totals
CDS	CDS inspections	OPEX						
Meter banks	Survey buildings with banks of meters	OPEX						
	Follow up repairs	OPEX						
Large services	Survey buildings with large single services	OPEX						
	Follow up repairs	OPEX						
High Rise work (>20m)	HRB inspections	OPEX						
	HRB major interventions (replacement, refurbishment and decommissioning)	REPEX	Redacted due to commercial sensitivity					
	HRB riser work to enable mains replacement	REPEX						
	HRB fault repair to ensure compliance	OPEX						
Medium rise work (<20m)	MRB inspections	OPEX						
	MRB major interventions (replacement, refurbishment and decommissioning)	REPEX						
	MRB riser work to enable mains	REPEX						

Asset	Activity	Predominant expenditure type	2021/22	2022/23	2023/24	2024/25	2025/26	Totals
High Rise other	replacement							
	MRB fault repair to ensure compliance	OPEX						
	Energy exchange programme	EXPENSED REPEX						
All	Increased engagement and associated asset management	OPEX						
Totals								

Table 2: Cost Summaries:

1. Introduction

Cadent owns and operates pipe systems within apartment buildings, known as multiple-occupancy buildings (MOBs). These range significantly in size and scale from three-floor, medium-rise buildings with six apartments (for example) to high-rise tower blocks with 40 floors or more and over 200 apartments. Cadent also owns and operates Complex Distribution Systems (CDSs), which are the gas pipeline systems within major commercial premises such as the Trafford Shopping Centre in Greater Manchester.

Our objectives are to not leave customers vulnerable without gas and to ensure that they are safe. However, our performance in relation to customers served by these assets has not been to the level expected. We have plans in place to turn this position around; this business plan reflects the steps that we are taking in RIIO-2.

Pipeline systems within MOBs are often referred to as riser pipes or riser pipe systems and are used to pipe gas to some or all units within the building, supplying gas for heating, hot water and/or cooking.

Maintaining pipe integrity through appropriate targeted condition-inspections and appropriate interventions (repair, replace, decommission) is critical to providing a safe, efficient and reliable gas supply for our customers, in line with the Pipeline Safety Regulations 1996. The HSE oversee the approach we take to MOBS and this plan is aligned with the engagements we have had with them.

All of our MOBs data is held in our core systems, electronic data capture on site is automatically filed against individual building records due to the data hierarchy being constructed around each MOB having a unique identifier created from its Ordnance Survey topographical reference. In this way every asset and every job carried out at a MOB is linked directly to the building.

The following document sets out our plans to improve the management of MOB and CDS risks and thereby to radically improve customer experience. Our response consists both of investment and of operational activities

This main document sets out:

- A summary of the asset base
- Our investment drivers
- Our current RIIO-1 performance
- How we intend to manage our MOBs gas-supply service in RIIO-2
- How we've built our plan
- A summary of our proposed RIIO-2 workload
- Our expected RIIO-2 performance
- Customer commitments

A detailed set of appendices provides more information, for each investment line, covering:

- The detailed investment need
- The approach taken to derive the investment case
- The options and analysis completed
- The workload and costs for RIIO-2.

2. Equipment summary: the asset base

2.1 Multi-occupancy Buildings

MOBs are buildings which have more than two supply meter points serving individual customers where the gas meters are within or close to dwellings.

Gas supplies in MOBs are provided by riser pipes. A riser pipe is like a gas main in a street. It brings the gas close to customers which are connected to the riser pipe by individual lateral pipes; these are analogous to gas service pipes.

Gas is supplied to the base of the riser by a buried 'approach main'. In most respects the approach main is treated like any other main; however, it is required to have a Pipeline Isolation Valve (PIV), which is a building safety feature. A PIV enables the gas supply to be turned off without delay if there is a fire or other building emergency. Our plans for managing the risks associated with PIVs and identifying the position of unrecorded approach mains close to properties are included in this plan. The schematic diagram below shows a simple three-floor domestic MOB.

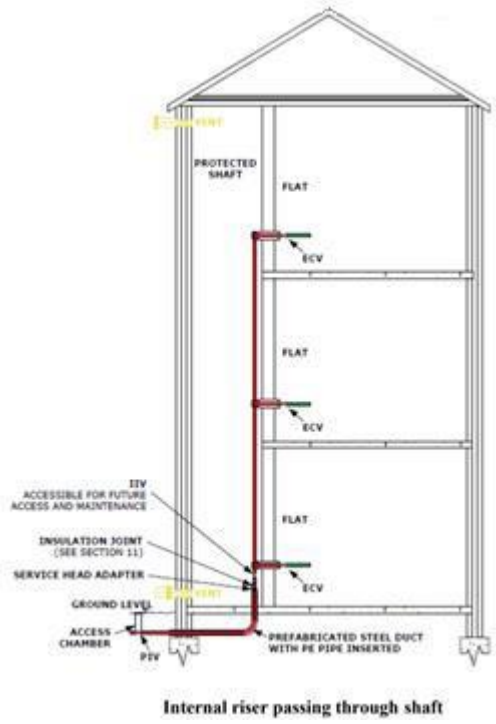


Figure 9: Schematic of Simple 3 floor domestic MOB

Our MOB asset data is linked in our core systems to the relevant building TOID (a unique reference produced by the Ordnance Survey who give every map feature a TOpographical IDentifier, that not only refers to the drawn object but also a data base describing the object i.e. a pond, a bridge, a block of flats). We have arranged that all our MOB work orders including asset inspections, work on assets and attending a MOB customer's premises for any reason must be attributed to the TOID. In this way information is automatically linked to the building and this ensures that records are kept up to date and reduces the chance of error. It also facilitates asset management because trends can be identified, and comparisons made. Inspections produce a building process risk score, and this is recorded against the TOID also.

To ensure that our records are complete we operate two processes which are to annually compare up to date Ordnance Survey topographical information with our records to look for discrepancies and to quarterly

check that every job carried out at a MOB e.g. attending an escape on an appliance has corresponding live Cadent asset data or the site is an iGT.

2.2 Domestic Multiple Occupancy Buildings

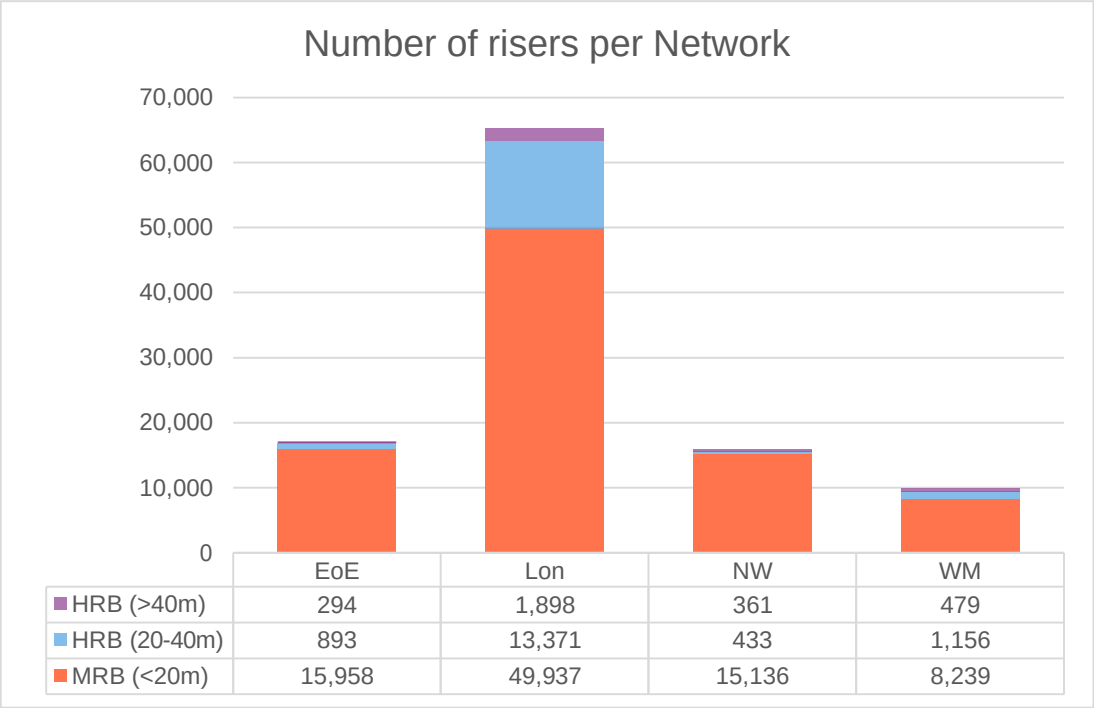
Most MOBs are domestic. Gas is used by customers for heating and hot water and / or cooking.

Low-rise domestic multi-occupancy buildings are not included within scope of this plan. They have only one or two above-ground floors, and their supply pipes are classified as gas service pipes. This paper focuses on three-storey buildings and higher. Ofgem divide such buildings into three height categories, which are:

- <20m (we interpret this as 3 to 5 floors above ground) – Medium Rise (MRB)
- 20-40m (we interpret this as 6 to 12 floors above ground) – High Rise (HRB)
- >40m (we interpret this as over 12 floors above ground) – High Rise (HRB)

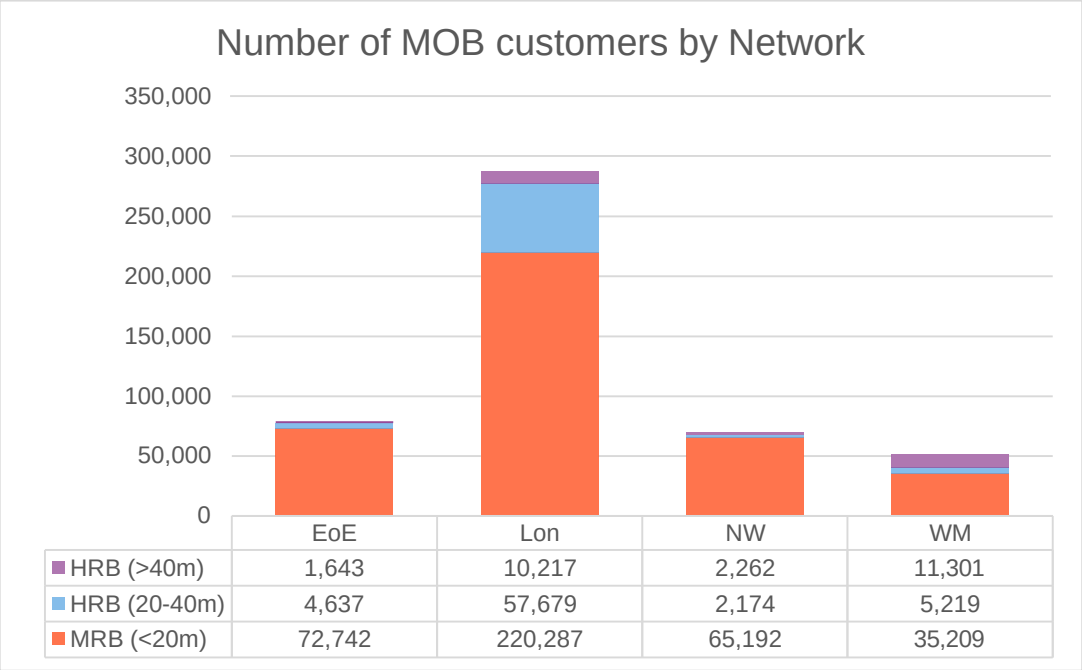
MOBs may have retail units on the ground floor with dwellings above them. These are treated in the same way as other MOBs; they are not included with the purely industrial or commercial buildings supplied by CDS because their characteristics are essentially similar to wholly domestic buildings.

A building may have a single riser or multiple risers. Each riser will have a number of laterals, which serve the individual customers, not all of which might be in use because some residents may not use gas. It is important to note that, for regulatory reporting Ofgem requires a count of risers and not buildings. Altogether, we operate around 108,000 riser pipe systems in domestic MOBs; supplying c. 500,000 customers. We must manage these assets to keep the supplies on and the people safe. The chart below details the number of riser pipelines in operation by network and building-height category:



	EoE	Lon	NW	WM
HRB (>40m)	294	1,898	361	479
HRB (20-40m)	893	13,371	433	1,156
MRB (<20m)	15,958	49,937	15,136	8,239

Figure 10: Number of Risers per Network



	EoE	Lon	NW	WM
HRB (>40m)	1,643	10,217	2,262	11,301
HRB (20-40m)	4,637	57,679	2,174	5,219
MRB (<20m)	72,742	220,287	65,192	35,209

Figure 11: Number of MOB Customers per Network

Our London Network has more riser pipe systems and more riser-connected customers than our other three Networks combined, and it has a higher proportion of larger and more complex buildings. Around 12% of London customers are MOB customers, compared with 2-3% in our other networks. The costs and outputs supporting MOB customers are significant in London and this impacts a variety of GDN comparisons ranging from overall operating efficiency to the setting of specific targets such as for interruptions.

2.3 Industrial and Commercial Multiple Occupancy Buildings – known as Complex Distribution Systems

CDSs are industrial and commercial buildings with Cadent pipeline systems that resemble MOBs. Like MOBs they have multiple meter points distributed around the building. Often these pipes run horizontally in areas such as underground vehicle loading bays with supplies piped through the ground floor to units above.

We have identified 371 CDS, some of which are very large. The picture below shows the Trafford Centre, which is supplied with gas by a CDS that we operate.

Figure 12:ExampleCDS Supply – Trafford Centre (by CB)

The following table summarises the number of identified CDS in operation.

Network	Number of CDS
EoE	114
NL	78
NW	99
WM	80
Total	371

Table 3: Identified CDS in operation

There is a more even geographic distribution of CDS assets, as compared to MOBs, which are predominantly London centric.

We propose to complete inspecting these assets in CDS during RIIO-2 (we expect to do 40 in RIIO-1). Detail of the proposed RIIO-2 inspection workload and its cost is provided in section 7. This inspection programme will ensure that we better understand the risk posed by assets in these buildings as required under the Pipeline Safety Regulations. During the period we will also be working to identify smaller CDS installations for example an industrial building that has been subdivided into several units that contain our equipment.

We have not experienced an escape from a pipeline in a CDS in recent years and are not proposing a proactive investment programme in respect of these buildings in RIIO-2.

2.4 Buildings with multiple occupants served by banks of meters or a single larger than domestic size supply

There are buildings with large numbers of occupants that do not have riser pipe systems within them. They have not given rise to significant long duration interruptions in RIIO-1 however these buildings potentially have some of the building safety related issues that MOBs have. They have not historically benefitted from a specific programme of intervention to improve the condition of the assets that serve them. Information relating to these assets is limited and there has been no programme to survey assets or buildings.

During RIIO-2 we are proposing to survey 1% of these buildings to provide evidence of the condition of the assets that serve them. The results of this survey programme will be used to help us to generate appropriate plans for RIIO-3. The work has been phased accordingly.

2.4.1 Buildings containing banks of meters

These buildings are typically small blocks of flats, often houses that have been converted into flats with the original single meter replaced by a bank of meters often located in a basement. There are also some purpose built installations.

Cadent operates the supply pipe and this includes the pipe from the main in the street to a manifold with a number of ECVs (Emergency Control Valves) attached to it, one for each gas meter. The meters, which are not operated by Cadent, are usually attached to a nearby wall each with an outlet pipe, which is owned by the building owner and which serves a customer within the building.

During RIIO-2 we will inspect in detail 1% of the estimated number of these installations that are in use, a total of 2,500 inspections. Inspections will take randomly across each of our four Networks with the intention of developing as comprehensive and unbiased a picture as possible.

The purpose of the inspections is to build up a better understanding of the nature of this asset, including gaining robust statistical information in relation to its condition. This information will be used to develop future plans.

Where a fault is identified during an inspection we will deal with it in the same way as we would deal with a fault that is located within a MOB with a riser pipe system.

Figure 13: Typical Converted Property

2.4.2 Buildings served by a single supply pipe with multiple occupants

The majority of industrial & commercial premises have a gas supply pipe that is greater than domestic size; many of these enter the premises and do not terminate in a separate meter house. There are many different kinds of buildings with such pipes. There are offices, factories, and schools however there are also hospitals, hotels, hostels, student accommodation and residential care homes. There are also blocks of flats with a boiler room instead of gas supplies to individual flats. These buildings may contain vulnerable people, and often the meter and boiler rooms are co-located perhaps in a basement or other part of the structure that is not frequently accessed.

Our RIIO-2 plans include our inspecting 3,000 of these premises spread across our Networks during the period. The purpose is to build up a picture of the condition of these assets and the risks that they pose so that future plans can be developed.

We will repair faults located during this inspection process.

3. Our current performance

Figure 14: Current Performance

Gas incidents in MOBs as a result of riser deterioration are exceptionally rare. This does not mean that we should be complacent, and a continued investment programme is warranted and required for us to maintain legislative compliance. As discussed in this document the industry has not historically addressed building safety related issues in a systematic way and our interruptions performance has deteriorated in recent years.

During RIIO-1, we have used two quantitative measures to help us understand the service we offer our MOBs customers. These are:

- Supply interruption minutes
- Inspection data (MOBs: HRBs and MRBs)

Also, during RIIO-1 we have worked with customers to improve our welfare package that is intended to mitigate the impact of interruption. This has involved an iterative process where we made changes and asked for further feedback enabling us to refine and evolve.

In preparation of our RIIO-2 plans we discussed what customers wanted us to improve, section 4.2 refers.

3.1 Security of supply / customer interruptions

During RIIO-1, our unplanned interruptions performance has deteriorated for MOBs; see the chart below. (It is not possible to provide disaggregated figures prior to 2015/16 because the RRP RIGs were changed for that year to report MOBs separately – they were not reported separately before.)

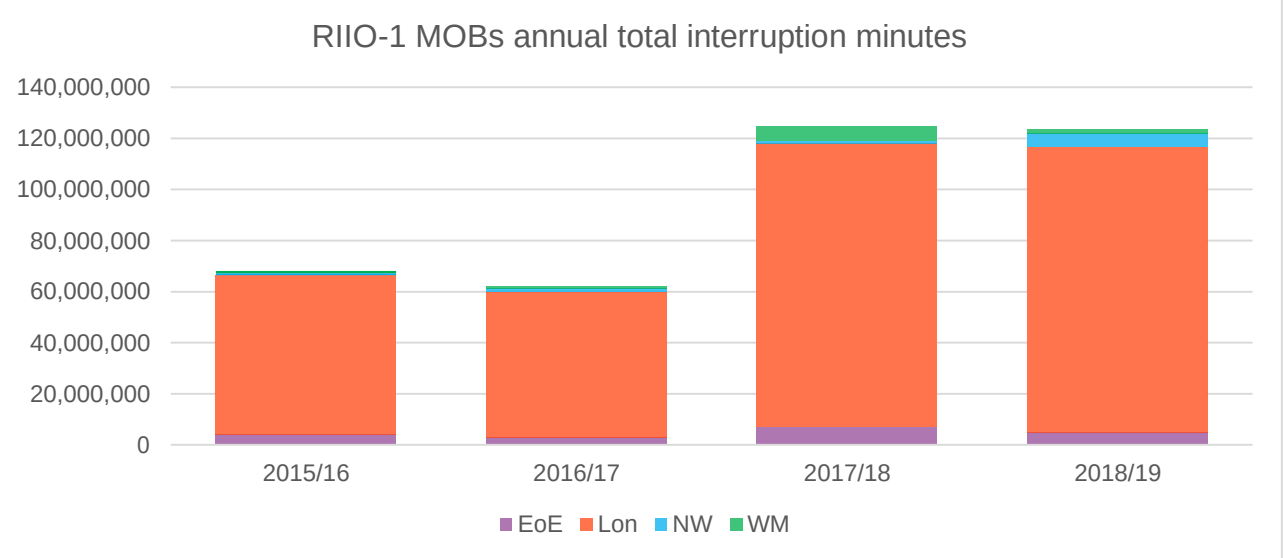


Figure 15: GD1 MOBs Interruptions Minutes

MOB unplanned interruptions are caused by gas escapes or other building emergencies (e.g. a building fire, that requires an isolation of the gas-supply, on safety grounds). This removes the immediate safety risk to customers, but the restoration of supplies is often complex and time-consuming.

In emergency situations it is sometimes not possible to avoid isolating a building, for a range of reasons, examples include:

- Fires - we must obey instructions of the Fire Brigade and where there is no alternative we must make safe by isolation
- The source of leakage being untraceable due to the building characteristics (e.g. a leak on a riser in a shaft that's inaccessible) or
- The leak may not be repairable and other options, such as the installation of a bypass system, are not possible.

Where MOBS are interrupted time off gas can be protracted because of the complexity of liaising with building owners, planning authorities and building residents to agree a route for the new pipes, as well as the inherent difficulties such as working at height. Therefore, a small number of riser-pipe isolations can result in a large number of unplanned interruption minutes.

Reducing the number of gas escapes will have an impact on supply-interruption minutes as will increasing the proportion of escapes that are repaired as opposed to isolated. Our proposals to address these points are detailed in section 8.3.

The deterioration in performance between 2016/17 and 2017/18 was partly driven by the understandable response of customers and stakeholders to the Grenfell fire tragedy:

- Building owners, the general public and local authorities became more aware of gas in MOBs, which resulted in requests for a higher inspection rate in 2017/18.
- The perception of risk by building occupants increased, leading to an increased number of public reports of escapes and emergency call outs.

In 2018 our recovery inspections of buildings that were overdue due to missing records also identified a number of buildings that had to have immediate intervention, and this caused additional interruptions in that year.

This explains the increase in the number of reported escapes and so the number of triggers for unplanned interruption. The average duration of interruption also increased at the same time as a result of the increased workload. To deal with this we had to hire additional contract resource. This took time and it was not until 2019 that average durations have started to reduce.

The rate of unplanned interruptions for MOB customers is similar to that experienced by typical domestic customers. Figures vary from year to year and between Networks however the probability of a MOB customer being interrupted is less than 1 in 200 per year so most MOB customers do not experience an unplanned interruption in their lifetime.

The challenge is that, once a MOB has been isolated, it can take a long time to restore supplies. This means that the small proportion of MOB customers who are interrupted can be significantly impacted.

There are inherent difficulties restoring supply to interrupted MOB customers however it is important that this is not used as an excuse, we must rise to the challenge and deliver an improved service, and that depends on improving all the controls we have.

- Improve the asset by targeted investment and fault repair
- Maintain supplies by repairing them instead of isolation
- Restore supplies more quickly
- Mitigate impact of interruption with welfare package

3.2 Past inspections have helped us understand pipe integrity risk.

Since 2002, we have been inspecting the condition of our assets in high-rise MOBs (i.e. those over 20m high) and, since 2013, we have been inspecting our assets in medium rise MOBs following a specific programme that was agreed with Ofgem for RIIO-1.

In 2019, we increased the scope of the MRB inspections so that they now match the level of detail collected in respect of HRB inspections.

The inspection system operates in three ways simultaneously:

1. It detects network escapes and other urgent issues (e.g. severe corrosion that requires intervention)
2. It identifies individual faults (e.g. a buried PIV that requires remediation that will be programmed as planned work)
3. It provides asset condition and building data that we can assess using our relative risk model and associated processes to determine the pipeline integrity risk

Items 1 and 2 result in specific interventions linked to particular issues identified. Item 3 (pipeline integrity risk assessment) considers the asset as a whole.

Buildings with a relatively high pipeline integrity risk score are more likely to contain Cadent apparatus that may give rise to an incident.

The relative-risk model considers the nature and scale of each building and the design and condition of assets supplying it. Assets that do not comply with current design standards, or which are in relatively poor condition, score more highly than those which are compliant and in good condition. Account is also taken of the nature and state of buildings: for example, if there factors such as damp penetration then the score will be higher because deterioration will occur more quickly.

Buildings that are identified by the model as having the highest pipeline-integrity risk assets in them are manually assessed to determine what factors are contributing to the elevated risk in each case. This enables us to create a building specific plan to tackle those factors. This can require the replacement of risers. However, alternative options, such as remediation or part replacement, are preferred because they manage risk effectively at lower cost and reduce customer interruption. All such activity is grouped together and referred to in this paper as riser major intervention.

It is possible to compare scores produced by the model, which clearly shows that pipeline integrity risk is concentrated in a minority of the buildings containing riser pipe systems. The charts below show how risk is concentrated, e.g. 86% of the HRB risk is in the top 10% of the buildings.

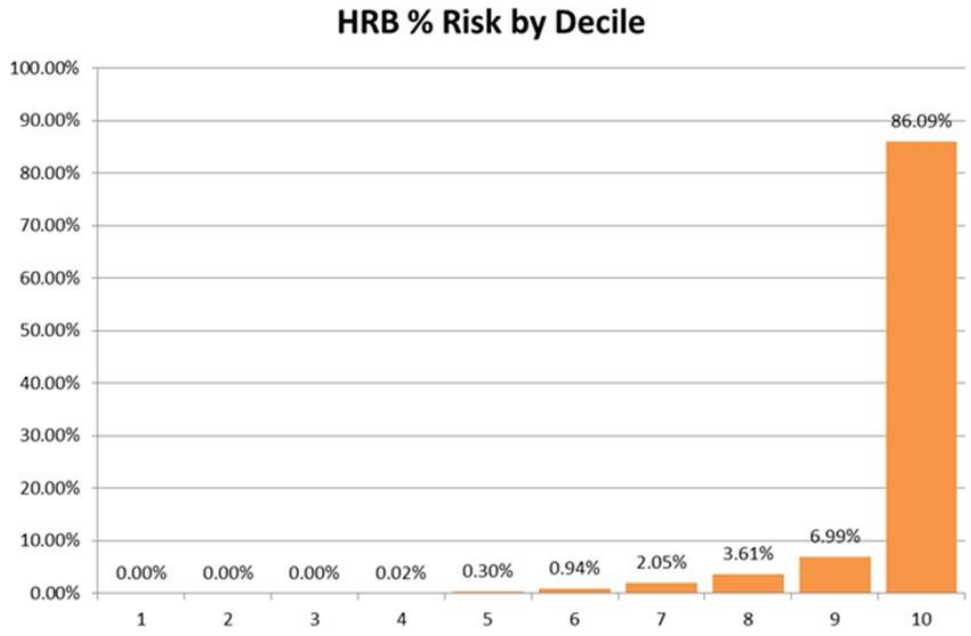


Table 4: HRB % Risk by Decile

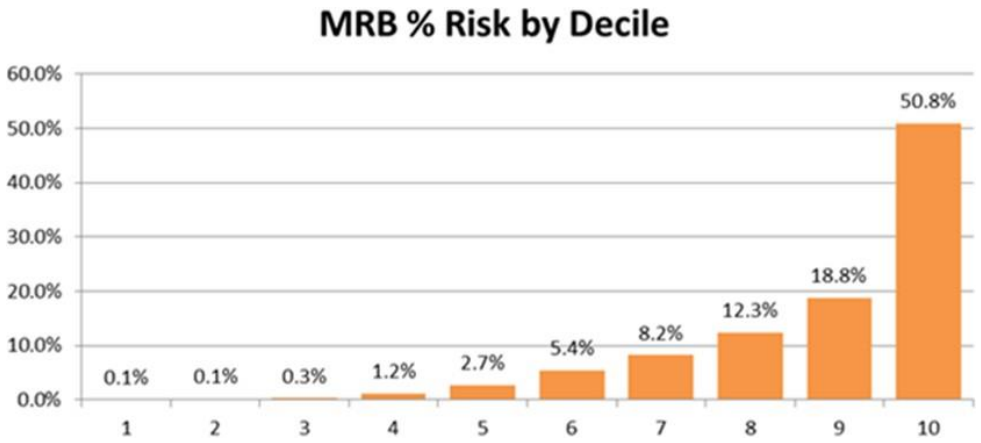


Table 5: MRB Risk by Decile

High-risk installations occur when a combination of factors are present in a building including a legacy asset design that would not be used today with asset deterioration and building features and/or building management practices that increase risk. For example, a pipe that contributes to a high building-risk score may have been installed fifty years ago in an inadequately ventilated and inaccessible space which has become damp due to leakage of water from another service and as a result the pipe has corroded. Such a combination of factors present a level of risk which make intervention entirely appropriate to protect people and property and comply with the law. Regular surveys of the assets would also be required in the interim. Had any one of the factors not been present then the pipe would have remained in good condition and the risk score would be much lower.

On average HRBs contain over five times more meter points than MRBs, and correspondingly contain more assets. They also expose a larger population to risk in case of a pipeline integrity failure. The risk scores of HRBs are therefore higher, as shown in the chart below:

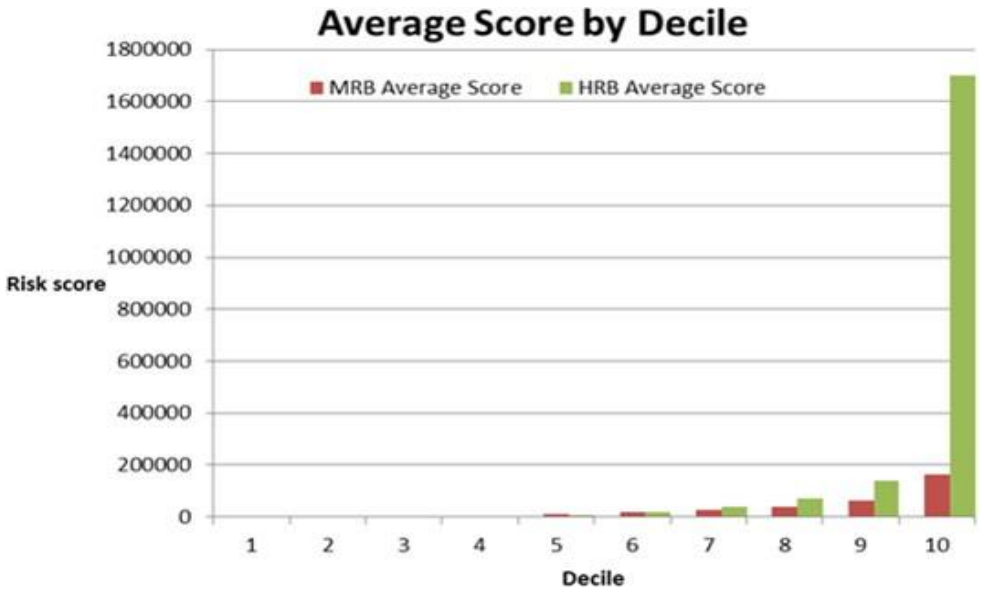


Table 6: Average Score per Decile

There are over twenty times more MRBs than HRBs (refer to section 2.2) so, while the HRB population contains the highest risk buildings, the total population risk of MRBs is greater than that of HRBs, as shown by the chart:

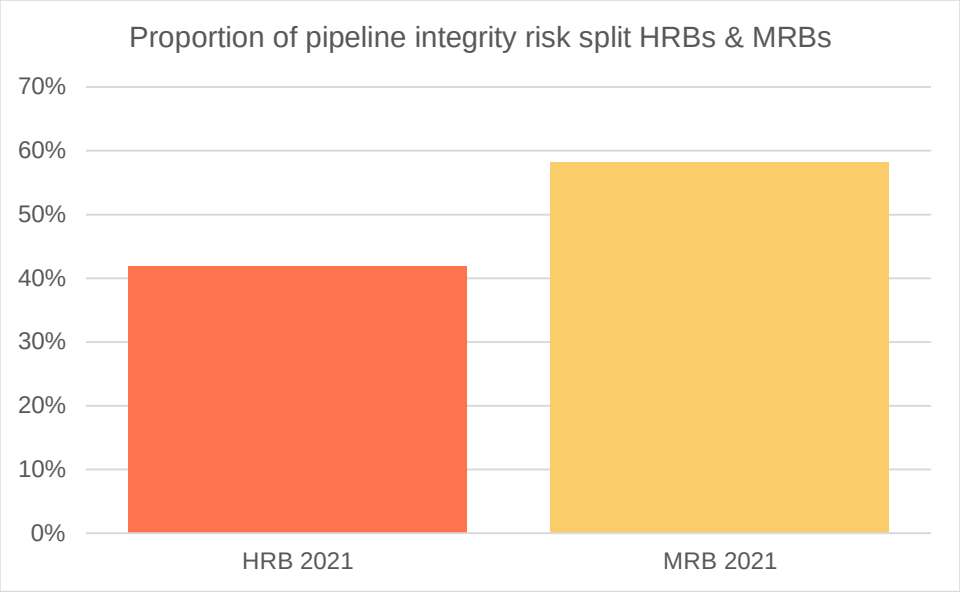


Table 7: Pipeline Integrity Split HRB's MRB's

Our comprehensive inspection and risk-assessment regime enables us to be confident that we have identified the buildings most likely to give rise to a gas pipeline-integrity related issue.

Summary:

- We have a good understanding of pipeline safety risk in MOBs.
- Pipeline integrity risk is concentrated in a small proportion of the overall asset stock
- The highest individual risk buildings are HRBs. The total risk is larger for MRBs because there are 20x more MRBs than HRBs.
- Targeting the highest pipeline integrity risk buildings provides a cost effective opportunity to control the risk exposure of our MOB customers

Our investment plans including the rationale behind why we have proposed the level of intervention that we have are set out in 4 and 5.

3.3 Conclusions

From an in-depth review of our MOBs inspection data and supply interruption data, we can conclude:

- We manage our riser systems using a relative risk model that is aligned to our legislative requirements under PSR and the HSE support the approach that we take.
- While most of our riser pipe systems are in good condition and have low pipeline-integrity risk, a minority of riser-pipe systems are at higher risk and require intervention.
- To understand this risk and to reduce the risk of gas related incidents and unplanned interruptions we need to continue proactively inspecting and carrying out interventions on our riser pipes and associated assets. This will enhance safety and minimise the number of reactive emergency call outs.
- A small reduction in the number of MOB building interruptions will have a large impact on the overall number of minutes customers are off-gas, especially for High Rise Buildings.

- Interruptions can be challenging particularly when permissions are required, and these are affected by third party delays. Typically, these are due to planning issues where third party consents are required, and we have limited ability to influence this process.
- We recognise that our performance in RIIO-1 on MOBS interruptions has been poor and we have committed to radically improve this by the end of RIIO-1.

4. Investment Drivers

Figure 16: Investment Drivers

The key investment drivers for inspecting and providing appropriate intervention to mitigate the risk from deteriorating riser pipes in MOBs and CDS systems are summarised below:

- **Providing a reliable gas supply**: We recognise that in addition to distress and inconvenience gas-supply interruption causes customer welfare issues. It complicates heating, washing and other important daily functions and potentially is a risk to health e.g. not washing properly impacting food preparation. During supply interruption customers do not receive the gas transportation service that they are paying us for.

- **Keeping our customers safe:** For customers and other building occupants, it is critical that we minimise the health and safety risks caused by failure of our pipes. Failure can result in an uncontrolled escape of gas and a risk of fire or explosion. In addition, minor faults that do not impact on pipeline integrity can put people at risk e.g. a missing electrical continuity bond between gas and water pipes. We have various legal obligations in relation to ensuring the safety of our pipes, from the Health and Safety at Work Act 1974, to the Pipeline Safety Regulations (1996). For example, Regulation 13 of the Pipeline safety Regulations requires us to ensure "*the pipeline(s) are maintained in an efficient state, in efficient working order and in good repair*".

- **Providing value for money to our customers**: We must provide the most efficient and cost-effective long-term solutions to minimise customer bills.

- **Providing wider benefits to society**: We recognise that gas leaks also have an environmental impact (gas is a greenhouse gas).

4.1 Keeping our customers safe

Our duty to maintain a safe network is underpinned by a number of statutory instruments.

Instruments	Main legislative drivers
Pipeline Safety Regulations (PSR – 1996) (PSR13a – 2003)	As a pipeline operator we have various duties under PSR 1996 including: • Regulation 8 requires that our pipelines are constructed of a suitable material. • Regulation 9 requires that our pipelines are constructed to be sound and fit for purpose. • Regulation 13 requires networks to ensure that the pipelines they operate are maintained in an efficient state, in efficient working order and in good

Instruments	Main legislative drivers
	repair.
Gas Safety (Management) Regulations 1996	As a gas transporter we have duties under the Gas Safety (Management) Regulations 1996. • To be able to convey gas in a network we must prepare a safety case that is accepted by the HSE as per Regulation 3. • We must conform with that safety case as per Regulation 5. • The duty to follow the arrangements in the safety case are only affected by the interests of health and safety and not any economic considerations.
Health and Safety at Work Act 1974	As a company, we have general duties to conduct our undertakings in such a way as to ensure, so far as reasonably practicable, that the health and safety of all employees and that of third parties are not exposed to health and safety risks as a result of what we do.

Table 8: Legislative Drivers

4.1.1 Discussions with HSE

In addition to routine ongoing discussions with the HSE as part of business-as-usual activity, the four GDN operators have, to date, held four sessions with them to specifically discuss the RIIO-2 process.

We have also held two bi-lateral meetings with the HSE to discuss the specifics of our approach to MOBs as outlined in this paper for example we have discussed our relative risk model with them and our proposed level of subsequent intervention work.

In December 2017 we reported to the HSE that we had identified gaps in our asset data base of high rise MOBs; during this investigation we also identified some outstanding work in relation to PIVs. We responded to these findings quickly and thoroughly including carrying out 1,066 building inspections.

Our work to remedy these issues and the new enhanced systems we have put in place has identified a significant amount of consequential workload, newly identified high relative risk buildings and building safety faults. This has been discussed with the HSE, and there is an expectation that we will complete the identified work by the end of RIIO-2.

4.1.2 Discussions with government and with the Hackitt enquiry

We have been meeting with the Ministry of Housing, Communities and Local Government in relation to the development of a revised safety management for MOBs. We have also made submissions to the Hackitt enquiry which is investigating related regulatory change.

As a result of this we believe that we have a reasonable understanding of what is being proposed.

During RIIO-2 additional duties are expected to be placed on building owners. In respect of HRBs they will be obliged to appoint a duty holder who must maintain a safety case for the buildings that they own or manage, and this will set out how safety of the building will be assured by their safety management framework. All interested parties will be obliged to comply with this safety management framework including the exchange of information and compliance with agreed risk controls.

We are supportive of the changes in principle because it will add rigor and certainty in respect of the obligations on interested parties.

We are expecting to have to comply with the requirements of safety cases of other organisations. This is expected to impact our business however the degree to which it will impact us is unknown because they are

yet to be created and the implementation date has yet to be decided by parliament. As a result, we are keeping close to the policy development processes and for business plan purposes are proposing to deal with the uncertainty by means of an Uncertainty Mechanism, section 9 refers.

4.2 Customer insights and feedback, customer service and safety

We have been undertaking a significant programme of customer engagement. Earlier sessions had a spectrum of customers and looked at the services that we offer. Safety and the environment were also important features of this phase of our engagement programme. Subsequently we held sessions with groups of MOB customers who had experienced supply interruption first hand. MOB customers were asked about their experiences and how we could improve our service offering, and also about our investment priorities and drivers. This section of the appendix will discuss both parts of our engagement programme in more detail.

Separately we have conducted telephone interviews with building owners to gain their perspective of the services we provide.

4.2.1 Engaging with customers

Phase 1 of our customer engagement aimed to obtain feedback from a cross section of customers. We met with customers in different networks and ensured that groups adequately represented the range of communities and social groups that we serve. We asked these customers about their priorities for us as a gas transporter and also held sessions that looked at the provision of specific services such as appliance gas safety checks and alternative welfare provisions.

Safety, including the prevention of emergency situations as a result of leaks on our pipes, was consistently highlighted as the most important or joint-most important priority across each engagement method during our customer research. This research included deliberative workshops, a domestic customer survey, a public survey, focus groups and meetings with hard-to-reach groups. We have also conducted interviews with vulnerable customers and stakeholders.

Ninety four percent of respondents to our domestic survey said that safety was very or quite important to them.

During joint GDN engagement with stakeholders, organised by the Energy Networks Association (ENA) in 2018, investing in infrastructure to ensure asset integrity and safety emerged as strong themes.

Other related feedback included the following points:

- During focus groups with hard-to-reach groups, e.g. elderly, participants requested more proactive checking of pipes, such as regular safety checks
- Participants expected us to predict problems more effectively before they cause an issue for customers, so that we can intervene in advance

Ensuring a reliable supply of gas was also highlighted as a priority across our phase 1 engagement.

Reliability was the joint second-highest priority in our public survey, after safety. Sixty nine percent of respondents to our domestic customer survey said that a guaranteed gas supply is very important to them.

Most participants stressed that people in vulnerable situations and businesses that depend on gas should always be protected, and the disproportionate impact of supply loss on customers in vulnerable situations was reinforced during phase 1 vulnerability interviews.

4.2.2 Engaging with impacted MOB customers

Phase 2 of our engagement programme involved our meeting with groups of MOB customers who had been interrupted. We were looking for insights in three areas, which were:

- To see to what extent the views of these customers differed from those expressed by representative customers
- To understand the impact of interruption, and how we might improve our services
- To elicit from them what their views of MOBs specific investment options were.

Comparison with other customers

The views of MOB customers did not differ substantially from typical customers. Safety was most important to them with virtually every participant putting it first when asked to order priorities. They wanted us to intervene quickly and effectively to keep them safe even if this meant a potentially long interruption.

The impacted MOB customers were more informed in relation to the causes of interruption and the difficulties faced by us in restoring supplies in large and sometimes complex buildings and had considered opinions in relation to this, this is discussed further below.

MOB customers had similar views to typical customers in respect of services like safety checks on appliances and services for vulnerable or priority customers although in the case of such customers they made some useful suggestions, discussed below.

Impact of interruption and how to improve

MOB customers who had been interrupted were able to relate the impact the interruption had on their lives. As might be expected different customers had different experiences ranging from near indifference to being forced to move out of their home. For example, an elderly customer had to move into her daughter's home to stay warm and another person had to go to her sister's flat for showers every day before work and this impacted her life significantly.

A key message that came out of this discussion was that customers should be treated as individuals and that the impact on two seemingly similar people in the same building might be quite different. Another message that came out of this was that customer circumstances might change during the period of interruption and we should respond to such change. These insights have been used in our ongoing process of evolving our interruptions welfare package and associated communications with impacted customers.

MOB customers were appreciative of the work we undertook to ensure their safety and to restore supplies. At first it might appear to be strange that customers who were interrupted would have a positive impression of our service, however there is a simple explanation. They witnessed the significant engineering work required to restore their supply and benefitted from the effort we put into mitigating the impact through our welfare provision. They could not know whether we could have prevented the emergency occurring or responded better in the initial phase and maintained supplies.

In relation to communications customers said that initial communications were good however they felt that after the initial phase during which we contacted everyone in the building they wanted improved visibility of the progress being made to restore supplies and an enhanced ability to contact us if they needed to access welfare provision that they had earlier declined.

We asked about GSOP1 payments. Customers were split in relation to the level of payment that was appropriate however the majority were opposed to an increase to XXXX (the example we gave them) on the grounds that the degree of harm done in respect of most customers did not justify it. Some customers suggested making different payment levels to some customer groups e.g. large families who might experience more inconvenience. An important point made in relation to GSOP1 was that customers wanted fast restore times much more than increased compensation. Customers liked our advance payments for expected long interruptions.

Customers were in general satisfied with the elements of our welfare provision. They made useful suggestions in relation to our maintaining links to Social Services and voluntary organisations that could expedite the provision of services to vulnerable customers.

In relation to gaining permissions to restore supplies it was encouraging to hear customers recommending greater ongoing building owner engagement and the creation of building specific plans that had been shared with the Planning Authority.

Views of MOBs specific investment options

We put forwards alternative investment priorities, safety, supply security, balanced benefits and low investment to see what they believed was most important to them. To enable customers to have the best opportunity to make an informed judgement we described possible investment scenarios and what they were expected to deliver in terms of projected outputs and customer bill impact.

Safety was the most important consideration for them, with supply security in second place.

In a second workshop customers were asked to provide their view of how we should balance our plan between safety and supply security and cost. The consensus was that we should adopt a plan that ensures safety whilst balancing improved customer service against delivery cost. It was interesting to learn that MOB customers who had been interrupted in some cases for months took a position that balanced the cost of investing to avoid interruption with its benefits.

4.2.3 Engaging with MOB building owners and planning authorities

Building owners

Building owners have an interest in everything that happens within their building. They are expected to experience an increase in their legal duties following the conclusion of the Hackitt enquiry. In addition, they have concerns for the comfort of their tenants or leaseholders. Their agreement to and potentially facilitation of our works and our integration of our safety management system with theirs are important considerations.

Since the October plan submission have held telephone interviews with building owners. Their feedback was that they want to see building specific plans developed and much increased communication between us and them together with more consistent Cadent interlocutors. In the past they have had to deal with different people in relation to different jobs or at different times. Our new focused MOBs management team should address these points.

Planning authorities

Working on external risers is not permitted development and so requires planning permission. This builds in delay into reactive riser replacement work and can result in protracted gas supply interruption in some cases. We engage with Planning Authorities regularly to obtain necessary permissions however our RIIO-2 plan proposes to produce building specific plans for HRBs and discuss these in advance of need with Planning Authorities.

We have been speaking with Planning Authorities in respect of how best to approach this and in particular how to leverage connections between Local Authority and Registered Social Housing providers and planners. We have also held discussions with the office of the London Mayor who has a role in strategic planning and this includes influencing boroughs to apply consistent planning policies.

4.2.4 Energy exchange programme consultation

Prior to introducing our energy exchange programme in 2018 we consulted to ensure that the programme was aligned around customer needs and to establish an effective process for engaging with customers and building owners.

We established that an effective relationship with the building owner was key to delivery of the programme, and that full use customers would understandably resist switching to electricity because it would cost them around *XXXX* pa. more to heat their home. We also established that there were numbers of cooking only buildings where the owners were happy to facilitate change because it simplifies their building safety management and where the majority of customers were happy to receive new appliances. The absolute right confirmed by the Gas Act Section 10 to the maintenance of a supply in these circumstances can be an issue because a single customer refusing to change can impact an entire project.

The consultation, and our subsequent six month pilot programme completed in 2018, gave us the experience required to create a business process that is effective at engaging with all the customers and stakeholders in candidate buildings and delivering the energy exchange in a way that is least disruptive to customers and which maximises benefits. We have operated our energy exchange programme subsequently and it continues to benefit from continuous improvement.

4.2.5 Business plan acceptability testing

We have held four focussed customer workshops, one in each of our Networks, that examined the overall acceptability of our plans. Care was taken to ensure a balanced cross section of domestic customers e.g. gender, social / economic group etc.

During the workshops our plans were presented and discussed – with emphasis being given to what they meant in terms of the output performance we are offering i.e. were outputs at appropriate levels and the consequent effect on charges i.e. the value of our offer to customers.

In summary the conclusions were that customers were prepared support our proposals.

- 84% of customers believed that our plans were acceptable or highly acceptable,
- 10% believed they were neither acceptable nor unacceptable and
- 6% believed that they were not acceptable.

Detail of these workshops has been provided in this business plan.

4.3 An economic view of customer needs

Full use gas customers, that is to say customers who use gas for heating and hot water as well as cooking, save typically *XXXX* a year vs the most realistic alternative fuel which is electricity. In contrast cooking only customers save nothing compared with electricity when standing charges are included, albeit that they may prefer a gas hob. During consultation prior to launching our energy exchange programme in 2018 we identified that full use customers are not prepared to switch, and that in most cases the building owner is neither prepared to invest in district heating or to force an unpopular change to expensive electric heating.

Our proposed RIIO-2 MOB related TOTEX equates to around *XXXX* per year per riser connected MOB customer, so the economics favour continued operation of gas supplies to all full use customers where other considerations such as structurally unsafe buildings do not apply.

The maintenance and replacement of MOBs riser-pipe assets can be expensive when the asset reaches the end of its serviceable life and disruption to customers can be significant if a riser fails unexpectedly and the supply has to be disconnected to ensure safety.

The targeted replacement or refurbishment of riser pipes allows us to proactively intervene to avoid future interruptions and reduce safety risks. It can be argued that the one off costs of replacing the riser pipes in a very large building are great relative to transportation income that we earn from such customers. The cost per customer to replace a riser in a 20 story HRB might be *XXXX* vs typical transportation income of *XXXX* per year per customer in the block. However when considered relative to the value of a gas supply to a full use customer (*XXXX* pa.) the investment to replace the supply has a payback time of around 10 years not taking into account the time value of money. The apparent poor return (*XXXX* investment vs *XXXX* income) is a feature of applying customer specific costs vs administered postage stamp prices.

There are buildings where there is low gas use, in particular cooking only MOBs. If major work is needed the economics of maintaining such supplies are not favourable because there are little or no savings compared with customers changing to the use of electrical energy. In this situation we will offer impacted customers some money to agree to cease using gas. We describe this process as the Energy Exchange Programme. During RIIO-2 we intend to seek out high rise buildings with low use and offer energy exchange. This programme depends on all customers in a building accepting our offer, there is no compulsion. Indeed the Gas Act Section 10 requires the maintenance of existing domestic size gas supplies regardless of economic considerations.

We are about to commence on an extensive programme of riser pipe system repair linked to building safety issues (in fact we started HRB work in 2018 and will extend the programme to MRBs in RIIO-2). This work was not carried out in the past and as a result was not included in either our historic costs considered by Ofgem when setting RIIO-1 allowed revenues or in our RIIO-1 business plan. For RIIO-1 Ofgem agreed funding for a MRB inspection programme, which has been effective at identifying assets and providing information upon which this plan is based,

In the cost-benefit modelling approach we have taken for RIIO-2, we have factored in the cost of repair, the cost of welfare packages and compensation (if we do interrupt the gas supply), the cost of lost gas, cost of carbon, customer safety and customers willingness to pay for interruptions. We have included all costs including those not directly experienced by Cadent, e.g. environmental impact, to ensure that our proposals provide the best whole system solution and do not merely serve the interests of one or more stakeholders potentially to the detriment of others.

When considering proactive investment to support major interventions we also used process safety risk modelling, to assess relative incident probability.

We used the values in the table below for the purpose of calculating the cost benefit of different investment options:

Customer Driver	Quantification (£ value)	Data source
Environment – Greenhouse gas emissions (£/t)	Increases from *XXXX* tCO2e in 2021 to *XXXX* in 2071	UK Government. Value agreed with Ofgem.
Safety – Fatalities (£/fatality)	*XXXX*	UK Government (HSE). Value agreed with Ofgem.
Safety – Injuries (£/injury)	*XXXX*	UK Government (HSE). Value agreed with Ofgem.
Leakage – commercial value of lost gas (£/m^3)	*XXXX*	Shippers. Value agreed with Ofgem.
Cost of repairs (£)	Ranges by building type and network based on RIIO-1 data	Company accounts.
Cost of replacement (£)	Ranges by building type and network based on RIIO-1 data	Company accounts. Benchmarked.
Interruptions	NERA supported customer impact value assessment combined with GSOP1 costs	Customer impact values were determined through customer impact consultation GSOP1 costs as per GSOP rules

Figure 17: Cost Benefit of Different Investment Options

4.4 Setting our strategic objectives

It is important to be clear about what our objectives are, and in that way it is possible to examine the risks that impact them and so develop appropriate risk controls. By reference to customer feedback and legislative requirements we have decided to adopt these objectives:

- Never leave customers vulnerable without gas, from customer feedback we have established that customers want good service balanced with cost effective delivery. It has been made clear to us that Ofgem expect improved performance in relation to interruptions.
- Reduce the impact of gas supply interruptions on our customers by responding to their needs, customers need to be protected when there is an issue with their supply so that their distress is minimised.
- Keeping our customers safe – addressing riser pipeline integrity and building safety risks, there are various legal requirements and customers place this as our highest priority and simply expect us to deliver this

The rest of this section explains these points in a little more detail.

Never leaving customers vulnerable without gas

This encompasses how we will maintain gas supplies, restore lost supplies; to deliver this objective we will:

- Improve the condition of assets so that fewer risers fail in service
- Improve our response if there is an issue so there are fewer interruptions
- Do as much work as possible up front and on a precautionary basis including working with building owner and planning authority to reduce the time taken to restore supplies
- Provide a customer specific welfare package and where appropriate and where the customer agrees put them in contact with statutory bodies and voluntary sector organisations who may help them

Reduce the impact of gas supply interruptions

When gas supplies are isolated customers suffer distress, in response to this we will:

- Contact every impacted customer as soon as possible to discuss their needs
- Keep in contact with customers to confirm that our service provision is adequate and so that they can request changes if they are needed
- Pay compensation in instalments to ensure customers are not out of pocket

Keeping our customers safe

This covers two safety risk areas – pipeline integrity risk, which is a gas specific process safety risk, and building safety risks, which are more diverse in nature.

We will operate in such a way as to control customer safety risk exposure – this means a structure programme of work that:

- Improves the condition of assets so the chance of an incident is reduced
- Repairs individual faults that impact building safety
- Works with building owners / managers to ensure holistic safety management
- Where appropriate (building has low gas use) and where agreed by customers selectively remove gas from buildings as part of our energy exchange programme

5. A summary of how we have built our plan

Figure 18:Five Step Planning

In developing our RIIO-2 plan, we considered the three risk areas discussed earlier in this paper and set out in the table below.

Risk type	Impact area of risk	Primary control measures
Customer service (Interruptions to supply)	Customers require a reliable energy supply; they want us to maintain supplies and minimise interruptions. Affects customer welfare and potentially their health	• Asset inspections, risk assessment and targeted intervention • Gas emergency service • Rapid response teams to restore supplies as quickly as possible • Effective and comprehensive proactive and reactive engagement with stakeholder to contain interruption durations • Welfare provisions
Gas pipeline safety	Containment of gas to prevent fire or explosion causing injury or loss of life, or damage to property	• Asset inspections, risk assessment and targeted intervention • Gas emergency service
Building safety	The presence of pipes and fittings within and adjacent to buildings impacts building safety, e.g. fire compartmentalisation.	• Asset inspections with subsequent corrective action to fix faults • Engagement with building owners / managers and other stakeholders

Figure 19: Risk Areas

Based on these, we have identified a series of controls which, for the purpose of this paper, have been split into 12 distinct elements of work. Some of the risk controls impact more than one risk e.g. the primary purpose of riser interventions is to restore pipeline integrity. However, reactive interventions restore supplies, and proactive interventions improve asset condition and substantially reduce the likelihood of a future escape that would result in an unplanned interruption. A description of each work type is summarised in the tables below and in further detail in the appendices. Here the controls are grouped around building type and

activity rather than objective as this is more closely aligned with the Ofgem cost tables and split between investment and operating costs.

Investment-related work areas

Asset	Title	Scope/Description
CDS	Inspection of Complex Distribution Systems	Inspection of pipework in non-domestic buildings where we own pipework within the building up to the primary meter points
High Rise (>20m)	HRB inspections	Carry out inspections of the gas apparatus (its design and condition) and nature of the building as this can impact the asset and contribute to the consequence of failure
	HRB riser intervention	Replace, part replace, remediate, decommission risers such that pipeline-integrity risk is controlled
	HRB fault repair to ensure legislative and building regulation compliance	Fix faults that have been identified by inspections e.g. missing brackets, buried PIV, to ensure the safety of buildings and their occupants
Medium Rise (<20m)	MRB inspections	Carry out inspections of the gas apparatus (its design and condition) and nature of the building as this can impact the asset and contribute to the consequence of failure
	MRB riser intervention	Replace, part replace, remediate, decommission risers such that pipeline integrity risk is controlled
	MRB fault repair to ensure legislative and building regulation compliance	Fix faults that have been identified by inspections e.g. missing brackets, buried PIV, to ensure the safety of buildings and their occupants
High Rise (>20m)	Energy exchange programme	Seek out building that only use a small amount of gas and fund the removal of gas supplies to avoid the need for inefficient investment where customers agree to change. Customers typically substitute gas with electrical energy.

Figure 20: Investment Related Work Areas

Operational work areas

	Title	Scope/Description
Improving interruptions performance	Improving customer service through our targeted pipeline integrity driven investment programme	Reducing the number of interruptions by intervening (replacing, refurbishing etc.) to improve the condition of riser pipe systems thereby preventing future gas escapes that could result in a riser isolation.
	Improving customer service by improved operational performance.	Reducing the number of gas escapes that become extended isolations by: • using innovation to increase the number that are repaired • tackling the number of long duration interruptions by having interruption response plans on the shelf for buildings where interruption is more likely and likely to be of long duration e.g. where planning issues are likely to cause significant delay.
	Improving customer experience by mitigating the impact of interruption	Continue to work with customers to further improve the welfare packages we offer and to develop improved communications including social media Remove the *XXXX* GSOP1 payment cap for MOB customers. Operate advance or staged payments for where interruptions are expected to take over a week to resolve
Improving building safety management	Enhance and influence building safety management	Partner with building owners to manage building change and to ensure building safety management

Figure 21: Operational Work Areas

5.1 Consideration of alternative options

Pro-active major interventions to improve the condition of the asset

We have some discretion in relation to the amount of pro-active intervention we should carry out. Low amounts would result in a deteriorating asset base accompanied by increasing interruptions and worsening process safety risk, conversely a high level of intervention would be more effective at controlling these risks.

To determine the most advantageous solution for customers we have used a combination of the customer engagement discussed in section 4 of this document and detailed analysis, discussed in Appendix 3 of this document.

Minor interventions to fix faults on riser pipes that affect building or customer safety

Following the Grenfell fire, building safety management has received additional emphasis, and the government is consulting in relation to regulatory change in this area (Appendix 6 refers). We have responded by improving our inspection processes and we are now identifying large numbers of faults related to building safety.

Whilst these faults are unlikely to directly cause a gas explosion they are real risks that impact customers. Take for example a valve box next to some flats that has a broken lid, somebody could trip and be injured. Our inspection programme is now detecting such faults. It is not acceptable to identify faults such as these and do nothing about them. We must fix such individual faults to avoid knowingly exposing members of the public to risk that could be mitigated through our taking appropriate action. The HSE has suggested that they would expect individual faults to be repaired within at most a few weeks of their being discovered, however given the backlog of outstanding faults it will be some time before we are able to achieve this standard.

In Appendix 4 there is a discussion of how we reached the workload that we are proposing.

Energy exchange programme

This is a discretionary programme that exists to promote future cost efficiency. It aims to remove some of the least cost efficient to supply customers, i.e. those with low gas use, who derive no financial benefit from a gas supply. The level of the programme has been set at the number of customers who are likely to agree to disconnect at a cost level below that which would be required to maintain their supply. This is the constraint because without agreement we cannot take action and increasing the amount paid to increase take up would impact the economics.

Further detail in Appendix 5.

5.2 Other work areas

There are areas of work that are required by legislation or licence requirements.

Inspections

We are obliged to inspect our assets in buildings to ensure compliance with the Pipeline Safety Regulations 1996. In 2018 we received an improvement notice because we had not inspected all of our buildings in line with good practice. Therefore, this plan assumes that inspections remain comprehensive and continue at their current frequency.

Attending and repairing network gas escapes

When there is a gas escape or other emergency, such as a building fire, we are obliged to attend, make safe and carry out repairs. This plan assumes that we will continue to comply with these Licence requirements and obligations under GSMR 1996. This appendix does not include these costs – they are elsewhere in the business plan. Nevertheless, they do cause interruptions and result in a requirement to restore supplies and so are mentioned here.

Restoring lost supplies to customers

Where repair is not possible, we must either replace, part replace or refurbish the impacted riser to ensure compliance with our Gas Act (Section 10) duties to maintain supplies. These requirements drive reactive intervention work. This plan assumes that we will continue this work.

Working on riser pipe systems in connection with mains replacement

Riser pipe systems are attached to gas mains, which may be scheduled for replacement. When mains replacement occurs we will try to transfer the existing riser pipe system onto the new main without impacting gas supplies however this is not always possible.

Section 8.2 of Appendix 09.02 contains further information relating to this work. Appendix 3 within this section of the business plan details the riser workloads and costs associated with supporting mains replacement. (It also details our proposed major interventions to improve riser asset condition.) The cost for this work has been included in the riser element of the plan and is reflected within the business plan data table 4.08 - Repex Multiple Occupancy Buildings (MOB).

6. Meeting our strategic objectives: Reducing the likelihood and duration of gas-supply interruptions and ensuring customer safety

Figure 22: Five Stage Planning

This section sets out our how we will manage our MOBs-related risks to deliver our objectives; specifically:

- Never leave customers vulnerable without gas
- Reduce the impact of gas supply interruptions on our customers by responding to their needs
- Keeping our customers safe – we will reduce riser pipeline safety risk and identified riser faults that impact building safety

It sets out how we will control pipeline and building-related safety risks in RIIO-2 and maintain, whenever possible, a continuous gas supply to our customers. It also explains how we will manage any suspected gas escapes and associated emergencies and provide support for impacted customers. As described in the executive summary we will operate a number of controls that work together.

6.1.1 Inspections

To maintain legislative compliance, it is critical that we routinely inspect all our multiple-occupancy gas-riser systems.

We subdivide our asset portfolio between ‘high’, ‘medium’ and ‘low’ pipe integrity risk categories using risk-score thresholds. The risk score thresholds are set in respect of HRBs and applied universally and correspond to 210,000 and 100,000 modelled relative risk points respectively. The high category corresponds to the highest risk 10% of HRBs, in statistics this is known as the top decile: the medium category to the second to top decile.

- High-risk buildings (i.e. those scoring over 210,000 points) are inspected annually to ensure we identify and monitor any ongoing deterioration and it is from this group that we will be carrying out proactive major intervention in RIIO-2. Our plans are designed to ensure we will mitigate risk in all high category buildings during RIIO-2 and 3 this is discussed in more detail in Appendix 3.
- Medium-risk buildings (those scoring between 100,000 and 210,000 points) are inspected every five years, we do not expect to do proactive major intervention in RIIO-2 in respect of these buildings.
- Low-risk buildings (those scoring less than 100,000 points) are inspected every ten years, around 80% of HRBs and 90% of MRBs are low risk. (MRB risk scores are on average lower due to scale of hazard and lower likely incident frequency and HRBs are used to set the threshold levels resulting in a lower proportion of MRBs being in high and medium pipeline integrity risk categories.)

These inspection frequencies are supported by HSE, required for us to meet industry good-practice and remain compliant with PSR. They ensure that buildings that cause concern are monitored appropriately and that lower risk buildings are inspected at an interval that it not unreasonably long, given that building change e.g. an owner refurbishing a building, and asset damage e.g. vandalism may occur in addition to

deterioration. About 80% of HRBs and over 90% of MRBs are low-risk buildings and surveyed at a 10-year frequency.

MOBs Record Keeping

A discussion about inspections would be incomplete without a discussion about the systems we use and completeness of our records.

All of MOB records are held in core systems. Inspections are supported by smart device applications linked to these systems. The systems support automatic fault identification enabling jobs to be raised. They include our process safety risk scoring model that ensures that building risk score is automatically updated when new inspection data is submitted. Our plans do not include any money to improve these systems.

An inspection will only occur if the building is known. During RIIO-1 we discovered our records were incomplete and we undertook a significant programme to put this right. We used three parallel processes to ensure we located buildings that we were not aware of; they were:

- Comparing Ordnance Survey building data with xoserve information to identify buildings with multiple meter points that were said by Ordnance Survey to be flats.
- Looking in our systems for job records of every kind where the data captured e.g. floor of building customer situated on implied the job had taken place in a MOB
- Writing to every Local Authority to obtain their records and comparison with ours

Where a discrepancy was located we visited the address to confirm its status and if it was a MOB we inspected it. In this way we have confidence that we have adequately addressed the historic issue.

We are confident that our improved systems and processes will ensure data maintenance however as safeguards we will repeat the Ordnance Survey / xoserve process every year during RIIO-2 and the search of job records every quarter and where either of these processes identifies a candidate building we will visit and if necessary inspect it. Our MOBs plans described here do not include any money to operate these processes.

6.1.2 Maintaining strong stakeholder management

Effective engagement with all stakeholders will be essential if we are to improve our service to the benefit of MOBs customers. We have restructured our business and established a MOBs management team and they will be taking this matter forwards. The table below sets out the areas where we will engage, how we will engage and what we aim to achieve.

Aim of engagement	Who we will engage with	How we will engage	Outcome we are aiming to achieve
Improving our ability to gain permission to do work	Building owners and managers Planning authorities	We will personally engage with the owner of every HRB and registered social housing providers with estates of MRBs We will engage with local planning officers identifying areas where special provisions apply and discussing with them how to accommodate these	Our work plans are more acceptable to both owners and planning authorities reducing delays. We have developed outline plans in advance for HRBs.
Expanding and improving welfare provision	Social services, voluntary sector providers	Identify voluntary sector providers in each part of the country and	Whenever we interact with customers we are able to identify areas of

Aim of engagement	Who we will engage with	How we will engage	Outcome we are aiming to achieve
		determine what services they offer. Discuss with social services and voluntary sector organisations the best routes to link customers to the services on offer	vulnerability and have the relationships in place to protect them
Improving building safety management	Building owners and managers	As for gaining permissions we will engage personally with building owners of HRBs and multiple MRBs and discuss our needs with them and identify what they need from us.	To prevent issues arising from building change e.g. risers being clad in unsuitable materials. To enable us to comply with owner's building safety management requirements
Engaging proactively with regulators and government in relation to safety	HSE, central government	We will utilise personal contacts that we already have and respond to public consultations.	To influence changes to the MOBs legislative regime such that gas safety and customer impact of change are taken into account
Engaging with regulators and government in relation to the future of heat in MOBs	Ofgem, central government	We will utilise personal contacts that we already have and seek to lead the debate on the future of heat in MOBs	Decorbonisation of heat is going to be a huge challenge, our objective is to move from a mandate to restore gas supplies to a more flexible one that looks at the cost effective provision of heat.

Figure 23: Effective engagement with all stakeholders

The last item in this table, future of heat in MOBs, is linked with the comments outlined in section 6.1.6 in relation to innovation and relates to work we are doing for the future, beyond the RIIO-2 period.

6.1.3 Proactive interventions – major work and fault repair

We propose to carry out proactive work to keep our gas-riser pipe systems operating safely and continuously. In turn, this will minimise the need to isolate gas supplies and ensure that our gas-riser systems and their associated assets do not pose any risks to safety (either from gas-leaks and fire, or due to contravention of safety legislation and building regulations).

Proactive interventions with asset management based on inspection data and risk assessment

Proactive risk mitigation is carried out on the highest-risk assets, aiming to reduce their risk to below 'high' risk priority (as described above). We will carry out this work in the most cost-effective way. A range of solutions have been considered. The table below discusses the intervention options:

Possible solution	Rationale for choosing solution
Repairing the fault or problem **Appendix 4**	When it is possible to deliver the required outcome a local repair is favoured as it is easiest to deliver and has the least impact on customers.
Refurbish (including part replacement) of riser pipe or related asset **Appendix 3**	Where the fault is more extensive, for example it impacts a large section of the riser-pipe system, then more comprehensive replacement or refurbishment needs to be considered. If the technology is appropriate to the situation, we refurbish the riser pipe (e.g. by treating corrosion and recoating the pipe or using an internal treatment process to seal joints and improve the gas tightness of the pipes). If there is sufficient access we will consider carrying out part replacement – just replacing those sections of pipe that are have deteriorated. Part replacement is often combined with repairs and refurbishment to produce a complete riser-pipe system that has had all of its significant issues resolved.
Replace riser pipe system **Appendix 3**	If repair or refurbishment (including part replacement) are not possible, we consider entire replacement of the riser-pipe system. This is the most expensive option and can be very expensive for the largest high-rise buildings.
Decommission the gas-supply	In extreme circumstances, where no compliant alternative riser-pipe route is available, or where the building is unsafe to retain a supply of gas, we consider decommissioning the supply. This is a last resort.
Energy exchange option **Appendix 5**	Where gas use rates are low (e.g. if there are few customers or low use – cooking only – customers), it is cost effective to offer customers a payment if they agree to stop using gas. In this circumstance, we only decommission the supply if all customers agree.

Figure 24: Intervention Options

Since 1971, building regulations have not permitted gas in Large Panel Construction buildings above 5 storeys high unless they have been strengthened to withstand an internal gas explosion.

The obligation to strengthen such buildings or remove the supply of gas rests with the building owner nevertheless since the Grenfell fire we carried out a programme of identifying such non-compliant buildings and have been isolating them in consultation with the owners. We expect to continue to find issues during RIIO-2 that will require buildings to be disconnected.

Minor interventions to fix specific non-compliances – identified by inspections

During RIIO-2, we plan to progressively reduce the number of outstanding specific non-compliances, as detailed in the table in section 8.2.

We will not eliminate such non-compliances, because ongoing inspections are expected to detect non-compliant installations, and there is continual deterioration.

In programming work we will risk assess faults so that our plans balance cost-effective delivery with the removal of individual risks in a timely way e.g. a proud valve box (i.e. a trip hazard) will be more risky in a footpath than a flower bed and so should be higher priority for resolution.

6.1.4 Keeping our customers safe in an emergency

We operate a gas emergency service that responds rapidly when there is a gas escape or a building emergency that may be affected by the presence of gas.

When a call is received from the emergency services in relation to a suspected MOB-related emergency, a special protocol is initiated: we dispatch multiple FCOs, a repair team and a supervisor immediately. This ensures that we can respond more rapidly to the potential needs of the primary responders (Fire Brigade or Police). If there is a building fire, we may be asked to immediately disconnect the supply of gas and adequate resources must be available on site to do this quickly and safely.

When a customer reports a smell of gas or other emergency, the gas emergency contact centre answers their call, the customer receives safety advice and a First Call Operative (FCO) is dispatched. We typically attend 98% of priority one emergency reports in less than 60 minutes.

The FCO investigates the circumstances and ensures public safety, if necessary, by evacuating. When there is a network gas escape, they will determine where the escape is occurring and its priority. Gas escapes within MOBs are likely to be high priority, given that they will cause Gas in Buildings (GIB), and the FCO will summon a repair team to assist them.

The repair team will attempt to diagnose the fault and repair any network escape that is occurring. If this isn't possible, they will isolate the gas-riser system and a process of investigating the optimum solution to repairing or replacing the gas-riser system is then initiated. During any gas-supply interruption, we provide additional support to customers that are affected, this is discussed in the section below.

This section has been included for completeness – it discusses an important risk control that is in operation the effectiveness of which impacts pipeline integrity and customer service risks by reducing the chance that a gas escape becomes an explosion or fire. The costs of providing our emergency response are detailed in other sections of this business plan.

6.1.5 Supporting our customers in the event of a gas-supply isolation

When supplies are isolated we estimate how long the interruption is likely to take to resolve.

Alongside this we make contact with every impacted customer within the MOB and discuss with them the likely impact that the interruption will have on them. The Priority Services Register contributes to this process however we go much further than this sub-set of customers.

Based on what we are told and the expected duration of the interruption we put together a customer specific welfare package for every impacted customer. The image below shows some of the items we provide. Through ongoing contact with customers and other interested parties such as social housing providers we expect to continue to evolve our welfare provisions

One improvement that we are making is to improve our ongoing communications with customers. Sometimes customers may be confident that they can manage and discover that over time they need to draw on different aspects of the welfare provision that supply and which initially they felt they could manage without. Improving our communications channels and periodically revisiting our provision to each customer should help to address this.

Oil filled radiators provided in addition to the normal fan heaters supplied at point of disconnections

Large commercial style electric kettles provided to aid provision of hot water where required

Thermal or electric blankets provided to ensure customers can keep warm

Rechargeable portable shower

Mini oven, grill and double hotplate provided in addition to normal boiling ring

B-Warm temperature controlled heated seat cover

Free meal and drink vouchers to allow customers to have access to a hot meal during the interruption

Temporary accommodation for lengthier interruptions lasting over 24 hours

Free gym memberships to allow customers to have access to shower facilities and other amenities

Figure 25: Improving Customer Engagement

We also pay for provisions such as gym memberships to enable customers to access local washing facilities and will put customers up in hotels where we identify hardship that cannot be mitigated in any other way.

In addition to welfare packages, throughout any supply interruption, we have a requirement to pay GSOP1 compensation payments. The *XXXX* payment cap per customer will not apply to MOB customers. This will be funded by shareholders in RIIO-1 (i.e. not in TOTEX subject to sharing) and the cost of making GSOP1 payments are not included in our RIIO-2 business plan submission.

We will continue to make GSOP1 payments, for the duration of the outage, even if the delay is outside of our control (e.g. if we are delayed in obtaining planning permission for the repair or replacement work). However

we think it is inequitable for our performance to be determined in part due to the actions of others over whom we have limited influence. We are therefore proposing that third party created delays be excluded from interruption performance measurement.

If we expect a long interruption, from the outset, we will where practicable make advance payments to the building occupants who will be affected. We intend to continue these discretionary measures in the future.

When we encounter an unsafe appliance we will make it safe and instruct the customer to ensure that it is repaired or replaced by a competent person. If the customer is vulnerable whether because of age, disability, illness or poverty and this is likely to prevent them from having the work done we will put the customer in contact with National Energy Action. National Energy Action will contact the customer, confirm their vulnerability and contribute towards or wholly pay for the repair or replacement of the appliance depending on the customer's circumstances. Energy efficiency advice will also be provided.

6.1.6 Innovation

We are pursuing a range of innovations in relation to improving MOBs customer service. When people think of innovation there is a temptation to focus on technological innovations however other forms of innovation are important, and in fact as the UK gas industry is over 200 years old and gas engineering is a mature discipline the greatest opportunities are to be had in other areas.

Information systems development

In the last two years we have upgraded our work and asset management systems and introduced smart phone apps to support data collection in the field. We have also improved our risk modelling systems. We will be taking this IS improvement programme forwards by extending technology to better support customer interactions. We will be working with customers and other stakeholders to see what innovations will be effective and favoured by customers e.g. how social media might be utilised most effectively.

Organisational change and cultural development

We are in the process of re-organising our business. The objective of the changes that we are making is to empower front line personnel so that they are able to provide a better service whilst at the same time clarifying accountabilities. In the area of MOBs we have recently (2019) set up a multi-functional team to drive performance and in the next few years they are expected to develop and progressively improve. As a result we will improve our focus and responsiveness to customer needs.

Related to this we will be working on organisational culture setting high expectations of what level of customer service should be provided and changing attitudes so that all of our people not just know what is expected of them but start to live their life at work in alignment with that expectation.

Stakeholder engagement

We expect the area of stakeholder engagement to evolve as we introduce our building specific plans. These will require considerable interaction with building owners and planning authorities and as this occurs we expect to gain learning and refine our processes and proposals.

As discussed elsewhere in these plans we intend to continue to improve our engagement with social services and voluntary sector organisations to better support vulnerable customers.

Technical innovation

Despite our operating in a mature industry we are developing and introducing new technologies and expect to identify further opportunities in the future. We have a number of initiatives, a few are detailed in this section.

We have looked at technologies to image or otherwise measure the condition of assets. Some of these methods are as simple as boreascopes however we have also been researching the use of artificial intelligence to assess pipe condition from simple photographs.

We have developed 'micro-stop' a technology that can be used to cut off and bypass sections of pipe enabling us to install valves and even cut out sections of riser within a building whilst keeping most or all customers supplied. In the future we will work to convert this specialist technique that a few personnel can use into a widely implemented technology unlocking its potential.

We are working on the technical aspects of Energy Exchange and doing the thinking that relates this to the future of gas. The economics are such that apart from low use properties Energy Exchange is not cost beneficial for customers. We are looking at the potential to move full use MOBs to centralised gas fired heating, where a boiler or CHP installation supplies one or more blocks with hot water. Were such a change to be made it would facilitate future change to a carbon neutral gas or a change to a different technology altogether such as heat pump technology. There are regulatory as well as technical obstacles to overcome in this space as discussed below.

Regulatory change and influencing

A key issue in relation to the maintenance of a supply of gas to customers in MOBs is that we have absolute obligations to ensure safety and maintain gas supplies – regardless of the economics – but can only deliver work with the consent of customers, building owners and planning authorities.

We are developing our stakeholder engagement to help us overcome these issues, however there are other opportunities that we will be exploring in RIIO-2 e.g. investing in building heat energy solutions rather than simply a gas pipe replacement solution. Customers want a supply of heat at a reasonable cost – not a supply of gas. Yet instead of selling this service that customers desire we operate within a fragmented industry selling a gas transportation service to shippers. The fragmentation occurred to encourage efficient delivery of activities without much consideration of the effect on customer service or the fact that it would inevitably lead to narrow focus by industry participants. Moving to a low carbon sustainable future will require leadership, more integration in service delivery and putting the customer and what they want at the heart of our offering. These are long term items; we intend to work to develop thinking in these areas during RIIO-2.

7. Our workload proposals

Figure 26: Five Step Planning

7.1 RIIO-2 work and cost summary

The tables summarise workload and required expenditure. Individual network values are provided in the appendices.

Asset	Activity	Unit	2021/22	2022/23	2023/24	2024/25	2025/26	Totals
CDS	CDS inspections	Buildings	71	69	65	65	61	331
Meter banks	Survey buildings with banks of meters	Buildings	500	750	750	250	250	2,500
Large services	Survey buildings with large single services	Buildings	600	900	900	300	300	3,000
High Rise work (>20m)	HRB inspections	Buildings	216	139	401	157	112	1,027
	HRB major interventions (replacement, refurbishment and decommissioning)	Risers	329	341	347	355	355	1,727
	HRB riser work to enable mains replacement	Risers	34	34	34	34	34	170
	HRB fault repair to ensure compliance	Faults	2,530	2,298	3,263	2,316	2,214	12,621
Medium rise work (<20m)	MRB inspections	Buildings	8,799	9,197	9,610	10,042	10,494	48,142
	MRB major interventions (replacement, refurbishment and decommissioning)	Risers	1,026	1,083	1,116	1,153	1,153	5,532
	MRB riser work to enable mains replacement	Risers	296	296	296	296	296	1,480
	MRB fault repair to ensure compliance	Faults	55,763	57,359	59,016	60,749	62,562	295,449
High Rise other	Energy exchange programme	Buildings	20	20	20	20	20	100

Table 9: Workload Summaries:

Not shown as a quantified activity in the table above – increased engagement and asset management.

Asset	Activity	Predominant expenditure type	2021/22	2022/23	2023/24	2024/25	2025/26	Totals
CDS	CDS inspections	OPEX						
Meter banks	Survey buildings with banks of meters	OPEX						
	Follow up repairs	OPEX						
Large services	Survey buildings with large single services	OPEX						
	Follow up repairs	OPEX						
High Rise work (>20m)	HRB inspections	OPEX						
	HRB major interventions (replacement, refurbishment and decommissioning)	REPEX		Redacted due to commercial sensitivity				
	HRB riser work to enable mains replacement	REPEX						
	HRB fault repair to ensure compliance	OPEX						
Medium rise work (<20m)	MRB inspections	OPEX						
	MRB major interventions (replacement, refurbishment and decommissioning)	REPEX		Redacted due to commercial sensitivity				
	MRB riser work to enable mains replacement	REPEX						
	MRB fault repair to ensure compliance	OPEX						
High Rise other	Energy exchange programme	EXPENSED REPEX						
All	Increased engagement and associated asset management	OPEX						
Totals								

Table 10: Costs Summaries

RIIO-2 proposed expenditure to manage all elements of MOB and Complex Distribution System gas-riser systems – figures in *£XXXX* in 2018/19 costs (except Energy Exchange)

7.2 RIIO-2 comparison with RIIO-1

The charts show how total riser major intervention workload (riser replacement, refurbishment or disconnection) has varied in RIIO-1 and it compares with the increased amount of work planned to be done each year during RIIO-2. In three of our Networks we are assuming for the purpose of this plan that there will be a flat delivery profile in RIIO-2. In West Midlands we have profiled the work delivery profile because resources have to be developed to achieve the required output. Workloads shown include reactive work and this varies from year to year.

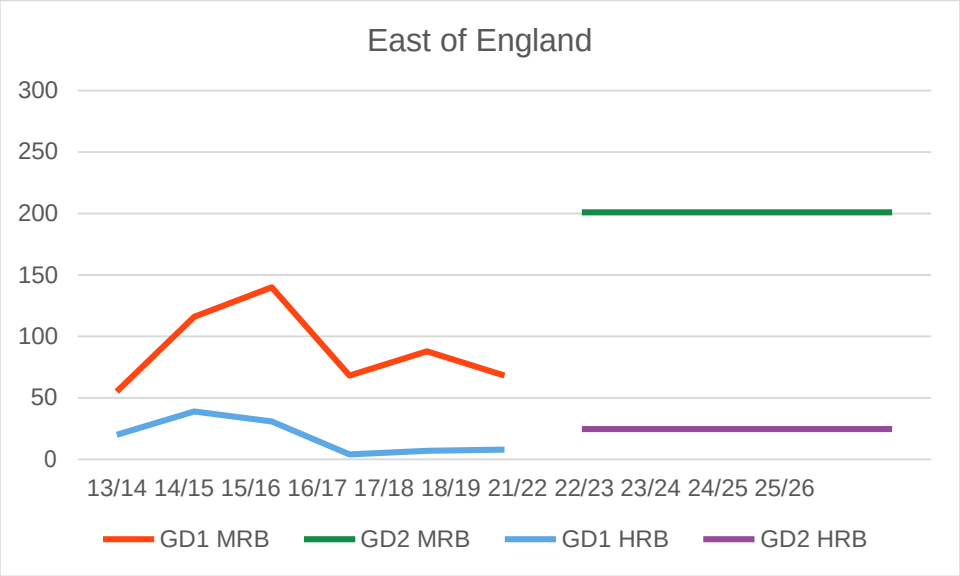


Figure 27: RIIO-2 comparison with RIIO-1- EoE

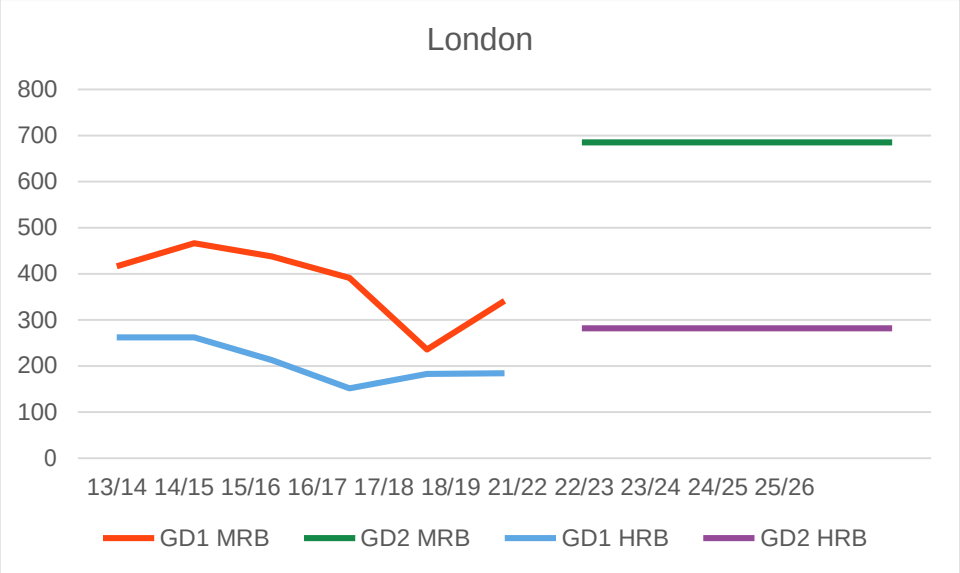


Figure 28: RIIO-2 comparison with RIIO-1- Lon

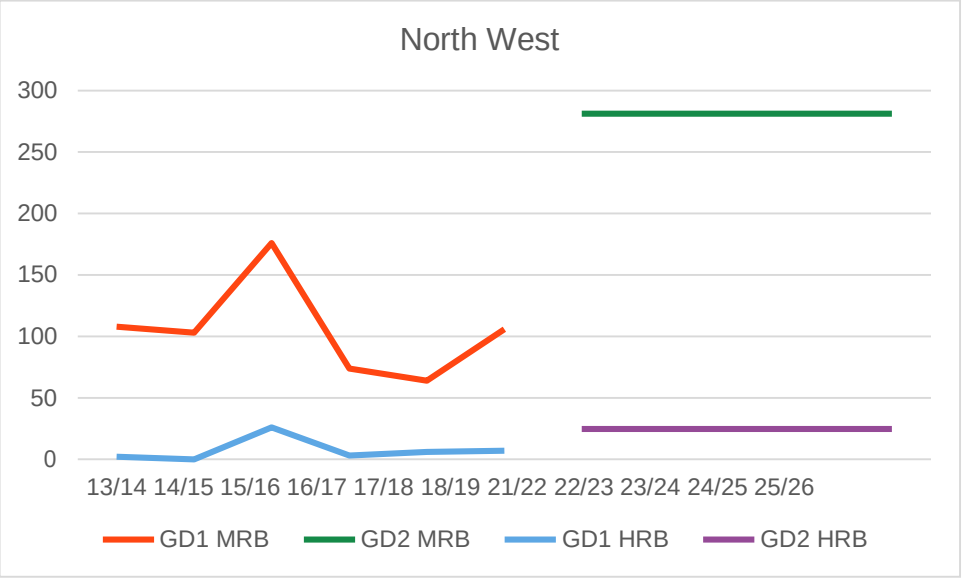


Figure 29: RIIO-2 comparison with RIIO-1- Lon

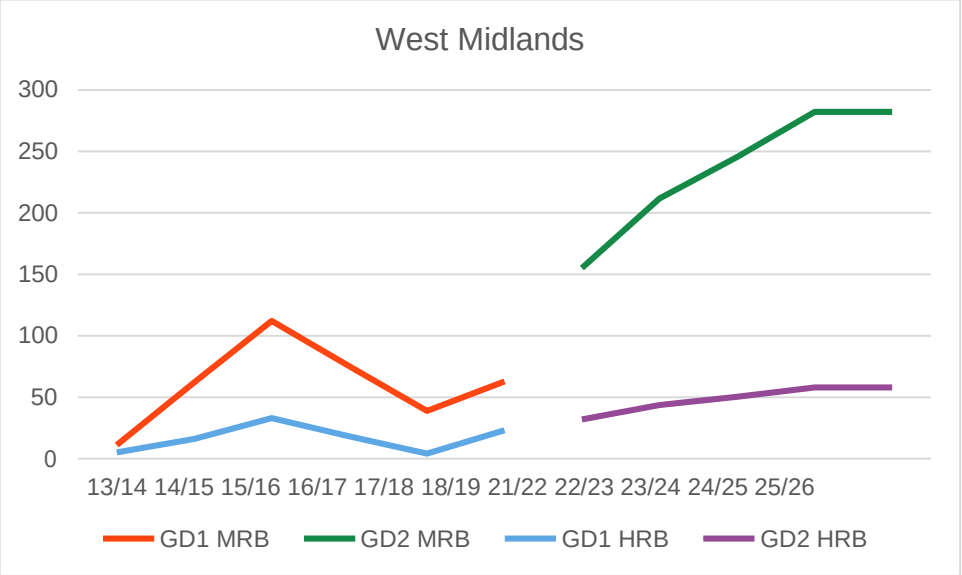


Figure 30: RIIO-2 comparison with RIIO-1- Lon

The charts are in numbers of risers not numbers of buildings. Note the different scale on the London Y axis.

The relative increases in work shown here from RIIO-1 to RIIO-2 by Network are related to our delivering our pipeline integrity risk output commitments as set out in this plan (Appendix 3 refers).

7.3 How our plans take account of the RIIO-3 period

In developing our plans for RIIO-2, we considered how they would be sustained into RIIO-3

Risk improvement in RIIO-2

Before discussing workload and expenditure, it is appropriate to discuss the expected risk exposures at the end of RIIO-2.

The level of risk exposure in respect of each of the three risk areas will have improved as a result of our plans.

During RIIO-2, customer-service risk will be better controlled than it has been during RIIO-1. Interruption frequency is expected to be less than for other domestic customers however despite improvement MOB customers will continue to experience the longest duration of any unplanned interruptions.

Pipeline integrity risk will have improved by around 23% as a result of the work proposed in this plan however, only around half the asset population with a 'high risk' score will have been addressed in RIIO-2. The programme is expected to continue into RIIO-3.

We will have fixed over 90% of identified building safety impacting faults detected up to the end of RIIO-2. Some buildings will not have been inspected during the period so not all existent faults will have been located.

The government's proposals for increased regulation of building safety management should be in full force by RIIO-3, and they are expected to put additional duties on everybody involved in managing safety in MOBs. Our proposals relating to the impact of policy change in RIIO-2 are discussed in Appendix 6.

Key planned expenditure areas in RIIO-3

Inspections are expected to continue as they do now.

Major interventions are expected to continue at an overall investment level similar to RIIO-2. This will complete work on the top 10% relative risk buildings by the end of RIIO-3.

Fault repair – about 65% of existent faults will have been resolved by the end of RIIO-2. There is ongoing deterioration; however, at this point we estimate that the fault-repair workload will approximately halve in RIIO-3, compared with RIIO-2. Thereafter the fault repair workload is expected to fall further.

Engagement and asset management – this could potentially require increased resources in RIIO-3 a result of building safety related regulatory change.

Based on these assumptions, total RIIO-3 period MOBs expenditure is forecasted to be *XXXX* in 2017/18 prices or around 10% lower each year than RIIO-2.

7.4 Works associated with Distribution Mains & Services Replacement

Section 8.2 of Appendix 9.02 Distribution Mains and Associated Services discusses the need for riser work in association with mains replacement. In summary when a main has to be replaced and there are riser pipe systems attached to it they have to be transferred onto the replacement main. Where the riser is due for replacement the projects will be combined, we have not double counted these costs. A proportion of riser pipe systems cannot be transferred e.g. because the new riser approach main cannot be connected with the existing riser and would not otherwise be due for replacement. A cost allowance for the replacement of these risers is contained within this element of the business plan and is reflected within the business plan data table 4.08 - Repex Multiple Occupancy Buildings (MOB).

In respect of mains replacement associated riser work there is a higher proportion of full riser replacements due to a requirement to relocate apparatus, this results in these jobs costing about 6% more than other major interventions where the proportion of part replacements and refurbishments is higher.

8. RIIO-2 our performance expectations

Figure 31: Five Step Planning

As a result, of the proposed RIIO-2 workload specified in section 7, we have made forecasts to demonstrate the benefits that we will be making for our customers. We have divided them into the three risk categories:

- Customer service
- Gas pipeline integrity
- Building safety

This section outlines the specific measures we will use to track our performance. Section 9 takes up the theme of output measures and discusses how we propose to deal with uncertainty. It also includes a discussion of the impact on NARMS.

8.1 Customer service - interruptions

This plan assumes that the radical improvements to interruptions performance that we have already committed to deliver by the end of RIIO-1 are successfully implemented. To achieve the step change in RIIO-1 we are seeking to rapidly deploy all of the identified improvements at pace. The tables below show our committed volumes and average durations together with the performance we expect to deliver.

During RIIO-2 our targeted investment programme to improve asset condition is expected to reduce the number of failed risers by 2% each year, having a cumulative effect during the period. Reduced numbers of riser failures will result in fewer interruptions. The table below shows anticipated numbers of interruptions during RIIO-2.

Expected interruption volumes by Network	2021/22	2022/23	2023/24	2024/25	2025/26
EoE	212	207	203	199	195
Lon	1,219	1,195	1,171	1,147	1,125
NW	220	216	212	207	203
WM	126	123	121	118	116

Table 11: Expected interruption volumes by Network

The table below shows the average interruption durations with recent past performance as a comparator.

Mean interruption duration by Network	Average of last 4 years interruption durations for comparison (minutes per interruption)	RIIO-2 commitment interruption duration (minutes per interruption) minimum standard	RIIO-2 expected average duration during period (minutes per interruption)
EoE	21,539	25,937	20,265
Lon	46,888	36,078	31,675
NW	9,440	17,906	9,440
WM	18,222	36,078	17,144

Table 12: Mean interruption duration by Network

The table below shows the anticipated MOB unplanned interruption minutes (in millions of minutes). The figures have been calculated by multiplying numbers of anticipated interruptions by the expected mean average duration for the Network in question.

Expected total annual interrupt duration by Network	2021/22	2022/23	2023/24	2024/25	2025/26
EoE	4.5	4.3	4.1	3.9	3.8
Lon	39.4	38.2	37.1	36.0	34.9
NW	2.1	2.0	2.0	2.0	1.9
WM	2.3	2.2	2.1	2.0	1.9

Table 13: Expected total annual interrupt duration by Network

Refer to comments in section 9 in relation to potential volatility in performance against this output metric.

8.2 Gas-pipeline integrity

We will target the highest risk assets in RIIO-2 pro-actively replacing around 3.5% of the assets in use (in 5 years). By targeting in this way we expect to reduce the overall pipeline integrity safety-score risk posed by operating riser pipe systems in HRBs by 40% and MRBs by 14% during the RIIO-2 period.

The scores referred to here are derived using a relative-risk model that considers the nature and scale of each building and the design and condition of assets supplying it. The information to do this is obtained by carrying out inspections.

Assets that do not comply with current design standards, or which are in relatively poor condition, score more highly than those which are compliant and in good condition. Account is also taken of the nature and state of buildings: for example, if there factors such as damp penetration then the score will be higher because deterioration will occur more quickly.

Detail of the relative risk model has been shared with Ofgem and the HSE.

Buildings that are identified by the model as being relatively high risk (scoring above 210,000 points which corresponds with the top scoring 10% of HRBs) are manually assessed to determine what factors are contributing to the elevated risk. Plans are then drawn up to tackle those factors. This can require the replacement of risers. However, alternative options, such as remediation or part replacement, are preferred because they are lower cost. Such activity is grouped together and referred to in this paper as riser major intervention. Its purpose is to improve the asset such that all the factors that were making the riser ‘high’ risk are addressed, after which the riser system will have a new lease of life with very low risk of interruption.

In relation to carrying out inspections and subsequently completing the risk assessments; we will:

- Complete 99% of inspections within the required year and

- Complete 99% of risk assessments within 6 months of completing a building inspection

This plan was submitted to Ofgem nearly two years before the start of the period however the commitment relates to reducing the actual risk outstanding at the start of the start of the RIIO-2 period. To overcome this issue, we propose using the values at the end of March 2021, as the starting point for this commitment and reduce scores by the stated percentages from those values. This is a similar approach to that used for iron mains risk in respect of the tier 1 iron mains primary output in RIIO-1.

The tables below provide a guide of the level of pipeline integrity risk our commitment will remove. They show the reductions that we would be delivering if our plans had started in April 2019 and operated for 5 years from that date delivering the work volumes described in section 7.

HRB	Risk at 31/03/2019 (points)	Risk after 5 Years (points)	Risk Reduced by (points)	Risk Reduced by (%)
EoE	51,573,365	29,198,629	22,374,736	43%
Lon	488,313,710	289,573,143	198,740,567	41%
NW	11,195,720	6,325,276	4,870,444	44%
WM	101,047,734	50,112,731	50,935,003	50%
Total	652,130,529	375,209,779	276,920,750	42%

Figure 32: Pipeline Integrity Risk Reductions - HRB

MRB	Risk at 31/03/2019 (points)	Risk after 5 Years (points)	Risk Reduced by (points)	Risk Reduced by (%)
EoE	127,940,937	122,473,596	5,467,342	4%
Lon	561,605,581	448,324,609	113,280,973	20%
NW	150,244,866	145,439,484	4,805,382	3%
WM	64,986,293	59,275,146	5,711,147	9%
Total	904,777,677	775,512,834	129,264,843	14%

Figure 33: Pipeline Integrity Risk Reductions - MRB

The 40% and 14% commitments we are making are overall Cadent risk reduction figures. The figures shown in these tables are indicative only.

8.3 Building safety

We will resolve 90% of all building safety faults identified in the period up to the end of March 2026 by the end of RIIO-2. In other words we are committing to roll forwards into RIIO-3 no more than the number of faults we would identify during six months of inspections. We are carrying over some faults that we expect to locate at the end of RIIO-1 and we will mobilise resources to take on the high volumes of work required to deliver this outcome. A list of faults is provided in Appendix 4.

Due to the requirement to ramp up delivery we will converge on our RIIO-2 end point position by progressively reducing the number of known faults outstanding each year; the table, which shows the maximum permissible number of faults outstanding at year end, refers:

Network	31/03/2022	31/03/2023	31/03/2024	31/03/2025	31/03/2026
EoE	8,702	7,897	7,093	6,288	5,484
Lon	73,718	60,622	47,527	34,431	21,336
NW	8,599	7,657	6,715	5,773	4,831
WM	6,830	5,767	4,705	3,642	2,580
Total	**97,850**	**81,945**	**66,040**	**50,135**	**34,230**

Table 14: Progressive Reduction in Known Faults

Whilst our other significant MOB related output commitments (i.e. riser interventions and interruptions) build upon outputs with associated work programmes that existed in RIIO-1 this commitment area is new and neither our RIIO-1 business plan nor the allowed revenues included this work.

9. Fair Regulatory Treatment

Figure 34: Five Step Planning

Targets for interruptions

An important consideration when setting a fair target is that it is achievable without incurring disproportionate costs that are ultimately paid for by customers.

Another consideration is that exogenous factors should not dominate. The analysis below refers:

The building depicted is in West Midlands Network and has over 200 apartments. There is no reason to believe that the risers within it are at elevated risk however were the supply to be interrupted, e.g. following a fire resulting in riser damage and precautionary isolation, then about 300,000 customer minutes of unplanned interruption would occur every day.

If replacement risers were needed the supply restoration time for a building like this is likely to be several months.

The table in section 8.1 shows expected total West Midlands MOBs interruption at around 2.1 million minutes per annum in RIIO-2, this is calculated as the product of planned average duration and the anticipated number of interruptions.

Therefore, an interruption at a building like this would result in an annual duration target being exceeded for the Network in one event.

Figure 35:Typical Apartment Block (200 No.)

In considering what target to set it is useful to agree criteria against which the proposed target can be evaluated. We propose these criteria:

- Incentivises good performance
- Dis-incentivises perverse behaviours
- Transparent and easy to report / monitor
- Outcome is not distorted by conceivable events such as interruptions at large buildings such as above

We presented these alternative options in our July plan:

Option	Description
Total interruption minutes no exclusions	This is a version of the current measure. It is a simple measure of total interruption minutes against a target. Currently targets relate back to historic performance without inter GDN benchmarking.
Numbers of interruptions	This would simply measure the number of interruptions and not consider their duration
Mean duration of interruption	This is a measure of total interruptions duration divided by the number of interruptions
Median duration of interruption	This ranks the interruptions by duration and takes the median (i.e. middle of the list) as representative of the whole
Total interruption minutes with regulated exclusions	This is similar to the total interruption minutes option however long individual duration interruptions (i.e. those above an agreed threshold) are taken out for individual consideration by Ofgem. If determined to be outside of control of GDN they remain excluded, if wholly or partly responsibility of GDN are included appropriately.

Figure 36: Alternative Options

In this plan we have included interruptions targets that comply with the approach set out in the SSMD (Sector Specific Methodology Decision) and have separately provided a forecast of our performance based upon the actions we are taking to improve. Our output case “getting our customers back on gas” identifies some issues with the measures that Ofgem have proposed and describes how we have looked to mitigate them in our plan. We have also discussed how alternative measures may be more effective in measuring interruptions performance. We are committed to continue to work with stakeholders, including Ofgem, to explore if there is a more effective measure than that set out in the SSMD.

We are considering how both the number and average (mean) duration of interruptions can be used to measure our performance. Using these two measures avoids the issues that arise if a duration (whether total or some form of individual job duration) target were to be used on its own. A twin measure incentivises a reduction in both the number and average duration of interruption. It also avoids the risk of dis-incentivising the resolution of hard to resolve interruptions in the event that a simple numbers of interruption measure was chosen or dis-incentivising the avoidance of numbers of short duration interruptions that a simple total durations measure would have.

Whatever is done with targets they do not address the issue of long interruptions where the delay is caused by a third party such as a planning authority.

Many planning authorities do not make use of their powers to insist on planning permission for riser pipes, particularly for small buildings and buildings that are not in conservation areas or listed. However, most London boroughs do require planning permission to be granted before work can start. This is a cause of longer restore times in London.

Indeed, the very fact that installing riser pipes is not permitted development is a systematic cause of delay because even if everything goes smoothly it can take days or weeks to get permission. Planning Authorities have 8 weeks to turn around an application, the link refers.

https://www.gov.uk/guidance/determining-a-planning-application#what-are-the-time-periods-for-determining-a-planning-application

In some cases, an impasse is reached for example where the building owner refuses to permit a gas industry design standard compliant internal route and the planning authority refuses to permit an external riser pipe. As a Gas Transporter we have duties to maintain supplies that are not matched by our powers. We must use persuasion combined with the moral pressure that we are able to leverage as a result of our acting on behalf of distressed customers. Sometimes permissions can take months to obtain, and occasionally it simply is not possible to satisfy the stakeholders involved.

We have previously suggested the exclusion of delays caused by third parties and we have been discussing how to resolve this issue with Ofgem and have engaged with stakeholders and other GDNs in relation to developing an appropriate solution. Ofgem have recently consulted in respect of this matter, in summary our response was that delays that are caused by third party actions or inactions should not be part of our performance measure.

The level and structure of incentive related to interruptions performance should relate to the scale of customer impact and take account of any other mechanisms that apply. For MOBs interruptions this would be GSOP1, which also places a penalty on poor interruptions performance. Customer Satisfaction scores also apply, although these are currently diluted in effect because MOB work is bundled with other work in the measure. We will be working to ensure that in RIIO-2 we can also report MOBs Customer Satisfaction Survey results separately.

We will be continuing to work with customers and stakeholders to refine thinking in this area.

Supporting customers in vulnerable situations

We are aligning our commitments to MOB customers in line with the services we are committing to in the 'supporting customers in vulnerable situations' section of the main Business Plan (Chapter 7).

We are building on our promises to provide enhanced welfare when we isolate gas supplies. This includes enhanced heating and cooking facilities as well as providing alternative options for hot water supply, food and accommodation. Through the customer stakeholder group proposed later in this section, we are committing to ongoing engagement with our customers to make sure our welfare provision services are fit for purpose.

In addition, we are proposing a range of additional measures to support our customers:

Proactive compensation payments – operate advance or staged payments for where interruptions are expected to take over a week to resolve

Priority Services Register (PSR) awareness and registration - as part of the MOBs-inspection process, we will raise awareness of PSR. We will also ensure that, subject to the customers' consent and data protection legislation, vulnerability information is also captured within the relevant building plan. We will also provide information about the PSR to Local Authorities and HRB building owners as we develop our relationships with them.

Customer gas-safety checks – We will provide basic gas-safety checks in customers' properties when we access specific flats in the course of our high-rise inspections. This will enable us to intervene on potential problems with the customers internal gas supply and will contribute to a reduction in reactive calls to attend gas escapes in HRBs. As part of this we will direct vulnerable customers who have issues with appliances or the insulation of their home to the voluntary sector body National Energy Action.

Enhanced stakeholder engagement

We will be developing building specific proactive plans for HRBs in conjunction with stakeholders, building owners and planning authorities. Our extensive building inspection and riser minor repair programmes provide the opportunity to continually link with customers and stakeholders to ascertain their requirements.

We intend to have a more proactive approach to enlisting help from senior levels within London's Mayoral and Local Authority constituencies so that we can target our efforts where they are most needed.

Over the remainder of RIIO-1, we will co-create a MOBs customer stakeholder group in London. This group will help us to continuously review our services and better understand opportunities to improve the experiences of our customers.

We have already built valuable relationships with key MOBs stakeholders in London. We will maintain these and expand them to all Local Authorities and HRB owners in London. To complement the partnerships we form with building owners, we are establishing a 'hotline' into the relevant teams that they or their building managers can contact to find out key information about their building and our maintenance plans (including inspections, maintenance and planned work).

Measuring our service (MOBS balanced scorecard)

The table below shows what we expect to deliver in the defined risk areas.

Risk area	Risk control activity & measurement of effectiveness	Expected performance
Gas pipeline integrity	Asset inspections completed	99% of asset inspections completed in required year
	Risk assessments completed	99% of risk assessments completed no more than 6 months post inspection completed date
	Pipeline integrity risk score	Total Cadent HRB risk score reduced by 40% during period Total Cadent MRB risk score reduced by 14% during period
Building safety	Repair of identified faults	In each Network resolve 90% of identified existent faults by the end of the RIIO-2 period
	Building safety management carried out	Have engaged with every HRB building owner by end of RIIO-2 and created a building specific asset management plan for every HRB
Customer service	Interruptions performance	Achieve the agreed target performance for interruptions
	Interruptions mitigation	Continue to work on welfare packages and maintain enhanced GSOP1 commitment
	Customer performance measurement	Introduce and report MOB specific Customer Satisfaction Scores to provide evidence of variance between MOB and other customers and to inform future incentives.

Figure 37: Defined Risk Delivery Areas

In addition to the items shown in the table we will continue to offer our Energy Exchange Programme to avoid the cost of maintaining gas supplies in respect of low gas use premises (i.e. premises where there are only a few users and extensive assets and premises where gas is only used for cooking); this mitigates future costs that would otherwise be incurred maintaining these supplies. In RIIO-2 we expect to remove gas from 100 buildings as a result of this programme.

We will implement a MOBs-specific customer satisfaction survey – as part of our wider commitment to work to measure the experience of all our customers. To ensure the integrity of the existing RIIO-1 customer

satisfaction surveys, only those customers that have not been independently selected for those surveys will receive the MOBs-specific survey. The outputs from the survey will help us improve the service we provide to these customers.

These outputs will feed into Monetised Risk, that will also be reported enabling riser related risks to be directly compared with other asset risks.

We plan to consult with customers to finalise how our performance should be measured in relation to these outputs. We expect to report this as a reputational Outcome Delivery Incentive (ODI).

We are not suggesting any measure of data accuracy. We have addressed issues in this area and have created and modified our systems and processes to prevent re-occurrence.

NARMS

Network asset condition and risk information will be reported using the approved NARMs methodology.

The MOBs aspect of NARMs contains pan-industry factors that reduce its ability to differentiate between the condition of assets or the impact of interventions. For example it downplays the benefit of refurbishing risers as opposed to replacing or disconnecting them. Furthermore as it does not include the customer benefit of a gas supply and as a result disconnection is a favourable option (because it eliminates risk) despite it being the least cost effective alternative from a whole system cost perspective in most cases (our Energy Exchange programme is targeting the least cost effective customers only).

In addition it does not adequately model the interventions we will be carrying out. For example the NARMs model was developed before the Grenfell fire and it does not consider building safety. It looks at Network safety, supply security and macro environmental considerations (CO2/CH4 emissions) but not at items such as fire compartmentalisation. Around a third of our RIIO-2 totex supports building safety and yet will generate no NARMs output.

We intend to work with Ofgem and other GDNs to improve the NARMs methodology. We will also record and be prepared to report our progress in respect of the work we will be doing using the score card outlined above.

Managing Uncertainty

Following the Grenfell Tower tragedy, there is an ongoing public inquiry and the Dame Judith Hackitt Review will lead to recommendations for the future management and construction standards for HRBs. The Ministry of Housing, Communities and Local Government consulted in June 2019 in respect of what these requirements might be, a copy of their consultation is provided in Appendix 6.

The consultation defines responsibilities for aspects of building management, construction and utilities. Were these proposals to be implemented, they will require gas-network operators to amend processes and potentially commit as-yet-unknown investment.

In order to protect customers and networks from risks of this nature, in RIIO-1 and previous price controls, Ofgem employed uncertainty mechanisms to accommodate potential costs that may be incurred. In this case, we are proposing an uncertainty mechanism referred to as a revenue driver, as this will allow Cadent to respond flexibly to any proposals from the inquiries and provide the investment needed in a timely manner.

To the extent work is required, we will be funded based on an efficient assessment of unit costs that protects customers by ensuring we only receive funding for actual work carried out. Further details of this mechanism are included in; Appendix 6 in this document, Appendix 10.10 Multiple Occupancy Buildings and Chapter 10 Managing Risk and Uncertainty.

Appendix 1. Complex Distribution Systems (CDS)

Introduction

This section covers the OPEX investment required to carry out periodic inspections of complex gas distribution systems (the industrial and commercial equivalent of MOBs).

Investment Need

The PSR 1996 require that pipelines are maintained in an efficient state, in efficient working order and in good repair.

There are 371 CDS buildings where we operate pipeline systems.

To ensure we are keeping our customers safe and maintaining compliance with legislation we have started to inspect CDS. We expect to complete 40 installations in the remaining years of RIIO-1. These inspections will enable us to refine the inspection process, enabling effective delivery in RIIO-2.

We are proposing to complete the inspection of our CDS buildings in RIIO-2 at a total period cost of *XXXX*

These inspections will operate in the same way as on domestic MOBs; they will:

- Identify any gas escapes that might exist, these will be dealt with straight away as per emergency procedures
- Identify specific faults that require repair
- Provide information on the buildings, asset design and condition to enable a future intervention programme to be developed – in RIIO-3

In recent years, we have not experienced any network gas escapes or interruptions from these installations and do not at this stage anticipate significant work in RIIO-2. As a result of this, our business plan does not propose any intervention expenditure during this period.

Approach to calculating the investment case for CDS

We have anticipated an inspection programme spanning the RIIO-2 period rather than completing all the work as soon as possible, because this is expected to be the most efficient way of delivering the work.

Options development and analysis

A do-nothing option has been discounted because it does not comply with our obligations under PSR 1996. Not inspecting these buildings potentially exposes customers and members of the public to increased risk.

RIIO-2 Proposed Workload for CDS inspections

The table shows the anticipated delivery of these inspections

CDS: Inspections	EoE	Lon	NW	WM
2021/22	21	14	20	16
2022/23	21	14	19	15
2023/24	20	13	18	14
2024/25	20	13	18	14
2025/26	19	12	17	13

The cost of this work is detailed together with other inspection costs in Appendix 2.

Appendix 2. Inspections of MOBS

Introduction

Inspections help us to understand the condition of our riser-pipe assets and to identify emerging risks to pipe integrity, building regulations or other non-compliance issues that pose a risk to health and safety or the security of supply. We must inspect our asset base to ensure that we comply with Pipeline Safety Regulations. By identifying risks before leaks or other issues occur, we maximise safety and security of supply and minimise the cost and impact on our customers (reduce expensive reactive work).

The interventions to mitigate the risks identified during inspections are discussed in subsequent sections

Customer Need

We have obligations under PSR 1996 to understand the condition of and maintain our asset base. Our customers also expect us to understand and manage the risks we expose them to.

We use these inspections as a touch point with building owners and customers. Awareness of our safety management of these assets is enhanced and we are able to provide safety advice to customers – for example, about Carbon Monoxide or the option for vulnerable or priority customers to be put on the priority services register.

Options development and analysis

A risk-based approach is used to set inspection frequency based on the risk of failure determined following the previous inspection.

We operate a risk-prioritisation decision support tool that uses inspection results to identify the riser pipe systems that require more thorough risk assessment to ensure that they do not leak. This risk assessment is carried out under the auspices of our MOBs Risk Control Group, which ensures that the particular circumstances causing increased risk are understood for each asset so that the most beneficial and timely intervention can be carried out as required.

The safety-risk model was developed in conjunction with an independent specialist GL-Nobel Denton (now DNVGL). The score it derives is a factor of:

- the installation-design, including the nature of the structure
- where the apparatus is located
- the condition of our apparatus
- the size of the population exposed to risk

In respect of HRBs, buildings with a risk-priority score of over 210,000 points (derived by the model) are inspected annually; buildings scoring between 100,000 points and 210,000 points are inspected every 5 years, and all other HRBs are inspected every 10 years. This ensures frequent assessment of the highest-risk buildings while avoiding the cost that would be associated with surveying the entire population at a short interval. These variable inspection frequencies create patterns of costs through time, these costs are included in our NOMs/NARMs reporting tool.

In respect of MRBs, we use the same safety risk thresholds. However, safety risk scores are on average much lower because fewer assets are in use and failures have lower consequences: fewer than 4% of buildings are required to be inspected annually, and over 90% are on the 10-year cycle.

The use of inspection is a cost-effective way to identify risks so that they can be mitigated or controlled before they have an external impact.

We are confident that our established safety risk-based model provides an appropriate inspection frequency to enable timely remediation and intervention on any riser-pipe system risks. The HSE have accepted our approach as being appropriate within the overall risk control framework.

A do-nothing option will result in a fix-on-failure approach to riser-pipe systems in MOBs and this will not allow us to properly manage the safety risk associated with these buildings as required by various regulations and agreed with the HSE.

Proposed Workload for MOB inspections

Based on the current risk scores, and so the required resurvey dates, the following volume of inspections has been identified for RIIO-2.

HRB inspection volumes	EoE	Lon	NW	WM
2021/22	3	207	2	5
2022/23	5	125	1	8
2023/24	13	319	12	57
2024/25	11	117	7	23
2025/26	17	86	2	6
Totals	**50**	**854**	**24**	**99**

MRB inspection volumes	EoE	Lon	NW	WM
2021/22	1,918	4,559	1,626	696
2022/23	2,005	4,765	1,699	728
2023/24	2,095	4,979	1,776	760
2024/25	2,189	5,203	1,856	794
2025/26	2,288	5,437	1,939	830
Totals	**10,495**	**24,943**	**8,896**	**3,808**

Cost of MOB inspections

We carry out inspections using our field force personnel, who have received additional training to enable them to carry out the work.

Historic information shows how long each inspection takes to complete and, by multiplying this by the fully loaded cost of employing personnel, we have determined the unit cost of our inspections. The table below shows the unit costs we have used, in 2018/19 cost base.

Year	EofE	Lon	NW	WM
MRB		Redacted due to commercial sensitivity		
HRB				

High-rise building inspections take on average 4 FTE days to complete, whereas medium rise inspections take about 3 FTE hours. This reflects the relative scale of the buildings that have to be inspected. Inspectors must inspect certain parts of an asset (e.g. the entry into the building), including any pipe located in a basement, and will attempt to inspect every part of the riser system within the building. This includes requesting the building owner or manager to remove panels where required to gain access to shafts and ducts or using a borescope (a camera which can be inserted into the duct).

We attempt to make an appointment with every occupier in a building prior to inspecting. To attempt universal coverage we visit every flat at least three times to gain entry leaving contact cards when we are not successful that request the customer contacts us to make an appointment. We will visit in the evening or at the weekend if necessary. We speak with neighbours and the building owner or manager to illicit from them where possible information about when a customer might be at home, or some alternate means of contacting the customer. Where a flat contains assets that we must inspect, for example the point of entry to the building we persist in attempting to gain entry even if we are refused; where necessary we will seek a warrant at the magistrate's court and gain entry using bailiffs and a locksmith. The cost of these measures is included within the unit prices provided above. Such persistence is necessary because a pipe may have a defect in a location where we fail to gain access.

The tables below detail the anticipated inspection costs (£*XXXX* 2018/19 prices) by Network and year.

HRB inspection cost by year and Network	EoE	Lon	NW	WM	Totals
2021/22					
2022/23					
2023/24		Redacted due to commercial sensitivity			
2024/25					
2025/26					
Totals					

MRB inspection cost by year and Network	EoE	Lon	NW	WM	Totals
2021/22					
2022/23					
2023/24					
2024/25		Redacted due to commercial sensitivity			
2025/26					
Totals					

Inspections of CDS buildings, buildings with banks of meters and multi occupancy buildings with an individual larger than domestic size supply into the building

In section 3 there is a discussion of the inspection of CDS buildings, the survey of buildings with banks of meters and multi occupancy buildings with an individual larger than domestic service pipe into the building. The total period costs of these inspections are set out in the table below:

Activity	EoE	Lon	NW	WM	Totals
CDS inspections					
Survey of buildings with meter banks		Redacted due to commercial sensitivity			
Survey of buildings with larger than domestic service pipes					
Totals					

Costs shown in 2018/19 cost base, *XXXX*.

As with other inspection costs these costs have been calculated from the time taken by our field force personnel to complete the work including travelling time and their employee related overheads but no central overheads.

Appendix 3.

Asset Health Engineering Justification Paper for "Riser Pipe Major Interventions"

A3 – 2: Introduction

Our plan for managing the assets serving MOB customers has been titled 'Transforming the experience for Multi Occupancy Building Customers'. We recognise that we have to improve our performance and control both customer service and safety related risks better. It is a holistic plan that brings together maintenance, inspection, stakeholder and customer engagement and customer support services. Combined with improved asset management processes and our investing in the replacement and refurbishment of assets. The part of our plan detailing the majority of the investment we are proposing has been structured so that it closely resembles the Asset Health Engineering Justification Framework.

Riser pipe major interventions occur to address significant asset health issues that cannot be resolved by repairing assets.

Interventions will take place throughout the RIIO-2 period and occur for two reasons: either a riser has failed in service and cannot be repaired (this is known as reactive work) or the intervention is being carried out proactively to prevent a potential future failure (in the RRP this is known as planned work).

Riser work is also required to facilitate mains replacement however when such work occurs risers are not selected on the basis of their particular condition. They are selected on the basis of a need to replace part or all of the riser to facilitate the replacement of the main supplying them whilst limiting the impact on customers e.g. by installing a new riser approach main before abandoning the old main to prevent customer interruption. We have included the impact of mains replacement associated riser work within our modelling to avoid double counting when fortuitously mains replacement work does impact a riser that we would otherwise be working on.

When a riser is in poor condition, we attempt to repair it. However, it is not always possible or efficient to do this. Sometimes risers are embedded with the building structure or otherwise inaccessible or their condition means the repair is not economic (e.g. there is extensive corrosion and a history of joint leakage). When repair is not an option, we must intervene, choosing one of the three options (replace, refurbish, disconnect). This is known as a reactive major intervention. Risers damaged by fire are usually not able to be repaired and at least the impacted parts must be replaced.

The investment driver, Asset Health, affects both safety and interruptions performance.

Our proposed programme contains thousands of individual riser interventions that are spread across our asset portfolio. Individual projects take weeks to months to plan and days to weeks to execute. This activity is ongoing in RIIO-1 and will continue beyond RIIO-2.

A3 – 3: Equipment summary

MOB customers are supplied with gas using riser pipe systems. Each MOB will have one or more riser systems. Cadent operates about 108,000 riser pipe systems. Riser pipe systems comprise:

- a buried approach main, which should have a Pipeline Isolation Valve (PIV) to shut off the gas in emergency. The approach main links the main in street with the building
- a building entry (for inside risers only, with isolation valve)
- a riser pipe or pipes that penetrates the building or in the case of outside risers run up the outside of the building. These pipes should have riser isolation valves where they branch enabling sectional isolation
- lateral pipes that connect the riser pipes with customers (laterals should have lateral isolation valves to enable individual customers to be isolated e.g. in response to their not using gas)
- Emergency Control Valves at each meter position

Further detail in section 2, above.

A3 – 4: Problem Statement

Customers are clear that safety, reliability and cost are the central elements of the service we offer. We can quantify these requirements in monetary terms using the NARMs methodology, although this approach has limitations with regards to articulating safety risks.

Assets have a finite life. The actual life of each riser pipe system is influenced by its design, the environmental factors it is exposed to and how it has been maintained, this includes the quality of building maintenance undertaken by the building owner and occupiers. For example a riser in a duct with a cracked drain pipe may become wet when the designer anticipated a dry environment for the pipe. This would promote corrosion and impact its life.

Major intervention is required when riser pipe systems can no longer be safely operated. It can be required following failure or done pro-actively to forestall future failure. Proactive intervention depends on effective asset management that itself relies on a combination of inspection information and monitoring the performance of the riser fleet i.e. looking at failure and maintenance data.

Why do the work

Riser pipes have a finite life. We will be carrying out an extensive programme of fault repairs in RIIO-2 that are described in Appendix 4 however some risers cannot be repaired because they are embedded within a building and cannot be accessed or are not economic to repair because they have large numbers of faults. If such deteriorated risers are not replaced or refurbished proactively they will eventually fail. This impacts customer safety and results in unplanned interruptions because failed risers give rise to escapes of gas within or beneath buildings and have to be isolated to ensure safety. Risers that have failed in this way and which cannot be repaired have to be replaced or refurbished reactively, and while this work is done impacted customers are without gas. Sometimes customers are interrupted for months as plans are created and permissions gained before work can commence.

Therefore, the two drivers for this work are linked. Poor asset health results in unsafe risers and their isolation when they fail impacts customer service. Our plans in relation to our riser asset portfolio are designed to address these issues; refer to the Executive Summary for a discussion of these points and our MOBs plan objectives.

The concentration of total process safety risk in a minority of high scoring buildings means that a targeted intervention programme can offer significant benefit.

Circumstances that might change the need or option

While customers are supplied with gas within MOBs the riser pipes that supply them must be maintained in safe working order and whilst we will be carrying out an extensive programme of fault repair (discussed in Appendix 4) this also requires both proactive and reactive riser investment.

Reactive major interventions result from riser failure, which by its nature can only be influenced by improving the asset base which requires proactive riser work or improved repair performance where a higher proportion of failed risers are repaired as opposed to isolated. We are already assuming that we will be repairing more riser faults and more riser gas escapes in RIIO-2 than we have in RIIO-1. If this improvement does not materialise the level of reactive work will be greater than that we have planned for.

Proactive interventions are intended to forestall reactive work. Our plans deliver the least work required to eliminate high risk scoring risers during a 10 year (RIIO-2 & 3) period. In RIIO-2 this equates to working on 3.4% of our risers. A higher intervention rate has been shown to have a greater NPV because of increased customer and environment benefits resulting from more work in addition to safety benefits however there are customer bill impacts particularly as around 60% of investment will be in London Network. We have proposed the smallest programme possible that delivers our safety obligations.

What are we going to do?

We are going to complete a highly targeted programme replacing and refurbishing risers as described in the options technical summary below. The programme makes use of the fact that process safety risk is concentrated in relatively few assets.

Our RIIO-2 plan pro-actively works on just 3.5% of the total assets in use and yet it removes 23% of total process safety risk.

It is also expected to cut interruptions by 10% by eliminating many of the risers most likely to experience an escape of gas and so be isolated on safety grounds.

What makes the programme difficult to deliver?

As well as the challenges of working at height.

Gaining permissions from building owners and planning authorities.

We are carrying out building work in buildings that we do not own and which is not ‘permitted development’ and so which frequently requires planning permission to be granted. These buildings can have complicated utility access and may also be listed requiring detailed intervention planning.

What are the milestones?

We will deliver substantial volumes (c. 8,900) of riser replacements and refurbishments during the period. Work i.e. numbers of completed interventions and cost will be reported annually in RRP as it is now.

How will we measure success?

The success of the programme will be measured by both customer and asset health measures:

Customer measures

- MOB customer interruption rates (subject to incentives)
- Scale of GSOP1 payments made to interrupted customers
- MOBs specific customer satisfaction score

Asset performance measures

- NARMs
- MOB process safety risk score (discussed in section 8.1 of this appendix)

Our business plan anticipates improvement in all these measures dependent on successful programme delivery.

A3 – 4.1: Narrative real-life examples

Salem House, E9 6LD

Interruption Summary

- MRB 5 storeys
- 1 riser affected
- Supply Disconnected due to PRE 9th April 2019
- Restoration survey completed 10th April 2019
- Building construction confirmation requested from Housing Trust 11th April 2019
- No response from HT for 5 days 16th April
- Restoration plan submitted to HT 16th April 2019
- Unable to commence work due to damaged sewer pipe
- Sewer repair effected 9th May 2019
- Works commence 10th May 2019
- Works complete 11th May 2019

Customer Impact

- 5 customers disconnected
- Full gas usage (heating/hot water/cooking)
- Temporary cooking, heating, shower facilities provided

Interruption Duration

- Total Interruption
- 32 Days/230,400 minutes
- Delay due to environmental issue
- 29 Days/208,800 minutes

Sutcliffe House, Hayes, UB3

Interruption Summary

- HRB 11 storeys
- 2 risers affected
- Supply Disconnected due to PRE 29th April 2019
- Restoration survey completed 30th April 2019
- Restoration plan submitted to Local Authority 30th April 2019
- LA confirm building construction as LPS 1st May 2019
- Structural reports confirming structural integrity 4th June 2019
- Supply restored 25th June 2019
- 24 customers disconnected
- Full gas usage (heating/hot water/cooking)
- Temporary cooking, heating, shower facilities provided to customers

Large Panel System

- Guidance issued by Ministry of Housing & Local Government following building collapse (Ronan Point)
- Building Regulations – Approved Document A (Structure)
- Risk assessment of structural integrity to safeguard against disproportionate collapse
- Evaluation of risk associated with gas supply must be provided

Interruption Duration

- Total Interruption
- 59 Days/2,039,040 minutes
- Delay due to LPS confirmation
- 35 Days/1,209,600 minutes

The Water Gardens, Westminster W2

Interruption Summary

- HRB 17 storeys
- Supply disconnected due to PRE 15th July 2019
- Supply restored to 3 of 4 risers 28th July 2019
- Asbestos removal required to restore gas to remaining 5 properties
- HSE notification required
- Supply fully restored 30th August 2019
- Mixed gas usage including cooking only and individual gas boilers for heating/hot water – 42 customers affected
- Temporary cooking, heating, shower facilities provided to customers
- Additional leisure centre facilities for showering provided (no uptake from residents)

Asbestos

- Asbestos removal required prior to restoration of supply
- HSE require14 day notification period before removal can commence

Interruption Duration

- Total Interruption
- 46 days/844,040 minutes
- Delay due to asbestos removal
- 27 days/194,400 (5 customers affected)

A3 – 4.2: Spend boundary

We will carry out investment in respect of all aspects of riser pipe systems i.e. approach main, entry, riser pipes and laterals.

Riser replacement is defined as replacing an entire riser pipe system.

Riser refurbishment comprises the replacement of some elements e.g. the approach main with improvement and recertification of other elements e.g. repair and recoating of internal riser pipes, such that the riser system is restored to an acceptable condition. The proposed work is described further in the section below titled 'Options technical summary'.

This investment case also covers riser-spend driven by mains-replacement.

A3 – 5. Probability of failure

Around 1% of risers in use experience a escape of gas each year and about 0.5% each year are partly or entirely isolated following a gas escape to ensure public safety. Failure information is reported in the RRP and provides an assured record of failures.

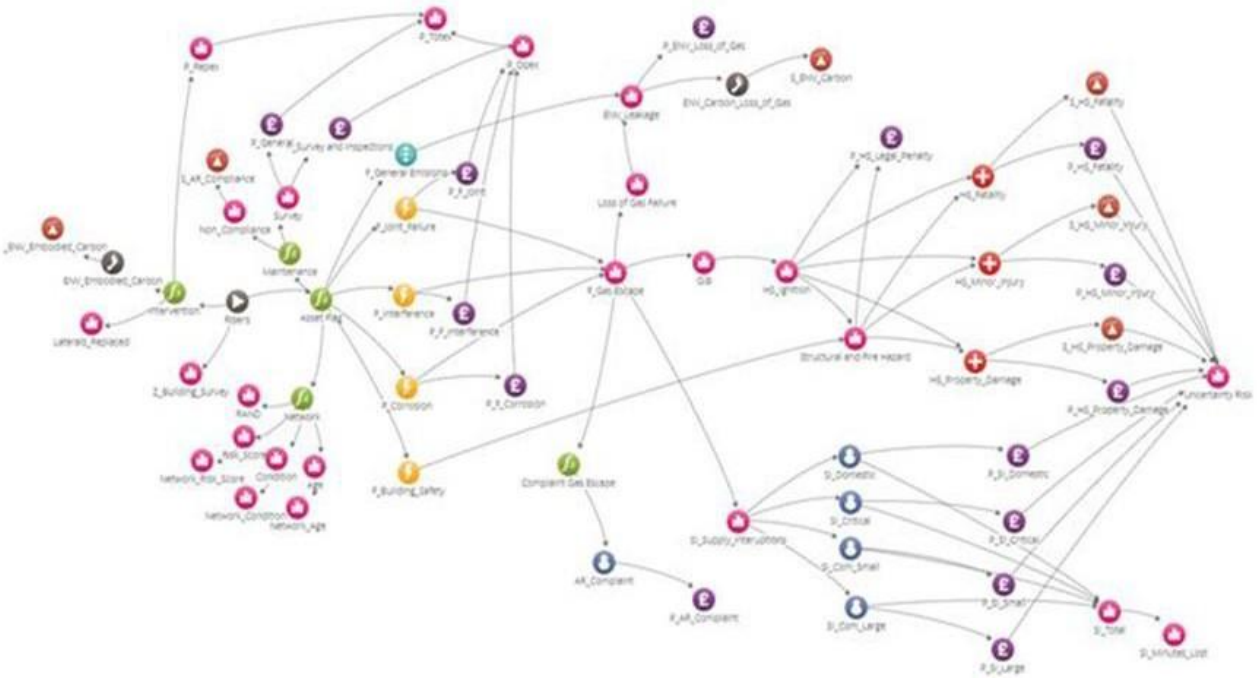
Failure modes

Failure occurs due to asset deterioration through time, corrosion and joint leakage. In addition, failure can be driven by third party action - building fires, negligent building work or vandalism.

We inspect our risers and identify those at risk of failure. For example, by identifying areas of corrosion and by analysing records of past gas escapes. Where faults such as areas of corrosion are identified we will attempt to repair them as described in Appendix 4 below however many riser pipes are inaccessible being located within the structure of buildings, for example under floors, behind kitchen cupboards and in respect of such buildings such maintenance is not possible.

In response to this we carry out reactive and proactive investments to deal with such issues – reactive if the riser has already failed, proactive to forestall future failure. Given the scale of the riser asset any proactive programme can only slowly influence the overall asset portfolio performance (we are planning to work on 3.4% in 5 years) and this means an ongoing reactive investment programme to replace failed and un-repairable risers will be required.

Our assessment of the probability of failure is part of developing our end-to-end analytical framework for these assets, which is shown in the risk map below. The yellow nodes show the failure effects. We do not consider the different detailed asset component failures that could occur to drive these failure effects.



Risk Map within AIMs model

This risk map also shows the consequence of failure, which is explained in the next section.

A3 – 6: Consequence of failure

Please refer to Section 3 for detailed information on the consequences of failure associated with our risers.

Interruptions: The riser customer interruption rate is actually somewhat lower than that for customers served by metallic distribution mains however failures can result in lengthy isolation due to the access issues discussed elsewhere in this document.

Riser failure contributed to a Cadent total of about 126 million customer minutes of interruption in 2018/19.

Safety: In addition it is possible that riser failure could result in an incident similar in scale to the Grenfell fire. Whilst this is a low likelihood outcome it has a high consequence. Gas risers carry a flammable and potentially explosive gas within buildings that can contain hundreds of people, it is possible that an escape could ignite causing a disaster. For this reason it is important that no unnecessary risks are taken and this in turn is a cause of interruption as risers are often isolated on a precautionary basis when there is a building emergency.

A3 – 7: Options considered

There are two aspects to option development specifically the scale of any proactive riser intervention programme and how risers within such a programme should be selected.

These two aspects are linked, to deliver a defined objective requires both riser selection and programme scale to align with the required outcome. However, it is useful to think about the two degrees of freedom because they help understand the choices being made.

- **In respect of scale** – a larger programme delivers greater benefits for riser customers; however, it has to be paid for and delivered. Even if a large programme might provide increased benefits there is a question about its acceptability to current customers who will have to pay for future benefits. In determining the scale of our programme, we combined CBA modelling with information from customer feedback discussed in section 4 above, which informed customer willingness to pay for enhanced outputs.
- **In respect of the riser selection criteria to apply** – again we used customer feedback and cost benefit modelling and have listened to feedback from stakeholders such as the HSE.

In relation to both scale and selection criteria we have tested our proposals against Licence and legislative requirements.

In respect of the reactive and mains replacement related riser work we used current performance information and modelled which mains will be replaced to derive volumes.

Modelling

We used a tailored version of the monetised-risk model, which included the impact of building safety risk and incorporated our actual asset and inspection findings data to evaluate options.

The model produces an analysis of costs and benefits in which all the influential costs, such as the cost of a life or the cost of replacing a riser pipe, are included. It is able to model scenarios to determine which provides the most economical solution. When run the model can choose which pipes it thinks should be replaced, in the real world there will always be an element of reactive work which will disrupt a model derived optimum.

To help analyse alternate options we first created a baseline model that has no proactive work. There is no do nothing option because such an option would leave customers without gas when there is a gas emergency within a building and repairs are not possible.

Alternate options considered

In considering options we created alternatives that matched back to the strategic objectives described in the Executive Summary, which are:

- Never leave customers vulnerable without gas
- Mitigate the impact of interruption and
- Keep our customers safe

Mitigation of the impact of interruption is not influenced by alternative asset intervention strategies, which impact the performance of assets not how customers are treated after a gas emergency has occurred. As such modelling has focused on asset solutions.

In response to our strategic objectives we evaluated options that focussed on improving safety and interruptions performance and we also examined an option that maximised benefits without constraining the overall amount being invested.

Ofgem and GDNs have developed the NOMSs methodology that models GDN risk in terms of Monetised Risk. To provide another comparator we modelled an option that holds Monetised Risk flat but which does not deliver a particular objective.

In total we have considered 5 options, set out below:

- **Baseline:** Reactive and mains replacement investment only
- **Option 1:** Focused investment to eliminate the top 10% of process risk scoring risers.
- **Option 2**: Focused investment to deliver a 20% step change in network escape reports
- **Option 3:** Unconstrained programme that delivers the highest NPV, known as the WLB (Whole Life Benefit)
- **Option 4:** The least investment that holds Monetised Risk at current levels (as a comparator to show amount that would be required to deliver this objective given no other considerations), The results of this analysis are weak because the model does not fully capture process safety risks and a 'hold risk flat' scenario allows trading of safety risks which is unacceptable.

These options cover both the scale and selection criteria points in relation to delivery against our objectives as outlined in the options considerations section above. They provide the information required to determine what our investment priorities should be, inform the scale of appropriate investment and predict likely benefit levels.

Riser work associated with mains replacement: Common to all options we have a volume of riser-interventions driven from our mains replacement programme. This work is needed because existing riser pipe systems, which may be in good condition, may not be able to be simply transferred onto a replacement main e.g. they may be embedded deep in a building making a transfer very difficult. In this case if we do not do riser work then either the main cannot be replaced or the supply of gas to the customers would have to be disconnected permanently.

This work has to be completed to facilitate the HSE mandated iron mains risk reduction programme (IMRRP) and does not influence the option choice.

This activity is being shown within the risers' part of our business plan but is not required to deliver riser deliverables and is not optimised to deliver such outputs. We have however considered the fact that some mains that are due to be replaced have risers that would be also be replaced because of the risk that they pose and ensured that there is no double counting in this plan of either work delivery or cost or benefits.

Solution options:

In the first instance we consider carrying out repairs to address issues identified with a riser pipe system however when this is not possible major intervention is required.

Once it has been determined that a riser pipe system requires major intervention, our asset manager must decide the least-whole life cost and most practical way to carry out the work, taking into account the likely impact on stakeholders who may be able to affect the delivery of the option selected. The choice of intervention is affected by a combination of riser and building design and the nature and scale of the issue(s) being addressed. Our order of preference for intervention is shown below.

Possible solution	Rationale for choosing solution
Refurbish (including part replacement) of riser pipe or related asset	Where the fault is severe, or it impacts on a large section of the riser-pipe system, more comprehensive replacement or refurbishment needs to be considered. If the technology is appropriate to the situation, we refurbish the riser pipe (e.g. by treating corrosion and recoating the pipe or using an internal treatment process to seal joints and improve the seal of the pipes). If there is sufficient access, we will consider carrying out part replacement – just replacing those sections of pipe that are in deteriorated condition. Part replacement is often combined with repairs and refurbishment to produce a complete riser pipe system that has had all its significant issues resolved. We are trying to increase the proportion of pipes that we refurbish; however, the majority cannot be dealt with in this way due to access issues.
Replace riser pipe system	If repair or refurbishment (including part replacement) are not possible we consider entire replacement of the riser-pipe system. This is the most expensive option in the short term particularly for the largest high-rise buildings.
Decommission the gas-supply	In very extreme circumstances, where no compliant alternative riser-pipe route is available, or where the building is unsafe to retain a supply of gas, we consider decommissioning the gas-supply. This is a last-resort and is not low cost when a high proportion of apartments within a block use gas. This option will also involve removing redundant assets from the block.

Solution-options considered for each riser-pipe intervention

For the purpose of evaluating options and calculating unit costs, we have assumed 70% replacement and 30% refurbishment. This is aligned with performance in the last 4 years. A few disconnections are completed each year; however, these are a none material and not included in our cost analysis. It should be noted that the unit cost of disconnection where all the apartments within a building use gas and we have to compensate customers to secure agreement to forgo their capacity rights is not much different from the cost of refurbishing a riser. This is why the separate Energy Exchange Programme, which is designed to deliver long term efficiency, is targeting low-use premises and separately trying to remove these on a proactive basis.

The unit costs calculated for each riser-pipe intervention and the efficiencies applied are discussed in Section A3 – 7.3: Options Cost summary table.

A3 – 7.1: Baseline option: Reactive intervention

In respect of this option we would deliver reactive work i.e. replacing risers that have failed in service and which cannot be repaired.

This option has been provided as a baseline against which the other options have been evaluated. It is not being proposed because whilst it is least investment cost in the short term it would result in our energy supply networks becoming progressively less safe and less reliable.

A3 – 7.2: Option 1: Process safety risk

This option removes process safety risk by intervening in respect of the top 10% of scoring risers during the RIIO-2 and 3 periods. It removes 23% of such risk in RIIO-2.

Risers score highly if they are in relatively poor condition and are located in areas where an incident might occur if there were to be an escape of gas. As a result, targeted pipes will be within or underneath building structures. We have a good understanding of these risks from our refined inspection programme and a robust scoring system developed with DNVGL.

Focused investment to eliminate the top 10% of process risk scoring risers. This should eliminate all assets now within 'high' relative process safety risk category + reactive and mains replacement work. Due to targeting investment on the highest process safety risk assets the option removes around 40% of the overall HRB and 14% of the MRB process safety risk in RIIO-2 giving an overall MOBs process safety score improvement of 23%. It is the most effective possible option for mitigating process safety related risk.

This option also delivers other benefits such as customer interruption benefits, which we have as a 2% per year cumulative impact as old risers are progressively replaced. This is included in our business plan interruptions forecasts.

A3 – 7.3: Option 2: Customer interruptions

Focused investment to deliver a 20% step change in network escape reports and reactive and mains replacement work.

This option seeks to avoid interruptions through investment to improve the condition of assets. We modelled a 20% improvement in network escapes (and so interruptions) to establish the cost effectiveness of making a significant investment to achieve a meaningful change in performance in this area via capex.

This is a considerable programme and would impact customer bills, particularly in London where it would represent an investment of about *XXXX* per connected customer.

There is a delivery issue because a programme of such a size is much greater than anything we have previously delivered, and this is likely to feed through to unit costs (an effect we have not modelled). In practice the delivery cost is likely to be greater than estimated as a result of this factor.

A3 – 7.4: Option 3: Maximum whole life benefit

Unconstrained programme that delivers the highest NPV, known as the WLB (Whole Life Benefit) option and reactive and mains replacement work

This option uses the power of predictive analytics and creates an integrated investment proposal that should achieve the best NPV if the overall scale of the programme is not constrained. It identifies all riser pipe systems which would have a positive modelled present value. The model is trading risks as they are quantified in the model. Although this may give an economically optimum solution, it is limited by the accuracy of the model (particularly around safety issues) and allows a trade of safety performance against other goods such as environmental benefits or reduced interruptions. Customers may not in reality accept such trades.

A3 – 7.5: Option 4: Hold monetised risk flat

The least investment that holds Monetised Risk at current levels. This option is run as a comparator to show amount that would be required to deliver this objective given no other considerations. The results of this analysis are weak because the model does not fully capture process safety risks and a 'hold risk flat' scenario allows trading of safety risks which is unacceptable. This option predicts the minimum amount of proactive work, that is to say selective targeted investment that delivers flat Monetised Risk without including in the analysis process investment that is reactive in nature.

A3 – 7.6: Options Technical Summary Table

Option	Option 0	Option 1	Option 2	Option 3	Option 4
Description	**No targeted proactive investment**	**Process safety risk focus**	**Customer interruptions performance focus**	**Maximise whole life benefit**	**Hold monetised risk flat**
First spend year	21/22	21/22	21/22	21/22	21/22
Final spend year	25/26	25/26	25/26	25/26	25/26
Volumes of riser interventions	No proactive 3,510 reactive	3,750 proactive 3,510 reactive 1,650 mains replacement	13,200 proactive 3,510 reactive 1,650 mains replacement	9,170 proactive 3,510 reactive 1,650 mains replacement	4,830 proactive No reactive within base option 1,650 mains replacement
Types of interventions	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment
Equipment design life	45 years	45 years	45 years	45 years	45 years
Total cost in RIIO-2	Redacted due to commercial sensitivity				

Options Technical Summary Table: Riser interventions

A3 – 7.7: Options Cost Summary Table

Year	Option 0	Option 1	Option 2	Option 3	Option 4
Description	No targeted proactive investment	Process safety risk focus	Customer interruptions performance focus	Maximise whole life benefit	Hold monetised risk flat
21/22					
22/23					
23/24					
24/25					
25/26					
Total					

Options Cost Summary Table

Deriving our Unit Costs for Risers

We have derived unit costs for both major and minor riser-pipe interventions based on RIIO-2 historic costs for riser-pipe remediation.

We have used the average cost of work delivered in the last three years to estimate the current cost of our carrying out intervention work and assumed that the ratio of refurbishment to replacement activity continues at a 30:70 ratio. In addition, we have applied a cost efficiency assumption in RIIO-2 that matches our productivity assumption we are applying to the delivery of our iron mains programme.

The small numbers of disconnected riser pipes carried out because supply restoration is not lawful or physically possible have not been included in this analysis because very few disconnections have taken place for these reasons and disconnections undertaken on economic grounds (the majority of disconnections) are included in Energy Exchange.

Using our current actual costs provides a good basis to estimate future costs, and as a result of this we have predicted a +/- 5% cost accuracy factor. Clearly macro circumstances e.g. the state of the economy may change and impact this prediction however factors like this are substantially outside of our control and not particular to working on MOBs and so not included within this assessment.

Major Riser Interventions

Our unit price assumptions are shown in the following table (in 2018/19 cost base). The figures shown for 2020/21 have been derived from current performance. They are based on contract rates. We have assumed that RIIO-2 contract rates will be similar to existing rates however for plan purposes we have applied efficiency assumptions during the RIIO-2 period. This saves around *XXXX*.

RIIO-2 unit prices, major intervention cost per riser						
Building type	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
HRB		Redacted due to commercial sensitivity				
MRB						

Major Riser interventions (cost per riser) (18/19 cost base)

A3 – 8: Business Case Outline and Discussion

A3 – 8.1: Key Business Case Drivers Description

We assessed the options by comparing their costs and benefits in our CBA.

We have also analysed the safety benefits produced by the different options.

The scatter chart provides a visual representation of the benefit of replacing our risers. It shows the process safety risk of each riser pipe plotted against their Monetised Risk. It will be useful to refer back to this chart as each option is discussed.

Note: the I and E category (in the key above) relates to riser pipes that are partly internal, partly external.

Option descriptions with their investment and benefit summaries are provided below with option summary and option comparison tables at the end of this section.

Option 0 - No targeted investment

In respect of this option we would deliver reactive work i.e. replacing risers that have failed in service and which cannot be repaired, and risers that have to be worked on to enable mains replacement. This option has no proactive intervention that targets riser risks.

With no targeted investment programme to proactively enhance the asset portfolio this option will result in our assets deteriorating over time.

This option has been provided as a baseline against which the other options have been evaluated. It is not being proposed because whilst it is least investment cost in the short term it would result in our energy supply networks becoming progressively less safe and less reliable.

Referring to the scatter plot, this option intervenes in respect of risers that have already failed but many of these will be external pipes that have corroded because of their exposure to weather, they are lower risk and have a low MR (Monetised Risk) benefit (they are shown in blue on the chart and are in the bottom left – least beneficial – quadrant).

Option 1 - Focussed investment to deliver reduction in process safety related risk

This option removes process safety risk by intervening in respect of the top 10% of scoring risers during the RIIO-2 and 3 periods. It removes 23% of such risk in RIIO-2. Risers score highly if they are in relatively poor condition and are located in areas where an incident might occur if there were to be an escape of gas. As a result, targeted pipes are likely to be within or underneath building structures.

Referring to the scatter chart above the risers targeted by this option are to the right of the diagram, they are to the right of the Asset Risk Threshold line. Internal risers (shown in orange on the chart) predominate in this region as these are far higher risk of causing Gas in Buildings than external pipes. This means that some lower MR benefit risers (bottom right quadrant) receive intervention in order to deliver the safety objective.

Due to targeting investment on the highest process safety risk assets the option removes around 40% of the overall HRB and 14% of the MRB process safety risk in RIIO-2 giving an overall MOBs process safety score improvement of 23%. It is the most effective option for mitigating process safety related risk.

We have discussed this option with HSE and they are satisfied that it meets their expectations.

This option also delivers other benefits such as customer interruption benefits, which we have as a 2% per year cumulative impact as old risers are progressively replaced. This is included in our business plan interruptions forecasts.

The overall cost of this option is *XXXX* in RIIO-2 of which about *XXXX* is for reactive *XXXX* and mains replacement *XXXX* work and *XXXX* for the pro-active programme. It has an NPV vs the baseline (option 0) of *XXXX*.

We have chosen this option because it is the least cost option that delivers our safety obligations whilst having a positive NPV and delivering customer benefits.

Option 2 - Focussed investment to achieve a 20% reduction in network escapes and so interruption numbers

This option seeks to avoid interruptions through investment to improve the condition of assets. We modelled a 20% improvement in network escapes (and so interruptions) to establish the cost effectiveness of making a significant investment to achieve a meaningful change in performance in this area.

This option focusses investment on relatively poor condition risers that are more likely to experience an escape of gas. However less than 1 in 200 risers experience an interruption event each year, and even with targeted intervention based on records of asset condition a large amount of money would have to be invested to deliver a significant output response. This is because it is hard to predict to a high degree of certainty which risers will fail in the near future requiring a large programme to deliver the proscribed 20% improvement benefit. The probability of a particular riser giving rise to an interruption can be predicted based

upon operating history and circumstances however this is not the same thing as predicting which riser will experience an interruption during a particular period of time. This difficulty in translating risk factors to adverse outcome in respect of specific assets in a relatively short timescale such as a 5 year price control period increases the amount of intervention required and so impacts the cost.

Were we to wish to reduce the number of interruptions by 20% through replacing and refurbishing risers we would have to do a significant number (>15,000) of proactive interventions. The estimated investment cost would be *XXXX* for proactive work, including mains replacement.

Many poor condition risers included in this programme are external, exposed to the weather and prone to corrosion and damage. Whilst working on these pipes will reduce interruptions and benefit the environment due to fewer escapes in the future the work will not significantly influence public safety. The reason for this is that external risers pose low process safety risk because any escape of gas from them disperses into the atmosphere. As a result the option is less cost effective at removing process safety risk than option 1. If the scatter chart is referred to these external risers are shown in blue and are situated to the left of the chart.

The option has an NPV vs the baseline of about *XXXX* so, ignoring the safety concerns, it would potentially be good value for customers. The value is generated because both the customer service and environmental benefits of this option are significant.

This is a considerable programme and would impact customer bills, particularly in London where it would represent an investment of about *XXXX* per connected customer.

There is a delivery issue because a programme of such a size is much greater than anything we have previously delivered, and this is likely to feed through to unit costs (an effect we have not modelled). In practice the delivery cost is likely to be greater than estimated as a result of this factor.

Due to the option leaving many high process safety risk assets in operation whilst having significant deliverability and customer bill impacts we have discounted this option.

Option 3 - Whole life benefit option

This option uses the power of predictive analytics and creates an integrated investment proposal that should achieve the best NPV if the overall scale of the programme is not constrained. It identifies all riser pipe systems which would have a positive modelled present value. When referring to the scatter diagram above the risers tackled by proactive investment are towards the top of the diagram – they are above the MR threshold line. This results in above process safety risk threshold risers that are below the MR threshold line (bottom right quadrant on the chart) being excluded from the programme. The consequence of this is that the majority of customers who are currently exposed to high individual process safety risk will be left in that condition if option 3 were to be selected. The model is trading risks as they are quantified in the model.

We have determined that to deliver the highest possible total NPV we would deliver an optimised programme totalling *XXXX* in RIIO-2. Were we to do this we could deliver a total NPV vs the baseline of around *XXXX*.

A factor that contributes to the NPV of this and other options – particularly options with large proactive workloads – is the impact of environmental improvement. Whilst these issues are important to our customers they would not except us to trade process safety requirements for environmental benefits.

Due to a combination of the fact that this option leaves many high process safety risk assets in use we have discounted this option despite it having the highest NPV.

Option 4 - Investing to hold the value of monetised risk flat

This option predicts the minimum amount of proactive work, that is to say selective targeted investment that delivers flat Monetised Risk without including in the analysis process investment that is reactive in nature.

The MR model does not adequately model investment to physically restore lost supplies by building new assets to reconnect existing customers who have no gas i.e. reactive work. Modelling the amount of proactive investment to hold the level of MR flat therefore ignores the requirement to invest for supply restoration. This having been said it is possible to achieve flat Monetised Risk by investing *XXXX* in a proactive programme with a further *XXXX* of mains replacement facilitation work, that contributes very little to riser risk management. This gives an option cost of *XXXX*, that does not include investment in support of supply restoration work. When considered without reactive work it gives an NPV of *XXXX*. In most respects

the proactive part of this programme is similar to option 3, with investment targeted at risers with the highest MR benefit, but is scale constrained.

The purpose of the option is to show the amount of funding that would be required to achieve this objective without confusing the analysis with investment that is being required as a result of reactive work.

Including the required reactive work could add another *XXXX* of investment cost to the total bringing the total sum invested to about *XXXX*.

In the light of the fact that as stated this option cannot on its own be delivered because it does not include restoring lost supplies and the fact that reduced emphasis on process safety improvements results in our not delivering our safety obligations we have discounted this option.

Were, hypothetically, we to pursue such an option we would be failing to deliver on the objectives that customers tell us that they value most highly (safety and network reliability). For this reason, this option is not aligned with what customers have told us that they want or with our stated objectives of improving the services that we offer.

Option summary table

Option	Option 0	Option 1	Option 2	Option 3	Option 4
Description	No targeted proactive investment	Process safety risk focus	Customer interruptions performance focus	Maximise whole life benefit no constraint to programme scale	Hold monetised risk flat
Volumes of riser interventions	No proactive 3,510 reactive	3,750 proactive 3,510 reactive 1,650 mains replacement	13,200 proactive 3,510 reactive 1,650 mains replacement	9,170 proactive 3,510 reactive 1,650 mains replacement	4,830 proactive No reactive within base option 1,650 mains replacement
Types of interventions	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment
Equipment design life	45 years	45 years	45 years	45 years	45 years
Total cost in RIIO-2		Redacted due to commercial sensitivity			

Notes:

The value of 3,510 reactive and,1,650 mains replacement related jobs is true (that is to say it avoids double counting) in the model for the chosen option. These values have been applied to alternate options. In practice options with higher proactive spends will have slightly fewer of these jobs and lower spend options slightly more. This is because increasing the proportion of proactive jobs delivered will impact the number of reactive and mains replacement jobs that subsequently need to be delivered. This is because the progressive improvement in the state of the overall asset base produced by proactive work reduces the need for these other jobs. The model used to compare options was not sophisticated enough to account for this effect in period, which is not large enough to impact option choice.

We assume that the calculated unit costs are applicable across the range of interventions considered by the model i.e. no scaling of costs has been applied

Design life has been given as 45 years, this is the regulatory asset life and has been used in analysis, in practice risers are expected to have a longer life than this.

Option comparison table

Option	Option 0	Option 1	Option 2	Option 3	Option 4
Description	Reactive & mains associated investment only	Process safety risk focus	Customer interruptions performance focus	Maximise whole life benefit no investment scale constraint	Hold monetised risk flat
Customer service output delivery	**UNSATISFACTORY** With no proactive programme our assets deteriorate over time	**SATISFACTORY** Delivers a 10% improvement in interruption performance in period	**GOOD** Higher bill Delivers a 20% improvement in interuptions performance in period	**GOOD** Delivers significant customer benefits c. 15% improvement in interuptions	**UNSATISFACTORY** With no reactive work included in option lost supplies are not restored. Including this work increases the option cost
Safety output delivery	**UNSATISFACTORY** Reactive only investment no active risk control. Risk increasing	**GOOD** Delivers required safety output. Option eliminates all 'high' risk risers in RIIO2 + RIIO-3 taking 23% of total risk out in RIIO-2 whilst pro-actively working on just 3.5% of assets in use.	**RISK EXPOSURE ISSUE** Targeting escapes and not looking at consequence risk factors means majority of high process safety risk assets are not included.	**RISK EXPOSURE ISSUE** Targeting heavily influenced by environment factors. Option excludes majority of high process risk assets which continue to expose customers to risk	**RISK EXPOSURE ISSUE** Similar to option 3, but relatively smaller programme so larger residual safety risk.
NPV (relative to option 0)		Redacted due to commercial sensitivity			
NPV to investment cost ratio					
Comments	No proactive work least short term cost but not good value in the long run	Least cost delivery of required safety improvement and also delivers 10% customer service improvement	Very large programme to achieve required level of customer output but not focused on safety	Large programme with greatest overall calculated benefits but which leaves significant numbers of customers exposed to high risk assets.	Not deliverable unless reactive work included which increases cost and adversly impacts the NPV
Total cost in RIIO-2 (included so no need to refer back to table on previous page)		Redacted due to commercial sensitivity			

Preferred option – option 1 – why chosen

We have adopted the programme that delivers the best process safety benefit relative to the amount invested, and which also delivers improved network reliability. It is the only option, which if continued to the end of RIIO-3 would remove all high process safety risk assets. It includes *XXXX* of proactive work during the period to control the process safety related risks and contribute to improving interruptions performance, and *XXXX* to restore lost supplies and enable iron mains to be replaced.

We have rejected proposals that would generate the highest NPV or greater levels of customer service benefits because whilst they deliver significant modelled benefits they also require high levels of investment and we do not think the benefits are justified by higher customer bills. In addition these options do not deliver the safest network. Customers have supported this stance. When we tested willingness to pay they told us that they were prepared to pay a little bit (of the order of a few pounds a year) extra for a better service but did not value increased outputs highly enough to pay significant sums for them.

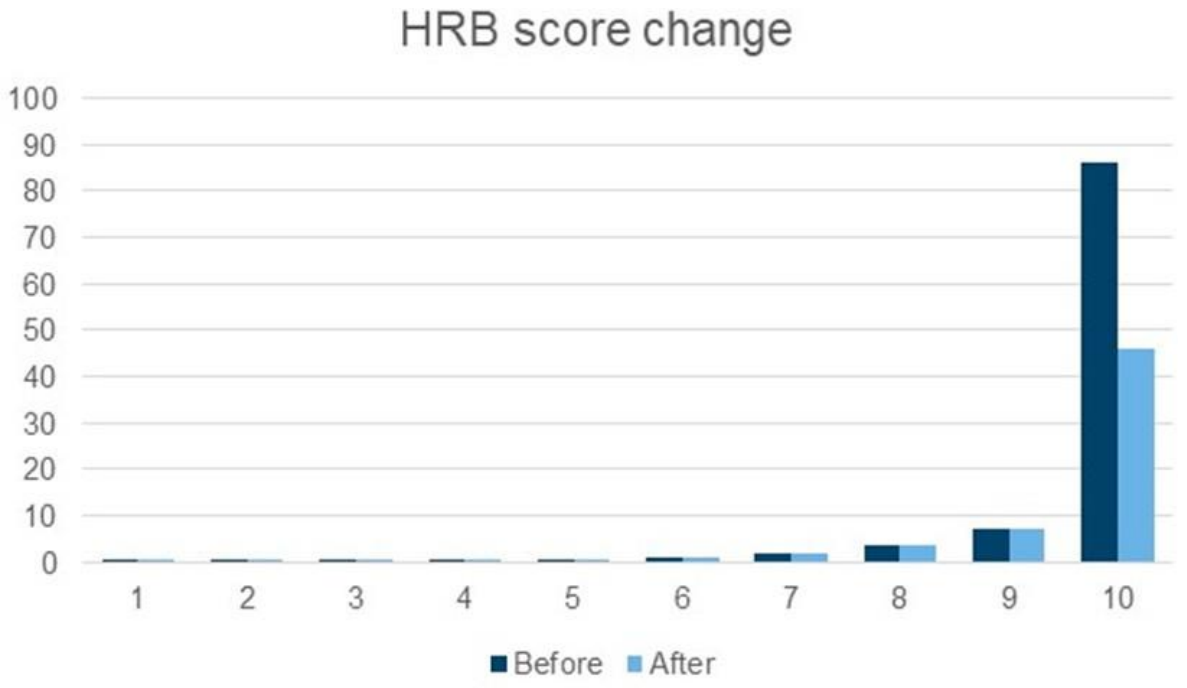
The programme that just holds Monetised Risk flat has to be rejected even though it is efficient in the employment of capital because on its own it does not deliver supply restoration work. If this work is included at a cost of *XXXX* the option would be more expensive than the chosen option with lower process safety risk benefit. Safety and reliability (supply restoration) were considerations that customers say are important to them.

Preferred option: Delivering for customers

We expect that our proposed programme will reduce HRB pipeline-integrity risk by 40% and MRB pipeline-integrity risk by 14% during RIIO-2.

In addition, our proposed programme is expected to reduce the number of unplanned interruptions by 10% during RIIO-2 relative to not carrying out proactive work.

The charts below show the reduction in pipeline integrity risk. They show our assets stratified by process safety risk with the amount of risk posed by each strata represented by the height of each bar. Our plans target intervention at the top decile, that is to say the top 10% of risk scoring buildings.



The charts show the projected risk distributions before and after the RIIO-2 proactive interventions are completed. Our plans address the risk posed by about 6.5% of the top 10% of high-rise building riser pipe systems and 3.5% of the top 10% of medium-rise building riser pipes during the period.

A3 – 8.2: Business Case Summary

We have assessed 5 options, including a baseline and 4 further options for the remediation of riser pipes.

These are summarised in the following table, together with the NPV results.

Option	Option 0	Option 1	Option 2	Option 3	Option 4
Description	No targeted proactive investment	Process safety risk focus	Customer interruptions performance focus	Maximise whole life benefit no constraint to programme scale	Hold monetised risk flat
Volumes of riser interventions	No proactive 3,510 reactive	3,750 proactive 3,510 reactive 1,650 mains replacement	13,200 proactive 3,510 reactive 1,650 mains replacement	9,170 proactive 3,510 reactive 1,650 mains replacement	4,830 proactive No reactive within base option 1,650 mains replacement
Types of interventions	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment	Riser replacement and refurbishment
Customer service output delivery	**UNSATISFACTORY** With no proactive programme our assets deteriorate over time	**SATISFACTORY** Delivers a 10% improvement in interruption performance in period	**GOOD** Higher bill Delivers a 20% improvement in performance in period	**GOOD** Higher bill Delivers significant customer benefits c. 15% improvement in interuptions	**UNSATISFACTORY** With no reactive work included in option lost supplies are not restored. Including this work increases the option cost
Safety output delivery	**UNSATISFACTORY** Reactive only investment no active risk control. Risk increasing	**GOOD** Delivers required safety output. Option eliminates all 'high' risk risers in RIIO2 + RIIO-3 taking 23% of total risk out in RIIO-2 whilst pro-actively working on just 3.5% of assets in use.	**RISK EXPOSURE ISSUE** Targeting escapes and not looking at consequence risk factors means majority of high process safety risk assets are not included.	**RISK EXPOSURE ISSUE** Targeting heavily influenced by environment factors. Option excludes majority of high process risk assets which continue to expose customers to risk	**RISK EXPOSURE ISSUE** Similar to option 3, but relatively smaller programme so larger residual safety risk.
NPV (relative to option 0)		Redacted due to commercial sensitivity			
NPV to investment cost ratio					
Comments	No proactive work least short term cost but not good value in the long run	Least cost delivery of required safety improvement and also delivers 10% customer service improvement	Very large programme to achieve required level of customer output but not focused on safety	Large programme with greatest overall calculated benefits but which leaves significant numbers of customers exposed to high risk assets.	Not deliverable unless reactive work included which increases cost and adversly impacts the NPV
Total cost in RIIO-2 (included so no need to refer back to table on previous page)		Redacted due to commercial sensitivity			

Business Case Summary Table

A3 – 9: Preferred Option Scope and Project Plan

A3 - 9.1: Preferred Option

Our preferred option is Option 1.

The table below shows the anticipated workloads based on the methodology described above. The phasing of plan delivery is shown in section 7.2.

Network	Proactive		Reactive		Mains replacement		Totals		
	MRB	HRB	MRB	HRB	MRB	HRB	MRB	HRB	Grand totals
EoE	600	68	200	35	205	20	1,005	123	**1,128**
Lon	1,125	548	1,670	735	630	125	3,425	1,408	**4,833**
NW	701	94	325	20	380	10	1,406	124	**1,530**
WM	431	182	480	45	265	15	1,176	242	**1,418**
Total	**2,857**	**892**	**2,675**	**835**	**1,480**	**170**	**7,012**	**1,897**	**8,908**

Numbers of Riser interventions: Chosen Option (Option 1)

A3 – 9.2: Asset Health Spend Profile

We have based the costs shown in the table below on our current costs and future efficiency assumptions (values *XXXX* in 2018/19 prices):

Network	Proactive		Reactive		Mains replacement		Totals		
	MRB	HRB	MRB	HRB	MRB	HRB	MRB	HRB	Grand totals
EoE									
Lon			Redacted due to commercial sensitivity						
NW									
WM									
Total									

Asset Spend Profile: Chosen Option (Option 1)

Phasing of expenditure is shown in section 7.1, costs shown in the business plan data table do not break out cost or work volumes between refurbishment and replacement – a 30:70 ratio between activity types has

been assumed based on RIIO-1 actual performance as reported in RRP; unit costs used also derived from RIIO-1 actuals as described in the Executive Summary and with our within RIIO-2 period REPEX efficiency assumption applied.

A3 - 9.3: Investment risk discussion

The risks identified below relate to the chosen option.

Risk number	Risk Description	Impact	Likelihood	Mitigation
09.04.01	**Cost / Resourcing** There is a risk that we cannot obtain resources and / or that we have to pay more to obtain required resources. These potential issues are linked because resource requirement is linked to work load (fixed for any particular option) and cost is linked to the numbers of personnel required.	If labour costs rise or expected productivity gains are not delivered this will potentially impact output levels and / or the cost of delivery.	Low	We are currently contracting for resources required to ensure that as effectively as possible we will develop the resource that we need. Bringing planning resource into Cadent and integrating it with the MOBs team, and improving the contract management structure should enable improved focus in relation to the delivery of this work.
09.04.02	**Future productivity assumption** There is a risk that the stretching efficiency targets we have included in the plan may not be deliverable (unit costs increase)	Outturn costs are not met increasing overall programme costs.	Low	Established market place - ability to manage the known commodity market
09.04.03	**Increased external constraints** There is a risk that obtaining consents proves to be more difficult than expected slowing work output.	Reduced amounts of proactive work delivered and no or reduced improvement in customer restore time after interruption due to delayed reactive work.	Low	Our new MOBs management team are tasked with improving engagement and the production of building plans that seek to overcome these issues.
09.04.04	**Weather / climate impact** There is a risk to output if weather is unusually bad because where work on external risers is required we have to 'work at height' and this requires scaffolding or hydralic access platforms – impacted by high wind speeds and freezing conditions.	Reduced productivity	Low	Controlled forecasting and maintenance of flexibility to react to unforeseen events.
09.04.05	**Ensure work delivers stated benefits** There is a risk that volumes of work are delivered but that asset management benefits are not forthcoming particularly as regards improved interruption performance. This risk exists because to deliver such benefit we must anticipate the assets that are most likely to fail, however failure probability of an asset is on average about 0.5% pa. and we are only proactively working on 0.7% of our assets pa.	We are predicting a 10% improvement in interruptions performance in 5 years as a result of investment, however this targeted investment only impacts 3.4% of assets in 5 years requiring the targetting to be 3x more effective than random selection. Failure to achieve this level of predictive power will result in failure to achive the improvement in interruptions output intended. There is a low risk that we will fail to deliver the intended process safey improvement because provided workload volumes are	Low	The process safety risk scoring system targets risers that are in relatively poor condition that are also internal risers. This means that of the internal risers in operation we will be working on ones more likely to experience an escape of gas, however external risers that are subject to more corrosion than internal ones will not be targetted because they have a very low incident probability. It is expected that improved escape repair techniques can be applied to these external and so potentially accessible pipes reducing the impact of our not

Risk number	Risk Description	Impact	Likelihood	Mitigation
		delivered and we select work from the to decile (top 10%) of process safety risk scoring assets the gas pipe integrity risk will removed.		working on them as per our choosen option.
09.04.06	**Legislative change** There is a risk that legislative change will impact the delivery of our work.	Potential increase in the amount of consultation and information exchange required and require us to align our plans with the safety management processes operated by the building owner. The potential impact is more engagement and slower delivery	Low	We have established a MOBs management team to address these issues. We have also included an Uncertainty Mechanism within our plans that enables us to obtain appropriate additional resources depending on the changes introduced.
	3rd party permissions There is a significant risk of delay because of the extensive permissions required from building owners and the need for planning permission, to allow Cadent to undertake the work.	Significant delay and increases in delivery costs	Med / High	Carry out early consultation with all 3rd parties and select a solution that minimises the need for permissions (whereever feasible)

Risks from delivering riser-pipe interventions

A3 – 10: Regulatory Treatment

See section 9 Fair Regulatory Treatment

The investment in this appendix is covered in BPDT 4.08_Repex_MOBs.

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Appendix 4. Fault repairs to ensure compliance

Investment need

Our gas riser systems, whether they are operational or decommissioned, affect the building configuration and thus the safety of the occupants. A decommissioned pipe that remains within the building structure continues to penetrate fire compartments, and may carry stray currents etc. To ensure that buildings remain safe our assets must be compliant with the various regulations and standards that apply.

Many individual regulations apply, covering different areas and ranging from electrical regulations dealing with continuity bonding through building regulations covering fire compartmentalisation to the common law which may be applied to matters such as trips within private land.

A list of the faults we will be working on has been provided in tabula form at the end of this section.

In the future, we are expecting additional obligations to be imposed on building owners. We expect that they will be obliged to have a safety case for the buildings that they own. A duty holder will have to be appointed who will have legal responsibility for building safety management and parties with an interest in the building will be obliged to cooperate with them. The new obligations are yet to be determined, so the implications are uncertain. This is discussed in section 9 below and in Chapter 10, which deals with uncertainty.

Options Development and Analysis

Our investment case for addressing identified faults is based on our detailed MOB inspection results.

To calculate the volume of faults that will be identified by the end of RIIO-2 we have:

- Determined by reference to when inspections are next due the numbers of inspections that we will carry out in the period to 31/3/2026
- Used current MOB inspection records to determine the frequency of detecting each type of fault when an inspection occurs
- Thereby determined the number of faults of each type that we expect to identify
- We included an estimate of the number of faults that will be carried forwards from the RIIO-1 period

In considering our work volumes we looked at the following options to resolve the identified faults:

- Minimal work: in this option we continue as we have done in RIIO-1 only working on some types of HRB faults. This is least cost but leaves our assets not compliant with legislation.
- Recover located faults over the RIIO-2 period: in this option we continue our scheduled inspections and recover the faults over the RIIO-2 period. This is the least cost option that can have any legal defence. In the event for example that a person is injured by an asset we have already identified as faulty we would argue that we have a plan to resolve our outstanding faults over the period and point to the low risk posed by each individual fault and the large number that we have to deliver as a defence to our not having already repaired the one that caused the problem.
- Complete fault repair at aspirational fault outstanding time: the HSE have said that they expect faults to be fixed in days to weeks of being identified the time based on the risk that they pose however this is not yet a mandatory requirement. Were we to adopt this for outstanding faults we would require higher resource levels, and this would impact costs and so customer bills.
- Accelerated identification and repair where inspections due in RIIO-3 are brought forwards to RIIO-2. Our inspection plan will complete improved inspections of about 70% of buildings by the end of RIIO-2. The other 30% were last inspected before we improved our processes to include the location of a wider range of fault types. These buildings will not be due for inspection again until RIIO-3. We could bring forwards the inspection of the 30% and thereby accelerate the identification of any faults that are associated with such buildings.

The criteria we considered these options against were:

- Legislative compliance
- Deliverability
- Impact of the cost of the work on customers

After consideration we decided to recover located faults during the five-year RIIO-2 period without attempting to accelerate the work or commit to deliver particular faults in prescriptive times. In other words, we will carry out the lowest rate programme commensurate with the control of known faults by April 2026. It is our aspiration to move to fault resolution within prescriptive timescales in RIIO-3 once the legacy issue have been recovered. We have confidence that this is the best option for customers. Not delivering this work would not be compliant with applicable legislation and higher output would add to costs and may not be deliverable. We have not proposed an acceleration of the inspection programme because inspected buildings are not re-inspected for ten years in most cases and we do not believe that accelerating the inspection of impacted buildings is justified by the risks posed.

Therefore, our proposals are to progressively resolve identified existent faults during the RIIO-2 period so that the carry over to RIIO-3 is no more than the number of faults that we expect to find during a six-month period of inspections. This enables faults that are located late in the period to be carried forwards, avoiding inefficient delivery in the last few months. The effect of this delivery plan is that 90% of identified faults will be resolved during the period, with the remainder being carried forwards. The table shows the maximum number of riser faults we expect to be outstanding at the end of each year, our commitment relates to the end of the period:

Network	31/03/2022	31/03/2023	31/03/2024	31/03/2025	31/03/2026
EoE	8,702	7,897	7,093	6,288	5,484
Lon	73,718	60,622	47,527	34,431	21,336
NW	8,599	7,657	6,715	5,773	4,831
WM	6,830	5,767	4,705	3,642	2,580
Totals	**97,850**	**81,945**	**66,040**	**50,135**	**34,230**

This will require us to resolve around 307,000 individual faults (medium and high rise) at an estimated RIIO-2 cost of *XXXX*. In addition to working on domestic MOB risers we will also be resolving faults located during CDS inspections and meter bank and large service pipe surveys at a cost of *XXXX*.

The inspection schedule gives us confidence that 70% of buildings will have been inspected and work identified before April 2026. Therefore, these proposals will remove around 65% of existent faults by the end of RIIO-2. It is expected that the remainder will be resolved in RIIO-3.

We have discussed the timeliness of fault repair with the HSE. Their expectation is that we should risk assess and repair faults in a timescale commensurate with the risk. We are recovering a backlog over the period but will apply a risk assessment methodology to ensure that the most urgent faults are resolved appropriately.

Faults develop because of deterioration, and because of interference, for example PIVs can become buried when resurfacing occurs, and this renders them inoperable.

Our work to engage with building owners and other stakeholders is intended to reduce the amount of damage from interference in the future. Nevertheless, we expect that our assets will continue to be impacted by a combination of natural deterioration and the actions of other people.

Our proposed workload and costs

The table below shows the expected numbers of faults to repair by network and year. These numbers use the most up to date information available and have benefitted from asset inspection data from the summer of 2019.

HRB Number of Faults Repaired	EoE	Lon	NW	WM	Total
2021/22	107	2,207	89	127	**2,530**
2022/23	114	1,953	89	142	**2,298**
2023/24	143	2,676	129	316	**3,263**
2024/25	136	1,892	107	181	**2,316**
2025/26	157	1,834	93	131	**2,214**

MRB Number of Faults Repaired	EoE	Lon	NW	WM	Total
2021/22	9,013	34,569	7,979	4,201	**55,763**
2022/23	9,362	35,395	8,272	4,330	**57,359**
2023/24	9,723	36,253	8,581	4,458	**59,016**
2024/25	10,101	37,152	8,902	4,594	**60,749**
2025/26	10,498	38,091	9,235	4,739	**62,562**

These workloads are about 50 times higher than historic levels. Prior to the Grenfell fire we concentrated on gas-pipeline integrity issues. Some fault categories were not recognised before 2018, and (apart from a trial programme in 2018) we did not have detailed inspections of medium-rise buildings until April 2019.

The overall cost of delivering this plan has been assessed at *XXXX*.

This is about *XXXX* per fault repaired. Excavating surface boxes, drawing, creating and installing network diagrams and the like may appear to be simple tasks however there are organisational and other issues to overcome such as notifying residents, gaining access and recording that faults have been rectified. In addition materials must be purchased, waste disposed of properly and personnel must travel to site.

The costs have been derived bottom up from our current costs of completing this work using our Field Force. We have used our actual inspection returns to determine fault numbers at an individual type level and determined the amount of cost our existing personnel incur fixing each type of fault. Given the huge increase in workload from historic levels, i.e. 50 times more, we are expecting to change the way that we deliver this work.

In the summer and early autumn of 2019 we tendered the majority of our 2020/21 fault repair work. We plan to step up our work significantly before the start of RIIO-2 from historic levels as our ongoing and much improved inspections are now locating significant volumes of repairs to carry out.

We received bids in response to our tender in our East of England, North West and West Midlands Networks however there was no interest amongst contractors in working for us in London Network. This is a concern because it indicates that it will be difficult procuring the resources we need in London.

When the direct costs of executing the work are considered the bids we received are between 26% and 30% cheaper than employing our field force to do the work. This is not unexpected as our personnel have to be trained to work on live gas and be available for out of hours working whereas these are not significant considerations in respect of this activity. However contractors also required money for their overheads and margin. When these figures are included and a comparison made with the cost of employing our field force and supporting them with our work management resources then the bids that we received are between 5% and 10% more expensive than using our own personnel.

This suggests that we should simply use our own personnel to do the work as we have historically however were we to do this we would have insufficient resources available to deliver our other work because of the increase in the numbers of faults to repair. We will be analysing how we will resource this important and safety impacting work in RIIO-2 for example we may hire contract personnel with appropriate craft skills and manage them ourselves.

In earlier versions of our plan we assumed that contracting out the work would deliver a 40% improvement in unit prices. Despite the failure of our tendering process to deliver any savings at this stage we still believe

that a combination of economies of scale and process improvements can deliver benefits relative to current costs. As a result we intend to retain an efficiency task as part of our plan but are proposing that it be set at 15% below current costs. This is an appropriately ambitious level given the risk inherent with obtaining the resources required.

The tables below show the amounts of planned expenditure by Network and year (amounts in *XXXX* in 2018/19 prices).

Network HRB fault repair cost by year	EoE	Lon	NW	WM	Totals
2021/22					
2022/23					
2023/24		Redacted due to commercial sensitivity			
2024/25					
2025/26					
Totals					

Network MRB fault repair cost by year	EoE	Lon	NW	WM	Totals
2021/22					
2022/23					
2023/24	Redacted due to commercial sensitivity				
2024/25					
2025/26					
Totals					

In addition, we will be working on faults identified by the surveys of meter banks and large individual services into multi occupancy buildings.

List of faults we will be working on

The table below lists the faults, with brief descriptions. It also shows the split in estimated numbers of faults that will be identified by type. Gas escapes may also be detected by inspections, however this work is not on the list because the work is included within our plans to work on escapes and detailed elsewhere in the business plan.

Type of fault	Description & reason for work	Anticipated number of faults located by type (HRB + MRB)
Corrosion	Treat severe corrosion and coat pipe to prevent future corrosion To prevent pipe failure and extend asset life	900
Identify location of buried pipe	Identify precise location and other details of buried pipe e.g. location of PIV and update records To prevent future damage by third parties, we have obligations to record the location of our mains and make these available to persons excavating to enhance their safety however approach mains to MOBs <=2" were not historically recorded. It is important to be able to locate a PIV quickly in an emergency, records show their position. Recording a PIVs location also helps if it gets buried and has to be dug out. Improved information also facilitates future asset management.	29,000
Missing PIV	Dig out the PIV (Pipeline Isolation Valve) and install a new lid. In some cases, it is cheaper to fit a new PIV in a different position. Almost every riser has a PIV however over the years they tend to get buried and disappear. The PIV must be accessible to enable rapid isolation if there is a building emergency such as a fire.	30,600
Trip hazard	Replace or re-site a valve box to remove a trip hazard that might result in a member of the public being injured. PIVs are accessed through lids. They get broken e.g. if a footpath box and driven over by a heavy vehicle, the box can sink, or the neighbouring ground can sink leaving the box 'proud' of the surface or the tarmac break up at the edge of the box. These faults expose members of the public to a trip hazard.	1,500
Missing brackets	Replace missing or broken brackets. Riser pipes are fixed to walls brackets hold them in place and support them. If brackets are missing or broken stresses can be placed on the pipes potentially damaging joints.	14,400
Venting & pipe compartmentalisation	Ensure the effectiveness of ventilation and that risers are appropriately boxed in to slow the impact of fire on them. Internal risers should be protected by a fire barrier in some circumstances and the voids that they are in should be sealed from the inside of the building but vented to the outside so that if there is an escape of gas it will not accumulate in the building.	25,000
Fire stopping	Ensure that pipes are sealed where they penetrate ceilings and walls. Where a pipe penetrates from one fire compartment to another it must be sealed to prevent the spread of fire or smoke.	30,800
Non gas related pipe fault including decommissioned apparatus	Electrical continuity bonding issues, unprotected apparatus in proximity to sole means of escape, presence of decommissioned apparatus that is not marked as decommissioned or which breaches fire compartment and is not capped adequately.	60,600
ECV operability & meter location	Restore ECV operability for customer where this has been impacted by building change. Every customer should be able to operate their emergency control so that they can isolate their gas supply if there is an emergency such as a gas escape on an appliance. Also HSE have required that when work is completed on a riser pipe meter points not in compliance with GSIUR should be moved or protected.	11,700

Illegal connections	Identified thefts of gas to be passed into appropriate process.	200
Missing Network Diagram	Ensure that every riser pipe system has a schematic diagram fitted to the wall near to the point where gas enters the building as per the requirements of the Gas Safety Installation and Use Regulations. Required so that emergency responders know which pipe supplies particular customers and so that isolation valves can be located.	66,500
Pipe / valve labelling	Install missing labels on pipes and next to valves. To prevent accidental damage and to identify valves that may need to be operated in emergency.	70,200

Appendix 5. Energy Exchange Programme

Introduction

The primary purpose of the Energy Exchange Programme is to deliver long term efficiencies, which will benefit customers.

Most MOB customers use gas for heating and hot water and typically save around *XXXX* a year using gas relative to the cost of using electricity. This is because gas is a much cheaper fuel per unit of energy.

A minority of MOB customers use gas for cooking only and when standing charges are included in the analysis these customers do not save any money. This is because domestic cooking uses very little energy and any saving in the unit cost of the energy is more than offset by the standing charge. Often cooking only customers are concentrated in apartment blocks that benefit from a centralised heating system that relies on a gas fired boiler. People occupying such a block benefit from cheaper gas heating without having heating appliances in their dwellings. Riser pipes exist in these blocks which supply cookers only, often just hobs as electric ovens are common.

Customers may prefer to use gas hobs however the alternatives have improved in function and the economics do not justify maintenance of supplies in these buildings. In addition taking gas out of such buildings reduces the complexity of the building safety management for the building owner and avoids the need for annual gas safety checks for landlords.

There are also MOBs where there are very few live customers, sometimes as few as one or two connected to each riser pipe that is designed to supply many customers.

In both of these circumstances we are operating riser pipes that are little utilised, but which must be maintained in the same way as other risers. This is inefficient.

Investment need

During RIIO-2 our MOBs related planned TOTEX works out at about *XXXX* per total connected customer per year.

If all the cooking only MOBs and very low utilisation buildings were disconnected this would fall by over 10%, not taking into account the cost of disconnecting the buildings and compensating customers for losing their gas supply. The customer population would benefit through lower charges if low use MOB customers were not connected to gas because the costs of serving these customers is greatly in excess of charges levied on them, and the cost benefit to them of using gas is marginal.

Our approach

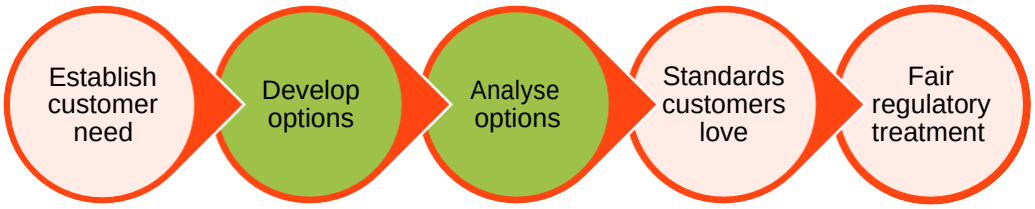
The Gas Act Section 10 requires that domestic supplies be maintained without an economic test being applied, consequently we cannot simply cut off customers that we identify as using little gas and incurring costs that ultimately fall on other customers. We can only operate by consent.

As a result of this we have introduced our Energy Exchange programme. The programme is already in operation although it was not specifically funded in RIIO-1. It was appropriate to start this work to generate customer benefits.

The programme identifies buildings where there is low gas use and approaches customers in such buildings to ask them if they are interested in switching. We typically offer new for old appliances and money to buy items such as pans suitable for use on induction hobs. If all the customers attached to a riser agree to switch then the Energy Exchange gas to electric takes place.

Since Energy Exchange started a little over a year ago we have found that working through Local Authorities and Housing Associations is much more effective than speaking with tenants / occupiers directly. This will be explained in the options analysis section below.

Options development and analysis



Whilst the removal of gas supplies in all low use MOBs would be in the interests of the customer population as a whole it is not a realistic short term (i.e. RIIO-2) goal. The reason for this it that we must gain the agreement of all the customers in a block before we are able to proceed. We cannot lawfully disconnect people who do not agree to be disconnected and leaving a few customers connected to a riser pipe system and paying others to disconnect is counter-productive. It is counter-productive because we would have incurred some cost for the proportion of customers within a block who cease using gas and still have the ongoing maintenance liabilities.

There is a sub-set of low use MOB customers who can be reached effectively. These are cooking only use MOB customers where the Local Authority or Housing Association is planning to refurbish the block. In this case customers are having kitchens replaced and the decisions relating to what replacement appliances will be fitted are taken collectively by the building owner, through consultation, rather than individual customers. In this circumstance customers will receive new cooking appliances as part of wider refurbishment works and the gas will be disconnected, this is does not increase disruption. Their total energy bill will not increase for the reasons discussed earlier.

Housing providers are often willing to have gas taken out of cooking only use apartments because it simplifies ongoing building management for them and does not impact bills. Our providing some funding and disconnecting the gas free of charge makes such decision easier for them.

The Energy Exchange Programme is aimed at HRBs as these buildings provide the greatest benefit if disconnected.

Our proposed workload, costs and benefits

Our work / payments comprise disconnecting the gas supplies, making safe and paying for replacement appliances.

Based on the work we are already doing with Local Authorities and Housing Associations we expect this programme to remove the gas supply from about 100 buildings during the 5 RIIO-2 years. The table refers:

Network	Number of Energy Exchange buildings	Cost (RIIO-2 period)
EoE	16	
Lon	60	Redacted due to commercial sensitivity
NW	14	
WM	10	
Total	100	

No allowance for inflation has been made in respect of the numbers in this table.

The TOTEX cost of operating risers in an average HRB is about *XXXX* during a 5 year period (calculated as planned RIIO-2 MOBs TOTEX multiplied by the mean number of risers in a HRB divided by the total number of risers in use).

The average cost of removing all the supplies from a cooking only HRB with appliances in all of the flats is about *XXXX* including compensation payments and doing the disconnection work. Typically, *XXXX* per dwelling is incurred replacing appliances and compensating customers with the balance required to disconnect and purge the gas riser pipes.

This cost implies a 40 year pay-back period not taking account of the time value of money. On this basis the programme appears to have marginal viability. However, we are targeting the least cost effective high rise buildings in the RIIO-2 period so the payback period will be less than the 40 years calculated for an average building. As a result the programme is cost beneficial for customers as a whole and makes a small contribution to future operating efficiency. There is no asset stranding risk.

Appendix 6 Managing Uncertainty

In our October plan we provided a section in this appendix to describe how we would manage uncertainty.

In this December plan such detail is now in Appendix 10.10 Multiple Occupancy Buildings and Chapter 10, which deals with uncertainty.

Appendix 7 – Managing MOBs data

Introduction – A Changing Landscape

We have undertaken asset inspection in respect of our HRB MOBs for many years and held records of the assets that served them. During RIIO-1 we have been carrying out our first inspection of our MRB assets. We expect to complete it by the end of March 2021. We will then have a comprehensive data set. Whether HRB or MRB our systems and processes will be essentially the same in RIIO-2.

The Grenfell fire tragedy triggered a series of events that led to our identifying deficiencies in our data, now since rectified (Grenfell Tower records were correct and it had an in date inspection). It also highlighted the need to place a far higher emphasis on the non-gas related aspects of managing our riser pipe asset portfolio. Previously we had focussed on the gas tightness of our assets, and on customer service (interruptions). As a result of this we have changed our inspection processes and started to capture many more data items such as fire compartmentalisation (impacted by a pipe penetrating a wall or ceiling) that we did not consider before.

Enhancing MOBs related data

During 2017 and 2018 we introduced a series of significant changes in respect of our MOBs related data that materially improved the scope of information held together with the accuracy and completeness of data and our ability to use data to manage our assets effectively.

These are the steps we have taken to achieve this:

1. Used Ordnance Survey information in conjunction with xoserve meter data to identify all potential MOBs
2. Wrote to all Local Authorities to obtain their MOB information
3. Used our existing job records in our SAP system to identify where we had worked in a MOB
4. Wrote to iGTs for lists of their MOBs in our footprint
5. Cross referenced the lists from actions 1-4 with our existing records to identify where we had records of potential Mobs and identified candidate buildings (i.e. potential MOBs not known to us) which would go forwards for validation and action
6. Visited all HRB candidates to check whether they were MOBs with riser pipe systems
7. Carried out desk-top survey of all MRB candidates
8. In respect of previously unknown HRBs ensured full inspection by 01/09/18
9. In respect of MRBs included within our first time ever inspection programme that completes at the end of March 2021
10. Improved HRB and MRB inspection processes by increasing the scope of inspection particularly in relation to building safety faults and by moving to a smart phone app based survey with field data capture and then direct input into core systems
11. Transformed core systems (SAP and ESRI) by changing asset hierarchy, increasing information stored, changing field force device software to ensure more robust relationship between work undertaken and asset information updating
12. Changed data capture requirements and processes for contractors who replace or refurbish risers to increase scope of data collected and to enhance data quality
13. Introduced team in our Data Assurance department to assure MOBs related information
14. Refreshed riser risk model and introduced automated risk scoring for inspection returns, which also re-scores riser risk when physical work is delivered
15. Introduced new reporting tools to empower asset management decision making and to systematically identify post inspection follow on work i.e. minor repairs
16. Introduced procedures to repeat actions 1 (annually) and 3 (quarterly) to ensure that any new intelligence is used to identify if there are missing buildings

The changes described here moved the dial a long way in respect of our MOBs data and our ability to use it effectively. We are now building on that change as we construct our MOBs management team to improve our engagement and asset management decision making.

In respect of the future for MOBs data, the focus is moving from simple building and asset data to integrating job history i.e. what work we have and are doing at premises and asset risk management. As this business plan is published we are doing further work to try to improve our ability to predict future asset performance from recorded past performance as this will make targetting interventions more effective at controlling both safety and customer service related risks.

We used a version of the CBA model to help to determine the optimal investment plan for RIIO-2. In future we expect to be able to use similar modelling together with the detailed information we are obtaining from our improved inspections and improved job data capture processes to help us with major intervention decision making.

Responding to legislative change

Dame Hackitt is currently carrying out a review of safety management in MOBs. Her initial findings are that there should be a duty holder for each building and that all persons with an interest in the building should be compelled to cooperate with the duty holder and operate within their safety management framework. To explain what this means, we would expect to have to provide the duty holder with details of our equipment, information relating to inspections and fault and repair information, possibly with evidence to provide the duty holder with assurance that there was no overdue work.

Prior to the General Election being called legislation was expected to be brought forwards in 2020 to require these changes. It is likely to take effect in the middle of RIIO-2. We have included an Uncertainty Mechanism in this business plan in respect of the costs of this change; ref. Appendix 10.10 Multiple Occupancy Buildings.

We anticipate that building safety related data, inspections information along with asset, job and asset condition information will be required by duty holders and that this will require a degree of information exchange. As a result of the changes we implemented in 2017 and 2018 we believe that our systems will in principle support these requirements, and that inspections completed since April 2018 contain most if not all of the building safety information that might be required. Information exchange protocols will have to be developed and there may need to be changes to our systems if for example duty holders are provided system access to information relating to buildings that they have an interest in.

Data contributing to customer experience and stakeholder engagement

By 2021 we will have completed our move to cloud based computing. Combined with the improvements we have made to core systems and data processes this will enable our personnel to see the full job and asset history whether in the office or the field. As we deliver on our customer commitments, we will rely on these systems to enhance the service that we offer.

Engagement with stakeholders such as the building owner is also facilitated by our systems. In RIIO-2 we will have comprehensive asset and job history information available to support conversations with stakeholders, not just in support of their safety management but also in support of our engaging with them to inspect or work on assets or in response to their enquiries when they are thinking about doing building work on their building for example.

Working with the Industry

We have been working with other GDNs in particular SGN (who have more risers than WWU or NGN) in relation to riser asset management issues. Understanding assets, how they perform and the risks that they pose are all key to delivering a pan industry safety management regime. The reason for this is that such change should be evidence based in order that it includes the most cost beneficial and effective measures.

We are confident that our data and systems will provide the information required to support such industry engagement.